

# EJA

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of  
Anaesthesiology

**Euroanaesthesia 2014**  
**The European Anaesthesiology Congress**

**Abstracts Programme**  
**Stockholm, Sweden, May 31 - June 3, 2014**



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## **Abstracts and Programme**

# **EUROANAESTHESIA 2014**

### **The European Anaesthesiology Congress**

31 May - 3 June 2014  
Stockholm, Sweden



# European Journal of Anaesthesiology

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# EUROANAESTHESIA 2014

The European Anaesthesiology Congress

Stockholm, Sweden, 31 May - 3 June 2014

## ABSTRACT PRESENTATION PROGRAMME

Please note that all abstracts are presented as poster presentations: abstract presenters do not make a formal presentation of their abstract in a separate room, using audiovisual aids (except for the Best Abstract Prize Competition). Instead, two chairpersons will conduct, in front of each poster, a short discussion of each abstract with the presenter and the audience, for every abstract in that session. Poster presenters have been asked to stand by their poster for 45 minutes before and 30 minutes after their session, to address further questions.

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**The ESA solicits the submission of abstracts for the  
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Berlin, Germany  
May 30 - June 2 2015**

**All abstracts must be submitted online via the ESA Website  
[www.esahq.org/Euroanaesthesia2015](http://www.esahq.org/Euroanaesthesia2015)**

**The submission module will be available to submitters  
from Saturday 1 November to Monday 14 December 2014**

### **Submission Conditions**

When submitting your abstract, you will be prompted to accept the submission conditions that will be made available on the ESA website at least one month before the submission starts.

# ESA Best Abstract Prize Competition (BAPC)

## ESAPC1-1

### Effect of lidocaine on preventing laryngospasm during general anaesthesia in children: a systematic review and meta-analysis

Mihara T.<sup>1</sup>, Uchimoto K.<sup>2</sup>, Goto T.<sup>2</sup>

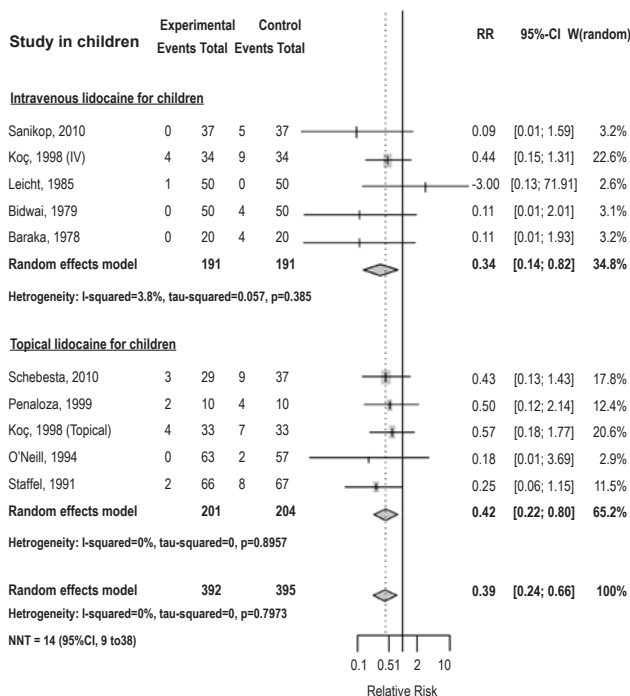
<sup>1</sup>Kanagawa Children's Medical Center, Dept of Anaesthesiology, Yokohama, Japan, <sup>2</sup>Yokohama City University, Dept of Anaesthesiology & Intensive Care, Yokohama, Japan

**Background and Goal of Study:** Laryngospasm is a potentially life-threatening complication of general anaesthesia that is known to occur more often in children than in adults. There have been numerous studies regarding the effect of lidocaine on preventing laryngospasm during general anaesthesia. However, most of the clinical studies are underpowered because of the relatively low incidence of laryngospasm, and thus the results have been conflicting. Moreover, the routes of administration have varied among these studies. The aim of the present meta-analysis was to evaluate the effect of lidocaine on preventing laryngospasm in children and to identify the most effective route of administration.

**Methods:** We used MEDLINE, the Cochrane Central Register of Controlled Trials, Embase, Web of Science, clinicaltrials.gov, UMIN clinical trial registry for this study. Controlled clinical trials reporting effects of intravenous and/or topical lidocaine on the incidence of laryngospasm during anaesthesia were included in this study.

Dichotomous data were summarized using risk ratio with a 95% confidence interval. Heterogeneity was quantified with the I<sup>2</sup> statistic. Sensitivity analysis was performed restricting to high quality studies. Publication bias was assessed using a funnel plot and Begg's asymmetry test.

**Results and Discussion:** Nine studies including a total of 787 patients were selected for this study. The combined results showed that lidocaine is effective to prevent laryngospasm in children (risk ratio [RR] 0.39, 95% confidence interval [CI] 0.24 to 0.66; I<sup>2</sup> = 0%; number needed to treat [NNT] 14, 95% CI 9 to 38) (Figure 1). Subgroup analysis revealed that both intravenous (RR 0.34, CI 0.14 to 0.82) and topical (RR 0.42, CI 0.22 to 0.80) lidocaine were effective in preventing laryngospasm in children (Figure 1). Sensitivity analyses have revealed that the results were not affected by low quality studies, which means that our results are robust. The asymmetry test result for the funnel plot was not statistically significant.



[Figure 1]

**Conclusions:** Both topical and intravenous lidocaine is effective for preventing laryngospasm in children during general anaesthesia.

## ESAPC1-2

### The distinct roles of hypoxia-activated transcription factors in atelectasis-induced lung injury: a pro-inflammatory role of nuclear factor-κB and an anti-inflammatory role of hypoxia-inducible factor-1 in lung epithelial cells

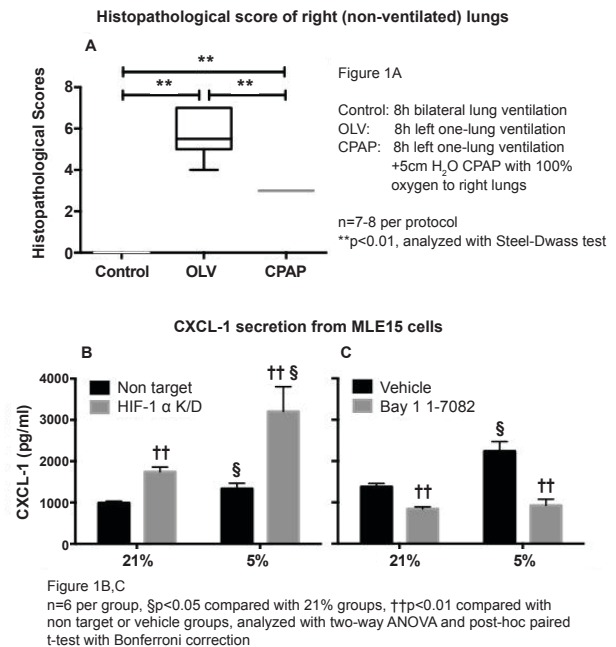
Tojo K.<sup>1</sup>, Yusuke N.<sup>1</sup>, Yazawa T.<sup>2</sup>, Mihara T.<sup>3</sup>, Goto T.<sup>1</sup>, Kurahashi K.<sup>1</sup>

<sup>1</sup>Yokohama City University, Dept of Anaesthesiology & Intensive Care, Yokohama, Japan, <sup>2</sup>Kyorin University, Dept of Pathology, Mitaka, Tokyo, Japan, <sup>3</sup>Kanagawa Children's Medical Center, Dept of Anaesthesiology, Yokohama, Japan

**Background and Goal of Study:** Atelectasis, a common complication during mechanical ventilation, leads to alveolar hypoxia, which is a potent inducer of lung injury. We previously reported that atelectasis causes lung inflammation due to alveolar hypoxia (American Thoracic Society Annual Scientific Meeting, 2013). However, the underlying mechanisms are not fully elucidated. Hypoxia-inducible factor (HIF)-1 and nuclear factor (NF)-κB are two major regulators of inflammation in hypoxia. We investigated the roles of these transcription factors in the atelectasis-induced lung injury.

**Materials and methods:** We established one-lung ventilation rat model to investigate atelectasis-induced lung injury. Histopathology, cytokine concentrations, and activities of HIF-1 and NF-κB in the non-ventilated, atelectatic lungs were assessed. As lung epithelial cells and alveolar macrophages are major sources of inflammatory mediators in lungs, a lung epithelial cell line: MLE15 and an alveolar macrophage cell line: MH-S were cultured in 5% O<sub>2</sub> to simulate the atelectatic lungs. We knocked down HIF-1α using siRNA and inhibited activation of NF-κB using selective IKK inhibitor: Bay 11-7082 to investigate their effects on inflammatory responses.

**Results and discussion:** One-lung ventilation caused histopathological damage (Fig 1A) and increased concentrations of TNF-α, IL-6, and CXCL-1 in the atelectatic lungs. Concomitantly, HIF-1 and NF-κB were activated in the atelectatic lungs. Oxygen supplementation with CPAP attenuated these pathological changes. Exposure to 5% O<sub>2</sub> increased CXCL-1 secretion from MLE15 cells stimulated with TNF-α, but not from MH-S cells. HIF-1α knockdown increased CXCL-1 secretion from MLE15 cells in hypoxia (Fig 1B), whereas inhibition of NF-κB abolished hypoxia-induced CXCL-1 up-regulation in MLE15 cells (Fig 1C).



[Figure 1]

**Conclusions:** These data indicated that atelectasis causes lung injury via hypoxia-induced NF-κB activation in the lung epithelial cells. On the other hand, HIF-1 seems to play an anti-inflammatory, protective role in the atelectatic lungs. Modulations of NF-κB and HIF-1 may be novel therapeutic approaches to the atelectasis-induced lung injury.

## ESAPC1-3

### Mechanistic insight regarding a possible inhibition of malignant cell metastatic potential by amide-linked local anesthetics

Piegeler T.<sup>1</sup>, Schl pfer M.<sup>1</sup>, Dull R.O.<sup>2</sup>, Beck-Schimmer B.<sup>1</sup>, Minshall R.D.<sup>2</sup>

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**Background:** Expression and secretion of matrix-metalloproteinases (MMP) by malignant cells are thought to play a crucial role in solid tumor metastasis[1]. Circulating cytokines, such as tumor necrosis factor  $\alpha$  (TNF $\alpha$ ), activate the kinases Src, Akt and Focal Adhesion Kinase (FAK) essential for MMP secretion and function[2,3]. We recently demonstrated that ropivacaine and lidocaine block TNF $\alpha$ -induced Src activation in malignant cells[4] and therefore evaluated whether these agents might also inhibit activation of Akt and FAK in malignant cells, thus attenuating MMP release.

**Methods:** Cell lysates from NCI-H838 lung adenocarcinoma cells were incubated with ropivacaine or lidocaine (1nM-100 $\mu$ M) in absence or presence of TNF $\alpha$  (20ng/ml) for 20 minutes. Activation/phosphorylation of Akt (threonine 308) and FAK (tyrosine 397) were evaluated by Western blot. The influence of ropivacaine and lidocaine on TNF $\alpha$ -induced MMP-9 secretion by NCI-H838 cells at 4 hours was assessed by ELISA in cell culture supernatant. Additionally, the effect of Wortmannin (100nM, blocks Akt activation) and FAK-inhibitor FI14 (5 $\mu$ M) on MMP-9 release was evaluated. Statistical analysis was conducted by two-way ANOVA with Bonferroni post-hoc testing.

**Results:** Ropivacaine (1nM) and lidocaine (10 $\mu$ M) both significantly reduced TNF $\alpha$ -induced activation of Akt (ropivacaine: 40% reduction,  $p=0.01$ ,  $n=6$ ; lidocaine: 40%,  $p<0.01$ ,  $n=11$ ) and FAK (ropivacaine: 42% reduction,  $p<0.01$ ,  $n=7$ ; lidocaine: 51%,  $p=0.04$ ,  $n=8$ ) in NCI-H838 cells. MMP-9 secretion triggered by TNF $\alpha$  was attenuated by 36% in presence of 1nM ropivacaine ( $p<0.01$ ,  $n=6$ ) and 52% in presence of 10 $\mu$ M lidocaine ( $p<0.01$ ,  $n=6$ ). The inhibition of MMP-9 release by the amide-LAs was similar to that observed in presence of Wortmannin or FI14.

**Conclusions:** Ropivacaine and lidocaine - at clinically relevant concentrations - reduced the release of MMP-9 by malignant cells via inhibition Akt and FAK activation. Although our findings were determined entirely in vitro, they provide significant insight into a potential mechanism by which amide-LAs might attenuate metastasis of malignant cells.

#### References:

1. J Biol Chem 1999; 274:21491-4
2. AJP Lung 2007; 292:L799-L812
3. Carcinogenesis 2013; 34:10-9
4. Anesthesiology 2012; 117:548-59.

## ESAPC1-4

### The GAS study: the postoperative apnea outcome in a RCT comparing spinal and general anaesthesia for infant hernia repair

Disma N.<sup>1</sup>, Davidson A.<sup>2</sup>, de Graaff J.<sup>3</sup>, Withington D.<sup>4</sup>, Morton N.<sup>5</sup>, McCann M.E.<sup>6</sup>, Gas Study Consortium

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**Background and Goal of Study:** The GAS study is a randomized trial comparing awake regional (RA) and general anaesthesia (GA) for effects on neurodevelopmental outcome and apnoea in infants. The primary objective of this trial is to determine whether awake regional and general anaesthesia, given to infants undergoing inguinal hernia repair result in equivalent neurodevelopmental outcomes at 2 and 5 year of age. Secondary objectives are to describe the frequency and characteristics of apnoea and other anaesthesia and surgical related complications in the post-operative period.

**Materials and Methods:** The study was performed at 27 sites in 7 countries. 722 infants < 60 weeks PMA, requiring inguinal hernia repair were randomized to sevoflurane (GA) or awake regional anaesthesia (RA). Exclusion criteria were pre-existing risk factors for adverse neurodevelopmental outcome, previous exposure to GA and < 26 weeks gestational age at birth.

A significant apnoea was defined as a pause in breathing >15 seconds or a

pause >10 seconds associated with an oxygen saturation <80% or bradycardia, and divided in early (<30 min after end of anaesthesia) and late (between 30 minutes and 12 hours).

**Results and Discussion:** Outcome data were available for 355 in the RA arm and 356 in the GA arm. Of the 355 randomised to RA, 54 (15%) were converted to GA and a further 18 (5%) required some form of sedation or brief exposure to sevoflurane. Apnoea was observed in 15/356 (4.2%) of GA and 10/355 (2.8%) of RA with an intention-to-treat analysis (Risk ratio 1.5, 95% CI 0.69 to 3.3,  $P=0.3$ ) and 15/356 (4.2%) in the GA and 6/283 (2.1%) in the RA by an as per protocol analysis (Risk ratio 2.4, 95% CI 0.88 to 6.5,  $P=0.08$ ). However, early apnoea was significantly lower in the RA arm if compared with the GA arm both with an intention-to-treat and as-per-protocol analysis (Risk ratio 4.0, 95% CI 1.1 to 14,  $P=0.02$ ; Risk ratio 9.5, 95% CI 1.2 to 73,  $P=0.007$ ; respectively).

**Conclusion(s):** With modern anaesthesia aiming for awake regional anaesthesia confers a reduced risk of apnoea only in the early post-op period. If a child has a successful awake regional the risk of subsequent apnoea is substantially reduced.

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## ESAPC1-5

### Serum from women undergoing breast cancer surgery, randomized to propofol-paravertebral anaesthetic technique, maintain natural killer cell anti-tumour activity compared with sevoflurane-opioid technique

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**Background:** Retrospective clinical data and animal inoculation models suggest that regional anaesthesia and avoidance of opioids and volatile agents may attenuate immunosuppression and minimize metastasis in cancer surgery<sup>1-3</sup>. Natural killer (NK) cells are an important component of the immune response to circulating tumour cells. We investigated the effect of serum from women undergoing primary breast cancer surgery, who were randomized to a propofol-paravertebral (PPA) or a sevoflurane-opioid (GA) anaesthetic technique, on healthy human donor NK cell function in response to an estrogen-progesterone receptor positive breast cancer cell line (HCC1500).

**Methods:** Ten patients who donated serum preoperatively and 24 hours post-operatively in an ongoing randomized prospective trial (NCT 00418457) were selected. Serum diluted to 10% from PPA  $n=5$  and GA  $n=5$  was co-cultured for 24 hours with HCC1500 and healthy human donor NK cells. NK cell activating receptors (NKp30, NKp44, NKp46, 2b4, CD16, NKG2D), cytokine production, cytotoxicity of NK cells and HCC1500 apoptosis were examined.

**Results:** Serum from patients receiving GA had reduced NK cell activating receptor CD16 (from mean $\pm$ SEM,  $82\pm 2\%$  to  $50\pm 4\%$ ,  $P=0.001$ ), IL 10 (from  $170\pm 80\%$  to  $120\pm 92\%$ ,  $P=0.001$ ) and IL1 $\beta$  (from  $68\pm 12\%$  to  $19\pm 4\%$ ,  $P=0.01$ ) compared with preoperative GA serum. No change in CD16, IL10 and IL1 $\beta$  was observed with PPA serum. No significant changes occurred in NKp30, NKp44, NKp46, 2b4 or NKG2D marker expression with either anaesthetic technique. A significant increase in NK cell cytotoxicity of HCC1500 (mean $\pm$ SEM%,  $23\pm 2$  vs  $37\pm 3$ ,  $P=0.009$ ) and apoptosis of HCC1500 ( $11\pm 1$  vs  $21\pm 2$ ,  $P=0.0009$ ) was observed with PPA serum, but not with GA serum.

**Conclusion:** Serum from breast cancer patients receiving a PPA technique stimulated increased healthy human NK cell activation and cytotoxicity to estrogen-progesterone receptor positive breast cancer cells in vitro, compared with serum of GA patients.

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## ESAPC1-6

### Poor agreement between meta-analyses and subsequent large randomised controlled trials in peri-operative medicine

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**Background and Goal of Study:** To compare findings of large randomized controlled trials (RCTs) with preceding meta-analyses which investigated the same topic.

**Materials and methods:** Principally using Medline, large RCTs in anaesthetic literature ( $\geq 1000$  subjects) were identified and compared with preceding meta-analyses which investigated the same topic, with particular focus as to

whether each study found a significant or non-significant result (at the conventional level of statistical significance,  $p < 0.05$ ).

**Results and discussion:** A total of 15 large RCTs and 40 meta-analyses addressing 13 clinical questions were identified, encompassing many important clinical topics in anaesthesia. Among all primary and secondary major clinical outcomes, 60 of 124 outcomes were predicted correctly by the meta-analysis, with agreement between the RCTs and meta-analyses being "worse than expected compared to chance alone" ( $\kappa = -0.07$ ;  $-0.193 - 0.054$ ). The positive predictive value of meta-analyses was 10.17% (3.85% - 20.84%); the negative predictive value was 83.08% (71.73% - 91.23%).

**Conclusion(s):** The outcomes of the 15 large RCTs were predicted correctly on 48% of occasions by the preceding meta-analysis. There was a strong tendency towards positive findings in meta-analyses which were not substantiated by subsequent large RCTs, which may in part be influenced by publication bias in the literature. This finding might influence the weighting of meta-analyses in clinical decision making.

## Evidence-based Practice and Quality Improvement

### 1AP1-1

#### Effects of alcohol consumption in quality of life after surgery and anaesthesia

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**Background and Goal of Study:** The effects of alcoholism are far reaching. Alcohol consumption increases the risk of postoperative complications, with higher rates of admission to high-dependence or intensive care units and increased length of hospital stay. Alcohol use is an independent risk factor for the development of acute confusion and *delirium* and significantly impacts quality of life (QoL). The aim of this study was to evaluate the effects of alcohol consumption in QoL after surgery.

**Materials and Methods:** Observational, prospective study conducted in patients aged above 45 years, admitted in the Post-Anaesthetic Care Unit (from June to July 2012), after elective major surgery. Ethics committee of the institution approved the study and informed consent was obtained for each patient, preoperatively. The study population consisted in 221 patients. Patients submitted to cardiothoracic and neurosurgeries, as well as those incapable to give informed consent were excluded. Patients were classified as having alcohol problems (APG), if they answered positively to 2 or more questions in the CAGE questionnaire. QoL was assessed using the SF-36 questionnaire and was performed preoperatively (T0) and 3 months after surgery (T3). Higher scores in SF-36 items express a better health status. Descriptive analyses of variables were used to summarize data and non-parametric tests were performed for comparisons (Wilcoxon signed rank test and the Mann Whitney U-test).

**Results and Discussion:** The incidence of patients presenting with alcohol problems was 10.4% ( $n=23$ ) and 82.6% ( $n=19$ ) were male subjects.

When comparing the median scores for each of SF-36 domains there were no differences between the 2 groups (non-alcohol problems (NAPG) versus (vs) APG), neither before nor after surgery, except for physical function at T0 (median 80 vs 40,  $p=0.018$ ).

Comparing each of SF-36 domains obtained before and 3 months after surgery, NAPG patients presented better scores in almost all SF-36 domains (except general health item). Patients with alcohol problems presented with better scores only in 2 domains: role limitations caused by physical problems (median 40 vs 55,  $p=0.017$ ) and bodily pain (median 42 vs 74,  $p=0.010$ ).

**Conclusion:** In this study, the incidence of alcohol problems was 10.4%. Patients without alcohol problems obtained better scores in almost all SF-36 scores denoting improving quality of life.

### 1AP1-2

#### Surgeons' efficiency in the operating rooms evaluated by data envelopment analysis

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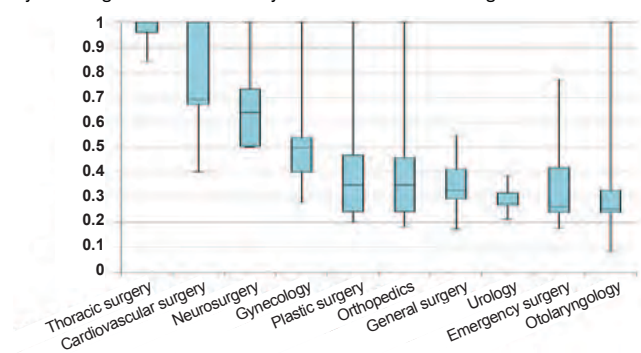
**Background and Goal of Study:** In Japan, most health care providers are reimbursed on a fee-for-service basis according to the fee schedule that set prices uniformly at the national level. The current fee-for-service reimbursement system does not formally define which cost components are covered by the surgical fee. The goal of this study is to examine the current surgical payment system in Japan from the equity viewpoint.

**Materials and methods:** IRB approved our study. We collected data from the Teikyo University electronic medical record system from April 1 till September 30, 2013. We defined the decision making unit as a surgeon with the highest academic rank in the surgery. We focused on the surgeons' activity and their clinical decision. The inputs were defined as

(1) the number of medical doctors who assisted surgery, and  
(2) the time from skin incision to skin closure. The output was defined as the surgical fee for each surgery.

We added all the inputs and outputs of the surgical procedures for each surgeon, and calculated his/her efficiency score using output-oriented BCC model of data envelopment analysis. The efficiency scores are expressed in the number between 0 and 1; the most efficient one is 1 and the least efficient one is 0. All the surgeons belong to one of the surgical specialties. We compiled their efficiency scores in their surgical specialties. We compared the efficiency scores of each surgical specialty using Kruskal-Wallis and Steel method. A  $p$ -value  $< 0.05$  was considered statistically significant.

**Results and discussion:** We analyzed 2,825 surgical procedures performed by 103 surgeons. The efficiency scores were shown in Figure 1.



[Figure 1: Efficiency scores]

The difference in efficiency scores was statistically significant ( $p = 0.0001$ ). The thoracic surgeons were the most efficient, and were significantly more efficient than plastic, gynecologic, urologic, otolaryngologic, orthopedic, general and emergency surgeons ( $p < 0.05$ ).

**Conclusion(s):** We demonstrated that the surgeons' efficiency in the operating rooms was significantly different among surgical specialties. This means that the Japanese surgical reimbursement scales are unfair in terms of resource utilization.

### 1AP1-3

#### Survey of current management of neuromuscular block in Brazil

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**Background and Goal of Study:** The practice use of neuromuscular blocking agents (NMB) differs widely within and between countries. This survey aimed to assess the extent of practice of Brazilian anaesthesiologists in the use of neuromuscular blocking agents (NMB), neuromuscular monitoring (NMM) and reversion of the neuromuscular block.

**Materials and methods:** All medical practitioner members (9910) of the Brazilian Society of Anaesthesiology were invited to complete an anonymous electronic survey. Questions concerned the routine choice for tracheal intubation (TI) for elective surgery and emergency, use of NMM, criteria adopted for the diagnosis of recovery, frequency of use of drugs for reversal of neuromuscular blockade, reports of residual neuromuscular block complications and outcome.

**Results and discussion:** A total of 1296 survey questionnaires were completed (response rate 13,07%). The most frequently used NMB for elective TI were rocuronium, atracurium and cisatracurium (35, 27 and 25%, respectively) and succinylcholine and rocuronium (48 and 39%) for emergence IT. Regarding NMM, 37% do not use, 25% rarely use, 23% sometimes and 15% use often.

About the existence of neuromuscular monitor in the hospital where the anaesthetist works, 55% answered that the hospital have some devices, 28% no offers and 18% of the hospitals have enough monitors. 60% used only clinical criteria, 35% used both clinical judgment and NMM, and 5% used NMM alone to diagnose the complete recovery of neuromuscular blockade. Regarding the frequency of use of neostigmine or sugammadex for reversal of neuromuscular blockade, 45% always use, 39% sometimes use, 14% depending on the value of TOF and 1% never use that kind of reversal.

Complications attributed to BNM: residual neuromuscular blockade (38%), prolonged block (25%), allergic reaction (15%), bronchospasm (9%), re-arrhythmia (6%), prolonged apnea after succinylcholine (5%), cardiac arrhythmia (1%), and malignant hyperthermia (1%). Outcome of cases in which anaesthetists considered major complications: without sequelae (96%), with sequelae that considered mild/moderate (2%), with sequelae that considered severe (6%) and death (18%).

**Conclusion(s):** This survey demonstrated large management differences in the practice amongst Brazilian anaesthetists. We believe that is necessary to adopt formal training programs and official guidelines in order to improve security and quality care.

### 1AP1-4

#### Are we wasting unnecessary preoperative tests?

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**Background and Goal of Study:** To verify, according to the National Institute of Clinical Excellence (NICE) Guidelines for preoperative tests<sup>1</sup>, how many elective patients in our Hospital (General Surgery, Orthopaedics and Urology) were not supposed to do blood coagulation tests and the costs associated with that decision.

**Materials and methods:** During a year, prospective descriptive study, of a random sample of 233 from a total population of 3495 patients, who were scheduled for Elective Surgery of: Orthopaedics, General Surgery and Urology.

We used descriptive analysis to characterize the patients who were submitted to blood preoperative coagulation tests and to the patients who shouldn't have done them.

Calculate the proportion of patients with no indication for blood coagulation studies with a confidence interval of 95%.

**Results and discussion:** Blood coagulation tests were made in all of the 233 patients. 118 patients (51%) had no formal indication to do so. This corresponds to a ratio of  $0.51 \pm 0.06$ .

**Conclusion(s):** If the Guidelines for preoperative blood coagulation tests from NICE were respected in the studied population, it would have prevented the waste of approximately €16,500.

Through this study, the author points out that routine preoperative tests performance for elective surgery should be rethought in his Hospital.

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### 1AP1-5

#### Influence of desflurane on postoperative oral intake compared with propofol

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**Background and Goal of Study:** Postoperative oral intake is an important predictor of early postoperative recovery, and anesthesia is known to influence this intake. We hypothesized that desflurane did not affect postoperative oral intake compared with propofol because this inhalational anesthetic agent provided early recovery from anesthesia state. We, therefore, compared the influences of desflurane anesthesia and propofol anesthesia on early postoperative oral intake retrospectively.

**Materials and methods:** The subjects included a consecutive series of patients who were received general anesthesia with propofol or desflurane between June and November 2013. Of these patients, those aged < 20 years, those who were admitted to the intensive care unit (ICU) after operation, those who received abdominal surgery, and those who were discharged earlier than 2 days after operation were excluded from the study. The total amount of calories and proteins taken orally and the incidence of postoperative nausea and vomiting (PONV) on postoperative days (PODs) 0, 1, and 2 were collected from electronic patient records. In our hospital, electronic patient records system calculated total amount of calories and proteins automatically based on nursing record about oral intake. A  $p$  value of < 0.05 was considered statistically significant.

**Results and discussion:** A total of 133 patients were analyzed. The desflurane (Des) and the propofol (Pro) groups included 44 and 89 patients, respectively. The incidence of PONV on POD 0, 1, and 2 did not show significant intergroup differences. Total calorie intake on POD 1 and 2 was not significantly different between the 2 groups ( $1125 \pm 526$  vs.  $1040 \pm 549$  kcal/day,  $p = 0.40$  and  $1486 \pm 391$  vs.  $1428 \pm 441$  kcal/day,  $p = 0.46$ , respectively).

The total amount of calorie per body weight on 1 and 2 POD were not also significantly different between the two groups ( $18.0 \pm 8.0$  vs.  $18.9 \pm 10.8$  kcal/kg/day,  $p = 0.62$  and  $24.5 \pm 7.2$  vs.  $25.9 \pm 9.1$  kcal/kg/day,  $p = 0.37$ , respectively).

Total amount of protein via oral intake on POD 1 and 2 were not significantly different between the two groups ( $46.0 \pm 22.0$  vs.  $43.9 \pm 22.9$  g/day,  $p = 0.61$  and  $60.4 \pm 15.7$  vs.  $58.3 \pm 18.3$  g/day,  $p = 0.50$ , respectively).

**Conclusion:** These findings suggest that desflurane and propofol affect postoperative oral intake in a similar fashion. These results should be confirmed in a future prospective study.

### 1AP1-6

#### Which provides better postoperative recovery after laparoscopic surgery, fentanyl or remifentanyl?

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**Background and Goal of Study:** Both fentanyl and remifentanyl are commonly used for analgesia in laparoscopic surgery. Compared to fentanyl, remifentanyl provides strong analgesia, which probably leads to less secretion of cortisol during the surgery. Meanwhile, administration of glucocorticoids before surgery has been shown to improve the postoperative recovery. We



therefore hypothesized that the higher level of cortisol by using fentanyl, the better postoperative recovery.

**Materials and methods:** The study was prospective, randomized, controlled clinical trial. ASA physical status 1 and 2, age 20 to 79 years old patients undergoing renal or ureteral laparoscopic surgery were enrolled. Patients with corticosteroid or opioid use, severe liver or renal dysfunction, or psychiatric disturbance were excluded. Subjects were randomized to receive fentanyl or remifentanyl as part of a standardized anesthetic. Cortisol was measured 4 times: before, during, and at the end of the surgery, and next morning. The primary outcome was the Quality of Recovery (QoR)-40 questionnaire at 24 hours after surgery. Data were analyzed using the Mann-Whitney U-test.

**Results and discussion:** 28 subjects were randomized and completed the study. Patients' baseline characteristics were not different between the groups (Table 1).

	Fentanyl (n=13)	Remifentanyl (n=15)	p value
Age (yr)	51.0 ± 15.0	55.1 ± 12.3	0.42
Sex (M:F)	7:6	9:6	1.00
Height (m)	1.65 ± 0.08	1.63 ± 0.10	0.52
Weight (kg)	63.9 ± 14.9	64.1 ± 12.9	0.96
ASA physical status ( I : II )	6:7	4:11	0.43

[Table 1]

Cortisol measured during and at the end of the surgery was significantly higher in the fentanyl group (Table 2).

Cortisol (mcg dl <sup>-1</sup> )	Fentanyl (n=13)	Remifentanyl (n=15)	p value
Before the surgery	9.5 (6.8-11.4)	9.3 (6.55-14.05)	0.963
An hour after insufflation	14.5 (11.7-21.5)	6.1 (3.45-8.45)	0.001
At the end of the surgery	16.5 (13.2-22.0)	4.1 (1.65-5.90)	<0.001
Next morning	13.9 (10.5-19.2)	16.4 (11.75-22.10)	0.311

[Table 2]

Global median (interquartile range) QoR-40 score was higher in the fentanyl group compared with the remifentanyl group (146.5 [137-168.5] v 133 [124-157];  $p=0.095$ ). Although this difference did not reach statistical significance, a sample size of 33 subjects per group was estimated to achieve 80% power to detect a difference assuming an overall standard deviation of 18.

**Conclusion(s):** Fentanyl may have better quality of recovery than remifentanyl, but a little more number of subjects are necessary.

## 1AP1-7

### Effect of oral intake of preoperative carbohydrate on the metabolism during anesthesia

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**Background and Goal of Study:** Patients undergoing elective surgery are in a state of acute starvation due to overnight fasting. ERAS protocol recommends preoperative carbohydrate loading, since carbohydrate-rich beverage attenuates the postoperative insulin resistance. In the current study, we investigated the effect of preoperative oral intake of carbohydrate on the metabolism during surgery, focusing on the ketogenesis and the respiratory quotient (RQ).

**Materials and methods:** Subjects were ASA I or II and non-diabetic patients of 20-65 years old undergoing oral surgery. They were allocated to two groups: a control group with tap water (group C) and a beverage with 18%/50g glucose group (group G). Patients took the test beverage at 2 hours before anesthesia after overnight fast. The blood glucose (BS) and serum ketone bodies were measured at 2 hours before anesthesia, at the induction of anesthesia, and 1 and 3 hours after the start of anesthesia, respectively. The RQ during anesthesia was evaluated by an indirect calorimeter. All results were expressed as mean±SD and statistical analyses were performed using the SPSS 21.0.

**Results and discussion:** Seventeen patients participated in this study: in the group C (n=9) and G (n=8). There was no significant difference in the background of patients between groups. BS in the group C was stable during anesthesia.

BS in the group G, however, decreased temporarily at 1 hour after the start

of anesthesia than at the induction of anesthesia (89±18 vs 66±17 mg/dL;  $p=0.020$ ). Ketone bodies level in the group C became significant higher at 1 hour after the start of anesthesia than that in the group G (168±154 vs 38±17.7 micromol/L;  $p=0.017$ ). Ketone bodies in the group G were maintained normally until 1 hour after the start of anesthesia, but increased significantly at 3 hours after the start of anesthesia (38±13.1 vs 181±88.4 micromol/L;  $p=0.044$ ).

The RQ in the group C were stable at low levels between 0.84 and 0.79, while the RQ in the group G at 1 hour after the start of anesthesia were higher than that in the group C and decreased significantly at 3 hours after the start of anesthesia (0.99±0.16 vs 0.83±0.11;  $p=0.028$ ).

**Conclusion(s):** Oral intake of carbohydrate-rich beverage containing 50g of glucose before anesthesia may be useful to suppress the catabolism and maintain glucose metabolism during anesthesia, but it may be effective only for first one or two hours after the start of anesthesia.

## 1AP1-8

### Control of the postoperative nausea and vomiting using a bispectral index-guide anesthesia and its economic impact

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**Background and Goal of Study:** PONV occurring between 20% and 30% of patients and between 70% to 80% of patients at high risk<sup>1</sup>. Pharmacological prophylaxis should be administered to patients with moderate or high risk of PONV. BIS monitoring reduces the anesthetic drug requirement in patients under anesthesia.

We have studied the effect of Bispectral index-guide anesthesia (BIGA) on the reduction of Postoperative Nausea and Vomiting (PONV) and its economic impact.

**Materials and methods:** In a prospected and randomized study we have enrolled 480 cases of gynecological laparoscopy surgery in women, age 18-72( mean 48),ASA I-II,240 with BIGA (group A) and 240 not (B). We have divided these 2 groups in three sub-groups, low, moderate and high risk of PONV according risk score<sup>2</sup>. All patients were given a balanced general anesthesia (induction with Propofol and maintenance with Desflurane, no N<sub>2</sub>O). Prophylactic antiemetic has been administered to patients with moderate (5-HT<sub>3</sub>antagonist,ondansetron) or high risk (ondansetron + dexamethasone), no one for low risk. The P values was derived from the X<sup>2</sup> Test.

**Results and discussion:** The incidence of PONV in the group A (14,7%) was lower than in B (27,4%) especially in the patients with moderate and high risk as shown in table on the following page.

risk	Patients with vomiting			total	desflurane cost mean cost euro/min
	low	moderate	high		
Group A	8	11	17	36	0.57
Group B	13	22	32	67	0.86
p value	0.24	0.031	0.023	0.0056	
BIS electrode cost					12.0 euro

[Table 1]

The use of BIS monitoring reduced Desflurane consumption by 38,6% between group A and B. Statistical analysis showed significant difference between groups with moderate and high risk of PONV. The cost difference in the consumption of desflurane between the two groups was 0.29 €/min, the cost of sensor was €12 per patient.

**Conclusion(s):** Our data suggest that a BIGA, associated with antiemetic therapy, can reduce the incidence of PONV especially in patients with moderate or high risk. The cost of BIGA is amortized with anesthesia longer than 40 min. For these reasons we consider the use of BIGA justified.

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**1AP1-9****Predictors of early mobilisation in primary total hip and knee arthroplasty patients on an enhanced recovery programme (ERP)**Wade S.<sup>1</sup>, Eitel C.<sup>1</sup>, Ayres B.<sup>2</sup><sup>1</sup>St Richards Hospital, Dept of Anaesthesiology, Chichester, United Kingdom,<sup>2</sup>St Richards Hospital, Surgical Data Analysis, Chichester, United Kingdom

**Background:** Prolonged postoperative immobility decreases muscle strength, tissue oxygenation and pulmonary function, placing the patient at increased risk of thrombo-embolism and other complications [1]. A key component of ERP is early mobilisation, which has been shown to minimise risks and significantly reduce length of stay.

The aim of our study was to identify factors that predicted early mobilisation after primary arthroplasty surgery.

**Methods:** All patients undergoing elective primary total hip or knee arthroplasty were enrolled onto an ERP involving standardised premedication, anaesthetic, surgical techniques and postoperative analgesia. Day 0 mobilisation was encouraged in all patients.

Data was collated prospectively from anaesthetic charts and real time ward review by a dedicated ERP data analyst. Parameters compared with day mobilised included gender, age, ASA score, BMI, diabetic status, type of anaesthetic and postoperative analgesic regime. One-way ANOVAs were used to check for statistical differences ( $P < 0.05$ ) in day mobilised between the independent variables.

Where there were greater than two independent variables, post-hoc analysis required t-tests with a Bonferroni adjustment.

**Results:** Between December 2012 and November 2013, 1203 patients underwent primary arthroplasty, of which 665 (55%) were knees.

Regarding hip arthroplasty, a significant difference was found in day of mobilisation between males (day 0.8) and females (day 1.0) ( $F 13.68_{(1)}$ ,  $P < 0.001$ ). Diabetic patients mobilised earlier than non diabetics (diabetes: 0.77; non diabetes: 0.95;  $F 5.34_{(1)}$ ,  $P 0.02$ ). Type of anaesthetic used had a significant effect on day mobilised ( $F 4.00_{(3)}$ ,  $P 0.01$ ), with post-hoc analysis showing patients having spinal/sedation (day 0.9) mobilised earlier than those having combined spinal/GA (day 1.3).

Significant differences were also seen between patients who received standard post-operative analgesic regimes and those who did not. No significant differences were seen between ASA score, BMI or age.

For knee arthroplasty, no significant differences were identified.

While a similar trend was seen in type of anaesthetic on day mobilised (spinal/sedation: day 0.73, spinal /GA: day 1.04), no significant differences were identified ( $F 2.11_{(5)}$ ,  $P 0.06$ ).

Gender	Male	Female					Statistical Analysis	
THR	0.80	1.00					$F 13.68_{(1)}$ , $P < 0.001$	
TKR	0.71	0.78					$F 3.15_{(1)}$ , $P 0.08$	
ASA	1	2	3	4				
THR	0.83	0.90	1.02	1.17			$F 1.83_{(3)}$ , $P 0.14$	
TKR	0.65	0.75	0.76	1			$F 1.10_{(3)}$ , $P 0.34$	
BMI	12-18	19-24	25-29	30-39	40+			
THR	2	0.95	0.90	0.86	0.96		$F 6.71_{(4)}$ , $P 2.81$	
TKR	0.5	0.77	0.76	0.72	0.79		$F 0.43_{(4)}$ , $P 0.79$	
AGE	<40	41-50	51-60	61-70	71-80	81-90		
THR	0.67	0.93	0.79	0.94	0.92	1.01	$F 0.96_{(5)}$ , $P 0.45$	
TKR	0.61	0.80	0.68	0.78	0.80	0.61	$F 1.72_{(5)}$ , $P 0.13$	
DIABETES	Diabetes	No Diabetes						
THR	0.77	0.95					$F 5.34_{(1)}$ , $P 0.02$	
TKR	0.76	0.74					$F 0.07_{(1)}$ , $P 0.80$	
TYPE OF ANAESTHETIC	Spinal	GA	Spinal & GA	Block & GA				
THR	0.90	0.89	1.3	0.75			$F 4.00_{(3)}$ , $P 0.01$	
TKR	0.73	0.81	1.04	0.83			$F 2.11_{(3)}$ , $P 0.06$	
GABAPENTIN DAY 0	0	300	600					
THR	1.21	0.92	0.90				$F 3.81_{(2)}$ , $P 0.02$	
TKR	0.67	0.74	0.75				$F 0.31_{(2)}$ , $P 0.73$	
OXYCONTIN	DAY 0 (Y)	DAY 0 (N)	DAY 1 AM (Y)	DAY 1 AM (N)	DAY 1 PM (Y)	DAY 1 PM (N)		
THR	0.91	1.16	0.89	1.21	0.89	1.14	0-F 4.79 <sub>(1)</sub> , P 0.03 A-F 11.31 <sub>(1)</sub> , P 0.001 P-F 10.20 <sub>(1)</sub> , P 0.001	
TKR	0.74	0.75	0.74	0.88	0.74	0.82	0-F 0.00 <sub>(1)</sub> , P 0.97 A-F 3.06 <sub>(1)</sub> , P 0.08 P-F 1.46 <sub>(1)</sub> , P 0.22	

[Average day of mobilisation + statistical analysis]

**Conclusion(s):** Patients having primary hip arthroplasty mobilise significantly earlier if they are male, receive spinal anaesthetic without GA, and adhere to prescribed analgesic regimes.

**1AP1-10****Anaesthesia associated anaphylaxis: a review of five years data from a British joint anaesthetist/immunologist allergy clinic**Low A.<sup>1</sup>, Karanam S.<sup>2</sup>, North J.<sup>2</sup>, Kong K.-L.<sup>1</sup><sup>1</sup>Sandwell and West Birmingham NHS Trust, Dept of Anaesthesiology,Birmingham, United Kingdom, <sup>2</sup>Sandwell and West Birmingham NHS Trust, Immunology, Birmingham, United Kingdom

**Background and Goal:** It is mandatory for patients suffering suspected anaesthetic related anaphylaxis to be investigated by both an immunologist and an anaesthetist, according to UK national guidance.<sup>1</sup>

The aims of this study are to examine the causative agents and nature of anaphylactic reactions during anaesthesia in patients attending a regional joint speciality allergy clinic.

**Methods:** An observational study of patients referred to our clinic between September 2007 - June 2013. 302 patients were reviewed. Referral details and clinic diagnosis were entered into a database retrospectively (ratified by our hospital's clinical effectiveness department). Patients were analyzed in two cohorts: those referred following an intra-operative reaction (the postoperative group); and those with a previous history of reaction (the pre-operative group).

**Results and Discussion:** Of 240 postoperative patients, 54% were diagnosed with IgE allergic anaphylaxis. The causative agents were muscle relaxants (40.7%), antibiotics (30%), latex (7.6%), chlorhexidine (6.1%) and patent blue dye (5.3%). 64.6% of the allergic anaphylactic reactions were severe (grade 3)<sup>2</sup>. Only 52.9% of patients had blood taken for serum tryptase analysis. The causal agent suspected by the referring clinician was confirmed in 39.8% of cases. Of 62 pre-operative patients, 40% had IgE mediated anaphylaxis, causes were: muscle relaxants (56%), antibiotics (12%), local anaesthetics (12%) and propofol (8%). The cardiovascular system was most commonly involved in confirmed IgE anaphylaxis compared to muco-cutaneous in the non-allergic anaphylaxis patients.

We will discuss how our data compare with other published European studies regarding causative agents. All patients were given written advice regarding conduct of future anaesthetics.

**Conclusion:** The main causative agents for anaesthetic anaphylaxis in our study were muscle relaxants, antibiotics, latex and patent blue dye. Serum tryptase sampling remains variable. Investigating anaphylaxis during anaesthesia can be challenging and it is essential to adhere to published guidelines.

**References:**

1. Membership of the Working Party: N.J.N. Harper, T. Dixon, P. Dugue et al. Guidelines: Suspected Anaphylactic Reactions Associated with Anaesthesia. *Anaesthesia*; 2009; 64:199-211

2. Brown SGA. Clinical features and severity grading of anaphylaxis. *J Allergy Clin Immunol* 2004;114:371-375

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**1AP2-1****A systematic review on the reliability of the American Society of Anesthesiologists' physical status**Parenti N., Martini N., Cantaroni C., Poli M., Biscione R., Saravo L.  
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**Background and Goal of Study:** Previous studies showed divergent conclusions on the American Society of Anesthesiologists' Physical Status (ASA-PS) reliability. The suggested measure of score's reliability is the kappa statistic (1). For this reason we conducted a systematic review to check the level of reliability of the ASA-PS and the quality of reporting of literature on this topic.

**Materials and methods:** This is a systematic review based on the PRISMA guideline on reporting systematic reviews. The systematic search of the international literature published from 1940 through 30 November 2013 in the PubMed, Embase, Cochrane Library, Web of Knowledge, and Scopus databases. We used ASA physical status as key word. Inclusion criteria were studies who investigated the reliability of the ASA-PS using kappa statistic. Three researchers selected studies using inclusion criteria and then assessed their quality using the STARD guidelines based on 25 items.

**Results and discussion:** Four studies were included and 2759 were excluded. Three studies were conducted using scenarios; two in adult and two in paediatric patients. There was only one prospective study with real patients. All studies included were conducted after 2002; two in the USA. The kappa value ranged from 0.21 to 0.53. Only one study respected more than 60% of items of STARD guidelines.

**Conclusion(s):** In this review, the American Society of Anesthesiologists' Physical Status shows fair to moderate interrater reliability. In accordance with the STARD guidelines three of four studies showed a low quality of reporting.

**References:**

1) Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977; 33: 159-174.

**Acknowledgements:** Dr. F Gelli, M Rizzi, P Trombetti

## 1AP2-2

### Postoperative adverse outcomes after major surgery in HIV-infected patients: a nationwide matched cohort study

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**Background and Goal of Study:** Patients infected with human immunodeficiency virus (HIV) were known to have a higher risk of complications during hospitalization. However, the association between HIV-infection and postoperative major adverse events among surgical patients has not been well validated in any large sample, well matched, confounders adjusted, and clinical severity-related study.

**Materials and methods:** We conducted a population-based study in 2566 HIV-infected patients and propensity-score matched 10,264 non-HIV controls receiving a broad range of various major surgeries from the Taiwan National Health Insurance Research Database from 2004 to 2010. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of major postoperative complications and 30-day mortality were evaluated.

**Results and discussion:** HIV-infected patients had higher risks of postoperative pneumonia, septicemia, acute renal failure, surgical infection, overall complications (OR 2.22; 95% CI 1.71-2.14), and 30-day postoperative mortality (OR 5.01; 95% CI 3.19-7.88), particularly in those with viral hepatitis, pulmonary tuberculosis, diabetes, preoperative HIV-related hospitalization, opportunistic infection and highly active antiretroviral therapy (OR 6.91; 95% CI 3.74-12.8). Besides pneumonia, surgical site infection and septicemia, acute renal failure was first identified in our study as one of the major postoperative complications for the surgical patients with HIV-infection receiving in-hospital major surgeries when comparing with controls after adjusting all preexisting covariates.

Our study suggests that HIV-infected patients encountered higher incidences of admission to intensive care unit and higher rates of postoperative complications, consumed more medical resources with increased medical expenditures, and longer hospital stay than patients without HIV infection. In particular, 30-day postoperative mortality rates were significantly higher in HIV-infected patients with coexisting medical conditions, opportunistic infection, venereal diseases, previous history of emergency visits and hospitalization for HIV care before surgery.

**Conclusion(s):** HIV-infected patients showed significantly higher postoperative adverse outcomes rates with fivefold risk of 30-day mortality when compared with patients without HIV infection. Our findings call special attention and urgency revising the protocol of postoperative care for this specific population.

## 1AP2-3

### Economic impact of unnecessary preoperative testing after application of a practice advisory for preoperative testing in a portuguese tertiary care hospital

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**Background and Goal of Study:** There is insufficient evidence to identify explicit decision parameters or rules for ordering preoperative tests (POT) on the basis of specific clinical characteristics.

Therefore this decision-making process must rely primarily upon practice advisories. The aim of this study is to evaluate whether POT are ordered unnecessarily and its economic impact in a tertiary care hospital (TCH) by application of a practice advisory (PA) for preoperative testing developed by the department of anesthesiology.

**Materials and methods:** The authors selected a randomized sample of non obstetric adult patients, submitted to elective orthopaedic, urologic or general surgery in a TCH during 2012. The PA was then applied. The PA consisted in

two patient variable categories, from which POT were selected. One was the type of surgery and the other the patient clinical characteristics. Any test requested 6 months before the surgery was considered a POT. The POT indeed requested were compared with the POT indicated under the PA. The amount of POT ordered in excess was determined. The direct costs were calculated based on the individual price of each POT. ANOVA correlation test with Bonferroni post-hoc correction was used to analyse if there was any significant correlation between the POT requested or the patient characteristics, with the month in which data was collected, or with the surgical speciality.

**Results and discussion:** Data from 392 patients was obtained, corresponding to 9.2% of the total study population. Table 1 shows the absolute number and relative percentage of the POT ordered in excess.

Haemogram	Blood Biochemistry	Hepatic function	Coagulation study	Electrocardiography	Trans-thoracic echocardiogram	Respiratory function test	Blood gasometry	Chest X-ray
133	146	114	290	81	26	18	38	106
38%	43%	88%	89%	33%	100%	100%	88%	94%

[POT ordered in excess]

Table 2 shows the cost of each exam and the total overspending for each.

Haemogram	Blood biochemistry	Hepatic function	Coagulation Study	Electrocardiography	Trans-thoracic echocardiogram	Respiratory function test	Blood gasometry	Chest X ray
6,4€	7,6€	7,4€	5,9€	6,5€	38,8€	22,6€	10,8€	5€
851€	1109€	844€	1711€	527€	1009€	407€	410€	530€

[Cost of each exam and total overspending in euros]

The total amount of money that could be saved if this PA was used would be of €7,397. There was significant positive correlation between the majority of POT requested and orthopaedic and general surgery.

**Conclusion(s):** POT were largely ordered in excess. Assuming our sample is representative of the total population, the savings in preoperative testing would be of €80,405. This PA should be disclosed at this TCH as a tool to help reducing overspending.

## 1AP2-4

### Predictors of acute kidney injury in patients undergoing vascular surgery: a retrospective analysis

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**Background and Goal of Study:** Postoperative Acute Kidney Injury (AKI) is associated with high morbidity and mortality. Patients undergoing major vascular surgery are at risk of developing AKI. Baseline renal function, ischemia time and intraoperative hypotension should be the key determinants of postoperative AKI. Recently Berg et al. investigate perioperative variables associated with AKI following cardiac surgery[1]. The aim of this study was to evaluate if the model of Berg et al. is able to predict the development of AKI after major vascular surgery.

**Materials and methods:** This retrospective study was performed between 2012 and 2013. All adult patients undergoing major vascular surgery at Sant' Anna Hospital were enrolled. Data were collected from anesthesiology medical records and laboratory information system. The onset of AKI was defined both as a relative increase in serum creatinine concentration of at least 50% or an absolute increase in serum creatinine concentration of 0.3 mg/dl [2]. Fluid replacement was performed with Ringer Lactate and/or Gelofusine 4%.

**Results and discussion:** Among the 134 enrolled patients, 40 (30%) developed AKI. Applying the Berg's model to our data the area under the curve was 0.56. The univariate associations of variables related to AKI are shown in Table 1; the same variables were included in the multivariable analysis, which shows that none of the parameters was able to predict AKI.



	Normal renal function (n=94)	AKI (n=40)	p value
<i>Preoperative</i>			
Age	73.5±9	72.8±6	0.62
BMI over 30	15%	15%	0.89
Previous vascular surgery	35%	26%	0.35
Lipid lowering treatment	31%	37%	0.50
COPD	15%	37%	0.007
Hypertension	85%	63%	0.006
Serum Creatinine (mg/dl)	1.46±0.7	1.37±1	0.68
Hb before surgery	12.1±2	13.5±2	<0.001
<i>Intraoperative</i>			
Emergency support	37%	20%	0.09
Need of inotropic support	21%	35%	0.09
Lowest Hb	9.8±0.7	8.7±0.65	0.38
Vasoconstrictor	29%	27%	0.62
Ringer Lactate (ml)	3000±750	3750±825	0.008
Gelofusine (ml)	400±150	750±175	<0.001
Need of RBC transfusion	21%	30%	0.28
Duration of surgery (h)	5±1	5.5±1.2	0.12
Fluid administration (ml/kg/h)	9.2±4	12.3±4.5	0.003
Inta-operative urine output (ml/kg/h)	1.1±0.5	1.8±0.8	p=0.01

[Table 1]

**Conclusion:** Our data suggest that the risk of developing AKI is related to preoperative comorbidity status and the type of surgical procedure. However, Berg's model for predicting AKI should not be used in presence of major vascular surgery, unless additional intraoperative variables are added.

**References:**

1. KS Berg, R Stenseth, A Wahba et al. How can we best predict acute kidney injury following cardiac surgery. *Eur J anaesthesiol* 2013; 30:704-712
2. Metha RL, Kellum JA, Shah SV et al. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. *Crit Care* 2007; 11:R31

**1AP2-5**

**Can patients recall anaesthesia information provided by the Pre-operative Anaesthesia Assessment Clinic (PAAC)?**

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**Background and Goal of Study:** Informed consent is a vital component of the practice of medicine, and fulfils the ethical principle of autonomy. However, though patients may initially comprehend the information provided at the PAAC, it is not known how well this information is retained.

We designed this study to evaluate the adequacy of recall of anaesthesia information counselled at the PAAC and to identify patient groups prone to poor recall.

**Methods:** In this prospective observational study, we recruited 901 adult elective surgical patients seen at the PAAC of Changi General Hospital in Singapore over 3 months. At the PAAC, days to weeks before the actual surgery, the types of anaesthesia and possible anaesthesia-related complications were verbally counselled to patients. On the day of surgery, prior to anaesthesia, subjects were asked to recall this information conveyed previously at the PAAC. Items successfully recalled were compared against the information counselled.

**Outcome measures:** Percentage recall of items counselled. Other factors that may influence recall, including patient demographics, educational level, occupation, previous anaesthesia, duration between PAAC visit and surgery, and seniority of anaesthetist counselling the patient were also recorded.

**Results:** Out of 901 patients, 59.1% did not recall any items. 94.4% recalled 50% or less of all items counselled. Only 5.6% had >50% recall. Majority of patients (52.6%) recalled the type of anaesthesia to be administered, but only 10.6%, 7.7% and 7.1% of patients could recall >50% of minor, major and regional anaesthesia (RA) complications counselled, respectively. 66.3%, 81.7% and 84.3% of patients had no recall of any minor, major, and RA complications counselled, respectively.

Univariate analyses showed that seniority of the counsellor, patient gender and duration between PAAC visit and surgery did not affect recall significantly. However, patients aged 50 years and above (p < 0.001), with primary level education (P=0.001), unemployed or retired (p < 0.001), and with no previous anaesthesia (p=0.004) had poorer recall.

**Conclusion:** There is often inadequate recall of anaesthesia information counselled prior to surgery at the PAAC. Certain groups of patients have been identified to be more prone to poor recall, and ways should be sought to improve this situation.

**1AP2-6**

**Validation of a patient self-administered pre-anaesthetic screening questionnaire**

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**Background and Goal of Study:** To structure and standardize the perioperative assessment process questionnaires are used. In order to further modernize logistic processing a patient self-administered questionnaire was designed based on a national (Dutch) minimal dataset (table 1). This study describes the validation of this questionnaire.

**Materials and methods:** After local approval from our institution's audit committee, a sample size of 457 subjects was calculated. In total 471 patients were recruited (demographics shown in table 2). The patient self-administered questionnaire, containing 49 items, was set in a web-based preoperative assessment system in a general teaching hospital. Evidence of criterion validity was evaluated by the agreement between the patient's responses and the PA's assessment (being the "gold standard"). Percentage agreement was used as measure of criterion validity

**Results and discussion:** 44 questions were ranked to have moderate to good criterion validity (table 3a). The 5 questions that gained poor criterion validity were further assessed. In general, most of the mismatches were either caused by semantics or ambiguity in the interpretation of the specific question. After correcting the raw data set only 2 questions remained classified as poor criterion validity (table 3b).

No.	Question	Response
<b>General items</b>		
1	Ask you or grand physical condition?	Yes / No / uncertain
2	Do you ever use medication?	Yes / No / uncertain
3	Do you have high blood pressure?	Yes / No / uncertain
4	Do you have a high cholesterol level?	Yes / No / uncertain
5	Do you suffer from diabetes?	Yes / No / uncertain
6	Have you ever had symptoms related to the heart (e.g. in the chest or the back) before and not being long (e.g. after a walk) without an explanation?	Yes / No / uncertain
7	Have you ever had symptoms related to the heart (e.g. in the chest or the back) before and not being long (e.g. after a walk) without an explanation?	Yes / No / uncertain
8	Have you ever had symptoms related to the heart (e.g. in the chest or the back) before and not being long (e.g. after a walk) without an explanation?	Yes / No / uncertain
9	Are you allergic (over-sensitivity) to certain substances?***	Yes / No / uncertain
10	Do you smoke?	Yes / No / uncertain
11	Do you use hard drugs such as cocaine, heroin, XTC, or have you ever done so?	Yes / No / uncertain
12	Do you ever use alcohol?	Yes / No / uncertain
13	Do you suffer from motion sickness (sea sickness, car sickness, etc.)?	Yes / No / uncertain
14	Are there any other, not yet mentioned, symptoms related to the patient's medical history?	Yes / No / uncertain
15	Do you have neurological symptoms (e.g. tingling, numbness, weakness)?	Yes / No / uncertain
16	Do you suffer from asthma?	Yes / No / uncertain
17	Do you regularly visit your general practitioner?	Yes / No / uncertain
<b>Anaesthesia items</b>		
18	Have you ever undergone an operation (under general or locoregional anaesthesia)?	Yes / No / uncertain
19	Did you experience any problems with the anaesthesia?	Yes / No / uncertain
20	Did anyone in your family experience any problems with anaesthesia?	Yes / No / uncertain
21	Are you feeling anxious especially for operations unrelated to the condition you are undergoing now?	Yes / No / uncertain
22	Are you feeling nervous about the planned operation (anaesthesia)?	Yes / No / uncertain
23	Do you have a preference for a particular type of anaesthesia?*	Yes / No / uncertain
<b>Agency assessment</b>		
24	Do you have a strongly reduced mobility in your neck or jaw?	Yes / No / uncertain
25	Do you have serious problems opening your mouth (less than 2 finger widths)?	Yes / No / uncertain
26	Do you have serious dental problems?	Yes / No / uncertain
<b>Cardiac assessment</b>		
27	Are you concerned by the condition of your heart (circulation)?**	Yes / No / uncertain
28	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
29	Have you ever suffered a heart attack?	Yes / No / uncertain
30	Have your heart ever stopped spontaneously?	Yes / No / uncertain
31	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
32	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
33	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
34	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
35	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
36	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
37	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
38	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
39	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
<b>Respiratory assessment</b>		
40	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
41	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
42	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
43	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
44	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
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76	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
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79	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
80	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
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88	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
89	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
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93	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
94	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
95	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
96	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
97	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
98	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
99	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain
100	Have you ever had a stroke, light or unconsciousness leading to your death?	Yes / No / uncertain

[Table 1: The 49-item containing questionnaire]

Parameter	Average	95% CI*
Age	50.8	49,5 - 52,1
BMI	26.2	25,6 - 26,8
Gender	Male 60% Female 40%	
AP 1	94,80%	
AP 2	1,87%	
AP 3	1,24%	
AP 4	0,21%	
CHF 1	95,44%	
CHF 2	1,66%	
CHF 3	1,24%	
CHF 4	0,21%	
DM	5,30%	
COPD 1	86,72%	
COPD 2	10,37%	
COPD 3	2,70%	
COPD 4	0%	
HT	23,70%	
ASA 1	51,87%	
ASA 2	43,36%	
ASA 3	3,53%	
ASA 4	0,21%	

[Table 2: Demographics]

BMI: body mass index. AP: angina pectoris (NYHA classification). CHF: congestive heart failure (NYHA classification). DM: diabetes mellitus. COPD: chronic obstructive pulmonary disease (GOLD classification). HT: hypertension. ASA: American society of anaesthesiologist physical rating scale

Question	% Agreement (a)	Criterion Validity (a)	% Agreement (b)	Criterion Validity (b)
1	91.3	Moderate	91.3	Moderate
2	90.0	Moderate	90.0	Moderate
3	88.9	Poor	88.1	Moderate
4	90.3	Good	90.3	Good
5	98.7	Good	98.7	Good
6	98.9	Good	98.9	Good
7	99.1	Good	99.1	Good
8	92.1	Moderate	92.1	Moderate
9	98.8	Good	98.8	Good
10	93.6	Moderate	93.6	Moderate
11	97.8	Good	97.8	Good
12	99.4	Good	99.4	Good
13	98.1	Good	98.1	Good
14	93.4	Moderate	93.4	Moderate
15	96.8	Good	96.8	Good
16	97.2	Good	97.2	Good
17	95.1	Good	95.1	Good
18	89.6	Poor	89.7	Moderate
19	96.6	Good	96.6	Good
20	94.4	Moderate	94.4	Moderate
21	93.4	Moderate	93.4	Moderate
22	94.2	Moderate	94.2	Moderate
23	70.6	Poor	71.9	Poor
24	99.9	Good	99.9	Good
25	98.6	Good	98.6	Good
26	97.2	Good	97.2	Good
27	88.8	Poor	88.8	Poor
28	91.9	Moderate	91.9	Moderate
29	96.6	Good	96.6	Good
30	99.1	Good	99.1	Good
31	98.9	Good	98.9	Good
32	92.9	Moderate	92.9	Moderate
33	96.3	Good	96.3	Good
34	98.3	Good	98.3	Good
35	98.5	Good	98.5	Good
36	98.7	Good	98.7	Good
37	96.9	Good	96.9	Good
38	99.2	Good	99.2	Good
39	97.8	Good	97.8	Good
40	94.6	Moderate	94.6	Moderate
41	98.9	Good	98.9	Good
42	98.7	Good	98.7	Good
43	97.6	Good	97.6	Good
44	99.1	Good	99.1	Good
45	97.0	Good	97.0	Good
46	97.2	Good	97.2	Good
47	92.9	Good	92.9	Good
48	98.1	Good	98.1	Good
49	98.9	Good	98.9	Good

[Table 3 (a) and (b): Percentage agreement and criterion validity of raw data (a) and corrected data (b)]

**Conclusion(s):** For these 2 questions “Do you have a preference for a particular type of anaesthetic?” and “Are you restricted by the condition of your heart (-function)?” alternative, more unambiguous questions have to be formulated. Although adaptation of these 2 questions is needed, in our opinion, this questionnaire can be used as a triage system tool, in automated preoperative assessment.

## 1AP2-7

### A multicenter study on the reliability of the American society of anesthesiologists’ physical status

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**Background and Goal of Study:** There are several studies on the American Society of Anesthesiologists’ Physical Status (ASA-PS) reliability but few studies were planned with a large population of patients and with the kappa statistic. To our knowledge there are not Italian reports on this topic.

For this reason we conducted a study on the inter-rater reliability of ASA-PS among a large group of Italian anesthesiologists in a large population of patients’ scenarios.

**Materials and methods:** This is a multicenter study conducted from July to November 2013 in two Italian hospitals. Twenty anesthesiologists were included to independently assign an ASA grade to 60 scenarios of patients who were undergoing to elective surgery. Scenarios were selected randomly from the clinical database of two hospitals and included patient demographic and clinical characteristics, the pre-surgery diagnosis. Quadratic weighted, unweighted kappa (Fleiss K) and Kendall’s concordance were used to calculate inter-rater reliability. Sample size of scenarios and raters was calculated using a confidence interval approach (1).

**Results and discussion:** Of the 60 patients included in scenarios 50 % were women, the mean age was 60,8 years (SD ± 19,6) ; there were 6/60 Intensive Care admissions after the surgery. The median years of experience in anaesthesia among the 20 raters was 9 (range 3-30 ). The distribution of ASA-PS grades was: ASA 1 =5%, ASA2=40%, ASA 3=35%, ASA 4= 18,3%, ASA 5=1,7%. The quadratic weighted k value was : 0,76; unweighted k (Fleiss) =0,47 ; weighted linear k=0,77; Kendall’s concordance=0,73. The weighted k values among ASA grades were 0,58 for ASA grade 1, 0,83 for grade 2, 0,78 for grade 3, 0,69 for grade 4, 0,75 for grade 5. In previous studies the ASA-PS showed a fair to moderate interrater reliability.

**Conclusion(s):** The ASA-PS shows a good inter-rater reliability. To our knowledge, this is the first multicentre Italian study which tests the reliability of the ASA-PS.

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## 1AP2-8

### Investigation on acute kidney injury following colorectal surgery: predictors, impact on the postoperative outcome, and comparison of predictability in outcome between AKN and RIFLE criteria

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**Background and Goal of Study:** There have been several studies on the acute kidney injury(AKI) diagnosed by the Acute Kidney Injury Network(AKIN) and the risk, injury, failure and end stage renal disease(RIFLE) classification in various surgical settings. Also, it has been investigated which criteria predicts the outcome better in some surgical settings. However, that information on postoperative AKI developed after colorectal surgery is quite limited. The objectives of this study were :1) to investigate the incidence and predictors of AKI in colorectal surgery by both AKIN and RIFLE criteria; 2) to evaluate the impact of AKI on the 30 day mortality and long-term mortality, and 3) to compare the ability in predicting outcome of both criteria.

**Materials and methods:** We conducted a retrospective review of the medical records of total 4237 patients underwent colorectal surgery between 1.1, 2008-12. 30, 2011. Postoperative AKI was diagnosed by AKIN and RIFLE criteria. Logistic regression to investigate the predictors of AKI and survival analysis including Kaplan-Meier method with log rank test and a Cox proportional hazard analysis with inverse probability of treatment weighting (IPTW) to assess the impact of AKI on 30-day and overall mortality were performed. Also, we compared the ability in predicting outcome of both criteria using diagnostic likelihood ratio test.

**Results and discussions:** The incidence of AKI was higher in AKIN (9.2%) than RIFLE criteria (5.7%) ( $P < 0.01$ ). The predictors of RIFLE criteria were albumin  $< 3.9$ , increasing ASA status, emergent surgery, intraoperative use of diuretics, use of sevoflurane, postoperative RBC transfusion, and history of hypertension and diabetics. For AKIN criteria, including the items described above except sevoflurane use, age  $> 70$  years and male sex were associated with AKI. AKI patients diagnosed by either AKIN or RIFLE criteria had higher 30-day overall mortality ( $P < 0.001$ ). Cox proportional hazard analysis indicated that AKI diagnosed by AKIN was associated with 30-day ( $P < 0.01$ ) and overall mortality ( $P = 0.04$ ), although AKI by RIFLE criteria was associated only with 30-day mortality AKI even after IPTW adjustment. There was no significant difference in the outcome predicting power between AKIN and RIFLE criteria.

**Conclusion:** This study demonstrated that AKI after colorectal surgery is associated with 30 day mortality, although it is not evident that postoperative AKI is related to overall mortality.

## 1AP2-9

### Early and late postoperative health status: patient's perception

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**Background and Goal of Study:** Quality of recovery (QoR) after anaesthesia is an important measure of the early postoperative health status. The aim of our study was to compare QoR with Quality of Life (QoL) 3 months after surgery.

**Materials and methods:** Observational prospective study conducted in adults scheduled for elective surgery in June 2013. QoR was evaluated with the 15-item QoR questionnaire (QoR-15), which contains 5 dimensions: Physical Comfort (PC), Emotional State (ES), Patient Support (PS), Physical Independence (PI) and Pain. We performed QoR-15 preoperatively (T0) and one day after surgery (T1). QoL was measured with EuroQol 5-Dimension questionnaire (EQ-5D) at T0 and 3 months after surgery (T3). EQ-5D is a standardised instrument to measure health outcome and contains a Visual Analogue Scale (EQ5D-VAS) and 5 dimension questions: Mobility (M), Self-Care (SC), Usual Activities (UA), Pain/Discomfort (PD) and Anxiety/Depression (AD). The primary end point was QoR at T1 and QoL at T3. Poor Quality Recovery (PQR) is defined as QoR-15 score less than one standard deviation below the group mean at T1. Non-parametric tests were performed for comparisons between numerical variables and Chi-Square test for categorical variables.

**Results and discussion:** 204 patients completed the study. At T1, the global mean QoR-15 score was  $112.12 \pm 22.03$ . PQR was identified in 31 patients (15.0%). At T0, QoR-15 scores did not differ between patients with and without a PQR (123 vs 131,  $p = 0.091$ ). According to the various QoR-15 dimensions, there were no differences at T0. However, at T1, PQR patients showed lower scores for all QoR-15 dimensions: ES (19 vs 34,  $p < 0.001$ ), PI (3 vs 15,  $p < 0.001$ ), PC (29 vs 41,  $p < 0.001$ ), Pain (10 vs 16,  $p < 0.001$ ) and PS (16 vs 20,  $p < 0.001$ ). At T0, there were no differences in the EQ5D-VAS between patients with and without PQR (66 vs 70,  $p = 0.397$ ). However, at T3, PQR patients had lower results for EQ5D-VAS (66 vs 79,  $p = 0.01$ ). They had more problems related with SC (40.7% vs 22.7%,  $p = 0.049$ ), UA (63% vs 29.2%,  $p = 0.001$ ), M (57.7% vs 25.2%,  $p = 0.001$ ) and PD (55.6% vs 35.7%,  $p = 0.046$ ). There were no differences for AD.

**Conclusions:** Patients who had a PQR refer lower QoL 3 months after surgery, compared to those without a PQR. This supports the belief that a PQR may predict a poor QoL after surgery. Hence, QoR-15 might be used as a predictive index to identify patients whose health status is about to change, and those who might need special care.

## 1AP2-10

### High STOP-BANG and bariatric surgery

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**Background and Goal of Study:** The STOP-Bang questionnaire is a screening tool that enables the identification of obstructive sleep apnoea (OSA) and may be used to determine its severity in surgical patients. The aim of this study was to determine the impact of a high STOP-Bang score in the incidence of postoperative complications after bariatric surgery (BS).

**Materials and methods:** After study approval by the institutional ethics committee, a prospective observational study was conducted for 3 months. Sixty-five patients undergoing BS were included. Exclusion criteria were inability to

give consent and pulmonary disease. Data was collected during all perioperative period, including arterial blood gases sampling (ABG) before surgery and at admission and discharge in the post-anaesthesia care unit (PACU). A STOP BANG  $\geq 5$  defined the group at risk for OSA (GR-OSA). We have registered postoperative pain scores and post-operative nausea and vomiting (PONV) and patients were followed for the occurrence of adverse respiratory events (ARE) defined as polypnea, bradypnea, airway obstruction and hypoxia, adverse cardiac events (ACE) defined as arrhythmias, angina and cardiac arrest. Ordinal and continuous data were tested for normal distribution, based on the Kolmogorov-Smirnov test. Descriptive analysis was performed and T student test, Mann-Whitney U test, Fisher's exact test or Chi-square test, were applied. **Results and discussion:** There were 45 (69%) GR-OSA patients. These patients were more frequently male ( $p = 0.029$ ), older ( $48 \pm 9$  vs.  $39 \pm 9$  years old,  $p = 0.001$ ) had more frequently history of previous arterial hypertension (60% vs. 24%,  $p = 0.033$ ) and depression [JM1] (60% vs 18%,  $p = 0.007$ ). GR-OSA patients had lower arterial oxygen saturations (94% vs. 96%,  $p = 0.004$ ) and PaO<sub>2</sub> ( $80.2 \pm 13$  vs.  $87.2 \pm 10$ ,  $p = 0.024$ ) before surgery. These patients also presented worse results in ABG at PACU admission with PaCO<sub>2</sub> ( $49.1 \pm 8.2$  vs.  $43.7 \pm 4.3$ ,  $p = 0.001$ ) and HCO<sub>3</sub><sup>-</sup> ( $24.5 \pm 2.4$  vs.  $22.4 \pm 2.6$ ,  $p = 0.007$ ) and at PACU discharge: PaCO<sub>2</sub> ( $45.4 \pm 6.1$  vs.  $40.3 \pm 4.4$ ,  $p = 0.001$ ) and HCO<sub>3</sub><sup>-</sup> ( $24.7 \pm 2.5$  vs.  $22.4 \pm 2.1$ ,  $p = 0.001$ ). Analgesic consumption, incidence of PONV and ARE were similar. GR-OSA patients did not stay longer in the hospital or in the PACU.

**Conclusions:** The incidence of patients with STOP-Bang  $\geq 5$  was 69%. A STOP-Bang  $\geq 5$  was associated with hypoxemia preoperatively and with higher PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> postoperatively. This study could not find an association between high STOP-Bang and ARE.

## 1AP3-1

### Goal directed fluid therapy does not alter the quantum of fluids administered when compared to conventional targets used in the intensive care setting after major liver resection surgery

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**Background and Goal of Study:** Goal directed fluid therapy (GDFT) is an important component of enhanced recovery pathway (ERP) which is a multidisciplinary strategy shown to reduce the length of hospital stay (LOHS) after major surgery<sup>1</sup>. As a part of an ethically approved randomised control trial (ISRCTN-03274575) evaluating enhanced recovery after open liver resection surgery, we compared the total fluid given in the first six hours in the post-operative phase in the intensive care unit.

**Materials and methods:** Ninety one patients were randomised into two groups; standard peri-operative care ( $n = 45$ ) and ERP ( $n = 46$ ). Elements of ERP included preoperative carbohydrate drink, GDFT, intensive physiotherapy, nutritional supplements and patient education. Both groups were comparable in their age distribution, P-Poosum score, anaesthetic plan and extent of surgical resection. Patients in the ERP group received GDFT based on cardiac output monitoring (LiDCO Rapid), while the standard group were rehydrated according to traditional markers of hypovolemia including blood pressure, lactate levels and central venous saturations (ScvO<sub>2</sub>). The total fluids (oral and intravenous) received in both groups were analysed at 6 hours post resection using Mann-Whitney U test.

**Results and discussion:** The total fluids given to both groups were similar in volume at six hours (2550 mls versus 2750 mls,  $p$  value = 0.071). However patients in the ERP group received significantly more colloids compared to the standard group. Further, the length of LOHS was significantly less for the ERP group (median stay 3 vs 6 days,  $p$  value  $< 0.001$ ).

**Conclusion(s):** Our study suggests that an ERP (incorporating GDFT) is effective in reducing LOHS after major liver resection. Perioperative fluid replacement based on meticulous monitoring for traditional markers is at least as effective as GDFT. However fluid replacement based on traditional markers is reactive to hypoperfusion rather than proactive to prevent it. Further the study also raises the debate of equivalence of crystalloids and colloids in the context of perioperative fluid resuscitation.

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### 1AP3-3

#### Desflurane in comparison to Sevoflurane in cirrhotic patients undergoing major liver resection

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**Background and Goal of Study:** General Anaesthesia for cirrhotic patients undergoing liver resection faces the challenge of possible haemodynamic changes, hepatic and renal dysfunction after resection. Desflurane (D) is compared to Sevoflurane (S) based anesthesia in cirrhotic patients

**Materials and methods:** A prospective hospital based comparative study. 50 cirrhotic patients (Child A) with simple random method (D group n=25 and S group n=25). Maintenance with Et Des or Sevoflurane changes by 1% from MAC to keep Entropy between 40-60. Liver and kidney functions tests, Urinary Microalbuminuria ( Microalb), blood Glutathione-S-transferase (GST), were assayed. Haemodynamics monitored with invasive blood pressure and Transoesophageal Doppler monitors. Extubation time, Inhalational agent consumption and cost, intensive care and hospital stay were recorded. Data presented as mean ± SD.

**Results and discussion:** Mean systemic vascular resistance (SVR) was better preserved with D vs S (835.04±12.02 vs 778.16±11.97dyn.sec.cm<sup>-5</sup>, P< 0.01) respectively, this was also associated with a higher mean Stroke volume (85.72±2.95 vs 76.16±6.52 ml, P< 0.01) respectively. CVP and corrected flow time FTc of Doppler kept within normal ranges. No difference between D and S post resection as regards hepatic and renal functions, blood Glutathione-S-Tranferase (GST) (316.96±16.58 vs 312.48±16.48 IU/ml, P>0.05) and urine Microalbuminuria (7.28±3.35 vs 7.28±3.35 microgram/ml, P>0.05). Extubation time was significantly shorter in D group (4.52±2 versus 7.72±2 min). Desflurane consumption compared to Sevoflurane was 73±17 vs 64±22 ml, P< 0.05, D cost was significantly more economic. No difference in intensive care and hospital stay (P>0.05).

**Conclusion(s):** Desflurane can be considered a more appropriate choice than Sevoflurane in cirrhotic patients undergoing major liver resections from haemodynamics prospective, recovery and costs, but neither is superior to the other in respect to liver and kidney functions.

### 1AP3-4

#### Effect of xenon anaesthesia on relapse-free survival in treatment of breast cancer: relation with immune status

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**Background and Goal of Study:** Problems concerning the influence of various methods and agents for anesthesia, on the development of distant metastases are widely discussed in medical literature. Risk of cancer progression is related to the state of immune system. The aim of the study was to investigate the influence of xenon anesthesia on the development of distant metastases in relationship with immune system state in patients with breast cancer.

**Materials and methods:** A comparative analysis of immune status was carried out in 60 breast cancer patients on day 1 and day 7 after radical surgery. The study group comprised 29 patients who received xenon anesthesia and the control group consisted of 31 patients who received anesthesia with nitrous oxide. Subpopulations of lymphocytes in peripheral blood, functional activity of neutrophils, levels of circulating immune complexes and the levels of three major immunoglobulins IgG, M and A were estimated. In comparison groups, rates of relapse-free survival (the incidence of hematogenous metastasis) were assessed during the 6-year follow-up period (2005 - 2011).

**Results and discussion:** A significant reduction (by 19%) in CD56+ lymphocytes (subpopulation of NK cells, p< 0.05) was observed in the control group patients on day 7 after surgery. The IgA level was increased by 35%, IgG by 8% and IgM by 18%, although these changes were not statistically significant. A statistically significant reduction in functional activity of neutrophils was found (p< 0.05). In study group, the level of T- and B-lymphocyte subpopulations remained in the initial values. The IgG level was significantly increased as compared to the initial levels (p< 0.05). No decrease in functional activity of neutrophils was found. In addition, the level of functional activity of neutrophils was significantly higher than in the control group.

The incidence rate of distant metastasis in the study group patients was significantly lower than in the control group (p< 0.05). The median survival time before metastasis occurrence in the xenon group was 26.2±7.2 months compared to 6.7±1 months in the control group (p< 0.03).

**Conclusion(s):** Analysis of changes in the immune status of patients who received xenon anesthesia showed not only the absence of suppression of cell-mediated and humoral immune responses but also the presence of protective effect on the functional activity of neutrophil phagocytes.

### 1AP3-5

#### Prognostic value of postoperative lactate levels in predicting complications after major abdominal surgery

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**Background and Goal of Study:** Lactate monitoring is widely used for outcome prediction in a variety of critically ill patients and after cardiac surgery. Its significance in abdominal surgery has not been thoroughly evaluated. The aim of our study was to investigate the association of blood lactate levels during the first 24 h after surgery with postoperative morbidity and mortality and to examine the ability of lactate values at different time points to predict postoperative complications (POC).

**Materials and methods:** Prospective observational study was conducted in a tertiary hospital from January till April 2013 in patients undergoing major abdominal surgery expected to spend at least 24 hours at the ICU following surgery. Blood samples were obtained on admission (L<sub>0</sub>), 4 (L<sub>4</sub>), 12 (L<sub>12</sub>) and 24 (L<sub>24</sub>) hours after surgery and lactate values were performed by a gas analyzer (upper normal range 1,6 mmol/l). Lactate area (LA; mmol×h/l) representing cumulative lactate values was calculated afterwards. During patient follow-up until discharge, occurrence and type of various POC (Dindo-Clavien ≥2) were recorded as well as the length of hospital stay. SPSS 19.0. was used for statistical analysis. ROC curves were constructed to determine prognostic value of different lactate measurements.

**Results and discussion:** During study period a total of 195 patients were included. They underwent 170 elective and 25 urgent operations. There were 184 complications in 76 (39%) patients including death in 18 (9.2%) patients. Mean length of ICU and hospital stay were 2.02(±2.69) and 13.21(±6.47) days. Blood lactate values were significantly higher in patients with complications in all time point (p< 0.001). L<sub>12</sub> and LA demonstrated the highest prognostic value in predicting majority of POCs (AUROC<sub>L12</sub>=0.722; 95%CI 0.706-0.937; p< 0.001 and AUROC<sub>LA</sub>=0.701; 95%CI 0.622-0.779). L<sub>12</sub> and LA showed the best discriminative power for hospital mortality as well (AUROC<sub>L12</sub>=0.821; 95%CI 0.706-0.937; p< 0.001 and AUROC<sub>LA</sub>=0.736; 95%CI 0.630-0.895; p< 0.001). The best cutoff value for L<sub>12</sub> to discriminate between survivors and non-survivors was 1.75mmol/l and 44.8mmolxh/l for LA.

**Conclusion:** Blood lactate levels during the first 24 postoperative hours were significantly associated with POCs after major abdominal surgery. L<sub>12</sub> and LA were shown to be useful (and superior over other time point measurements) for hospital morbidity and mortality prediction in this cohort of surgical patients.

### 1AP3-6

#### Analysis of opioid and sedative discrepancies in the university hospital identifies the need for quality improvement in auditing system

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**Background and Goal of Study:** Anesthesia providers obtain opioids and sedatives from pharmacy in a sealed envelope. Administered, wasted, and returned amounts of opioids and sedatives are written on those envelopes as hard copies by the anesthesia personnel and tracked by pharmacy. The anesthetic Electronic Medical Record (EMR) documents medications administered by anesthesia personnel. The pharmacy randomly audits ten percent of all anesthesia cases by reviewing four adult cases, four pediatric cases, and one obstetric case daily. The pharmacy reports that drug discrepancies among anesthesia providers is 4%. Limitations to the current system include: 1) use of pen and paper in combination with electronics,

- 2) inability of the different systems to interact,
- 3) lack of timely accountability, and
- 4) lack of identification of trends.

We believe that a better system needs to be developed.

**Materials and Methods:** We studied the accuracy of the pharmacy discrepancy reporting system by reviewing every EMR entry and pharmacy envelope over a three month period (January, 2013 to March, 2013) and then compared the results to the official pharmacy audits over the same time period. 2,876 anesthesia EMR entries and pharmacy envelopes were reviewed and compared.

**Results and Discussion:** The total drug discrepancy rate was 40%. The most common discrepancies were: fentanyl - 7.3%; propofol - 15.4%; morphine - 1.2%; ketamine - 1.9%; midazolam - 5.4%; hydromorphone - 5.6%; remifentanyl - 1.1%. The current system of auditing medications by the pharmacy is irregular, inconsistent, and lacks accountability which could potentially lead to patient harm. Our review clearly outlines that the current auditing system of the pharmacy needs quality improvement. We anticipate that this will require significant changes by the Department of Pharmacy as we transition to an all electronic medication tracking system.

**Conclusion(s):** In Anesthesiology, accountability for narcotics and sedatives is crucial. An insufficient auditing system lacks accountability. With an enhanced auditing system, we expect an improvement in the identification of discrepancies as well as an improved intervention timeframe. We anticipate drug diverting behavior to be identified earlier, and that better patient care will result.

### 1AP3-7

#### A diagnostic conundrum: establishing the cause of profound retrograde amnesia following general anaesthesia

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**Background:** We describe a patient who experienced extensive memory loss postoperatively. Subsequent investigation and management involved close liaison with neurological and psychiatric services to determine the likely cause.

**Case report:** A 43 year old married recently unemployed male presented for day-case myringoplasty. Previous anaesthesia had been uneventful. There was no history of substance abuse. Anaesthesia was induced with propofol 200mg and fentanyl 100mcg. A spontaneously breathing anaesthetic using sevoflurane in air administered via LMA was employed. Head elevation with moderate hypotension (MAP 60 mmHg) facilitated surgery which lasted 80 mins. Upon return to the ward the patient was disorientated, unable to recollect any personal or world events occurring after 1995. Full neurological examination was normal. Contrast enhanced MRI of the head revealed no acute infarct or bleed. Memory began to return on the fourth day although this was incomplete. Whilst still convinced he was living in 1995, he accepted the reality of his situation. Although he had no past psychiatric history it did emerge that significant stressors, including recent unemployment and military combat in the patient's earlier life may have contributed to this unusual postoperative course.

**Discussion:** Having excluded an organic intracerebral event the psychiatric differential diagnosis included Transient Global Amnesia (TGA) or Dissociative Amnesia (DA). Post operative TGA occurs rarely with only a handful of cases reported[1] [2] [3]. A key feature of TGA is an inability to form new memories during the amnesic episode, whereas our patient did have limited recollection. In contrast, DA features memory loss, commonly involving recent significant life events, in the absence of an organic cause. This patient fulfilled the ICD-10 diagnostic criteria for DA with the anaesthetic as its trigger in a patient with a high risk personality and significant life stressors prior to the operation.

**Learning points:** In the absence of an organic cause, psychiatric assessment is likely to assist determination of the cause of retrograde amnesia.

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### 1AP3-8

#### Comparative study of preoperative residual gastric volume obtained after ingestion of a protein supplement versus classic fasting

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**Background and Goal of Study:** The protein supplement (PS) used is a non-milk liquid with suggested use in preoperative fasting patients. This prospective randomized double-blinded study aimed to confirm its anesthetic security concerning residual gastric volume.

**Materials and methods:** Local Ethics Committee approval and patient consent was obtained. Sample size was determined for power of 80% with  $\alpha < 0.05$ . Inclusion criteria: ASA 1-3; 18-75 years old; for routine non-obstructive colorectal surgery. Exclusion criteria: neurological deficit; contraindication to succinylcholine; clinical conditions or medication affecting gastric emptying. 30 patients were randomized into 3 groups to receive 200ml of either PS (group P), Juice (group J) or Water (group W) by oral route 2 hours before surgery. After rapid-sequence induction, gastric contents were aspirated by gastric tube and quantified. Volume/Weight Index (VWI) was obtained for each patient dividing the aspirated gastric volume by the patient's weight. Blood sugar levels (BSL) were assessed before ingestion of the liquid and after induction and the difference between the latter and the former was calculated. Comparisons among groups were done by ANOVA and Tukey test or by Kruskal-Wallis test and Mann Whitney U test with Bonferroni correction as appropriate.  $p < 0.05$  was considered significant.

**Results and discussion:** (table 1) P group showed significantly higher VWI than W group ( $p=0.015$ ), raising doubts regarding PS preoperative security, even though there were no complications. Mean variation between BSL after induction and before liquid ingestion was significantly different for J vs. P group ( $p=0.003$ ), with lower BSL after induction in J group. This finding must be further investigated and may be due to a decrease in insulin resistance and a diminished catabolic response to perioperative stress.

Variable	P group	J group	W group
Volume/Weight Index, [median (quartiles)], mL/Kg	0.51 (0.07-1.90)	0.02 (0-0.1)	0 (0-0.1)
BSL difference (mean $\pm$ SD), mg/dL	48 $\pm$ 47.5	-8 $\pm$ 12.1	27 $\pm$ 28.2

[Table 1: Descriptive results of the outcomes]

**Conclusion(s):** Based on our results, PS needs further studies to prove its security in preoperative use up to 2 hours of induction, concerning the residual gastric volume. Studies with bigger populations are advised. Juice appears to be safe, however glycemic profile should be further studied.

### 1AP3-9

#### Clinic advantages of oral clonidine premedication compared with Diazepam in the patients undergoing elective cholecystectomy surgery

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**Background and Goal of Study:** Preanaesthetic premedication is an important part of management of anesthesia. Clonidine an  $\alpha 2$ -adrenergic agonists for its pharmacological profile as anxiolytic, analgesic and sympatholytic is being made one of premedication drug of choice for patients who undergo surgery.

The aim of our study was to evaluate the clinic advantages of oral clonidine premedication 90 min prior to anesthetic induction on hemodynamic stability and anesthetic requirements perioperative and its postoperative effects compared with commonly premedication with Diazepam in the patients undergoing cholecystectomy surgery under General Anesthesia (GA).

**Materials and Methods:** In this randomized prospective study were included 86-patients aged 32 to 66 years, ASA I-II, scheduled for elective cholecystectomy surgery under the GA. The patients were divided into two groups according to the premedication they received: Clonidine group(C) = 42 patients - 90 min before anesthetic induction received tablet oral Clonidine 150  $\mu$ g, group Diazepam (D) = 42 patients -30 min before anesthetic induction re-



ceived 10 mg i.m Diazepam. After standard monitoring, anesthetic induction for both groups was induced: Thiopental, fentanyl, pavulon and anesthesia was maintained with O2+ izofluran + fentanyl. For both groups were collected data: variations of hemodynamic parameters during induction, endotracheal intubation, skin incision, extubation, isoflurane concentration and fentanyl requirements in perioperative period, the incidence of vomiting, shivering and analgesic requirements for the 24h postoperative.

**Results and discussion:** The variations of hemodynamic parameters perioperative were significantly lower in group C than in group D  $p < 0.001$ . Requirements for the isoflurane concentration and fentanyl were significantly lower in group C then in D  $p < 0.038$ . The incidence of vomiting and shivering was less in the group C then in group D  $p < 0.05$ . Analgesic requirement in 24 h was significantly less for group C then in D  $p < 0.03$ .

**Conclusion(s):** Oral premedication with Clonidine 90 min before anesthetic induction, provides better hemodynamic stability, reduces anesthetic requirements perioperative and it also reduces the incidence of vomiting, shivering and the need of analgesic postoperative compared with premedication with Diazepam in the patients undergoing elective cholecystectomy. We suggest that clonidine is a ideal premedication drug in anesthesia.

### 1AP3-10

#### Efficacy of intraoperative optimisation of fluids guided with transoesophageal doppler monitorisation: a multicentre randomised controlled trial

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**Background and Goal of Study:** Several single-center studies and meta-analyses have shown that perioperative goal-directed therapy may significantly improve outcomes in abdominal major surgical patients. The main objective of the study was to compare the stay among surgical patients monitored with oesophageal doppler versus unmonitored patients, into a protocol of restrictive goal-directed fluid therapy (based on CI=2.5 achieved by SV control).

We hypothesized that using a treatment algorithm based on ODM parameters variation, in a study group, would result in reduced complications, reduced length of hospital stay and quicker return of bowel movement postoperatively in abdominal surgical patients, when compared to a control group.

**Materials and Methods:** The study design is a randomized multicenter clinical trial on patients Treated conducted in Spain from July 2012. We present preliminary results regarding hospital stay and critical care units stay. Surgeries were for general surgery, urology, gynecology and orthopedic surgery specialties. **ISRCTN93543537.**

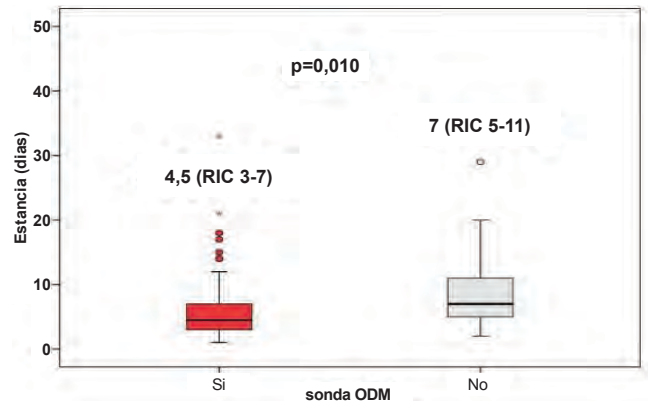
**Results and Discussion:** 121 patients were studied. There were no statistically significant differences in any of the baseline variables recorded. We can point out that randomization worked and the intervention and control groups were homogeneous in their baseline characteristics.

59.1% of the patients were men. Mean age of patients was 65.80 years. According to the surgical specialty 63.4% belonged to the general surgery group, 10.2% of gynecological surgery, 24.72% of urologic surgery and 1.68% of orthopedic surgery. According to the surgical technique were 28.5% open surgeries and 71.5% were laparoscopic.

The results were favorable to the intervention group for the outcome variables, total stay, postoperative critical care unit stay (ICU stay), oral tolerance time and walking time. We emphasize the difference in postoperative stay in ICU of 1.73 days less ( $p = 0,000$ ) and total stay of 1,76 days less ( $p = 0,010$ ).

Outcome	Units	ODM N=62	Control N=56	p value
SurgTime	Minutes	181,12	240,43	0,013
Tot Stay	Days	9,17	10,93	0,010
PostSurg (ICU)	Days	1,88	3,61	0,001
PostSurg (ICU)	Hours	45,12	86,64	0,000
Enteral	Days	1,73	3,13	0,046
Deambul.	Days	2,52	4,38	0,039

[Table 1]



[Graph 1]

**Conclusion(s):** Results obtained in a primary outcome, postsurgical length of stay, as in most of the rest of outcomes were favorable to monitoring by esophageal doppler. Final analysis of the trial will permit us to obtain conclusions about the use of this device in a perioperative restrictive protocol of goal-directed therapy.

**References:**

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### 1AP4-1

#### Peri-operative diabetes regulation and protocol compliance (the PC study)

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**Background:** Peri-operative diabetes regulation differs between hospitals. Compliance with regard to peri-operative glucose regulation protocols is notoriously low and evidence with regard to efficacy is lacking. There are, however, convincing studies demonstrating that improving post-operative diabetes control decreases complications. We therefore investigated whether implementing a modified and stricter peri-operative diabetes protocol improved compliance and peri-operative glucose regulation.

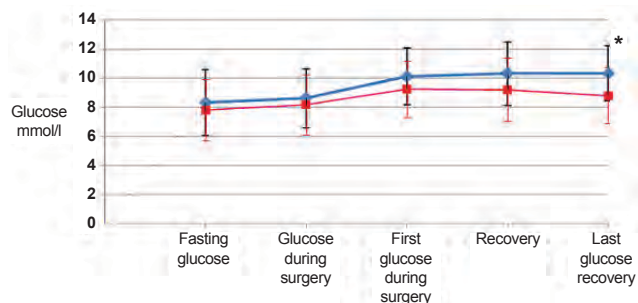
**Methods:** We performed a prospective observational cohort study from March 2013 through July 2013, comparing compliance and glucose regulation following protocol A (conventional protocol) with protocol B (strict protocol) (table 1). In May 2013, we switched from protocol A to protocol B (Table 1). Analyses were performed with the Mann Whitney U test and multivariate regression analyses.

**Results:** 192 patients were included in protocol A and 183 in protocol B, mean age was 64 years and 54% was female, 10.4% of patients (n=20) had diabetes type 1, 86,5% (n=166) type 2, 3.1% (n=6) other. There were no differences between the patient characteristics in protocol A and B. The median compliance (IQR) was 67% (57-83) for Protocol A and 71% (57-83) for Protocol B,  $p=0.04$ . Differences between peri-operative glucose values are shown in graph 1. Adjusted for age, gender, ASA status, DM type, emergency procedures, fasting glucose and compliance, protocol B (red line) improved the proportion of patients that reached the target of  $< 10$  mmol/l (OR 0.36, 95% CI 0.19-0.70,  $p < 0.01$ ) before discharge to the ward.

**Conclusion:** Implementing a stricter peri-operative diabetes protocol only slightly improved compliance, but significantly and relevantly improved post-operative glucose control before discharge from the recovery.

	Protocol A (conventional)	Protocol B (strict)
Infusion	Glucose-Insulin-Potassium	Glucose-Insulin
Amount of insulin/500ml glucose 5%	8 IU or 1/6 daily dose	1/8 daily dose
Infusion rate	Not prescribed	83 ml/hr
Insulin correction schedule	Not prescribed	prescribed
Potassium	< 50 IE/day: add 10 mmol KCl > 50 IE/day: add 15 mmol KCl	measure potassium postoperative
Glucose control in the recoveryroom	every 4hr	every 2hr

[Table 1 Protocols]



[Median blood glucose]

### 1AP4-2

#### Major gastrointestinal surgery is associated with a specific gene expression profile that is quantitatively associated with infectious complications

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**Background and Goal of Study:** Risk stratification for postoperative complications most commonly utilises demographic data. Quantifying the immune response to major surgery may represent a more specific approach.

**Materials and methods:** Research ethics approval was granted to study patients undergoing scheduled major abdominal surgery. Messenger RNA (mRNA) was extracted from whole blood collected preoperatively, and at 24 and 48 hours after surgery. Mediators descriptive of specific immune pathways were quantified using polymerase chain reaction (PCR). Postoperative infections were assessed using predefined criteria. Data were analysed using a Wilcoxon signed-rank test and Mann-Whitney U test and are presented as median and IQR. PCR data are presented as a relative quantification ratio between the candidate and reference genes.

**Results and discussion:** Of 129 patients recruited 49 (37%) developed infections after surgery. Median time to clinical diagnosis was 8.5 days (range 5-11). There were no differences in gene expression at baseline between patients who did and did not develop infection. Three (2%) patients died in hospital. From baseline to 24 hours IL-10 mRNA concentrations increased ( $p < 0.0001$ ), whilst TNF $\alpha$ , IFN $\gamma$ , IL-12, T bet, IL-23, ROR $\gamma$ t, Foxp3 and GATA-3 concentrations decreased ( $p < 0.0001$ ). Patients developing infections had greater postoperative IL-10 mRNA levels and lesser levels of pro-inflammatory mediator mRNA

	postoperative infections (n=49)	no postoperative infections (n=80)	p value
Age (years)	66 (58.5-74.5)	64 (57-71)	0.3
Diabetes (%)	18	16	0.81
Cancer diagnosis (%)	55	70	0.09
Preoperative immunosuppression (%)	14	14	1.0
Current smokers (%)	24	17	0.37
IL-10 mRNA at 24 hours	4.63 (2.9-8.6)	3.06 (2.3-4.1)	0.003
IL-12 mRNA at 24 hours	1.56 (0.9-4.6)	2.41 (1.6-3.3)	0.01
T-bet mRNA at 24 hours	5.50 (3.1-8.6)	8.02 (4.7-10.8)	0.02
TNF $\alpha$ : IL-10 mRNA ratio at 24 hours	10.1 (6.6-16.4)	16.0 (12.0-28.7)	0.0001

[Patient demographics and gene expression data]

Mortality was associated with greater IL-10 mRNA levels at 48 hours ( $p=0.002$ ) and lower levels of IL-23 mRNA at 24 and 48 hours ( $p=0.02$ ) and ROR $\gamma$ t mRNA at 48 hours ( $p=0.04$ ).

**Conclusion(s):** Elective major abdominal surgery is associated with a distinct pattern of predominantly immunosuppressive gene expression. This immunological response is quantitatively associated with postoperative infection and death.

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### 1AP4-3

#### Monitored anaesthesia care with dexmedetomidine is superior to general anaesthesia for laryngeal framework surgery

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**Background:** Tracheal intubation (TI) has deprived patients of opportunity for vocal testing during laryngeal framework surgery (thyroplasty and/or arytenoid adduction: LFS). To resolve the defect of general anaesthesia, we have converted anaesthetic technique for LFS to monitored anaesthesia care (MAC) without TI from general anaesthesia with TI in 2011 [1]. Our objective was to evaluate whether or not MAC with dexmedetomidine (DEX) could provide the patients more safe and effective outcome compared with general anaesthesia in LFS.

**Methods:** After obtaining approval of our Ethical Review Board, we undertook a retrospective review of patients who underwent LFS in our hospital from January 2009 to October 2012. General anaesthesia was maintained with propofol and/or sevoflurane with fentanyl and remifentanyl. MAC with DEX was performed under local anaesthesia and some sedatives (propofol and ketamine) and analgesics (fentanyl and remifentanyl) were used as needed. Moreover, wake-up test for vocal cord modulation was added in MAC technique. The best value of postoperative maximum phonation time was recorded from medical records and compared by unpaired t-test.  $P < 0.05$  was considered statistically significant.

**Results:** Eight patients received general anaesthesia (January 2009 - December 2010) and 11 patients underwent MAC (January 2011 - October 2012). Patients' profiles in the two groups were similar. No patients revealed oxygen desaturation ( $SpO_2 < 90\%$ ) during anaesthesia or sedation. Only one patient in MAC failed in wake-up test for vocal modulation. Maximum phonation time in MAC was significantly longer than in general anaesthesia ( $14.9 \pm 5.1$  vs.  $9.8 \pm 3.6$  seconds;  $P=0.042$ ).

**Discussion:** DEX produced appropriate airway securement and good surgical condition. Moreover, MAC with DEX improved postoperative maximum phonation time as a successful index in LFS by making possible intraoperative vocal testing. On the other hand, DEX has a risk to fail the wake-up test during LFS due to its longer half-life than other sedatives.

**Conclusion:** MAC using DEX could provide better outcome, that is, the longer postoperative maximum phonation, for laryngeal framework procedures compared with general anaesthesia.

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1. Jense RJ et al. Ann Otol Rhinol Laryngol. 2008;117(9):659-64

### 1AP4-4

#### Perioperative glycaemic control among patients undergoing craniotomy in two centers

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**Background and Goal of Study:** Neurosurgical patients often have hyperglycemia, related to dexamethasone administration and stress response. Hyperglycemia is associated with increased morbidity and mortality and can even promote tumor growth. Therefore glucose levels should be  $< 10$  mmol/L (180mg/dL) at all times.

We evaluated peri-operative glucose levels in craniotomy patients in two centers: Addenbrooke's Hospital in Cambridge (AHC) and University Medical Centre Groningen (UMCG).

**Materials and Methods:** This retrospective study was performed as part of quality control programs. Ethical committee approval and informed consent were therefore not obtained. The medical records of all patients who underwent craniotomy for tumor resection and received peri-operative dexamethasone in the period of January 2010-September 2011 (UMCG) and February 2011-September 2012 (AHC) were evaluated. We obtained patient characteristics and glucose levels. The maximum glucose levels per patient were determined for four clinical phases: pre-operatively (pre-op), intra-operatively (OR), on the intensive care or recovery (ICU) and post-operatively after ICU/recovery discharge (post-op).

**Results and Discussion:** Data from a total of 411 patients were collected (AHC: 229; UMCG: 182) of whom 40 (10%) were diabetics. Glucose levels are summarized in table 1. Data on patients with more than one glucose level available were included. At all phases, in both centers, a considerable number

of glucose levels were outside of recommended range (<10 mmol/L). In some patients glucose values >20mmol/L were found.

**Conclusions:** Glycemic control in diabetic and non-diabetic patients undergoing craniotomy was sub-optimal in all phases we studied. Many non-diabetics had fasting glucose levels consistent with glucose intolerance. In other settings hyperglycemia can enhance tumor growth and impair outcome. The significance of glucose deregulation in craniotomy patients should be assessed in long-term outcome studies. Additional measures may be required to improve glucose control.

Phase	Addenbrooke's hospital				UMCG			
	Diabetic patients		Non-diabetic patients		Diabetic patients		Non-diabetic patients	
	N	Glucose [mmol/L] (mean±SD)	N	Glucose [mmol/L] (mean±SD)	N	Glucose [mmol/L] (mean±SD)	N	Glucose [mmol/L] (mean±SD)
Pre-op	16	19.3 ± 7.6	44	9.76 ± 2	15	10.5 ± 4.9	123	6.3 ± 2.4
OR	21	12.1 ± 4.2	162	7.5 ± 2.3	14	12.0 ± 3.4	108	8.2 ± 2.0
ICU	8	12.1 ± 2.8	17	8.4 ± 2.4	16	11.6 ± 2.3	166	8.9 ± 2.2
Post-op	21	20.1 ± 6.6	67	10.8 ± 4.6	9	14.7 ± 4.8	41	8.3 ± 2.7

[Maximum glucose levels per phase]

## 1AP4-5

### Nitrous oxide related postoperative nausea and vomiting depends on duration of exposure

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**Background and Goal of Study:** Inclusion of nitrous oxide (N<sub>2</sub>O) in the gas mixture has been implicated in postoperative nausea and vomiting (PONV) in numerous studies. However, these have not examined whether duration of exposure was a significant covariate. This distinction might affect the future place of nitrous oxide in clinical practice.

**Materials and methods:** PubMed listed journals reporting trials in adults which randomized patients to a nitrous oxide or nitrous oxide-free anesthetic for surgery were included, where the incidence of PONV within the first 24 postoperative hours and mean duration of anesthesia was reported. Meta-regression of the log risk ratio for PONV with nitrous oxide (lnRR PONV<sub>N<sub>2</sub>O</sub>) versus duration was performed.

**Results and discussion:** 29 studies in 27 papers met the inclusion criteria, randomizing 10,317 patients. There was a significant relationship between lnRR PONV<sub>N<sub>2</sub>O</sub> and duration, ( $r^2 = 0.51, p = 0.002$ ). RR PONV increased 20% per hour of nitrous oxide after 45 minutes. The number needed to treat (NNT) to prevent PONV by avoiding nitrous oxide was 128, 23, and 9 where duration was less than 1 hour, 1-2 hours, and over 2 hours, respectively. The RR for the overall effect of nitrous oxide on PONV was 1.21 (confidence intervals 1.04 - 1.40),  $p = 0.014$ . This progressive, duration related effect is not consistent with most traditional explanations of N<sub>2</sub>O induced PONV. A new mechanism should be considered, namely the disturbance of methionine and folate metabolism caused by N<sub>2</sub>O inhibition of methionine synthetase. Recent clinical studies provide compelling evidence for this hypothesis.<sup>1</sup>

**Conclusion:** No clinically significant effect of nitrous oxide on the risk of PONV exists under an hour of exposure. Nitrous oxide-related PONV should not be seen as an impediment to its use in minor or ambulatory surgery.

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## 1AP4-6

### Pain, nausea and vomiting after laparoscopic bariatric surgery

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**Background and Goal of Study:** Obese patients have a higher risk of perioperative respiratory complications and continuous positive airway pressure (CPAP) has been suggested to reduce this risk.<sup>1</sup> However, it may increase postoperative nausea and vomiting (PONV).<sup>2</sup> The aim of this study was to evaluate the incidence of pain and PONV after bariatric laparoscopic surgery (BLS) and the effect of postoperative CPAP on these outcomes.

**Materials and Methods:** After approval by the institutional ethics committee, a prospective study was conducted for 3 months. Exclusion criteria were in-

ability to give consent and previous history of pulmonary disease. Patients were randomized for the use of CPAP during 2 hours in the post-anaesthesia care unit (PACU). Visual analogue scales (VAS 0-10) for pain and PONV were performed and vital signs registered at PACU admission and every 30 minutes until discharge. Descriptive analysis of variables was used to summarize data. T student test and Mann-Whitney test were used for normal and non-normal distribution variables, respectively. Pearson's correlation test and Chi-square test were also performed.

**Results and Discussion:** Sixty-five patients undergoing BLS were included (85% women, 42±10 years old, body mass index 43,8±5,4 kg/m<sup>2</sup>), ASA II or III (9 and 91%, respectively) undergoing gastric bypass (78%), sleeve gastrectomy (5%) and gastric band procedures (17%). Thirty-two patients were treated with 2 hours of CPAP in the PACU. The median pain at PACU admission was 3. Forty-two patients (65%) presented with pain at PACU at any time (37 gastric bypasses, 1 sleeve gastrectomy and 4 gastric band procedures). Patients treated with CPAP at the PACU had lower scores of pain ( $p=0,004$ ). Higher scores of pain were associated with a longer anaesthesia duration ( $p=0,042$ ), PONV ( $p< 0,001$ ) and prolonged hospitalization after surgery ( $p=0,044$ ). Nineteen patients (29%) had PONV at PACU at any time. These patients experienced more pain ( $p=0,006$ ). There were no differences in PONV regarding the type of procedure or the use of CPAP. Patients over 50 years old experienced less pain ( $p=0,021$ ) and less PONV ( $p=0,015$ ).

**Conclusions:** Pain and PONV had a high incidence after BLS and age seems to play an important role. Patients treated with CPAP presented lower scores of pain. In this study, CPAP was not associated with a higher incidence of NVPO.

#### References:

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2. Meng, L. *Obes Surg* (2010) 20:876-880

## 1AP4-7

### Prevalence and risk analysis for depression after open-heart valve replacement surgery

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**Background and Goal of Study:** Cardiac surgery may account for long term complications and although growing interest has been shown concerning depression, it is still not well characterized after open-heart valve replacement procedures. Geriatric Depression Scale (GDS) is a reliable 30-item questionnaire for assessing depressive symptoms in the geriatric as well as other populations that has been validated for the portuguese population. The aim of the present study was to determine the prevalence and predictors of depression as a complication after open-heart valve replacement surgery in our institution.

**Materials and methods:** Prospective observational study enrolling a sample of 52 patients (55.8% men, mean age 67.7 ± 11.3 years) with no history of depression, submitted to elective open-heart valve replacement surgery. Patients completed the GDS questionnaire at 6-month follow-up and those with a score over 10 points were diagnosed with symptoms of depression. They were categorized as 'not depressed' (GDS score 0-10), 'mildly depressed' (score 11-20) or 'severely depressed' (score 21-30). Cardiovascular risk factors, medical history, left ventricular function, prescription table, analytical and surgical variables and length of hospital stay were collected to verify its influence on postoperative depression.

**Results and discussion:** Twenty-seven patients (41.4% men, mean age 69.3 ± 10.3 years) had scores consistent with symptoms of depression (GDS score >10), representing 51.9% of the sample. Twenty-one (77.8%) were mildly depressed and 6 (22.2%) were severely depressed and only 4 (19.0%) and 3 (50.0%) were on antidepressants, respectively.

Postoperative complications (29.6 vs 8.0%,  $p 0.045$ ), lower postoperative hemoglobin concentration ( $8.9 ± 0.8$  vs  $9.8 ± 1.5$  g/dL  $p 0.015$ ) and longer time of hospitalization ( $12.2 ± 7.7$  vs  $8.2 ± 3.4$  days,  $p 0.020$ ) were found to be significant predictors for postoperative depression. No other statistically significant differences were found.

**Conclusion(s):** Depression after open-heart valve replacement surgery is frequent but appears to be generally overlooked. Postoperative complications, lower postoperative hemoglobin concentration and longer time of hospitalization seem to be the most important factors influencing emotional outcome. Strategies for systematic screening and early guidance should be implemented to ensure better health and quality-of-life of patients undergoing major cardiac surgery.



## 1AP4-8

### Prophylactic practice and incidence of postoperative nausea and vomiting (PONV) in inpatient surgery

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**Background and Goal:** PONV is one of the main complaints of patients in the postoperative period. The goal of this study was to assess the prophylactic practice of PONV in inpatient surgery comparing it to what is recommended according to an ambulatory model (Apfel's Simplified Score-ASS) and to evaluate their effectiveness.

**Material and Methods:** We included all patients undergoing urologic, general and vascular elective surgery, during the month of December 2012. Exclusion criteria were: discharge from the hospital < 24h, admission to an Intensive Care Unit and impossible access to the medical records. The ASS was applied. The prophylaxis used was classified as adequate or inadequate (above or below that recommended by the score). PONV was assessed in the post-operative care unit and 24h after the end of the surgery. Chi-square test was applied with  $p < 0,05$  for significance.

**Results and Discussion:** 255 were evaluated and 187 were included. 34% had 0-1 risk factors (RF), 45% 2 RF and 21% 3-4 RF Prophylaxis was classified as adequate in 53% and inadequate with 16% above the recommendations and 31% below. 22% was the total incidence of PONV - 24% in the adequate prophylaxis group and 20% in the inadequate prophylaxis group ( $p=0.35012$ ). In the group with adequate prophylaxis the patients with 1-2 RF showed no reduction in the incidence of PONV compared with the ASS. In the inadequate prophylaxis group, this was less than recommended among the patients with 2 RF, with 71% of PONV; it was above the recommendations mainly in patients with 1 RF. The incidence of PONV was lower with loco-regional anesthesia vs general anesthesia (13% vs 27%,  $p < 0,001$ ).

**Conclusions:** Despite of adequate prophylaxis in some RF groups, there was no reduction in the incidence of PONV, compared with the predicted by the score. This reinforces the importance of other RF not predicted by this score and that these recommendations may be insufficient for PONV prophylaxis for inpatient surgery. As expected the incidence of PONV was lower in patients receiving loco-regional anesthesia vs general anesthesia. These results highlight the importance of adopting strategies to reduce the baseline risk.

## 1AP4-9

### Low functional reserve as a risk factor for postoperative delirium

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**Background and Goal of Study:** Postoperative delirium (POD) is defined by an acute change in cognitive status, characterized by fluctuating level of consciousness and inattention in the post-operative period.<sup>1</sup> There are several risk factors for its development, including patients comorbidities.<sup>2</sup> The aim of this study was to determine the incidence of POD and the presence of previous conditions related to its development.

**Materials and methods:** After approval by the institutional ethics committee, an observational, prospective study was performed in patients scheduled for elective surgery. Inclusion criteria: age > 18 years, non-cardiac, non-obstetric and non-neurological surgery, admission to the Post Anesthetic Care Unit (PACU) between June and July of 2012. Exclusion criteria: inability to give informed consent, inability to speak Portuguese and cognitive impairment (Mini Mental State Examination < 24). The presence of POD was assessed by the Nursing Delirium Screening Scale (NUDESC) at discharge from the PACU and 24h after surgery. Various comorbidities were considered: chronic obstructive pulmonary disease (COPD), hypertension (HT), low functional reserve (LFR) (defined by METS < 4) and anemia, conditions present at the Revised Cardiac Risk Index of Lee, peripheral vascular disease and obstructive sleep apnea syndrome. Descriptive analysis, Chi-square and Fisher tests were used for comparisons. A multivariate analysis using linear logistic regression with calculation of the odds ratios (OR) and its confidence interval at 95% (95% CI) was performed.

**Results and discussion:** In a population of 221 patients POD was found in 25 patients (11%). Patients who developed POD had more often ischemic heart disease (IHD) (35% vs 9%,  $p=0.001$ ), chronic renal failure (CRF) (33% vs 10%,  $p=0.05$ ), hypertension (19% vs 4%,  $p = 0.001$ ), COPD (31% vs 10%,  $p=0.009$ ) and LFR (60% vs 9%,  $p < 0.001$ ). LFR was considered an indepen-

dent risk factor for POD (OR=15.2, 95% CI 3.9 to 58.5,  $p < 0.001$ ).

**Conclusions:** The incidence of POD in the study population (11%) is consistent with that described in the literature (5-15%)<sup>2</sup>. The comorbidities associated with its development were IHD, HT, CRF, LFR and COPD. LFR was an independent risk factor for the development of POD.

#### References:

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## 1AP5-1

### The effects of anaesthesia maintained with isoflurane or propofol on antioxidative/oxidative biomarkers in patients undergoing surgery

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**Background and Goal of Study:** The effects of general anaesthesia on antioxidant system have been poorly explored in patients<sup>1,2</sup>, with conflicting results. Evaluating minimally invasive surgeries and using differentiated endpoints, the present study was designed to evaluate antioxidant biomarkers and antioxidant defense, as well as oxidative genomic damage, in patients before and during surgical procedure under general anaesthesia maintained with isoflurane or propofol.

**Materials and methods:** The Ethical Committee of the Institution approved the protocol of the study. The study included 30 adult ASA physical status I patients who underwent otorhinological surgery. Patients were randomised to receive anaesthesia maintained with isoflurane (n=15) or propofol (n=15). Blood samples were collected before (baseline) and 120 min after the beginning of anaesthesia. Plasma individual antioxidants were determined by high performance liquid chromatography (HPLC). Total antioxidant performance (TAP), that measures the oxidisability of both aqueous and lipid compartments of plasma, was evaluated by fluorometry. Oxidative genomic damage was evaluated in lymphocytes by alkaline comet assay.

**Results and discussion:** There were no significant differences between groups in relation to patient's characteristics. Most of the lipophilic antioxidants (carotenoids, alpha-tocopherol and retinol) significantly decreased 2 h after the beginning of anaesthesia in both groups. A significant increase of gamma-tocopherol was detected only in the intravenous group ( $P < 0.001$ ). Propofol and its intralipid solution, which contains soybean oil, may have increased gamma-tocopherol concentration during anaesthesia. TAP increased during surgery in both anaesthetic techniques ( $P < 0.05$ ), but with no differences between groups.

There were no differences in oxidative genomic lesions between time points or groups ( $P > 0.05$ ).

**Conclusion(s):** Isoflurane and propofol showed a similar response, with a consumption of some endogenous antioxidants, except for gamma-tocopherol in the propofol group, and an increase of plasma total antioxidant defense, without changing oxidative genomic damage, in patients without comorbidities who underwent minimally invasive surgeries.

#### References:

1. Hans P, Canivet JL, Pincemail J, et al. *Acta Anaesthesiol. Scand.* 1991; 35:302-305.  
2. Cavalca V, Colli S, Veglia F, et al. *Anesthesiology* 2008;108:988-997.

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## 1AP5-2

### PONV in bariatric surgery

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**Background and Goal of Study:** Postoperative nausea and vomiting (PONV) after general anaesthesia is a frequently occurring problem with an incidence of up to 30%. There are limited reports in the literature regarding PONV after bariatric surgery. We investigated the incidence of PONV in this group and evaluated the efficacy of PONV-prophylaxis related to current PONV risk-assessment methods.

**Materials and methods:** During a four-month period, 39 patients at Sundsvall Hospital undergoing bariatric surgery were included in this prospective observational study.

All patients received total intravenous anaesthesia. PONV-prophylaxis was given according to individual risk and local routines. Independent of the anaesthesiologists preoperative assessment we evaluated risk factors for PONV and retrieved an Apfel-score (1) for each patient. We regarded the PONV-prophylaxis as suboptimal when Apfel-score was higher than 1 + the number of given prophylactic drugs. Patients were assessed postoperatively regarding PONV and pain at 2, 4 and 6 hours and at midday the following three days using a standardised questionnaire. PONV was defined as experiencing nausea or vomiting/retching.

**Results and discussion:** 28 of 39 patients (72%) experienced PONV during the follow-up period and all these patients had their first PONV episode during the first 6 hours. Among the patients with PONV 15 of 28 patients (54%) reported that nausea had prevented them from moving freely or taking part in normal activities.

No significant differences were found in the incidence of PONV among those who received suboptimal PONV-prophylaxis versus those who received optimal or more than optimal PONV prophylaxis. In those who experienced PONV, pain-scores were higher the first postoperative hours.

**Conclusions:** Patients undergoing laparoscopic bariatric surgery had high incidence of PONV with a relatively high degree of discomfort. Our study indicates that current prophylactic and risk-assessment methods for PONV may be inadequate for patients undergoing bariatric surgery.

**Reference:**

1. Apfel et al, *Anesthesiology* 1999;91:693-700

### 1AP5-3

#### Predictive model for postoperative vomiting based on CoPlot visualization technique

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**Background and Goal of Study:** Predictive accuracy of two known risk scores for postoperative vomiting (POV), Koivuranta and Apfel's, are limited. Improvement of POV predictive model requires exploration of interactions and relationships among predictive variables.

**Materials and methods:** After obtaining IRB approval and informed consent, 421 women (ASA I-II) undergoing laparoscopic gynecological surgery were enrolled in a prospective study. Of these women, 47 were excluded and 374 completed the study. No POV prophylaxis was given. Thiopental was used for induction and isoflurane or sevoflurane with or without N<sub>2</sub>O for maintenance of anesthesia. POV and pain scores were measured at 2 and 24 hours postoperatively. 16 predictive factors were selected based on the result of univariate logistic regression (P < 0.05) and clinical relevance. For CoPlot visualization, distance metrics between observations were defined as "city-block metrics".

For goodness-of-fit diagnostics coefficient of alienation, and correlation between the original data for each variable and projection of each observation on CoPlot vector were used.

**Results and discussion:** CoPlot analysis of 16 possible predictors describing orientation and corresponding correlation of each predictor are shown in tables.

Predictor	Orientation	Correlation
Age	8	0.43
BMI	32	0.38
Medication	-23	0.35
POV history	95	0.16
Kinetosis	133	0.06
Smoking	-129	0.13
Allergies	74	0.10
Blood pressure	-17	0.23

[Table 1]

Predictor	Orientation	Correlation
Menstrual status	151	0.24
Type of surgery	57	0.23
Duration of surgery	-7	0.34
Duration of anaesthesia	-1	0.34
Anaesthesia technique	16	0.46
Intraoperative opioids	3	0.27
Postoperative pain (0-2h)	35	0.19
Postoperative opioids	31	0.34

[Table 2]

Final CoPlot model includes 4 predictors: age > 40 years, BMI ≥ 30 kg/m<sup>2</sup>, medication, anaesthesia technique with N<sub>2</sub>O. Coefficient of alienation was 0.17 and mean correlation was 0.819.

**Conclusion:** Further validation of this original predictive model on a new data set as well as comparison with two known predictive models for POV is needed.

### 1AP5-4

#### Prospective audit of a protocol to reduce post-operative nausea and vomiting in urologic surgery

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**Background and Goal of Study:** Postoperative nausea and vomiting (PONV) are one of the main complaints in postoperative period.

Based on national recommendations for ambulatory surgery<sup>(1)</sup> and Society of Ambulatory Anaesthesia guidelines<sup>(2)</sup> we applied the recommended protocol (table 1) in inpatient surgery.

RISK FACTOR (RF)	SCORE	PONV RISK LEVEL	PROPHYLAXIS
FEMALE	1	0 RF - 10%	NONE
NON SMOKER	1	1 RF 10%-20%	NONE
PREVIOUS PONV/ MOTION SICKNESS	1	2 RF 30%-40%	DEXAMETHASONE 5mg INDUCTION
POST-OPERATIVE OPIOIDS	1	3 RF 50%-60%	DEXAMETHASONE 5mg INDUCTION + ONDANSETRON 4 mg END OF THE SURGERY
TOTAL	4	4 RF 70%-80%	DEXAMETHASONE 5mg INDUCTION + ONDANSETRON 4 mg END OF THE SURGERY

[1 - Protocol for PONV prophylaxis according to RF]

The aim of our study was to test compliance and efficacy of the proposed protocol.

**Materials and methods:** This audit was approved by the hospital's audit committee.

We recommended the protocol to all consecutive patients submitted to elective urological inpatient surgery between February-June 2012, anesthetised by 3 anaesthetists.

Excluded if re-intervention/discharge < 24hours(h) or no access to records. Compliance to protocol and PONV were evaluated 24h after surgery (records and interview). We used chi-square and exact binomial tests (p < 0.05).

**Results and discussion:** 243 patients were evaluated (26 excluded). 51,6% with 0-1 risk factors (RF), 41% with 2 RF, 7,4% with 3-4 RF

In 78% of the patients protocol was followed. Total PONV incidence was 16,6% (20,8% in the patients in whom protocol was not followed, 15,4% in those in whom it was followed) (p=0,370).

Observed PONV incidence compared to the expected according to Apfel simplified risk score<sup>(2)</sup> are shown in table 2.

PONV risk factors	Predicted incidence (Apfel simplified risk score(1,2))	Observed incidence (protocol)	p value
0	10%	20% (n=3)	0,1841
1	10-20%	9,5% (n=7)	0,2412
2	30-40%	20,6% (n=14)	0,015
3	50-60%	18,2% (n=2)	0,02873
4	70-80%	0 (n=0)	0

[2 - PONV incidence according to PONV RF]

PONV incidence according to RF was less in all groups compared to expected, except for group 0 RF (20%vs10%).

**Conclusion:** Protocol compliance was effective in reducing PONV incidence. Antiemetic drugs more than proposed seem not justified. However, in patients with 0 RF, antiemetic prophylaxis or other measures to reduce PONV risk should be considered. The small size of our sample could be a limitation of this study, however it suggests that ambulatory surgery protocol should be adjusted to inpatient surgery.

#### References:

1. Revista SPA2011; 20(2):10-21
2. Anesthesia & Analgesia2007;105(6):1615-1628

## 1AP5-5

### Intraabdominal hypertension in aesthetic abdominoplasty

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**Background and Goal of Study:** Abdominoplasty is a surgical procedure, indicated according to the majority of surgeons for aesthetic deformities of the abdominal wall. The previous experience of hernia repair revealed the potential for intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) in the postoperative period.

The study was aimed at investigating the phenomenon of intra-abdominal hypertension in abdominoplasty and determining the predictive criterion of intraabdominal hypertension in the postoperative period.

**Materials and methods:** A prospective, controlled study of abdominoplasty impact on intra- and postoperative changes in intraabdominal pressure was performed in 50 patients. Intraoperatively, the peak inspiratory pressure (PIP) and intra-abdominal pressure (IAP) were measured via the urinary bladder before and after the diastasis recti repair. The absolute increase in PIP ( $\Delta$ PIP) and IAP ( $\Delta$ IAP) as the intraoperative difference between the values of airway and abdominal pressure, respectively, was calculated.

**Results and discussion:** The PIP value after the anterior abdominal muscle correction increased by 14,7% ( $p < 0.001$ ) compared to the baseline values. IAP increased 2.6 times ( $p < 0.001$ ).

IAH was observed in 9 cases (18%): I degree IAH in 7 (14%) and II degree IAH in 2 (4%) cases. The intraoperative increase in IAP correlated with the increase in PIP -  $r = 0.5$  ( $p < 0.001$ ). The elevated IAP was recorded in all patients on the next day after the surgery: IAH was recorded in 11 cases (22%), including I degree IAH in 8 patients (16%), II degree IAH in 2 patients (4%), and III degree IAH in one patient (2%). When the peak pressure increased by 4 cm H<sub>2</sub>O or greater, 88.8% of patients developed intra-abdominal hypertension and 37.5% developed respiratory disorders.

ROC-analysis confirmed the significance of PIP increase by 2 cm H<sub>2</sub>O for IAH risk prediction in the postoperative period.

**Conclusion(s):** Aesthetic abdominoplasty is associated with an increase in intra-abdominal pressure. The predictive criterion for the development of abdominal compartment syndrome is an increase of peak inspiratory pressure more than 4 cm H<sub>2</sub>O after the diastasis recti repair.

## 1AP5-6

### Should we systematically calculate the simplified Apfel score?

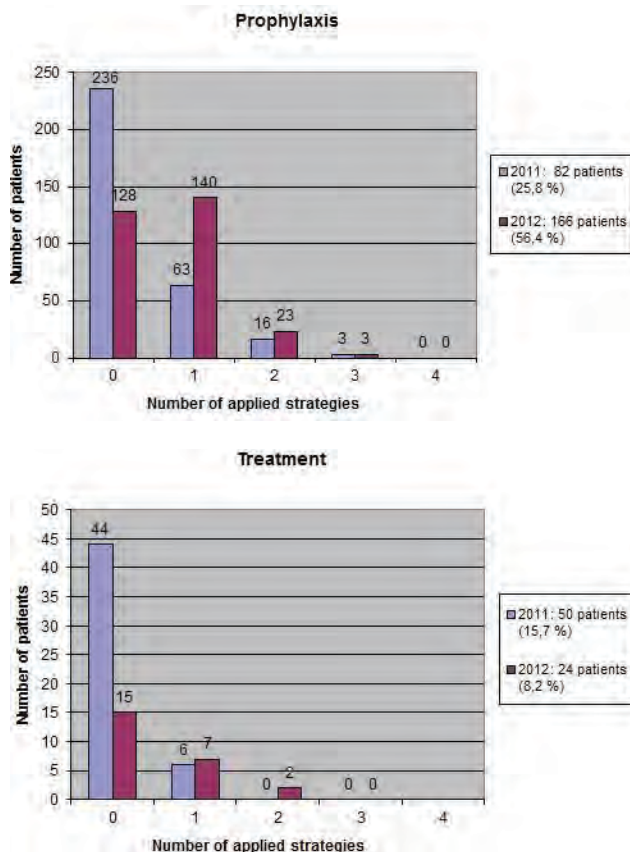
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**Background and Goal of Study:** Since the end of the 90s, the simplified Apfel score (1) allows to predict the postoperative nausea and vomiting (PONV) risk. Although all the anaesthetists know it, it isn't calculated for every patient. The goal of this study is to evaluate the interest of the systematic implementation during pre-anaesthetic consultation.

**Materials and methods:** Retrospectively, data were collected concerning elective gynecological surgery (breast surgery excluded). 318 patients were

included during 3 last months in 2011 and 294 during the same period in 2012. The simplified Apfel score were calculated for the second group during pre-anaesthetic consultation. No awareness-raising activities were given to anaesthetists about PONV prophylaxis. Groups were comparable concerning patients age, type and length of surgery and opioids use during per and post-operative period. The preventive medicine consumption for PONV (propofol, droperidol, dexamethasone, alizapride and ondansetron (2)) was collected. In the recovery room, the medicines used for the PONV treatment (alizapride and ondansetron (2)) were collected too.

**Results and discussion:** After simplified Apfel score implementation, preventive medicine increased twofold ( $p < 0.001$ ) and twice fewer medicine were used for PONV treatment ( $p < 0.001$ ).



[Figure]

After simplified Apfel score implementation during the pre-anaesthetic consultation, anaesthetists were sensitive to this « big little problem » (3). Collected data included the per and immediate postoperative period and PONV can be late and unknown. Furthermore, no PONV assessment scale exists in the recovery room and the medicine use was at the nurse discretion. In order to improve PONV management, it could be interesting to inform anesthetists about the number of preventive medicine to administer according to the number of risk factors (2).

**Conclusion(s):** The simplified Apfel score should be calculate for all patients during the pre-anesthetic consultation in order to raise anesthetists' awareness of PONV preventive medicine.

#### References:

1. Anesthesiology 1999; 91: 693-700.
2. Expert Opin pharmather 2011; 12: 2283-96.
3. Anesthesiology 1997; 87: 1271-3.

## 1AP5-7

### Postoperative delirium in patients with history of alcohol abuse

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**Background and Objectives:** Postoperative Delirium (POD) is an acute confusional state characterized by changes in consciousness and cognition, which may fluctuate, developing in a small period of time. It occurs up to 40% of patients and is associated with persistent cognitive deficits, increased phys-



ical dependence and prolonged hospital stay, resulting in significant personal and economic burden. Several risk factors for POD have been identified in previous studies. The aim of this study was to determine the relationship between alcohol abuse and the development of POD.

**Materials and methods:** After approval by the institutional ethics committee, a prospective study was conducted in 221 Portuguese patients (mean age  $55 \pm 17$  years; 57.5% female) scheduled for elective non-cardiac, non-obstetric and non-neurological surgery, admitted in the Post Anesthetic Care Unit (PACU), for 6 consecutive weeks. The POD diagnosis was made by the NUDESC scale ("Nursing Delirium Screening Scale") applied at the day of discharge from the PACU and at 24 hours postoperatively. Before surgery, alcohol consumption was inquired and alcohol abuse was assessed by the CAGE ("Cutting down, Annoyance, Guilt and Eye-opener") questionnaire. Score  $\geq 2$  defined alcohol abuse. Demographic and perioperative variables were recorded. A descriptive analysis of the variables was used and the Fisher exact test or chi-square were applied in the comparisons as appropriated.

**Results and discussion:** In this particular population the incidence of global POD (at discharge from the PACU and/or at 24 hours after surgery) was 11.3%; the incidence of alcohol abuse was 10.4%. Patients with alcohol abuse were mostly men (82.6% vs. 37.9%,  $p < 0.001$ ) and had a higher ASA status (43.5% vs. 21.7% for ASA III/IV,  $p = 0.021$ ). There were no differences between patients with and without alcohol abuse, referring to age, cardiac risk factors Lee, other comorbidities (hypertension, dyslipidemia, chronic obstructive pulmonary disease) and anesthesia type (general, loco-regional and combined). The occurrence of POD was more frequent in the group of patients with alcohol abuse (30.4% vs. 9.1%,  $p = 0.002$ ).

**Conclusions:** The overall incidence of POD in our population was 11.3%, being more frequent in the group of patients with alcohol abuse. In this context, these patients should be subjected to a more rigorous clinical surveillance and preventive measures in order to reduce the occurrence and consequences of the POD.

## 1AP5-8

### The effects of liver transplantation on donor anxiety and quality of life scores

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**Background and Goal of Study:** Anxiety disorder, which is encountered in surgical patients receiving general anesthesia is a psychological and physical condition, and characterized by sudden onset of hazard perception and extensive fear. Although studies primarily focus on liver transplant recipients, life quality of donors and their mood changes, such as anxiety and depression, have been calling more attention nowadays. We aimed to determine anxiety levels of liver transplantation donors via a questionnaire and reveal their quality of life and anxiety status during the 1<sup>st</sup> postoperative day and month.

**Materials and methods:** Following the Ethics Committee approval, forty subjects, between the ages of 18 and 75 years, on the list of liver transplant donors were included. A 10-item anxiety and quality of life questionnaire was prepared using scales applied to surgical patients, such as Amsterdam Preoperative Anxiety and Information Scale for preoperative anxiety, Spielburger State-Trait Anxiety and Inventory, the Short Form with 36 questions and the Profile of Mood States. We had the subjects complete this questionnaire on the 1<sup>st</sup> postoperative day and month. Data regarding the donor's age, sex, marital status, educational background, history of previous surgeries, the degree of affinity between donor and the recipient, number and age of their children, and duration of patient's disease were recorded.

**Results and discussion:** The total score on questions "I am worried about anesthesia" and "I wanted to have more information about anesthesia" was significantly lower than the total scores on the questions "I am worried about the success of the surgical procedure" and "I wanted to have more information about the surgery" ( $p = 0.007$  and  $p < 0.001$ , respectively). Additionally, the total score on the question "I am worried about anesthesia" was significantly lower than the score on "I am worried about the risk of anesthesia-related mortality" ( $p = 0.001$ ).

**Conclusion(s):** Many living donors are motivated to make their decision on this procedure in a short time. Donors were more anxious about surgical risks for themselves, while they had higher anxiety about the risk of anesthesia-related mortality for the liver transplant recipients. We, therefore, believe that allocating more time to informing patients and donors and holding information meetings on anesthesia and surgical procedures at intervals may be beneficial.

## 1AP5-9

### Correlation of nosocomial infection with chronic obstructive pulmonary disease (COPD) and smoking - prospective cohort study

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**Background and Goal of Study:** Nosocomial Infection (NI) is a well-known concern associated with great morbidity and longer hospitalization. The role of COPD and smoking in the development of NI is unclear. The recognition of these conditions as independent risk factors for NI is inconsistent among literature. Primary outcome of this study was to define the correlation between NI and history of COPD; secondary outcome was to correlate NI with smoking.

**Materials and methods:** We performed a prospective Cohort study of patients proposed for Orthopedic surgery between May and December 2012. Patients were excluded on the following criteria: less than 18 years old; pregnant; outpatient surgery; surgical indication repairing a previous surgical site infection; language barrier; cognitive impairment. Preliminary univariate data analysis to determine potential predictors included nonparametric and parametric two-tailed tests; categorical data were evaluated using two-sided Fisher's exact test or chi-square ( $p < 0.05$ ). Statistical analyses were performed using SPSS version 20.0 software (SPSS Inc, Chicago, Illinois).

**Results and discussion:** After consent was obtained, a total of 307 patients were included. Most of the patients were female (51.6%), with a mean age of  $59.6 \pm 18.09$  years. The majority of patients (58%) had an ASA physical status of 2. Patients were operated mainly for major risk surgery (51.1%), with a mean surgery duration of  $2:17 \pm 1:17$  hours.

The Incidence of NI was 14.7% (44). We observed 32 (10.42%) patients with history of COPD and 33 (10.78%) patients with history of smoking. In univariate analyses, history of COPD ( $p < 0.001$ ) and smoking ( $p < 0.003$ ) had statistic significant difference.

These results are similar to those described by Nan et al and Bochicchio et al. However, there are other studies<sup>1</sup> that didn't recognize COPD and smoking as independent risk factors for NI. Our findings highlight the need of optimization of COPD patients and the importance of incentive to quit smoking.

**Conclusion(s):** This study showed that patients with COPD are more susceptible to develop NI. Furthermore, we concluded that smoking also increase the risk of developing NI. The evidence that NI contributes to hospitalization extension and consequent increase in health care costs must alert for the importance of identifying risk factors.

#### References:

1. Nan D. et al, Nosocomial infection following video-assisted thoracoscopic surgery, Rev Esp Quimioter 2011;24 (4): 217-222

## 1AP5-10

### Postoperative cognitive dysfunction and its impact on quality of life and recovery

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**Background and Goal of Study:** Postoperative cognitive dysfunction (PCD) is a decline in cognitive function after surgery, which interferes with quality of life. The aim of this study was to determine the incidence of PCD and its influence on recovery and quality of life, in patients admitted in the Post-Anesthesia Care Unit (PACU).

**Materials and methods:** Observational, prospective study conducted in patients aged above 45 years, undergoing elective surgery (non neurosurgery), admitted in the PACU (june - august 2013). Patients with Mini mental state examination  $< 24$  were excluded. Cognitive function was assessed with the *Montreal Cognitive Assessment* test (MOCA), quality of life with the EuroQol five-dimension (EQ-5D) and quality of recovery with 15-item Quality of Recovery score (QoR-15). MOCA and EQ-5D were performed preoperatively and three months after surgery. QoR-15 was performed preoperatively and 24 hours after surgery. A change of at least 2 points between the scores preoperatively and three months after surgery was considered as clinically significant and qualified as PCD. Descriptive analyses were used to summarize data. Ordinal and continuous data were tested for normal distribution, based on the Kolmogorov-Smirnov test. Pearson's chi-square test or Fisher exact test was used for analyses of categorical data. Non-parametric tests were performed for comparisons.

**Results and discussion:** Fifty-eight patients were enrolled. The incidence of PCD three months after surgery was 41%. Median scores for MOCA test

were similar before surgery (22 vs. 24,  $p=0.284$ ), but after surgery median scores for MOCA test were lower for PCD patients (18 vs. 27,  $p < 0.001$ ). Three months after surgery, patients with PCD reported significantly more problems in two dimensions of EQ-5D: usual activities ( $p=0.001$ ) and pain/discomfort ( $p < 0.001$ ). Patients with PCD had similar scores on Qor-15 before and after surgery.

**Conclusion(s):** The incidence of PCD three months after surgery was high. Patients with PCD had an overall worst quality of life, with pain or discomfort and with more problems in usual activities. Parameters measured at recovery of anesthesia had no effect on PCD.

#### References:

S. Deiner et al; Postoperative delirium and cognitive dysfunction; Br. J. Anaesth. (2009) 103 (suppl 1): i41-i46.

## 1AP6-1

### Electrochemotherapy for breast surgery: general anesthesia or deep sedation?

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**Background and Goal of Study:** Electrochemotherapy (ECT) is useful for treatment of cutaneous secondary breast carcinomas with any classic surgery space (1-2), by an increment of cells membrane permeabilisation (electroporation) to a chemotherapeutic agent given in systemic flow, determined by applied local electric energy(3)(IGEA CLINIPORATOR® System) It is a painful procedure, adding electric intensity and application time of trans cutaneous stymolous with puncture probe and needs a good anesthetic and plan. Often, patients are high ASA people and a "light anesthesia" should be useful instead of general one, but literature is very few to alternatives. We compare general anesthesia and a deep sedation protocol in spontaneous breath to find a less invasive pathfor ECT.

**Materials and methods:** Operatory room of Breast surgery (January 2012-november 2013). Two groups of random patients:

**Group A:** 8 pts in General Anesthesia with tracheal intubation or laryngeal mask,

**Group B:** 10 pts. with sleep Induction by propofol: 1,5 mg / kg in 3 minutes after ev chemoterapeutic agent Neomycin plus fentanyl 50/100 mcg or remifentanyl 0,05 mcg/Kg/min. We collected HR and PAOS during surgical procedure, pain and therapy after, pts sensations for postoperative arousal, and PONV.

**Results and discussion:** Groups compatible for age ( $\geq 58$  y) and ASA score ( $\geq$  III) . No statistical difference for HR and PAOS but in Group A MAP is lower. In Group B 6/10 pts needed O2 facial mask ventilatory help Both groups had post operative NRS 3-5 and no difference for use of Paracetamol analgesia. Group B seems to be, "more present" with less emesis .

**Conclusion(s):** Two anesthetic plans for ECT for cutaneous local metastasis of breast cancer. The deep sedation protocol seems to be the better choice because we've got the same intraoperative results with better arousal and no difference in analgesic needs. Furthermore, we see in the second group better emodinamic stability for high ASA patients. PONV was lower in B Group (3 /10 ) vs. A ( 7/10 ). No difference for hospital length of stay .

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## 1AP6-2

### A simple and no-cost face tent improves oxygenation and reduces severe oxygen desaturation and the need for assisted ventilation in patients under deep propofol sedation during endoscopic retrograde cholangiopancreatography

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**Background and Goal of Study:** Patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) often receive IV sedation and nasal cannula (NC) O<sub>2</sub>. NC O<sub>2</sub> reservoir is lost when the mouth is kept open with a bite-block. Deep sedation and/or airway obstruction may cause severe desaturation (Desat) and require assisted ventilation and oxygenation. A simple

plastic sheet has been shown to improve oxygenation by transforming NC to a face tent in deeply sedated patients<sup>1-3</sup>. We have used this technique and wish to confirm its effectiveness in improving oxygenation in propofol-sedated patients during ERCP

**Material and methods:** This retrospective review of patients who underwent ERCP identified 2 groups. NC (n=7) received only NC O<sub>2</sub>. FT (n=83) received NC O<sub>2</sub> and a clean plastic sheet covering patient's eyes, nose and mouth<sup>1-3</sup>. Patients received NC O<sub>2</sub> (3-5 l/min or higher as needed) and only IV propofol. Student t-test and Chi Square test were used for analysis. A p value < 0.05 was considered as significant. (Mean±S.D.)

**Results and discussion:** There were no differences in age (NC:68±17 yrs; FT:56±15), BMI (NC:28±5 kg/m<sup>2</sup>; FT:26±6), ASA Physical Status (NC: 2.3±0.5; FT: 2.3±0.6), baseline O<sub>2</sub> Sat (NC:96±3%; FT:97±2%), overall propofol dosage (NC:196±43 mcg/kg/min; FT:193±61) and duration (NC:47±24 min; FT:50±30).

There were significant differences in the highest NC O<sub>2</sub> flow (NC:5.7±1.3 l/min; FT:4.5±0.9,  $p < 0.002$ ), FiO<sub>2</sub> (NC:0.27±0.06; FT:0.57±0.16,  $p < 0.0002$ ), O<sub>2</sub> Sat after 5 min pre-oxygenation (NC:98±2%; FT:100±1%,  $p < 0.003$ ), the lowest O<sub>2</sub> Sat (NC:87±7%; FT:98±3%,  $p < 0.0001$ ), severe Desat (O<sub>2</sub> Sat < 85%) (NC:5/7; FT:0/83,  $p < 0.001$ ) and assisted bag-mask ventilation (NC:1/7; FT:0/83,  $p < 0.001$ ).

Five NC patients had severe Desat (O<sub>2</sub> Sat: 83±1%). One of these NC patient received assisted bag-mask ventilation. Four others' NCs were converted to FTs and their O<sub>2</sub> Sat was improved to 97±4%, 99±2% and 99±2% at 5 min intervals ( $p < 0.0001$ ).

**Conclusion:** These data show that this face tent improves oxygenation and reduces severe desaturation and the need for bag-mask ventilation in propofol-sedated patients during ERCP. It increases O<sub>2</sub> delivery without raising NC O<sub>2</sub> flow. Although it can also be used as a rescue device when oxygenation deteriorates, it should be routinely used prior to sedation during ERCP. This face tent takes only a few sec to prepare at no extra cost and may improve patient safety.

#### References:

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## 1AP6-3

### Malignant hyperthermia followed by rhabdomyolysis during laparoscopic surgery with sevoflurane

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**Background:** Malignant hyperthermia is a hyper-metabolic syndrome triggered by volatile anesthetics or depolarizing muscle relaxants. Perioperative rhabdomyolysis has been associated with a prominent symptom of malignant hyperthermia.

**Case report:** A 33 year-old male received emergency laparoscopic operation undergoing general anesthesia with sevoflurane due to perforated appendicitis and generalized peritonitis. Anesthesia was induced with thiopental and rocuronium while maintaining with sevoflurane. After 90 minutes of anesthesia induction, end-tidal CO<sub>2</sub> elevated up to 106 mmHg with temperature raised to 41.4°C. A request of dantrolene was made to the available hospital. Inhalation anesthesia was switched to the propofol and remifentanyl. The patient was given body surface cooling with ice packs and intra-abdominal packing with iced.

Five hours after the anesthesia, end-tidal CO<sub>2</sub> tension, body temperature, and blood pressure became stabilized. After four hours transferred to ICU, the vital signs again became unstable, and the body temperature increased to 38.0°C, dantrolene was quickly administered which restored vital signs back to normal levels.

On the 1<sup>st</sup> postoperative day, habdomyolysis had developed, renal replacement therapy was initiated on a continuous basis. On the 2<sup>nd</sup> postoperative day, his consciousness level started to improve and was fully regained by next day. With his gradual improvement, the patient was transferred to a general ward on the 19<sup>th</sup> postoperative day.

**Discussion:** When malignant hyperthermia is suspicious, the inhalation anesthetics and other suspected drugs must be ceased. In addition, hyperventilation with 100% oxygen and dantrolene can improve the outcome. Rhabdomyolysis provoked acute kidney injury, electrolyte imbalances, or death. Continuous renal replacement therapy could decrease mortality rates. Recurrence of malignant hyperthermia can occur in about 20%, within 2.5~72 hours



after the first attack. Burkman et al. reported that recurrence of malignant hyperthermia was significantly associated with high body temperature, clinical grading scale above 35 points, and anesthesia agent.

#### References:

Burkman JM, et al. Analysis of the clinical variables associated with recrudescence after malignant hyperthermia reactions. *Anesthesiology*. 2007; 901-6.

**Learning Points:** Successful treatment of malignant hyperthermia and rhabdomyolysis depends on early detection of the clinical signs and prompt initiation of appropriate treatment.

### 1AP6-4

#### Factors affecting length of stay after major joint replacement surgery in orthopaedics patients (retrospective analysis of 5 years)

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**Background and Goal of Study:** The unique factor to the successful major joint replacements is effective management of patient's length of stay (LOS). Shortening LOS is indicator of good quality care and caters to larger population. We hypothesized that besides patient risk factors, day of admission, urgency of surgery, type of anaesthetic and centre where joint replacements are performed are important predictors of LOS after major orthopaedic joint replacements.

**Materials and methods:** We retrospectively evaluated factors associated with LOS of 3577 patients operated at two centres Cannock and Stafford for Major joint replacements in 5 years span (2008 to 2013). The factors derived from ORMIS (Operation Room Manager Information System) were

- age
- gender
- ASA grade
- days of admission before surgery
- NCEPOD classification: routine or urgent
- length of surgery in minutes
- centre of surgery Stafford/Cannock
- types of anaesthetic.

The patients were classified into 4 groups by type of surgical operation: THR, RTHR, TKR and RTKR ie (Primary Hip and Knee: THR and TKR); (Revision Hip and Knee :RTHR and RTKR).

**Results and discussion:** About 95% of the patients underwent Primary surgery (Total knee replacement TKR =1914; &Total hip replacement THR = 1478 and 5 % of the patients received Revision surgery; (Total hip replacement RTHR = 121 or Revision Total knee replacement RTKR = 64)

The distribution of LOS was not normal and very highly skewed; thus non-parametric statistics tests were used for evaluation. A two-way Shearer-Ray-Hare test studied the effects of time in years (2008 to 2013) and type of operation on LOS;

Kruskal-Wallis tests indicated whether LOS varied with days of admission before surgery, routine or urgent operations (NCEPOD); the centre; age; gender; ASA classification and type of anaesthetic.

Spearman's rank coefficients were used to determine if LOS was correlated with the length of the operation.

**Conclusion(s):** All factors except length of surgery (minutes) had significant effect at the 5% level. The LOS was significantly longer for Hip than for Knee replacement surgery. A significantly longer LOS was recorded for patients who were admitted one day before surgery; urgent operations; over 80 yrs age; female; higher ASA grade. A Kruskal-Wallis test indicated that type of anaesthetic had significant effect on length of stay at the 5% level ( $\chi^2 = 30.39$ ,  $p = 0.002$ ).

### 1AP6-5

#### Weekend admission, weekend operation and mortality: a systematic review, Bayesian and frequentist meta-analysis

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**Background and Goal of Study:** Admission to hospitals on weekend is generally considered to be increased mortality compared with that on weekday. Previous meta-analysis has demonstrated the mortality rate of patients who admitted on weekends in ICU was higher than that on weekdays. However, the results of other studies focusing on patients who admit to wards except ICU was less conclusive. We performed a systematic review and meta-analysis to compare the mortality for the patients on the weekend with the weekday admitted to hospital.

**Materials and methods:** We followed the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines. A comprehensive search of the literature was conducted using electronic databases. The primary outcome was in-hospital mortality. We performed subgroup analysis by dividing patients into 6 categories type of admission: patients who had stroke; cardiovascular disease; upper gastrointestinal haemorrhage; medical disease; mixed medical and surgical disease; and who received operation. Both Bayesian and frequentist random-effects meta-analysis were used. The median posterior risk ratio (RR) with the corresponding 95% bayesian credible intervals (BCIs) and the pooled RR with the corresponding 95% confidence intervals (CIs) were calculated. The heterogeneity of the results was examined by  $I^2$  test.

**Results and discussion:** 72 studies including 55,053,719 participants met our inclusion criteria. Weekend admission was associated with increased mortality compared with the weekday admission (Bayesian RR=1.17; 95%BCI: 1.10-1.24, frequentist RR=1.15; 95% CI: 1.15-1.16;

$P < 0.0001$ ,  $I^2 = 98.8\%$ ). Subgroup analysis revealed that weekend admission was at higher risk of death than weekday admission in patients in all categories except for the patients who received operation. There are at least two potential explanations for our results. First, these differences reflect poorer quality of care in hospital at the weekend, and second, patients admitted on at weekend could be more severely ill than those admitted on at weekday. The reason for the lack of a significant association between postoperative patients and mortality might be explained by the low number of studies included, and hence a lack of power to detect any statistical significance.

**Conclusions:** Our systematic review shows that weekend admission is associated with higher mortality compared with weekday admission.

### 1AP6-6

#### Allergic dermatitis due to long term exposure to sevoflurane: a clinical report

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**Background:** Allergic phenomena caused by volatile anesthetics are rare, but are capable of damage the professional career of exposed staff. We report a case of allergic dermatitis after long term exposure to sevoflurane.

**Case Report:** The person is a 60 year-old surgeon who has developed over 10 years a skin rash consisting of itchy erythematous lichenified risen areas with small vesicles on the reverse of hands and forearms, which progressively worsened and extended to distant fold areas leading to the deterioration in his professional activity and finally to the need to leave it. These symptoms disappeared during holiday periods.

Blood tests were normal but for eosinophilia and risen total IgE. Respiratory, specific globulins and skin prick tests for common environmental allergens were normal.

After 8 years, a malfunction in the anesthetic gas scavenging system. Following its replacement, symptoms remitted within a week.

Repeated open application test (ROAT) with sevoflurane led to the appear-

ance of the same lesions in the tested area as well as erythema and pruritus in body folds.



[ROAT test with sevoflurane]

**Discussion:** The cause-consequence relationship seems evident. ROAT positivity, lesions on unexposed areas, eosinophilia and IgE increase support the allergic diagnosis. The etiological role of sevoflurane is clear, having ruled out the rest of common allergens from the environment.

Allergic complications due to inhaled anesthetics in the literature are limited to isolated reports related to halothane and isoflurane, generally as skin reactions features to those in our patient<sup>1,2</sup>.

In our systematic bibliography review we only found two cases of hypersensitivity to sevoflurane related to bronchial hyper-reactivity but no skin alterations<sup>3</sup>.

**Learning points:** There were no publications regarding cutaneous allergic reactions to sevoflurane to date.

This report must also warn about similar symptoms and their potential relationship to sevoflurane exposure in professional environments.

#### References:

1. Bodman R. *Br J Anaesth* 1979;51:1092
2. Caraffini S. *Contact dermatitis* 1998;38(5):286
3. Vellore AD. *Allergy* 2006;61(12):1485-6

## 1AP7-2

### The impact of ageing on anesthesiologist's professional performance in Poland

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**Background and Goal of Study:** Among 6170 of Polish anesthesiologists, 54% are above 50 y.o. and 22,3% above 60 y.o. Numerous publications on occupational fitness describe ageing as an inevitable process, leading to underperformance. Quite a good amount of studies state that ageing physicians perform similarly to their younger colleagues. In an attempt to scrutinize the problem we studied the prevalence of five separate factors contributing to reduced professional efficacy in different age groups of anesthesiologists.

**Materials and methods:** A cross-sectional study was performed by means of an internet portal survey (POLANEST) and by e-mail. We were able to obtain 209 responses based on self-assessment. Categorical data were arranged in the contingency tables. Fisher's exact test was used for hypothesis testing. P value of less than 0.05 considered to be significant. Variables were compared by odds ratios. (Stat Soft 12).

**Results and discussion:** Participants were categorized into two groups: below 50 y. o. (reference group- RG) and 50 and above group (study group-SG). Excessive fatigue associated with regular working mode was observed among 42.6% of physicians in SG vs. 26.8% in RG (OR -2.0, p=0.017). Permanent exhaustion during night shifts was observed in 44.5% of physicians in SG vs. 16.6% in RG (OR-4.0 p< 0.001).

Incidents of patient-management difficulties associated with impediments in cognitive process were reported by 13.8% physicians in SG vs. 3.8% in RG (OR 4.2, p=0.0014).

Incidents of patient-management difficulties associated with impediments in the fine motor skills and psychomotor speed were reported by 14.9% phy-

sicians in SG vs. 4.6 % in RG (OR 3.6, p=0.002). Incidents of patient-management difficulties associated with shortage of up-to-date knowledge were reported by 5.9% physicians in SG vs. 10.1% in RG (OR 0.56, p=0.26). The results of the study suggest that the most sensitive factors affected by ageing are night shift exhaustion as well as cognitive and fine motor skills impediment. There was insignificant difference between SG and RG regarding shortage in up-to-date knowledge.

**Conclusion(s):** Changes associated with ageing of anesthesiologists should not be conceptualized as a homogenous process. Of special concern are deteriorations related to permanent exhaustion during night shifts and difficulties linked with impediments in cognitive process and fine motor skills.

## 1AP7-3

### Perception of the anaesthesiologist among the Israeli public

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**Background:** The profession of anaesthesiology has long been suffering from low appraisal among the Israeli public. On a survey in 2005, only 64% of the public recognized the anaesthesiologist as an M.D, and only 30% believed he is the physician in charge of the patient's well-being during surgery.

As a result, the Israel Society of Anaesthesiologists undertook several actions to increase lay communities' awareness of the training and the pivotal role of the anaesthesiologists in- and outside the operating rooms (ORs). The aim of this study was to evaluate whether this helped educating the public regarding the anaesthesia profession.

**Methods:** Questionnaires regarding perception of different aspects of the anaesthesia profession and the anaesthesiologist's responsibilities were handed out to 500 subjects. Descriptive statistics were used to analyze the answers, and results are presented with comparison to the 2005 survey.

**Results:** Demographic data of the 500 participants are shown in table 1. More than 92% knew that the anaesthesiologist is an M.D, compared with only 64% in 2005. More people acknowledged that the anaesthesiologist is responsible for their well-being during surgery (47.5% vs. 30% in 2005). About a quarter of the responders believed the anaesthesiologist does not attend in the OR for the whole procedure (similar to the reported rate in 2005).

Most participants believed that both anaesthesia and surgery are risky to the same extent (76%), although fear from anaesthesia was rated higher (mean±SD 3.57±1.3 on a scale of 1 to 5) than fear from the surgery itself (3.47±1.24, p< 0.05). Greater concern from both anaesthesia and surgery was found among women (p< 0.05) and among participants who never underwent surgery (p< 0.05).

Most participants (92%) stated they would like to meet an anaesthesiologist prior to their surgery, and 95% preferred to specifically meet the anaesthesiologist who will be treating them in the OR.

**Conclusion:** Education of the public regarding the anaesthesiologists' roles helped to increase knowledge. This may explain the high percentage of people who express desire to meet their anaesthetist before the operation and to be able to choose the anaesthesiologist for their surgery. Current educational efforts should focus on the critical role of the anaesthesiologist outside the OR.

## 1AP7-4

### Should anaesthetists offer lifestyle advice to patients?

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**Background and Goal of Study:** Lifestyle choices such as smoking, alcohol consumption, diet and exercise are known to have an effect on long term health and can increase the risks associated with surgery and anaesthesia.

The General Medical Council states that all doctors "must support patients in caring for themselves to empower them to improve and maintain their health."<sup>1</sup> However, there is conflicting evidence over whether brief lifestyle interventions are effective and there have been reports of Anaesthetists receiving complaints when advising patients on the negative effects of their lifestyle.

We aimed to find out if patients expect or want lifestyle advice from their Anaesthetist and in what circumstances. We also wanted to find out whether Anaesthetists currently offer lifestyle advice and if they would be willing to do so should evidence support a change in practice.

**Materials and methods:** We conducted a survey of 30 patients who attended hospital for pre-assessment prior to undergoing surgery. We asked about their views on lifestyle advice from Anaesthetists to patients particularly around smoking, alcohol use and weight.

We also surveyed 30 Anaesthetists. We asked their opinions on offering lifestyle advice to patients, their current practice and whether they would change be willing to change that practice.

**Results and discussion:** 24/30 patients answered that Anaesthetists should offer lifestyle advice to patients. 10 patients felt that advice should be given on the morning of surgery, and 8 felt that it should be given following surgery. Only 50% of Anaesthetists answered that they should give lifestyle advice to patients, however, 24 Anaesthetists said they would change their practice if there was evidence that patients wanted advice and 26 Anaesthetists would change their practice if there was evidence that advice provided lifestyle improvements.

The most frequent reason given by Anaesthetists for not giving lifestyle advice was fear that it would affect their rapport with the patient (16/30).

**Conclusion(s):** Most patients think that Anaesthetists should offer lifestyle advice to patients. Whilst only half of Anaesthetists have the same view, most were willing to alter their practice if evidence supported a change.

Patients were most in favour of advice being given on the morning of surgery (before arrival in the anaesthetic room) or after surgery.

**References:**

1. Good Medical Practice (2013), General Medical Council

## 1AP7-5

### Is earlier consultant-delivered surgery associated with a reduced 30-day mortality in patients with fractured neck of femur?

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**Background and Goal of Study:** Across the UK in recent years mortality following fractured Neck of Femur (#NOF) is around 8.3% at 30 days, according to the UK National Hip Fracture Database (NHFD). Guidelines from NICE and the NHFD report (2013) suggest that 85% of patients should get to theatre within 36-48 hours of admission, and that anaesthesia and surgery should be consultant delivered. We set out to discover if we were achieving this in our hospital and how any change was associated with outcome.

**Materials and methods:** Analysis was performed on retrospectively collected data of all fractured neck of femur patients admitted between January 2010 and Nov 2013 to our hospital. Patient demographics, ASA status, and 30 day all cause mortality were collected from the Hospital Information System and our submissions to the NHFD. This data was then cross-referenced against theatre logbooks to identify grade of operating surgeon and anaesthetist. The proportion of consultant-delivered cases was recorded

The primary end point was 30 day mortality from time of admission. Grouped years 2010-11 were compared against 2012-13. Statistical significance was tested using Fisher's Chi-squared test.

**Results and discussion:** Data was fully complete for 1059 (75%) of 1440 patients. The median age was 85 years (IQR 79.5-90) and 76% were female. Over this period there was a marked changes as shown in table 1.

	2010-11	2012-13	P=
% theatre in <48 hrs	582 of 708 (82%)	623 of 663 (94%)	<0.001
% Consultant Anaesth delivered	240 of 452 (54%)	423 of 607 (70%)	<0.001
% Consultant Surgeon delivered	163 of 451 (36%)	177 of 603 (29%)	0.024
% Mortality	40 of 452 (8.8%)	47 of 607 (7.7%)	0.58

[Table 1]

**Conclusion(s):** Fractured neck of femur remains an injury with a high associated mortality and morbidity. Recommendations from national and international bodies agree that anaesthesia should be provided by the highest grade of anaesthetist available. Nationally the 30-day mortality of hip fracture has risen. Our data shows a non-significant trend toward a reduction in mortality associated with earlier operation and an increased proportion of consultant-delivered anaesthesia.

**References:**

- <http://www.nhfd.co.uk/20/hipfractureR.nsf/resourceDisplay>

## 1AP7-6

### Effectiveness and safety of continuous stimulation without needles with STIPER® puncture in the prophylaxis of postoperative nausea and vomiting in elective breast surgery

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**Background and Goal of Study:** The incidence of postoperative nausea and vomiting (PONV) has a wide range (20-80%) in high-risk patients, despite the introduction of new drugs for prophylaxis and treatment. The acupuncture 6 Pericardium (6PC) point is commonly used to treat PONV. Nowadays, there are no studies about the beneficial effects of continuous stimulation without needles (Stiper® puncture) applied to the acupuncture 6PC point in the prophylaxis of PONV. The aims of this study were to evaluate the effectiveness and safety of Stiper® puncture in 6PC acupoint applied as prophylaxis of PONV during the first 24 hours after elective breast surgery.

**Materials and methods:** In this prospective, randomised, double-blind, placebo-controlled study, all consecutive adult female patients scheduled for elective breast surgery (more than 1 hour) were collected over a period of 10 months. After ethics committee approval and signed informed consent, patients were randomly allocated into 2 groups: G2 received Stiper® puncture applied in the acupuncture 6PC point bilateral 30 min before anaesthesia, and G1 (placebo group) received a cotton ball with identical dimension as the Stiper® in the same location.

A general balanced anaesthesia was performed in all patients according to the protocol. Variables recorded were: demographics, PONV risks factors and incidence, pain, anaesthetic, analgesic and antiemetic drug requirements during the first 24 h postoperatively, intraoperative incidents, kind of surgery and duration, bleeding, fluids and patient's satisfaction (skin reactions, allergies). Data are presented as percentages and/or absolute numbers;  $p < 0.05$  was significant.

**Results and discussion:** 102 women were included (G1: 49, G2: 53); mean age was  $56.34 \pm 13.16$  ys. There were no statistical differences in preoperative or intraoperative variables among groups. The global percentage of patients presenting PONV in G1 was 63.3% (31) and 35.8% (19) in G2 ( $p=0.006$ ); 53.1% (26) in G1 required an antiemetic treatment versus 30.2% (16) in G2 ( $p=0.019$ ). Only 5% of the patients were not satisfied with the treatment. No local or systemic adverse effects were observed.

**Conclusion(s):** Stiper® puncture applied to the acupuncture 6PC point is an effective, safe, non-pharmacological treatment for the PONV prophylaxis in elective breast surgery. It has no side-effects and it is well tolerated. It could be recommended in patients with moderate-high risk for PONV or drugs contraindications.

## 1AP7-7

### Risk factors for preoperative worrying and fear and patient information source

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**Background and Goal of Study:** Fear for anesthesia and surgery is a disturbing experience in the preoperative period (1). Different risk factors for pre-operative anxiety were already reported (2), but data on the importance of different information sources are less abundant. Several information channels were considered.

**Materials and methods:** The medical records of 706 patients who underwent surgery between January and April 2013 were reviewed. The method was approved by the Ethical Committee of the hospital. Age, gender, weight, length, type of surgery, type of anesthesia and premedication were collected from the anesthesia record while the HADS (Hospital Anxiety and Depression Scale), the source of pre-operative information (physician contact, books, magazines, internet, etc) in relation to their surgery, the experience of previous anesthesia/surgery and the degree of pre-operative fear came from internal quality control data. Pre-operative fear and the degree of worrying were measured by a 10 cm linear analog scale. Independent predictors for pre-operative fear were tracked by forward stepwise logistic regression. SPSS Statistics 20® (IBM).

**Results and discussion:** Three classes of anxiety trait were derived from the HADS-score: 0 to 8 (class A), 9 to 12 (class AA) and 13 to 21 (class AAA). The cut-off for significant fear/worry was chosen at  $> 3/10$ . HADS-score AA (OR=6,892), female sex (OR=2,144) and the prospect of undergoing medium and major surgery (OR=2,734 and OR=2,426 respectively) are independent



predictors of pre-operative worrying. Fear for anesthesia was predicted by a HADS-score AA (OR=3,693) and female sex (OR=2,181). The experience of a previous anesthetic procedure was an independent predictor for reduced fear for anesthesia (OR=0,467). None of the different information sources were independent predictors.

**Conclusion(s):** Female patients with a substantial anxiety trait (HADS 9-12) may need more than a pre-operative physician visit, active info gathering or premedication in order to reduce pre-operative fear, especially if it is their first procedure.

#### References:

Bradt et al. Cochrane Database Syst Rev 2013, Issue 6.  
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## 1AP7-9

### Parental presence during anesthesia induction. Does it improve quality of anesthesia?

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**Background and Goal of Study:** Induction of anaesthesia can be distressing for parents and children. The effect of parental presence at anaesthesia induction on children anxiety and children anesthesia compliance has been previously investigated but the few studies existing show contradictory results; and nobody has investigated about parental experience and total perceived quality.

The aim of this randomized controlled trial is to evaluate the impact of parental presence during induction of anaesthesia on parent and children anxiety during the perioperative period and perceived quality.

**Materials and methods:** After local ethics committee approval, written informed consent was obtained from the parents of 60 ASA I pediatric patients scheduled for tonsillectomy. Those with previous surgery were excluded. Patients were randomly allocated to two groups: one with the presence of a children's parent during induction of anesthesia (P) or control (C).

The State Trait Anxiety Inventory (STAI) is a parental self-report measuring state and trait anxiety. The form is filled in the waiting area (baseline and moment 1), after separation (C) or just before entering the operating room (P) (moment 2), during induction of anaesthesia (moment 3), and in the postanesthetic care unit (moment 4).

Modified Yale Preoperative Anxiety Scale (mYPAS) measures children's anxiety in the same moments: preoperative holding area, entering the operating theatre and induction.

Induction Compliance Checklist (ICC) represents the negative behaviors present during induction; ICC≥4 was considered poor behavioural compliance.

When leaving the postanesthetic care unit all parents answered a questionnaire about their experience and evaluated the experience in a scale from 0 to 10.

Student's t test, Mann Withney U test or Chi square were used as appropriate. A  $p < 0,05$  was considered significant.

#### Results:

Group	mYPAS 1	mYPAS 2 (*)	mYPAS 3 (*)	STAI baseline	STAI 1	STAI 2 (*)	STAI 3 (*)	ICC<4 (*)	Perceived quality (*)
P	35.0 (18.8)	37.0 (11.4)	45.3 (29.5)	12.8 (8.9)	11 (4.5)	13.2 (2.5)	13.6 (3.3)	50 (83.3%)	9.3 (1.2)
C	32.5 (14.2)	79.2 (12.6)	78.6 (5.3)	11.3 (8.9)	11.5 (4.0)	32.5 (6.1)	33.6 (3.8)	12 (20%)	6.8 (1.7)

#### [Children and parental anxiety]

No children was withdrawn. All were ASA I. Children and parental anxiety decreases in group P, as well as 83% of children in group P showed good ICC. Perceived quality was higher in group P. All parents in group P would repeat the same experience. 87% parents in group C would prefer staying with their children.

**Conclusions:** Parental presence during anaesthesia induction improves quality of anaesthesia both for parents and children.

## 1AP7-10

### Sentinel drugs as a key factor in cost-limiting of pharmacy anaesthesia bill

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**Background and Goal of Study:** Optimization programme of our annual expenses in anesthetic drugs include analyse of pharmaceutical medium cost for anesthesia and selection of sentinel drugs responsible of such cost. Sentinel anesthetic drug selected were: 1.- Representatives of the more frequently used drugs (hypnotics, analgesics, muscle relaxant or antidotes, fluids and vasoactive agents) and with the highest impact on anesthesia bill 2.- Susceptibles to improvement in use by protocolization or price renegotiation 3.- With possibility of interchange by another product. With this criteria we selected as a sentinel drugs: 1% propofol, sevoflurane, remifentanyl, atracurium, rocuronium, sugnamdex, granisetron, ephedrine, levosimendan, 0.9% SS, succinylated gelatine, 130/0.4, hydroxyethyl starch, Ringer L and, Plasma-Lyte.

**Objective:** Comparison of total cost of farmaceutical anesthesia bill in years 2011 and 2012, before and after implementation of the programme.

**Materials and methods:** Clinical meetings with team of anesthesiologist for discussion of criteria on the best use of drugs.

Protocolization of the most expensive drugs: levosimendan and sugnamdex Commercial meetings for drug renegotiations, when possible

**Results:** Total surgical procedures between study periods were 22.260 vs 21.975 with no sensible changes in type of surgeries (ambulatory surgery, in-hospital surgery, emergency surgery). Average pharmaceutical expenses for each anesthesia were €43.79 and €36.71 between study periods (-16.18%) Total savings in annual pharmacy anaesthesia were €155.619. The 97.94% of such saves were in sentinel drugs. Half of the savings in centinel drugs was obtained by price renegotiation and the other half for improvement of anesthetic drugs utilization.

**Discussion and Conclusion(s):** Analysing the cost of anaesthetic drugs allows a more efficient use and cost-limiting policy without worsening patient's security or assistential quality.

Sentinel anesthetic drug selection is an efficient way to analyse professional habits and improve criteria of utilization of them.

## Ambulatory Anaesthesia

### 2AP1-1

#### Comparison of remifentanyl and midazolam in combination versus midazolam for sedation during fiberoptic bronchoscopy: a preliminary study

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**Background and Goal of Study:** Fiberoptic bronchoscopy (FOB) is an important tool in diagnostic strategy. However, it generates discomfort and pain and can worsen respiratory and/or hemodynamic condition. The aim of this study was to evaluate the effectiveness and safety of sedation with midazolam associated or not with remifentanyl infusion in patients with spontaneous ventilation undergoing conscious FOB.

**Materials and methods:** In the study were recruited 33 adult patients undergoing a routine diagnostic FOB with broncho alveolar lavage. They were randomly assigned to one of two groups (group "M"- midazolam, 17 patients; group "R"- midazolam and remifentanyl, 16 patients). Respiratory and hemodynamic parameters, as well as comfort and level of sedation, were assessed:

1. before administering the study drugs;
2. immediately before starting the procedure;
3. 30 seconds after introducing the bronchoscope through the nasopharynx;
4. every minute till the end of the procedure;
5. every 5 minutes till the patients left the bronchoscopic room.

The depth of sedation was evaluated using the Observer Assessment of Alertness/Sedation scale (OAA/S). At the end of the procedure a questionnaire was submitted to the patient considering the degree of amnesia, the global acceptance of the procedure and the acceptance of another FOB in the future.

**Results and discussion:** The two groups were homogeneous. In R group, there's a better respiratory and hemodynamic control during procedure ( $p < 0.001$ ). Patients reported low level of pain, reduction of cough episodes ( $p < 0.001$ ) a better level of sedation ( $p < 0.005$ ) and a good satisfaction with the procedure. In group R, 90% of patients referred not having any discomfort while in group M almost all of the patients thought the procedure was from bothersome to acceptable ( $p < 0.05$ ). Moreover the patients were able to leave the bronchoscopic room 21 minutes after the end of the procedure. Another important finding of our study is the capability of remifentanyl to significantly attenuate haemodynamic response to FOB.

**Conclusions:** The association Midazolam-Remifentanyl infusion is an adequate choice for sedation during outpatient diagnostic bronchoscopy. Such results could be the first step towards wider use of Remifentanyl in patients experiencing awkward and/or painful procedures in this setting.

#### References:

1. Putinati S, Ballerini L, Corbetta L, Trevisani L, Potena A (1999) Patient satisfaction with conscious sedation for bronchoscopy. *Chest* 115:1437-144

### 2AP1-2

#### Comparative efficacy of levobupivacaine and ropivacaine for epidural block in elderly outpatients with degenerative spinal disease

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**Background:** It is known that levobupivacaine has less toxic potential both on cardiovascular and central nervous system than bupivacaine. Although epidural levobupivacaine widely has been used for postoperative epidural analgesia, there are few reports on the efficacy of epidural levobupivacaine in elderly outpatients. This study was carried out to evaluate the efficacy of epidural levobupivacaine and ropivacaine in elderly outpatients with degenerative spinal disease and sciatica.

**Methods:** With approval of the institutional Ethics Committee and written informed consent from each patient, we studied 8 patients over 75 years olds having the indication of epidural block for radiculopathy associated with degenerative spinal disease and sciatica.

The study was performed in a prospective, double blind and crossover fashion.

Epidural block was performed by caudal approach with 15ml of 0.125% levobupivacaine or 0.2% ropivacaine.

The upper level of analgesia was evaluated by pin prick. Residual pain was evaluated by visual analogue scale (VAS). Motor blockade was evaluated by Bromage scale. VAS and Bromage scale were evaluated at 15, 30, 60 and 90 minutes after epidural block. Systolic arterial blood pressure (SAP) and heart rate (HR) were recorded simultaneously. The recovery times to mobilization, ambulation and spontaneous micturition were also measured. Significant difference ( $< 0.05\%$ ) was determined by Wilcoxon's rank sum test and Mann-Whitney U-test.

**Results:** There were no significant differences in the level of analgesia, VAS, Bromage scale, SAP, and HR between 0.125% levobupivacaine and 0.2% ropivacaine throughout the time course. There were no significant differences in the recovery times to mobilization, ambulation and spontaneous micturition between 0.125% levobupivacaine and 0.2% ropivacaine.

**Conclusion:** The results show that 0.125% levobupivacaine and 0.2% ropivacaine for lumbar epidural block by caudal approach provide similar pain relief, motor blockade and sympathetic nerve blockade in the elderly outpatients with degenerative spinal disease.

### 2AP1-3

#### Randomized, double-blind, controlled, clinical trial to compare the effectiveness of two methods of sedation in outpatient colonoscopy

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**Background and Goal of Study:** Despite the frequent use of propofol for day-case anaesthesia, sevoflurane (Sv) has pharmacological properties which suggested it could be a viable alternative<sup>1</sup>. Our study tested the hypothesis that analgesia/sedation with Sv would be as effective as that obtained with propofol/remifentanyl (P/R). We present a randomized double-blinded clinical trial to compare the efficacy and safety of the inhaled anaesthesia with Sv versus P/R in patients undergoing ambulatory colonoscopy.

**Materials and methods:** Adult patients (n=100, ASA I-III) undergoing to receiving either sedation with Sv or P/R. After approval by our ethics committee, written informed consent was obtained. All procedures were performed by the same experienced endoscopist and anaesthesiologist. Sedation was achieved by infusion of remifentanyl (0.05 to 0.10  $\mu\text{g}/\text{kg}/\text{min}$ ) and propofol in titrated doses in the P/R group, and by inhaled sevoflurane administered by a face mask in the Sv group. Cardiorespiratory parameters, time employed in colonoscopy, movements of the patients during the procedure, and recovery levels were recorded. Quality of sedation was assessed by the endoscopist and by the patient with a Visual Analogic Scale (VAS). Statistics: data are presented as a mean  $\pm$  SD. Wilcoxon's test and Fisher's exact test were used to determine differences between P/R group and Sv group.

**Results and discussion:** All colonoscopies were performed successfully to the cecum. Both groups were comparable with respect to demographic data and initial parameters. There were not statistically significant differences in the duration of the procedure, or in the quality of sedation assessed by the endoscopist or by the patient. In the P/R group, the signs of respiratory depression were statistically significant ( $p=0.027$ ) compared with the Sv group. This result may be due to the properties of Sv. Cardiorespiratory parameters, movements during the procedure and recovery levels were similar in both groups.

**Conclusion(s):** Both sedation techniques provided sufficient analgesia, satisfactory haemodynamic stability, and rapid recovery of the patients. The Sv group showed minor respiratory depression. Quality of sedation evaluated by endoscopist and by the patient were similar in both groups.

#### References:

1. Ghatge S, Lee J, Smith I. Sevoflurane: an ideal agent for adult day-case anaesthesia? *Acta Anaesthesiol Scand* 2003; 47: 917-931.

## 2AP1-5

### Simplified topical anaesthetic protocol for ambulatory cataract surgery: safety and satisfaction

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**Background and Goal of Study:** Cataract surgery (CS) is one of the most frequent surgical procedures in developed countries and topical anesthesia (TA) is increasingly used for it. Limited access to pre-anaesthetic evaluation and availability of anaesthesiologists may delay CS. The aim of our study was to assess safety and efficiency of CS under TA alone, i.e. without pre-anaesthetic evaluation and without direct presence of an anaesthesiologist. To this end we assessed

- incidence of preoperative patients' anxiety,
- perioperative adverse events,
- patients' and surgeons' satisfaction.

**Materials and methods:** After ethics committee's approval and written informed consent, patients undergoing CS under topical anaesthesia were included during one month. Patients with organ transplantation or advanced cardio-pulmonary disease were excluded. Standardised information was given to all patients prior to CS by the ophthalmologist. At arrival in the operating room (OR) patients received an iv-line; heart rate, blood pressure and oxygen saturation were monitored. Anaesthesiologist and anaesthesia nurse were present in the area and could intervene in case of an adverse event. Patients' anxiety was scored using Amsterdam Preoperative Anxiety & Information Scale (APAIS) their satisfaction with IOWA Satisfaction with Anaesthesia Scale (ISAS). Patients with an APAIS anxiety score (APAIS I)  $\geq 13/20$  and an APAIS information score (APAIS II)  $\geq 8/10$  are considered as anxious. Surgeons' satisfaction was scored with a VAS from 0 to 10 (0: surgery not possible & 10: excellent surgical conditions). Data are mean ( $\pm$  SD) or individual data.

**Results and discussion:** 124 consecutive patients were included without any dropout; 71 with hypertension, 19 with diabetes. Mean age was 71 ( $\pm 9.4$ ), mean duration of CS was 14.6 ( $\pm 6.6$ ) min.

Mean APAIS I was 6.4 ( $\pm 3.7$ ), 10 patients had a score  $\geq 13$ . Mean APAIS II was 3.1 ( $\pm 1.8$ ), 7 patients had a score  $\geq 8$ . Mean ISAS score was 5.5/6 ( $\pm 0.6$ ), indicating a high patients' satisfaction. Surgeons' satisfaction score was 8.9/10 ( $\pm 1.7$ ).

21 adverse events occurred, 15 of them of required intervention: 5x supplemental regional anaesthesia, 4x iv-analgesia, 1x iv-sedation, 5x hypertension.

**Conclusion(s):** These preliminary data suggest that simplified TA protocol for ambulatory CS seems to be feasible and, as long as an anaesthesia team is present in the area to intervene if needed.

## 2AP1-6

### Comparative study to evaluate the antiemetic strategy used in patients undergoing ambulatory surgery vs. hospitalization

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**Background:** Postoperative nausea and vomiting (PONV) are some of the most common complications after surgery. Current consensus guidelines recommend that the use of prophylactic antiemetics should be tailored to the patient's risk of PONV. The level of accomplishment of these recommendations by the anaesthesiologists, and whether there are differences between the regimens used in ambulatory surgery (AS-group) and in patients undergoing hospitalization (H-group) remain unknown. The aim of this study was to compare the antiemetic strategy in AS versus hospitalized patients.

**Materials and Methods:** After ethics committee approval, a retrospective, comparative cohort study was performed in adult patients operated on AS or H under general anesthesia. Apfel risk of PONV (female, smoker status, history of PONV/motion sickness, and postoperative opioids use) and demographics, anesthesia and surgery relevant data were recorded. We compared whether the antiemetic strategy was adapted to Apfel factors and type of surgery in each group. Emetic events were collected up to 72 hours after surgery. Statistical analysis: Student T-test and X<sup>2</sup> test.

**Results and Discussion:** 228 patients were evaluated (114 patients in each group), ASA I-III. Patients undergoing ambulatory surgery were significantly younger (AS=44 $\pm$ 16 years, H=57 $\pm$ 17,  $p=0.0001$ , results expressed as mean $\pm$ standard deviation), but there were no significant differences between both groups in mean Apfel risk factors (AS=1.6 $\pm$ 0.9, H=1.7 $\pm$ 0.9,  $p=0.29$ ). The antiemetic measures used was higher in AS group (1.99 $\pm$ 0.7) compared to H-group (1.4 $\pm$ 0.86),  $p=0.0001$ . The percentage of patients in

whom prophylaxis was below recommended was significantly lower in patients undergoing ambulatory surgery (AS=8%, H=46%,  $p=0.0001$ ), as it was the incidence of emetic events during the first 24 hours (AS=5% and H=17%,  $p=0.002$ ). There were no differences in emetic events at 48 and 72h after surgery between groups.

**Conclusions:** The results showed that in our hospital, there was a better achievement of PONV prophylaxis protocols in patients undergoing ambulatory surgery than in hospitalization. These finding suggests that there was a greater awareness to prevent this complication among anaesthesiologists in charge of patients in AS. The implementation of prophylaxis according to the Apfel-scale, was more efficient in AS, consequently there were less emetic events in the population of AS in comparison with hospitalization.

## 2AP2-1

### Hyperglycaemia and complications after ambulatory surgery (H2A study)

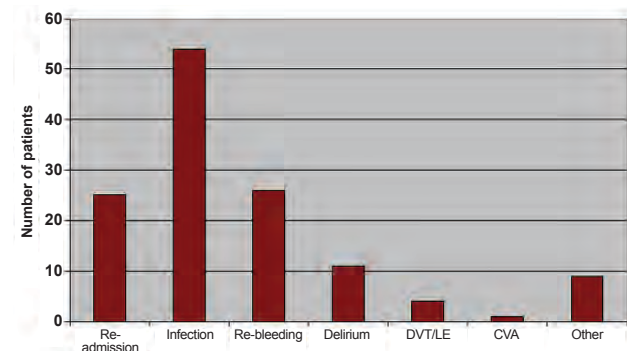
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**Background:** Peri-operative hyperglycaemia is associated with postoperative complications after major surgery and glucose lowering is beneficial after coronary surgery. However, more than 50% of operations are performed in an ambulatory setting, where plasma glucose is not routinely measured. It is unknown how often and in which patients hyperglycaemia occurs during ambulatory surgery and whether this might have clinical consequences. The objective of this study was to investigate the glucose change during ambulatory surgery, to identify patients at risk for peri-operative hyperglycaemia (glucose  $\geq 7.8$  mmol/l) and to determine whether hyperglycaemia predisposes for complications after ambulatory surgery.

**Methods:** Patients scheduled for ambulatory surgery, aged 18-85 years, were included in an observational, prospective cohort study. Capillary blood glucose was measured one hour before- and after surgery. Patients were contacted 3 months later to register complications after discharge. The Wilcoxon signed rank test, the Mann Whitney-U test and multivariate binary logistic regression were used for analysis.

**Results:** We included 951 patients. 51% was male, mean age was 47.0 (SD 15.8) years and 51 (5.4%) patients had diabetes. The median glucose changed from 5.4 preoperative to 5.6 mmol/l postoperative ( $P < 0.001$ ). Hyperglycaemia  $\geq 7.8$  mmol/l occurred in 85 (8.9%) patients. Follow up was completed for 667 (71.1%) patients. Any complication occurred in 93 (13.4%) patients (figure 1). In logistic regression analysis, age (OR 1.1, 95%CI 1.0-1.1), BMI (OR 1.1 95% CI 1.0-1.2), operating time (OT)  $> 28$  min (OR 3.9 95% CI 2.0-7.6) and diabetes (DM) (OR 34.5, 95%CI 13.1-90.0) were associated with hyperglycaemia. DM (OR 2.3, 95%CI 1.0-5.0,  $p = 0.04$ ) was, when adjusted for sex, age, BMI, dexamethasone administration, ASA-status and OT, significantly associated with complications after ambulatory surgery. After adjustment for hyperglycaemia this association disappeared. Hyperglycaemia was not associated with any postoperative complication.



[Figure 1 Complications]

**Conclusion:** Glucose increases significantly during ambulatory surgery. Patients with increased age and BMI, pre-existent DM and OT  $> 28$  min are at increased risk for hyperglycaemia. However hyperglycaemia ( $\geq 7.8$  mmol/l) during ambulatory surgery is not associated with complications in patients without diabetes. Future studies investigating the risk of hyperglycaemia in diabetes patients undergoing daytime surgery is warranted.



## 2AP2-2

### Five year retrospective study of unanticipated admission after ambulatory surgery

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**Background and Goal of Study:** Outpatient surgery has increased substantially including a wider range of procedures and patients of higher risk. The goal of this study was to identify the reasons for unanticipated admission in our ambulatory care population, to monitor the quality of care, to improve efficiency and avoid adverse events in the future.

**Materials and methods:** We retrospectively analyzed records from all patients admitted to our Ambulatory Surgery Unit (ASU) from June 2008 to May 2013 using S. Teotónio Hospital database and IBM SPSS statistics 20. Demographic data, American Society of Anesthesiology (ASA) physical status classification, type of surgery and of anesthesia, procedure duration and reasons for hospital admission were recorded. Unanticipated admission was defined as unplanned admission following a day surgery procedure, without prior discharge.

**Results and discussion:** Over the 5 year period we registered 122 unplanned admissions after ambulatory surgery at S. Teotónio Hospital, out of a total of 22 736 patients operated in our ASU (0,54%). Patient median age was 49 years with 63,1% being classified as ASA physical status II.

The patients were operated in the following surgical specialties: general surgery 42,6%, gynecology 23,8%, orthopedics 9,8%, gastroenterology 9,0%, urology 7,4%, ophthalmology 5,7%, vascular surgery 0,8% and dermatology 0,8%. Gynecology had the highest (2,35%) relative rate of admission, followed by general surgery 1,29%, urology 1,25%, gastroenterology 0,77% and the remaining specialties.

Most prevalent surgical procedures among admissions were inguinal hernia repair (18%), tension-free-vaginal tape (11,5%) and pilonidal sinus excision (8,2%). Procedure median duration was 45 minutes. Most admissions were surgery related (69,7%) with the major reasons being a more extensive surgery than planned and bleeding, followed by anesthesia related issues (21,3%), where pain was the major reason, and miscellaneous reasons (11,5%). In most cases, hospital stay was 2 days.

**Conclusion:** Our unplanned admission rate was 0,54%, which compares favorably to what we've found in the literature. This result further supports the view that ambulatory surgery is a safe practice. It is essential to monitor unplanned admission rates to maintain a high quality of care, ensuring cost efficiency and patient satisfaction.

## 2AP2-3

### Patient- versus medical practitioner-controlled sedation with propofol: systematic review and meta-analysis

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**Background:** Patient-controlled sedation (PCS) with propofol, alone or in combination with an opioid, is a sedation technique used for minimally invasive therapeutic and diagnostic procedures. It remains unclear whether PCS compared with medical practitioner-controlled sedation (MPCS) results in higher patient satisfaction, lower propofol consumption and a lower risk of propofol-related adverse effects, without affecting operator satisfaction or increasing procedure duration.

**Methods:** We performed a comprehensive search in electronic databases (Pubmed, Embase, Cochrane Library, Google Scholar) and bibliographies for published full reports of randomised trials comparing propofol-PCS with propofol-MPCS in patients undergoing minimally invasive procedures. The last search was in December 2013.

**Results:** We analysed data from 14 studies that were performed in 910 low risk adults undergoing a variety of diagnostic and therapeutic procedures. With PCS, the cumulative propofol dose was significantly decreased (7 trials, 528 patients, weighted mean difference [WMD] -8.8 mg [95% confidence interval, -15.7 to -2.0]), and there was a trend towards an increased patient satisfaction (7 trials, 582 patients, WMD on a 0-10 point visual analogue scale, 0.16 [-0.02 to 0.34]).

There was no difference in the incidence of amnesia related to the procedure (7 trials, 549 patients, odds ratio [OR] 0.73 [95% confidence interval, 0.51 to 1.05]), the incidence of desaturation (SpO<sub>2</sub> < 90%) (11 trials, 811 patients, OR 1.2 [0.53 to 2.68]), operator satisfaction (5 trials, 412 patients, WMD on a 0-10 point visual analogue scale, 0.12 [-0.36 to 0.12]), procedure duration (10 trials,

617 patients, WMD 0.15 min [-1.78 to 2.08]), and time to achieve the desired sedation level (3 trials, 140 patients, WMD 0.7 min [-0.9 to 2.3]).

**Conclusions:** Low risk adults undergoing minimally invasive therapeutic and diagnostic procedures with propofol-PCS consume less propofol and seem to be at least as satisfied as with propofol-MPCS. There was no difference in the risk of propofol-related adverse effects, in procedure duration or in operator satisfaction.

## 2AP2-4

### Early recovery with continuous infusion propofol versus sevoflurane in day-case surgery

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**Background:** Today, approximately 43% of all surgical procedures in Spain are performed on an outpatient basis. To maintain high quality standards, anesthesia in day-case surgery requires a smooth and pleasant induction, rapid recovery and a low incidence of side effects. Two of the most commonly used drugs are propofol and sevoflurane.

The efficacy in day-surgery of sevoflurane or propofol deep sedation associated with the use of supraglottic devices today has been rarely analyzed.

Our aim is to assess whether it is equally effective inhaled sevoflurane vs propofol as an intravenous continuous infusion in day-case surgery without nitrous oxide or opioids administration.

**Materials and methods:** After local ethics committee approval, written informed consent was obtained from patients over 18 years old included for day-case surgical inguinal hernia repair for this randomized clinical trial. Patients were randomly allocated to propofol (propofol lipuro® 1%, Braun, Spain) or sevoflurane (Sevorane®, Abbott, Spain). After NIBP, ECG and oxymetry monitoring, induction of anesthesia was performed using either sevoflurane 8% (Group S) or 2 mg/kg iv propofol bolus (Group P). A supraglottic device (i-gel®, Intersurgical, UK) was applied to all patients and spontaneous ventilation resumed. Anesthesia was maintained with 2-3% sevoflurane or 2-6 mcg/kg propofol. Pre-incisional field-block with 30 ml 1% mepivacaine was used. At the end of surgery drug administration was stopped and recovery time was measured as time to open eyes when called, or voluntary movement.

**Results and discussion:**

	Group P	Group S
N	29	30
Weight (kg)	76±13	73±14
Height (cm)	172±10	168±9
Age (yr)	61±8	63±9
Sex (M/F)(*)	20/9	19/11
Time to eye opening (min)(*)	17±7	9±3
Surgery time (min)	39±7	41±13

[Demographics data show mean ± SD. (\*)p < 0.05]

60 patients were included, 1 patient in the (P) group was excluded for surgical reasons. Many studies show earlier recovery with sevoflurane compared to propofol (1,2). In our study we found similar results when no opioid, nitrous oxide or any other drug was added on either group.

**Conclusion:** Early recovery was faster with sevoflurane compared to propofol TCI in day-case patients in this study.

**References:**

1. Anesth Analg 2004; 98:632-41
2. Eur J Anaesth 2012; 29:371-79

## 2AP2-5

### Our anaesthesia experiences outside the operating room

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**Background and Goal of Study:** Many kinds of invasive and non-invasive diagnostic and therapeutic procedures are being performed outside the operating room and patients usually need either sedation or general anaesthesia in order to provide analgesia and/or immobilization. In this study we aimed to present our experiences outside the operating room.

**Materials and methods:** The medical records of the patients, who required any type of anaesthesia outside the operating room between December 2012 to August 2013, were reviewed retrospectively. The demographic data, types and durations of the procedures and anaesthesia, status of emergency, anaesthesia-related complications and management of those complications were recorded.

**Results and discussion:** Between December 2012 and August 2013, 1264 patients needed anaesthesia outside the operating room. Mean age of patients was  $26.5 \pm 5$  and mean duration of procedures was  $44.6 \pm 4$  minutes. Types of procedures were curettage/oocyte pick up ( $n=417$ ), MRI/CT ( $n=383$ ), angiography ( $n=116$ ), endoscopy/colonoscopy ( $n=86$ ) and others ( $n=262$ ). General anaesthesia was preferred for 954 patients, sedation for 295 patients and epidural for 14 patients, respectively. 444 of them were paediatric patients. Ninety seven procedures were performed under emergency conditions. Major complications were observed in 15 patient (1.18%): allergic reactions (0.4%), intubation difficulty and hypoxia (0.3%), hypotension (0.2%) and bradycardia (0.2%). The complication rates cases were similar between the emergency and elective ones. Additionally, the incidences of allergic reactions and bradycardia were significantly higher in paediatric patients compared to adults ( $p=0.015$ ). One of these patients needed to be taken to intensive care unit unexpectedly due to hypoxia.

**Conclusion(s):** The major complication rates for the anaesthesia given outside of the operating room were reported as 3-7%. Inadequate pre-procedural evaluation of the patients, inadequate equipments, narrow and darkness working areas, extreme ages of patients, high incidence of congenital disorders and complexity of the procedures are the factors which increase the anaesthetic risk ratio for these procedures. But, this increased anaesthetic risk may be decreased by a careful pre-procedural visit, using appropriate monitoring and standardized anaesthesia equipments.

## 2AP2-6

### Optimum opioid for day case gynecological procedures

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**Background and Goal of Study:** Day case surgery services are increasing all over the world. Dilatation and curettage (D&C) is commonly performed as a day case surgery. The anesthetic required has to provide adequate analgesia, rapid onset and rapid recovery. The purpose of this study is to compare the effect of different opioids on awakening and quality of recovery in day case gynecological procedures.

**Materials and methods:** We studied 60 patients ASA I-II, aged 20-61 years old scheduled for D&C procedures. All patients received for induction propofol 2.5 mg/kg and atropine 0.5 mg while anesthesia was maintained with repeated bolus doses of propofol 0.5 mg/kg. Each patient was randomly assigned to one of three groups. Group A ( $n=20$ ) received alfentanil 1000  $\mu\text{g}$ , Group F ( $n=19$ ) received fentanyl 100  $\mu\text{g}$  and Group R ( $n=21$ ) received remifentanyl 100  $\mu\text{g}$ . The duration of surgery and recovery time from anesthesia were recorded. Pain, sadness, ability to forward numbers and to stand without assistance were assessed by Verbal Scale Rating 45 minutes after recovery. Blood pressure, heart rate, peripheral oxygen saturation, nausea, vomiting and their ability to drink water within 30 minutes were also recorded. As rescue analgesia paracetamol 1 g was given intravenously. Statistical analysis was achieved by using chi-square test, student t-test and Mann-Whitney U-test.

**Results and discussion:** The demographic data and duration of surgery were comparable in all groups. There were statistical differences in the recovery times, pain scores and ability to forward numbers as shown in the following tables:

Time (min)	Group A	Group F	Group R
Duration of surgery	9.03 $\pm$ 0.33	8.28 $\pm$ 0.34	8.03 $\pm$ 0.24
Duration of anesthesia	11.54 $\pm$ 0.34	12.22 $\pm$ 0.29	9.06 $\pm$ 0.23*
Eye opening	2.51 $\pm$ 0.20	3.54 $\pm$ 0.27	1.03 $\pm$ 0.16*

[Table 1]

PQRS at 45 min	Group A	Group F	Group R
Pain 1-5 (median)	2*	2	2
Forwarding numbers 1-6 (median)	4	4	5*

[Table 2]

\* $p < 0.05$

The consumption of paracetamol was increased in group R (4/21) compared to groups A (1/20) and F (1/19) but with no statistical significance.

**Conclusion(s):** Taking into consideration the above results remifentanyl is the optimum opioid in terms of speed and quality of recovery in gynecological day case procedures.

## 2AP2-7

### Predictive factors in anaesthetic satisfaction in major ambulatory surgery: preliminary results

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**Background and Goal of Study:** Patient satisfaction is considered an indicator of quality care. The aim of our study is to assess the degree of satisfaction of patients undergoing major ambulatory surgery in our centre and to identify predictive factors of dissatisfaction in order to obtain information about measures for improvement.

**Materials and methods:** Between January and April 2012, we collected data from postoperative telephonic surveys of patients undergoing major ambulatory surgery in our centre. This survey was conducted 24 hours postoperatively and included demographic data, the postoperative analgesic regimen, the level of satisfaction (very satisfied, satisfied, adequate, not very satisfied, not satisfied), the pain numeric scale and the presence of complications such as: nausea/vomiting, dizziness/vertigo, beginning of oral tolerance, fever, headache, wound bleeding and revisiting the emergency room. We excluded patients in whom the data collection sheet was not complete.

Data were analyzed with SPSS 18.0. Quantitative variables were analyzed with the t-Student test or U-Mann-Whitney, and Chi-square test or Fisher's test for qualitative data.

**Results:** 566/874 patients were included in the study. 288 patients underwent general surgery, 112 ENT surgery and 166 orthopedic surgery. 370 patients underwent general anesthesia. 59.7% of patients were very satisfied, 38.9% were satisfied and 1.4% were not satisfied. Orthopedic patients had a higher degree of satisfaction than other specialties ( $p < 0.05$ ). Pain numeric scale was  $3.25 \pm 1.8$  in very satisfied patients,  $3.04 \pm 1.5$  in satisfied and  $9.0 \pm 1.1$  in not satisfied patients.

Dissatisfied patients underwent inguinal hernia repair and septoplasty. They all received general anesthesia ( $p < 0.05$ ). Dissatisfaction was related to postoperative malaise, poor oral tolerance, postoperative bleeding, higher score in the pain numeric scale and need to revisit the emergency room ( $p < 0.05$ ).

**Conclusions:** The rate of satisfaction in our centre was high. The confluence of symptoms 24h after operation is a predictor of dissatisfaction with anesthesia.

We are continuing our study in order to determine specific interventions to improve patient satisfaction.



## Monitoring: Equipment and Computers

### 3AP1-1

#### How closed is the wash-in phase of the Zeus?

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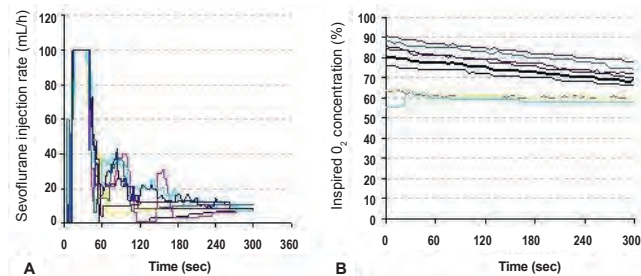
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**Introduction:** By using liquid injection and a blower, the Zeus (Dräger) has uncoupled carrier gas and inhaled agent administration and made the speed of wash-in independent of fresh gas flow (FGF). This combination allows closed circuit anaesthesia (CCA) from the start of agent administration. New software (SW4.03MK04672-00) has been programmed to reduce carrier gas. We hypothesize the new software maintains CCA during the wash-in phase.

**Methods:** After obtaining IRB, 8 patients were enrolled. Anaesthesia was maintained with Sevoflurane in O<sub>2</sub>/air, with a target end-expired sevo (F<sub>Asevo</sub>) of 1.8% and a target inspired O<sub>2</sub> (F<sub>I,O<sub>2</sub></sub>) of 60%.

To determine how closed the system was, a balloon was attached to the exhaust to collect the gases in excess of patient uptake. Sevo waste was calculated from the sevo% and the volume contained in the balloon (measured with gas analyzer and a glass syringe). Sevo usage between 60 and 300sec could be calculated by integrating the injection rate of sevo (V<sub>sevo</sub>, mL liquid sevo/h) that is displayed on the monitor screen. The initial bolus (0-60sec) couldn't be reported exactly because initial loading of the circuit and lungs requires an high injection rate and only a message, V<sub>sevo</sub>>100mL/h appears. Because the injection rate during this period can only range from 100 and 300mL/h (the max V<sub>sevo</sub> that the injector can provide), we can report the upper and lower boundary.

**Results:** Patient age, height and weight were 58±13 years, 177±10cm and 82±10kg. Sevo waste (mL vapor) was 0 in 4 patients, and 3.21, 1.67, 2.75 and 2.56 in the other patients (or 18, 9, 15, 14μL liquid respectively). From the injection rate (Figure 1A), the initial bolus (0-60sec) was calculated to range between 0.96±0.69 and 2.33±2.26mL liquid sevo, during the last 240sec, 0.77±0.05mL liquid sevo was used.



[Figure 1]

**Conclusion:** With the new software, the Zeus works in CCA during the wash-in phase with O<sub>2</sub>/air mixtures. Figure 1B illustrates how the software succeeded in maintaining FGF at CCA by allowing the F<sub>I,O<sub>2</sub></sub> target to be reached slowly by gradually replacing O<sub>2</sub> by N<sub>2</sub>. Under the conditions specified in this study, it is unlikely that any further reduction in agent waste can be made.

### 3AP1-2

#### The humidity of the inhaled gas in a low-flow anaesthesia workstation with or without a heat and moisture exchanger

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**Background and Goal of Study:** During general anaesthesia, patient's tracheal intubation limits the normal warming and humidifying functions of the upper airways. In this situation, ventilation with dry and cold gases leads to considerable loss of water and heat from respiratory tract, unless appropriate means of humidification are used. A circle breathing system increases the humidity of the inhaled gas, especially with the use of a low fresh gas flow (FGF). A heat and moisture exchanger (HME) can be used to further heat

and humidify the inhaled gas. The Dräger Fabius GS Premium anaesthesia workstation has a built-in hotplate to heat gases in the breathing circuit. The warming and humidifying properties of this anaesthesia machine have not yet been investigated. The aim of this study was to compare the humidity of the inhaled gas from a low-flow breathing system of the Dräger Fabius with or without a HME.

**Materials and methods:** Forty one ASA I-II adult female patients scheduled for general anaesthesia with tracheal intubation were randomly allocated into two groups: without (no-HME) or with a HME into the breathing circuit. The patients were ventilated using a circle breathing system with CO<sub>2</sub> absorber with a low FGF (1 L/min) of the Dräger Fabius GS Premium workstation. Temperature and relative and absolute humidity of the inhaled gas were determined close to the tracheal tube using a thermo-hygrometer. The measurements were made at 10, 30, 60, 90 and 120 minutes after connecting the patients to the breathing circuit.

**Results and discussion:** After 120 minutes of ventilation, the use of an HME provided significant higher mean temperature (29.2 ± 1.3°C vs 27.5 ± 1.0°C in the no-HME group; P = 0.003), mean relative (96.3 ± 2.4% vs 93.5 ± 3.8% in the no-HME group; P < 0.001), and absolute humidity (28.1 ± 2.3 mg H<sub>2</sub>O/L vs 25.0 ± 1.8 mg H<sub>2</sub>O/L in the no-HME group; P < 0.001) of the inhaled gas. During anaesthesia, a minimum moisture target of 20 mg H<sub>2</sub>O/L is recommended to reduce the risk of dehydration of the respiratory tract.

**Conclusion:** The low-flow circle breathing system of the Fabius GS Premium workstation reaches the minimum requirements for humidity of inhaled gas during anaesthesia. Insertion of an HME in the breathing circuit increases the humidity of the inhaled gas, bringing it close to physiological values.

**Acknowledgements:** S.A.R.O. received a fellowship from CAPES.

### 3AP1-3

#### The effect of electrically heated humidifier to intraoperative temperature management in elderly patients receiving open abdominal surgery

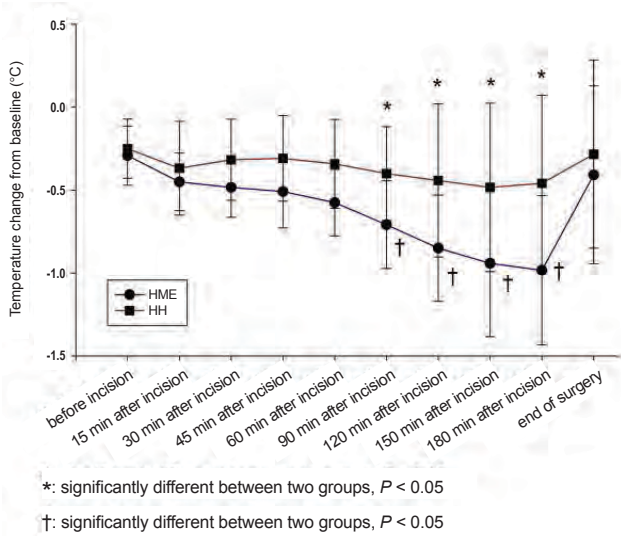
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**Background and Goal of Study:** The body temperature can be decreased during general anaesthesia. Anaesthesia induced vasodilation results in core-to-peripheral redistribution of body heat during the first hour of general anaesthesia, subsequently core temperature decreases linearly as heat loss to the environment exceeds metabolic heat production. In elderly patients, decreased muscle mass and metabolism attribute to increased risk of intraoperative hypothermia. Heated humidifier (HH), an active heating and humidifying device, maybe helpful to maintain the body temperature compared with passive device such as a heat moisture exchanger (HME). We investigated the effect of HH to core body temperature change during open abdominal surgery in elderly patients.

**Materials and methods:** Twenty four elderly patients receiving open urologic surgery in supine position were randomly assigned into two groups; group using heated humidifier (group HH) and group using heat moisture exchanger only (group HME). The esophageal temperature as a main outcome was measured at several specific time-points during surgery; after intubation as baseline, right before skin incision, 15, 30, 45, 60, 90, 120 minutes after skin incision, and at the end of the operation. Skin temperature at right forearm was recorded simultaneously. For secondary outcomes, extubation time, dynamic lung compliance, and postoperative respiratory complications were compared.

**Results and Discussion:** The change of esophageal temperature was shown in Figure 1. Esophageal temperature was decreased significantly after 90 minutes of skin incision in group HH and there was a significant inter-group difference after 90 minutes of incision. Skin temperature showed similar pattern between both two groups and showed no inter-group differences at all time-points. Secondary parameters were not significantly different between two groups.



[The change of esophageal temperature]

**Conclusion(s):** In elderly patients receiving open urologic surgery, heated humidifier can be effective for maintaining core temperature during surgery. It may be due to providing appropriate heat to the respiratory tract, thereby overcoming heat loss to the environment.

### 3AP1-4 Role of two anaesthesia machines for inhalational sevoflurane anaesthesia induction

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**Background and Goal of Study:** Time to anaesthesia induction is well known to be due to pharmacokinetics of inhalational agents, but the role of the anaesthesia machine has not been well studied yet. Our aim is to evaluate the role of the anaesthesia machine in the time taken for a 8% sevoflurane anaesthesia induction.

**Materials and methods:** After local ethics committee approval, a total of 40 patients were included in this study. All patients were scheduled to undergo any kind of surgery under general anaesthesia in six operating theatres. After standard monitoring and iv line placement, a BIS sensor (Aspect Medical) was placed according to the manufacturer's instructions. Patients were given 1.5mcg/kg of fentanyl and a face mask with 100% oxygen was placed, allowing each patient to breathe spontaneously. The patients were randomly allocated to receive a fresh gas flow of 6 or 12 litres per minute for anaesthesia induction. 8% sevoflurane was set. When BIS fell under 60 the anaesthesia induction was considered finished and the rest of the anaesthesia procedures were followed as appropriate. Two anaesthesia machines were used: a General Electric (GE) Avance (General Electric, Finland), and Dräger Primus (Dräger, Sweden). Difference between induction times and normally distributed variables were compared by Student's T test or ANOVA (with Bonferroni's post-hoc correction), and proportions with chi square test. A p < 0.05 was considered statistically significant.

**Results and discussion:** Demographics were similar. Results are shown in table 1 and 2. One patient in the 6L/min datex group was excluded due to face mask induction refusal in the operating room.

FGF	6 L/min				12 L/min			
	Weight (kg)	Size (cm)	Sex (M/F)	ASA (I/II)	Weight (kg)	Size (cm)	Sex (M/F)	ASA (I/II)
Datex Avance	77.8 ± 15.1	172.3 ± 10.8	6/4	6/4	72.3 ± 16.5	170.2 ± 12.3	5/5	6/3
Dräger Primus	80.5 ± 16.2	171.2 ± 11.3	7/3	5/5	80.2 ± 12.3	173.2 ± 14.2	4/6	6/4

[Table 1. Data show number or mean (±SD)]

	Maximum ET Sevoflurane (%)		Time to BIS < 60 (sec)	
	6 L/min	12 L/min	6 L/min (**)	12 L/min (**)
FGF				
Datex Avance	8.1 ± 0.2	6.5 ± 0.3	78.4 ± 15.1	76.5 ± 17.1
Dräger Primus	8.2 ± 0.3	6.7 ± 0.2	233.4 ± 35.8 (*)	121.7 ± 26.8 (*)

[Table 2. p < 0.05 (\*) within or (\*\*) between machines]

**Conclusion(s):** GE ventilators are faster than the Dräger ones. As FGF increases, the Dräger grow faster, but not as fast as GE. There is no need to increase FGF over 6L/min for the General Electric ventilators.

### 3AP1-5 Comparison of respiration rate derived from pulse oximetry and transthoracic impedance

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**Background and Goal of Study:** Determination of accurate respiration rate (RR) is an important parameter for non-ventilated patients. The Covidien Nellcor Respiration Rate Software (CNRRS) derives RR by tracking three components from the pulse oximetry waveform that varies during the respiratory cycle. [1] The CNRRS technology is compared to the transthoracic impedance (TTI) which is commonly used in the PACU today. TTI detects impedance changes during inspiration/expiration in the thoracic cavity air space. Both technologies have the ability to provide respiration rate continuously, non-invasively without impacting current workflow. They were compared to a clinician overscored capnography waveform as the reference. The objective was to determine if there was a statistically significant difference between the two technologies.

**Materials and methods:** With IRB approval and informed consent, two independent, prospective, observational studies in 1) healthy volunteers and 2) hospital general care floor patients were conducted. In both studies, RR was determined simultaneously by 3 independent measurements every five seconds: 1) CNRRS, 2) TTI and 3) clinician overscored capnography waveform, which was selected as the reference for RR.

The bias, precision and root mean square difference (RMSD) between both CNRRS and TTI were made versus clinician overscored capnography waveform. This was then used to determine if there is statistical difference between the performances of each technology, assuming a 95% confidence interval.

**Results and discussion:** The mean age and standard deviation was 43.7 ± 14 years and 60.8% were female. The mean breath per minute (Brpm) and standard deviation from the clinician overscored capnography for both studies were 15.3 ± 4.3 Brpm with a minimum of 4 Brpm and maximum of 34 Brpm. The bias and precision of CNRRS versus the clinician overscored capnography waveform is 0.18 ± 1.65 breaths per minute (Brpm), respectively an RMSD 0.84 Brpm across 23,243 data points collected in the studies (Table 1). TTI had a bias and precision of -2.56 ± 9.01 Brpm and a RMSD of 5.21 Brpm (Table 2). The P-value between the two technologies was 0.000.

**Conclusion(s):** The accuracy performance of CNRRS is statistically significantly better than TTI. From the one sensor connected to the pulse oximeter, one is able to obtain oxygen saturation, pulse rate, and respiration rate.

Technology (location)	Subjects	N data pts)	Bias (Breaths per minute)	Precision (Breaths per minute)	RMSD (Breaths per minute)
CNRRS (Healthy)	26	8,683	0.37	± 0.78	0.84
CNRRS (GCF)	53	14,560	0.07	± 1.98	1.60
CNRRS (Total)	79	23,243	0.18	± 1.65	1.35

[CNRRS Performance summary statistics]

Technology (location)	Subjects	N (data pts)	Bias (Breaths per minute)	Precision (Breaths per minute)	RMSD (Breaths per minute)
TTI (Healthy)	26	8,683	-5.68	± 13.01	8.81
TTI (GCF)	53	14,560	-0.70	± 4.42	3.44
TTI (Total)	79	23,243	-2.56	± 9.01	5.21

[TTI Performance summary statistics]

#### References:

1. Addison et al, J Clin Monit Comput. 2012 February; 26(1): 45-51.

### 3AP1-6

#### A novel carbon-dioxide based method for continuous measurement of effective lung volume in mechanical ventilation

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**Background:** By using a differential Fick's principle for CO<sub>2</sub> the effective lung volume (ELV) can be derived. ELV equals the volume participating in gas exchange at end of expiration. We have developed a new continuous CO<sub>2</sub> based method to measure ELV, fully integrated in the ventilator.

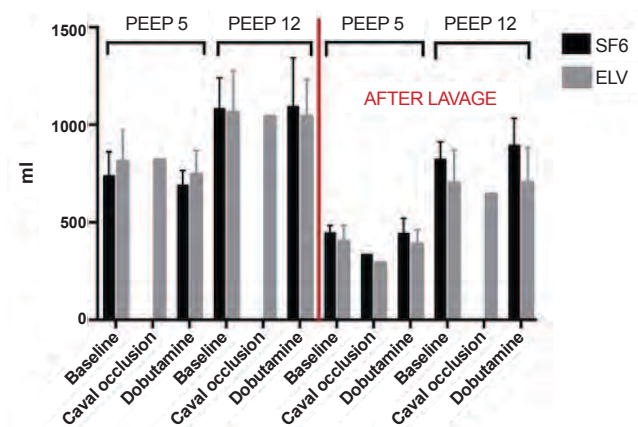
**Goal of Study:** To evaluate the ELV method during major changes in cardiac output in a porcine model before and after induction of lung injury.

**Materials and Methods:** Experimental protocol: 10 anesthetized pigs (24-30 kg) were intubated and ventilated in a volume-controlled mode using a Servo-I ventilator. Expired CO<sub>2</sub> was analyzed using a standard mainstream capnometer.

An ultrasonic flow probe placed around the main pulmonary artery monitored cardiac output. The sulfur hexafluoride washout technique (SF6) was used as a reference for ELV.

Cardiac output was decreased 30-50% by brief inferior vena cava balloon inflations, and increased 30-50% by infusion of dobutamine at PEEP 5 and 12. Similar measurements were performed after inducing lung injury by repeated lung lavages.

#### Results and discussion:



[ELV/SF6]

Figure shows hemodynamic interventions before and after lavage at different PEEP levels. Mean (SD) values for ELV and SF6 at baseline PEEP 5 were 810 (163) mL and 735 mL (126), respectively. At PEEP 12 an increase in both ELV and SF6 was detected. No significant changes were shown during hemodynamic interventions within the same PEEP level.

Because of circulatory instability during caval occlusion SF6 was not measured.

Due to a severe lung injury after lavage, ELV and SF6 decreased to 442 (42) and 400 (85) at baseline PEEP 5, respectively.

Mean difference between methods (limits of agreement) was -58 mL (-222-107) indicating a slight trend of the ELV method to underestimate the EELV when compared to the ref method. Percentage error (PE) was 24%.

**Conclusions:** The CO<sub>2</sub>-based ELV method performed with high accuracy, low bias and percentage error in both healthy and lung-injured pigs at different hemodynamic conditions and PEEP levels. In this experimental setting the ELV method seems to be interchangeable with an EELV reference method such as SF6-washout.

Further studies in humans are warranted.

### 3AP1-7

#### Sevoflurane usage with different O<sub>2</sub>/air fresh gas flows during end-expired target control administration with the Aisys

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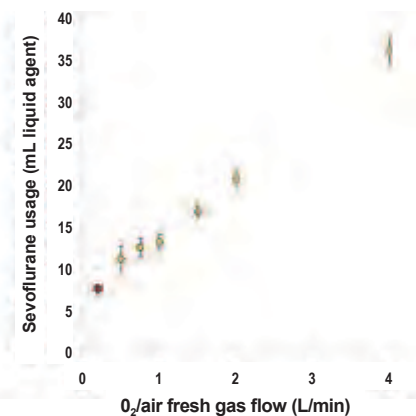
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**Background:** To examine the extent to which automated agent delivery minimizes anesthetic waste, we measured sevoflurane usage with the Aisys® (Helsinki, Finland) in target control mode across a wide fresh gas flow (FGF) range.

**Materials and methods:** After IRB approval and informed consent, anesthesia in 48 ASA I-II patients undergoing abdominal surgery was maintained with the Aisys® in target control mode (target end-expired O<sub>2</sub>=40%, target end-expired sevoflurane % (F<sub>A,t</sub>sevo) = 2.0%, balance N<sub>2</sub>) with 1 of 6 FGFs (n=8 patients in each) : 4, 2, 1.5, 1, 0.75, and 0.50 L/min (0.50L/min= lowest FGF possible in target control mode). To obtain sevoflurane usage, the Aladin cassette was weighed (XP10002, Mettler-Toledo, Columbus, Ohio) before and after exactly 60 min of sevoflurane administration, and the weight difference was converted into mL liquid agent using sevoflurane's density (1.5203 g/mL). Groups were compared using ANOVA. Agent usage in the 0.5L/min group was compared with that during closed circuit anesthesia (CCA) using data from the literature (see ref. 1) and the prime dose needed to attain 2% sevoflurane in the Aisys with a 2 L breathing bag attached (1.3mL sevoflurane).

#### Results and discussion:



[Figure 1: Sevoflurane usage (yellow diamond, with standard deviation) decreases linearly with fresh gas flow, except <1L/min. Red circle = agent usage during closed circuit anesthesia]

Patient demographics did not differ between groups, except for height between the 1.5 and 2 L/min group ( $p < 0.013$ ). F<sub>A,t</sub>sevo was 2% within 3.5 min in all groups. Agent usage differed between all groups, except between the 0.5 and 0.75 and between the 0.75 and 1 L/min group (Figure 1); average agent usage in the 0.5 L/min group (10.9 mL liquid sevoflurane) remained ≈3.6 mL above CCA conditions (7.3 mL).

**Conclusion(s):** During target controlled delivery with the Aisys, lower FGFs reduce agent usage, but this reduction is no longer linear below 1 L/min, probably because the Aisys' algorithms impose a high FGF during the first few minutes (thus overriding the FGF settings set by the anesthesiologist) to ensure F<sub>A,t</sub>sevo is attained sufficiently rapid. The initial high FGF and the use of a maintenance FGF above patient O<sub>2</sub> uptake (200 mL/min) explain why agent usage in the lowest possible FGF group (0.5L/min) remains above CCA conditions.

**References:** BJA 1998,81,495-501



### 3AP1-8

#### Comparison of different methods ( $p_a\text{CO}_2$ , $p_{et}\text{CO}_2$ , $p_{tc}\text{CO}_2$ ) to determine carbon dioxide partial pressure ( $p\text{CO}_2$ ) in mechanically ventilated patients from an intensive care unit: a prospective, observational study

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**Background and Goal of Study:** Critical ill patients need measurement of carbon dioxide partial pressure ( $p\text{CO}_2$ ) and has therefore become standard in intensive care units (ICUs). Due to their clinical consequences hyper- or hypoventilation should be generally avoided. Different methods are available to determine  $p\text{CO}_2$  in clinical practise on ICU or emergency departments, including arterial blood gas analysis ( $p_a\text{CO}_2$ ) [1], end-tidal ( $p_{et}\text{CO}_2$ ) [2], and transcutaneous ( $p_{tc}\text{CO}_2$ ) [3,4] measurements. This study compares the reliability and accuracy of different methods to measure  $p\text{CO}_2$  in mechanically ventilated patients on ICU.

**Materials and methods:** After approval of the local ethics and informed consent was gained from the legal guardians,  $p\text{CO}_2$  was determined in  $n=32$  ICU patients requiring mechanical ventilation. Measurements were gathered every 30 minutes within a 2 hours period by:

- (1) arterial  $p_a\text{CO}_2$  blood gas analysis with Radiometer ABL 625 (ABL; Radiometer, Copenhagen, Denmark; gold standard),
- (2) arterial  $p_a\text{CO}_2$  analysis with Immediate Response Mobile Analyzer (IRMA; Keller Medical, Bad Soden, Germany),
- (3) end-tidal  $p_{et}\text{CO}_2$  (main stream gas flow) by a Propaq 106 EL monitor (Protocol Systems, Beaverton, OR, USA) and
- (4) transcutaneous  $p_{tc}\text{CO}_2$  determination by a Tina TCM4 (Radiometer, Copenhagen, Denmark).

Bland-Altman method was used for statistical analysis [5];  $p < 0.05$  was considered statistically significant.

**Results and discussion:** Statistical analysis revealed an excellent correlation between  $p_a\text{CO}_2$  by IRMA and ABL ( $r=0.88$ ;  $p < 0.01$ ) as well as between  $p_{tc}\text{CO}_2$  and ABL ( $r=0.79$ ;  $p < 0.01$ ), whereas correlation between  $p_{et}\text{CO}_2$  and ABL was weaker ( $r=0.64$ ,  $p < 0.01$ ). Bland-Altman analysis revealed a bias and precision of  $2.0 \pm 3.7\text{mmHg}$  for the IRMA,  $2.2 \pm 5.7\text{mmHg}$  for transcutaneous, and  $-5.5 \pm 5.6\text{mmHg}$  for end-tidal measurement.

**Conclusion(s):** Best accuracy of arterial carbon dioxide partial pressure compared to the reference measurement (ABL) was provided by IRMA ( $p_a\text{CO}_2$ ) and by transcutaneous  $p_{tc}\text{CO}_2$ . Capnometry / capnography as a supplement to arterial blood gas analysis seems to be inferior to transcutaneous monitoring for critical ill and ventilated patients who need tight control of  $p\text{CO}_2$ .

### 3AP2-1

#### Prediction of response to tetanic stimulation: what is best, an interaction model or a direct brain measurement?

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**Introduction:** The response to titanic stimulation can be predicted by a population derived interaction model (e.g. The Adaptive Neuro Fuzzy Inference System (ANFIS))<sup>1</sup> or an individual measure derived from electroencephalogram (EEG) (e.g. qNOX, Quantum Medical, Barcelona, Spain) or a combination of both. This study evaluates which approach has the highest accuracy for predicting responsiveness.

**Methods:** The qNOX is derived from EEG matched with clinical signs from anesthetized patients. Four frequency ratios with optimal prediction probability of response to noxious stimuli were fed into an ANFIS Model, where the output was the qNOX.

We reused data from a previously published study<sup>2</sup>, including observations of response to titanic stimulation in 45 adult female patients, who were scheduled for gynecological surgery. Before stimulation they received a propofol effect-site concentration of 1.5  $\mu\text{g/ml}$  in the three groups, while remifentanyl was targeted to 0, 2 or 4  $\text{ng/ml}$  respectively.

We calculated the prediction probability for qNOX, ANFIS model and qNOX + ANFIS combined model. The combination of the interaction model with qNOX was done using an ANFIS model as well.

**Results:** The results of the Pk analysis are shown in table 1.

Model	Pk for prediction of response to noxious stimulation.
qNOX	0.88
ANFIS model Ce prop + remi	0.88
ANFIS model Ce prop+ remi + qNOX	0.94

[Table 1. Pk analysis]

**Conclusion:** The combination of qNOX and ANFIS had a significantly higher Pk =0.94 compared to respective performance of each method separately. Hence combining interaction surfaces with a direct measurement may be the optimal approach for accurate prediction of response to a noxious stimulus.

#### References:

1. Struys MM, Vereecke H, Moerman A, et al Anesthesiology. 2003 Oct;99(4):802-12.
2. Gambús PL, Jensen EW, Jospin M, et al Anesth Analg. 2011 Feb;112(2):331-9.

### 3AP2-2

#### The relationship between the EC50 for sedation as predicted by the GE-Navigator and awakening after anaesthesia

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**Background and Goal of Study:** Commercial drug interaction displays such as GE-Navigator and Drager SmartPilot View model combined effects of multiple drugs on the level of sedation and response to noxious stimulation and present this data as the likelihood of a specified response. For the model used for sedation in Navigator Johnston et al (1) found 90% of subjects woke within +/- 1min of crossing the 50% isobole. This data was obtained in subjects receiving only sevoflurane and fentanyl. In daily practice a wide range of anaesthetic drugs and adjuvants are used.

The aim of our study was to determine the point patients awoke after a range of procedures and anaesthetic techniques compared a predicted probability of responsiveness of 50% from GE-Navigator (E50-sedn).

**Materials and methods:** Ethics committee approval with a wavier for individual consent. Patients undergoing anaesthesia in OR with Navigator available were observed. Where the anaesthetist was not actively using Navigator drugs doses were entered by an observer. Time at which patient first eye opened in response to command noted. Data files from Navigator were used to determine predicted probability of response at the actual time of response, and time of E50-sedn.

**Results and discussion:** Data was available for 59 subjects. Ages ranged from 18 to 88 yr (mean 52yr), weight 43-122kg (79). Duration of anaesthesia was 29-269 min (91min). The mean probability of sedation at the time of first response was 0.31 (SD 0.30). This occurred at 3.3 (4.0) min after the time of E50-sedn. 31% first responded within 1 min of reaching E50-sedn while 66% responded between -1 min and +5min. There was no correlation between sedation probability at first response and duration of anaesthesia, or patient age or weight.

**Conclusion(s):** A diverse group of patients woke over a wide range of sedation probabilities. The mean probability at which patients first responded was lower than expected. Less than 10% of patients woke > 1min before reaching E50-sedn while 75% of patients were awake within 5min after E50-sedn. Navigator provides a useful tool for individualising drug dosing and controlling the rate of emergence

#### Reference:

1. Johnson KB et al. Anesth Analg. 2010 111:387-94.



### 3AP2-3

#### Diagnostic prediction of minimum alveolar concentration that blocks adrenergic responses by using heart rate variability during desflurane-remifentanyl anesthesia

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**Background and Goal of Study:** The attenuation of autonomic nervous system activity under anesthesia is assessed by hemodynamic changes. Minimum alveolar concentration that blocks adrenergic responses (MAC BAR) was defined by guiding volatile anesthetic administration and monitoring clinical signs such as somatic or autonomic responses. However, there are limitations to predicting MAC-BAR in individual patients owing to variations in anesthetic drug choices and type of surgical invasion. Therefore, it is important to identify other indexes that can quantify sympathetic nerve activity. Heart rate variability (HRV) has already been used to evaluate attenuation of sympathetic and parasympathetic activity in various studies where anesthesia is administered. We aimed to verify whether HRV could predict MAC BAR during desflurane-remifentanyl anesthesia.

**Materials and methods:** Twenty-one ASA PS I-II patients (age, 20-80 years) undergoing laparoscopic cholecystectomy were enrolled. After inducing anesthesia, tracheal intubation was performed. Depth of hypnosis was monitored using the bispectral index. Spectral analysis of HRV using a logistic regression analysis resulted in a characteristic power spectrum with 2 main regions: high and low frequency (HF) and low (LF). Mean arterial blood pressure (MAP), heart rate (HR), LF, HF, and LF/HF were recorded before anesthesia, at surgical incision, and 5 min thereafter. According to the adrenergic responses, the patients were divided into 2 groups: positive group (AR+), in which the HR or MAP increased  $\geq 15\%$  (Roizen's method) and negative group (AR-).

**Results and discussion:** Adrenergic responses were observed in 12 patients (AR+). The LF/HF was significantly greater in the AR+ ( $4.54 \pm 3.58$ ) than AR-group ( $1.33 \pm 0.73$ ). The ratio of post-incisional LF/HF to pre-incisional LF/HF (post- to pre-LF/HF ratio) was significantly greater in the AR+ ( $3.49 \pm 2.13$ ) than AR- group ( $0.99 \pm 0.18$ ). ROC curve analyses showed that the post- to pre-LF/HF ratio had a high discriminative ability for adrenergic responses (AUC=0.99, 95% confidence interval 0.961-1.02). The optimum cut-off score for the post- to pre-LF/HF ratio was 1.43, indicating that it reflects adrenergic responses as well as methods for determination of MAC BAR.

**Conclusion:** We defined the optimum cutoff for post- to pre-LF/HF ratio using a non-invasive real-time HRV analysis, and assessed sympathetic nervous activity. Post- to pre-LF/HF ratio may be a useful autonomic index.

### 3AP2-4

#### Is the surgical plethysmographic index (SPI) measuring the nociception-anti-nociception balance during anaesthesia?

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**Background and Goal of Study:** The idea to measure the balance between intensity of nociception and the level of antinociception during anaesthesia is very attractive. Surgical Plethysmographic Index (Huiku M et al. 2007) is one of the modern attempts to measure this balance. However, authors' opinions about usefulness of this method are controversial (Hans P et al. 2012, Bergmann I et al. 2013).

**Materials and methods:** We performed two pilot studies. 8 patients (7 male and 1 female) and 10 patients (5 male and 5 female) were included in the first (cardiac surgery) and the second (mix surgery) study respectively. All patients had elective surgery with isoflurane-fentanyl anaesthesia. The isoflurane concentration was adjusted according to entropy SE (40-50) in both cases. During first study we assessed SPI and HR during steady-state anaesthesia after intubation using the several points: T0 (before fentanyl administration), T1, T2 (1 and 2 minute after), T3 (incision), T4, T5 (1 and 2 minute after), T6 (before fentanyl administration), T7, T8 (1 and 2 minute after), T9 (sternotomy), T10, T11 (1 and 2 minute after).

During second study we assessed SPI and HR during steady-state anaesthesia after intubation using the two points: before and 1 minute after atropine administration (0.1 mg/kg).

**Results and discussion:** We couldn't find any significant changes in SE, SPI and HR during cardiac surgery study (ANOVA). But we revealed a strong significant correlation between SPI and HR  $r=0.76$  ( $p < 0.05$ ) (Sperman rank correlation analysis). As in the first study, there were no changes in SE and BP in

mix surgery study. On the other hand, HR and SPI increased significantly after atropine administration from 42 (40-57) till 73 (62-82) and from 22 (18-30) up to 42 (26-54) respectively ( $p < 0.05$ ) (Sign test).

**Conclusion(s):** SPI doesn't change after incision and sternotomy during adequate antinociception defense. But it has a significant correlation with HR in spite of the fact that HR takes only 30% in SPI calculation. Medicaments that increase HR can change SPI significantly which must be taken into account during anaesthesia.

#### References:

Huiku et al. Br J Anaesth. 2007 98(4):447-5, Hans P et al. Acta Anaesthesiol Scand 2012 56(6):787-96, Br. J. Anaesth. 2013 110(4):622-628.

### 3AP2-5

#### A multimodal indicator of depth of anaesthesia: detection of loss and return of consciousness using intravenous and volatile anaesthetics

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**Background and Goal of Study:** Electroencephalographic (EEG) monitoring of the hypnotic component of anaesthesia has obtained increasing interest as a supplement to standard monitoring. The present investigation evaluates the ability of BIS and the recently introduced anaesthesia multimodal indicator (AMI) which links EEG and standard monitoring parameters [1] to detect loss (LOC) and return of consciousness (ROC).

**Materials and Methods:** Approved by the ethics committee and after written informed consent, 263 adult patients undergoing surgery under general anaesthesia were included in a study conducted in 6 European centers [2]. Data of patients receiving propofol/propofol during induction/emergence (group A: n=57), propofol/desflurane (B: n=40), propofol/isoflurane (C: n=30) or propofol/sevoflurane (D: n=21) were analysed. Standard parameters and EEG were continuously recorded. After LOC, anaesthetic doses were increased and anaesthesia was performed according to standard clinical practice. At the end of surgery, drugs were discontinued until ROC. The AMI is based on a data driven adaptive neuro fuzzy inference system which maps EEG parameters, standard monitoring parameters, patient data and drug protocol onto an output indicator [1]. AMI and BIS (calculated offline) were analyzed 15s before and 30s after LOC/ROC. Prediction probability ( $P_K$ ) including 95% bootstrap confidence intervals (CI) indicates the indicators ability to separate consciousness from unconsciousness ( $p < 0.05$ ). Optimal indicator threshold values (g) were estimated using the maximum sum of sensitivity and specificity.

**Results and Discussion:** At LOC the AMI yields a  $P_K=0.94$  (CI=0.91-0.96) which is significantly higher than  $P_K=0.84$  (0.79-0.88) for BIS. At ROC AMI provides also significantly higher  $P_K$  (A:  $P_K=0.94$ , CI=0.89-0.97; B: 0.91, 0.84-0.96; C: 0.85, 0.75-0.93; D: 0.91, 0.80-0.98) than BIS (A: 0.73, 0.63-0.82; B: 0.61, 0.48-0.73; C: 0.59, 0.46-0.74; D: 0.57, 0.37-0.74). Threshold g ranges from 79 to 85 (sensitivity and specificity: 0.76 to 1.00) for the AMI and from 69 to 82 (0.39 to 0.89) for BIS.

**Conclusion:** LOC and ROC may be governed by specific drug and cortical / thalamic mechanisms [3]. BIS seems to be sensitive to these different processes in part, whereas the AMI detects reliably both transitions at similar threshold values.

#### References:

1. Anesthesiology 2011; LBT06  
2. Anesthesiology 2006; 105: A1553  
3. Anesthesiology 2011; 114: 1218-33

### 3AP2-6

#### The effect of ketamine and rocuronium on the quantum consciousness index (qCON) during steady-state anesthesia with propofol and remifentanyl

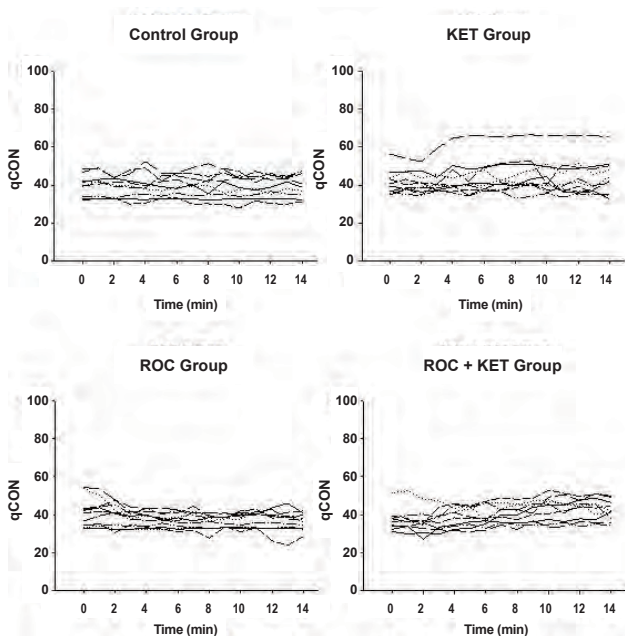
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**Background:** We tested the effects of ketamine (KET) and rocuronium (ROC) on an ANFIS transformation algorithm of the electroencephalogram (EEG), as calculated by the qCON<sup>®</sup> monitor (Quantium Medical S.L., Barcelona, Spain). We reanalyzed raw EEG obtained from a prior study<sup>1</sup>.

**Methods:** After ethics' committee approval, 41 patients were allocated to four groups. Baseline measurements were performed after implementing calculated steady-state anaesthesia with propofol and remifentanyl. No additional drugs were given in the CONTROL group. The KET group received a bolus of ketamine (0.4mg/kg) followed by 1 mg/kg/h. The ROC group received rocuronium (0.9 mg/kg). The ROC+KET group received both. All data was stored during 14 minutes after baseline (Figure 1). qCON was extracted post-hoc from raw EEG obtained on the mastoid position by the A-line<sup>®</sup> AEP monitor (Danmeter, Odense, Denmark). Mean qCON changes from baseline were tested within each group (*t*-test+Dunnett) and compared with CONTROL.

**Results:** In CONTROL, one patient was excluded due to artifacts not properly filtered out by the qCON artifact rejection algorithm. Compared to baseline, qCON increases in KET ( $p < 0.05$  at min 9, mean (SD): 41(9) versus 46 (9)), decreases in ROC ( $p < 0.05$  from min 2 to min 14, mean (SD): 41(8) versus 36(4) at lowest point) and increases in ROC+KET ( $p < 0.05$  from min 9 to min 14, mean (SD): 37(6) versus 43(6) at highest point). In the intergroup comparison, only the changes in ROC and ROC+KET remained significantly different compared to the CONTROL group.



[Figure 1: raw qCON values]

**Conclusion:** Rocuronium decreases qCON when calculated from EEG on a mastoid channel. The increase in qCON evoked by ketamine is more pronounced when electromyographic activity is inhibited by rocuronium. Our conclusions must be confirmed by frontal derived EEG. Results may be affected by the applied artifact rejection algorithm, which is not developed for mastoid electrode position.

#### References:

1. Vereecke HE, et al. Anesthesiology 2006; 105: 1122-34

### 3AP2-7

#### Quantitative analysis of the electroencephalogram under desflurane anesthesia: changes in the bispectral index and suppression ratio

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**Background and Goal of Study:** Desflurane is one of the popular general anesthetics with rapid onset and offset. But there are few studies analyzing the desflurane effects on electroencephalogram, especially bispectral index (BIS) and suppression ratio (SR). The purpose of the present study was to clarify the changes in the BIS values under desflurane anesthesia between light and deep levels.

**Materials and methods:** After obtaining an approval of Hospital Ethics Committee and written informed consent, 22 ASA physical status I and II patients scheduled for elective surgery were enrolled. Anesthesia was maintained with combined epidural and desflurane anesthesia. On arrival in the operating room, the BIS (BIS A-3000, version 4.1; Covidien, CO, USA) sensor was placed as recommended by the manufacturer. Epidural catheter was inserted and 0.5-1.0% ropivacaine was used. Anesthesia was induced with fentanyl, propofol and rocuronium, and maintained with O<sub>2</sub>, air and desflurane. Both BIS and SR values were recorded at desflurane concentrations of 0.5, 1.0, 1.5 and 2.0 MAC. The measurements were performed 20 minutes after the changes in desflurane concentrations. Data are expressed as mean±SD. Statistical analysis was performed using ANOVA and post-hoc Bonferroni. *P* values < 0.05 were considered statistically significant.

**Results and discussion:** Of 22 patients, 10 patients underwent major surgeries and the others were minor surgeries such as urological, gynecologic and orthopedic. The BIS values at each desflurane concentration were 54±8 (0.5 MAC), 39±6 (1.0 MAC), 38±9 (1.5 MAC) and 23±13 (2.0 MAC), respectively. The BIS values at 0.5 MAC were significantly higher compared with the others. There were no significant differences in the BIS values between 1.0 and 1.5 MAC. Isoelectric EEG was observed in 3 out of 13 patients at 1.5 MAC and 6 out of 8 patients at 2.0 MAC, although no patients showed isoelectric EEG at both 0.5 and 1.0 MAC. SR was 6±19 at 1.5 MAC and 35±37 at 2.0 MAC, respectively. The BIS values have not decreased in a dose-dependent manner between 1.0 and 1.5MAC of desflurane. This issue is probably caused by the proprietary algorithm of the BIS monitor. Anesthesiologists have to know this issue not to misinterpret the depth of anesthesia. At desflurane concentrations more than 1.5MAC, SR increased in a dose-dependent manner. conclusion; Present study demonstrated that BIS monitor has not shown linear function at moderate to deep desflurane levels.

### 3AP2-8

#### Randomized comparative study on the effects of epidural dexmedetomidine on heart rate variability during general anesthesia in patients undergoing gastrectomy

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**Background and Goal of Study:** Dexmedetomidine causes sedation, anesthesia and marked cardiovascular effect, such as bradycardia and hypotension. Elhakim et al. investigated the action of preemptive epidural dexmedetomidine on postoperative pain for the patients undergoing thoracic surgery. We hypothesized that preemptive thoracic epidural dexmedetomidine would increase parasympathetic activity, it could be detected by analyzing heart-rate variability.

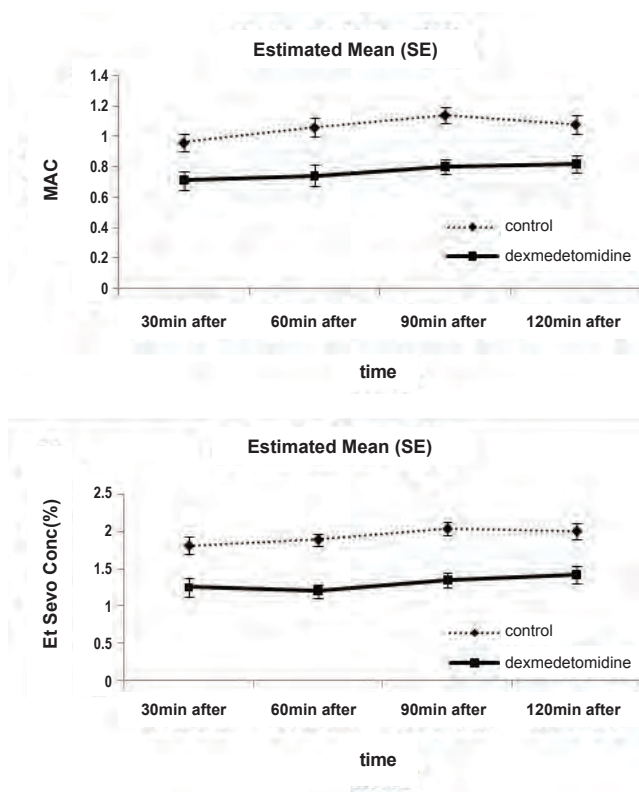
**Materials and methods:** A total of 43 patients undergoing gastrectomy were enrolled. Patients were randomly divided into two groups. Dexmedetomidine group (n=22) vs Control group (n=21)]. A thoracic epidural catheter was placed before the surgery. After the induction, patients received the epidural dexmedetomidine (1.5µg/kg) mixed up to 10ml of normal saline before the surgical incision. Electrocardiogram data acquisition was done after vital sign stabilization following anaesthesia induction (T1) and 30 min after the administration of study drug (T2).

**Results and discussion:** No differences were found between groups at total power, high frequency, low frequency and ratio of LF/HF

Time	Group Dexmedetomidine	Group control	p-value
Total power T1	3580.87±1784.45	2686.00±1697.35	0.718
Total power T2	1577.32±1244.88	2684.66±1184.12	0.523
High frequency T1	1189.89±507.96	164.66±483.16	0.152
High frequency T2	147.99±43.52	66.13±41.71	0.184
Low frequency T1	1211.45±453.19	176.83±431.07	0.106
Low frequency T2	223.85±72.61	162.17±69.06	0.542
LF/HF T1	2.37±0.40	2.11±0.38	0.637
LF/HF T2	2.87±0.68	3.11±0.65	0.803

[Table 1. HRV]

During the surgery, MAC values of sevoflurane and end tidal sevoflurane's concentration significantly different between the 2 groups ( $P < 0.005$ ) (Fig 1.)



[Fig 1]

The VAS score in Group D was significantly lower in the early postoperative period (0–6 hr) ( $P < 0.05$ )

**Conclusion:** We conclude that HRV could not predict the hemodynamic effect of preemptive thoracic epidural dexmedetomidine. The use preemptive thoracic epidural dexmedetomidine decrease significantly the anesthetic requirements and improve immediate post-operative analgesia within 6 hours.

### 3AP2-9

#### Target-controlled dosing of remifentanyl guided by the analgesia nociception index: a feasibility study

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**Background and Goal of Study:** Measurement of the balance between nociception and analgesia during anesthesia is challenging and not yet clinically established. Mean remifentanyl doses range between 0.25–0.50  $\mu\text{g}/\text{kg}/\text{min}$ , 0.05–0.20  $\mu\text{g}/\text{kg}/\text{min}$  for major and minor to moderate surgeries respectively (1). Recently, the analgesia nociception index (ANI), a 0–100 non-invasive index derived from heart rate variability spectral analysis was proposed as surrogate measure of nociception. However, how to modify remifentanyl dosing according to the ANI values has never been described. The aim of the present

study was to evaluate the feasibility of guiding remifentanyl target-controlled infusion (TCI) by the ANI.

**Materials and methods:** One hundred sixty three ASA I–III status patients, undergoing scheduled vascular and orthopedic surgery under propofol - remifentanyl anesthesia were included in this monocenter prospective observational study. After intubation, propofol was adjusted to maintain the steady entropy (SE) between 40 and 60 and remifentanyl was adjusted up or down by 0.2  $\text{ng}/\text{mL}$  steps to maintain the ANI between 50 and 70 (adequate analgesia). Unwanted events such tachycardia, hypertension ( $> 20\%$  baseline) or movements were recorded. Mean remifentanyl doses between minor, moderate and major surgeries were compared using a Kruskal-Wallis test.  $P < 0.05$  was significant. Values are expressed as mean  $\pm$  SD or median [min - max].

**Results and discussion:** Patients were aged  $67 \pm 14$  years, and have a mean body mass index of  $26 \pm 4 \text{ kg}/\text{m}^2$ . The median duration of surgery was 144 [41–522] min. Median propofol dose was 0.11 [0.05–0.18]  $\text{mg}/\text{kg}/\text{min}$  and median remifentanyl doses were 0.03 [0.01–0.07] for minor, 0.04 [0.02–0.10] for moderate and 0.05 [0.02–0.11]  $\mu\text{g}/\text{kg}/\text{min}$  for major surgery respectively ( $p < 0.001$ ). Twenty four unwanted events (20 movements, 2 tachycardias and 2 hypertensions) occurred in 19 (12%) patients. ANI was  $< 50$  in 9 cases, SE raised  $> 60$  in 6 cases and in 9 cases ANI and SE remained both unchanged.

**Conclusion(s):** The present study showed that ANI can adequately guide target-controlled remifentanyl dosing and markedly reduce the intraoperative remifentanyl consumption. However, further controlled studies are needed to confirm these encouraging results.

#### References:

1. Hogue, C et al. *Anesth Analg* 1996;83:279–85

### 3AP3-1

#### Repeated sugammadex reversal of neuromuscular blockade during lumbar spine surgery with intraoperative neurophysiological multimodal monitoring (IOM). An N of 1 study

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**Background:** NMBA attenuates IOM responses during spine surgery.

**Hypothesis:** very low sugammadex doses permits partial neuromuscular block (NMB) reversal and IOM, while maintaining NMB.

**Case report:** Discectomy and vertebral fixation (anterior and posterior approaches) in a 38 year-old, ASA II patient, due to L2–L3 spondylodiscitis. Invasive monitoring, surface accelerometry, and IOM (SSEP, c-MEP with TES, EMG with frEMG, and tEMG trough pedicle screw stimulation). Neurophysiologist blinded of sugammadex doses and injection times (quality of IOM: unuseful or useful to detect an injury or near injury).

Propofol iv anesthesia was used and rocuronium 1  $\text{mg}/\text{kg}$  injected (TOF count 0, PTC 2, MEP absent). Forty-five min afterwards: right lateral decubitus (TOF 4), rocuronium 15  $\text{mg}$  administered (TOF 0, PTC 2, MEP absent) plus rocuronium infusion. Surgery: anterior approach, intervertebral disc accessed (TOF 0, PTC 6), MEP requested. Rocuronium infusion was stopped and 0.2  $\text{mg}/\text{kg}$  (plus 0.1  $\text{mg}/\text{kg}$  15 min afterwards) sugammadex injected (IOM adequate). Surgery: discectomy (TOFr 0.12, 32 min after sugammadex, MEP useful) and screw fixation (tEMG useful).

After ninety min, rocuronium 10  $\text{mg}$  iv bolus (TOF 1). Surgery: prone position, posterior approach. IOM was requested, sugammadex 0.2  $\text{mg}/\text{kg}$  (plus 0.1  $\text{mg}/\text{kg}$  twice at 5 and 10 min) injected (MEP adequate). Surgery lasted 200 min. Reversal with sugammadex 2  $\text{mg}/\text{kg}$  showed TOFr of 0.35, 0.65, and 0.95 at 2, 3 and 4 min. No neurologic deficits were observed at 6 months.

**Discussion:** NMBA interfere with MEP and EMG. The multimodality IOM permits redundancy in checking neural pathways. PK-PD models showed slow recovery times at low sugammadex doses. In our patient, the “adequate for IOM” recovery lasted  $> 30$  min from a profound neuromuscular block (first reversal), and 14 min from a moderate neuromuscular block (second reversal). The time spent and the dose needed for the second reversal could have been predicted from the first one (total sugammadex dose 0.3  $\text{mg}$  and 0.4  $\text{mg}$  respectively). Again re-onset rocuronium blocking times were longer than usual. Three articles reporting sugammadex complete reversal during spine surgery with standard doses.

Learning points. Accelerometry correlated with IOM. If intraoperative reversal is needed for IOM, rocuronium is the agent of choice.

This is the first case reporting on reversal with low dose sugammadex to obtain useful IOM lectures, and to restart the NMB twice.



### 3AP3-2

#### Sugammadex and Entropy values in urologic surgery

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**Background and Goal of Study:** Sugammadex is a selective antagonist of neuro-muscular blocking agent Rocurinium. Data, concerning the influence of muscle relaxation on deep of anesthesia are contradictory. EEG entropy is a clinically validated method for measuring the level of hypnosis and analgesia. Entropy derived indexes are: RE entropy- includes EEG frequencies + EMG activity from the facial muscle, and SE entropy- only EEG activity. Aim of the study is to evaluate the effect of Sugammadex on entropy values.

**Materials and methods:** 21 patients were enrolled in this prospective study. All patients underwent general anesthesia for planned urologic surgical procedures. The muscle relaxation was performed with Rocurinium. At the end of the surgical intervention the neuro-muscular blockade was antagonized with Sugammadex 2mg/kg. Entropy values were recorded 5 minutes before and 10 minutes after Sugammadex injection.

**Results and discussion:** No significant difference in entropy values was recorded before and after Sugammadex application.

Previous findings suggest that arousal may be induced by the reversal of neuromuscular blockade by Neostigmine (Vasella et al. 2005) and Sugammadex (Pühringer et al. 2008). In our study even a complete neuromuscular recovery did not affect the depth of anaesthesia as measured by entropy. Thus, the results of this study do not support the afferentation theory or the theory of Sugammadex-induced arousal.

**Conclusion:** Sugammadex has no influence on entropy values, respectively on anesthesia depth.

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### 3AP3-3

#### Laboratory and clinical effect of newly designed fluid warming kit using the humidified and heated circuit

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**Background and Goal of Study:** It has been recommended that all fluids and blood should be warmed using many kinds of blood/fluid warmers. Unfortunately, some anesthesiologists unintentionally lose sight of the fact that hypothermia-induced complications may result from even mild hypothermia, and they frequently do not monitor core temperature in the clinical routine. The Mega Acer Kit® (MAK) is a new-designed heated circuit kit that can warm fluid through the circuit lumen for maintenance of body temperature. We therefore evaluated the effect on fluid warming and hypothermia according to warmers during spinal surgery under general anesthesia.

**Materials and methods:** After institutional review board approval, ninety patients were randomly assigned to 3 groups. Fluids infused at 400 ml/hr without any warmers (Group C, n = 30), via the standard Ranger (Group R, n = 30), or via The MAK (Group M, n = 30) by a random number table. Fluid temperatures were recorded at 3 points; the inlet (Tin), 108 cm from the warming devices (Tout), and after the last 90 cm extension line (Tdistal). Distal esophageal temperature (Teso) was also recorded. All temperatures were recorded before infusing warmed fluid, and then at 15 min intervals during 180 min. When the Teso was less than 35.0°C, we applied a forced-air convective warming device set.

**Results and discussion:** In laboratory findings, a total of 1170 temperature measurements were made with crystalloid infusions. The temperature of fluids infused in group M were significantly highest at Tout and Tdistal at all measured time points, even though group R also was higher than the group C (P < 0.05). The mean Tout and Tdistal were 23.5 ± 0.3 vs. 34.7 ± 0.8 vs. 37.4 ± 1.7°C, and 23.0 ± 0.3 vs. 32.8 ± 0.6 vs. 35.4 ± 1.0°C, respectively the group C, R and M (p < 0.05). The Tout-Tin was 13.8 ± 1.8, 10.7 ± 1.1, and -0.4 ± 0.8 °C, respectively the group M, R, and C (p < 0.05). The Tout-Tdistal resulted in 2.3 ± 1.5, 1.8 ± 0.7, and 0.5 ± 0.2°C decrease, respectively group M, R and C (p < 0.05). In clinical findings, The final Teso was 34.8 ± 0.3 vs. 35.1 ± 0.1 vs.

35.8 ± 0.3°C, respectively group C, R and M (P < 0.05). 17 and 30 patients in the group R and C required a forced-air convective warming device for treatment of hypothermia versus none in the group M.

**Conclusion(s):** The Mega Acer Kit® is more effective equipment for warming fluid and preventing hypothermia than the standard Ranger.

### 3AP3-4

#### Temple Touch Pro continuous temperature measurement comparison with invasive temperature measurement techniques

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**Background and Study Purpose:** Core-temperature measurements require the use of invasive techniques, associated with rare but sometimes life-threatening complications. Therefore the use of a noninvasive core temperature measurement thermometer is strongly warranted. We compared a continuous noninvasive core temperature measurement technique with two standard invasive core temperature measurements.

**Methods:** In an observational, prospective study, we included 45 patients undergoing major elective surgeries. Core temperature was measured continuously using the Temple Touch Pro (TTP Medisim Ltd, Israel) non invasive thermometer.

Simultaneous measurements of core temperature were recorded using two invasive temperature measurements: either nasopharyngeal (N=25) or esophageal (N=20).

**Statistics and Results:** Both absolute and relative differences between the measurements were examined using regression analysis. Trending concordance was examined using regression analysis and linear modeling.

**Results:** Demographic data were similar between the groups. None of the paired differences was significant between TTP and nasopharyngeal measures, establishing absolute agreement (Fig. 1). AUC for TTP was significantly correlated with AUC for nasopharyngeal (r=0.94, p< 0.0001) and AUC for esophageal (r=0.74, p< 0.0001), confirming relative agreement.

**Conclusions:** Continuous non invasive temperature measurements using Medisim Temple Touch Pro (TTP) thermometer were significantly correlated to those recorded by the invasive nasopharyngeal and esophageal thermometers. Larger sample size is warranted to confirm the efficacy and accuracy of this new thermometer. Non invasive core temperature measurement may also be a promising temperature measurement tool in the PACU and ICU patients, where the use of invasive thermometers may be problematic.

### 3AP3-5

#### Effect of rocuronium on transcranial muscle-evoked potentials restored by sugammadex in the patients with cervical myelopathy

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**Background and Goal of Study:** Transcranial muscle-evoked potential (MsEP) is commonly measured during spine surgery as intraoperative neurophysiological monitoring. Although muscle relaxants facilitate easy and safe tracheal intubation, they also potentially suppress MsEP. Muscle relaxation by rocuronium (R) can be restored to a normal state with administration of sugammadex (S). However, there are few reports regarding the effects of R and S on MsEP. We hypothesized that suppressed amplitude (A) and extended latency (L) caused by R will be restored to a normal state by S, and performed this study to clarify the effects of those agents on A and L in MsEP in the patients with cervical myelopathy.

**Materials and methods:** 79 patients (Group I: 53 patients with cervical myelopathy, Group N: 26 patients undergoing thoracic or lumbar spine surgery without neuromuscular dysfunction in upper extremities) were enrolled in this study. All patients were intubated without being given a muscle relaxant, and then placed in a prone position. MsEP was measured by transcranial stimulation and muscular action potentials from the bilateral abductor digiti minimi muscles. A and L of MsEP were calculated. Data are expressed as a percentage as compared with the baseline measurement. Intervention RS: After obtaining the baseline measurement values, 0.6 mg/kg of R was administered and MsEP was recorded every 10 minutes. When more than a single train-of-four count appeared, 2-4 mg/kg of S was administered. Intervention C: MsEP was recorded every 10 minutes without R and S.



**Results and discussion:** There were no significant differences among groups in patient characteristics. A was suppressed in both Group I and N (8.33 % and 4.29% respectively,  $P < 0.05$ )(median). L was extended in both groups (102% and 104% respectively,  $P < 0.05$ ). Suppressed A and extended L induced by R were restored to a normal state following administration of S in both groups. There were no differences in A and L between Group IRS and Group IC (101% and 93.6%, 100% and 102 % respectively). There were no differences in A and L between Group IRS and Group NRS (108 % and 93.8%, 99.4% and 101% respectively).

**Conclusion:** Suppressed A and extended L in transcranial MsEP measurements induced by R administration were restored to a normal state following administration of S in both cervical myelopathy patients and normal patients. We concluded that it is safe to use R combined with S in those patients with neurophysiological monitoring.

### 3AP3-6

#### Which is more useful to non-obese patients (BMI < 30) undergoing tracheal intubation, T1% of the corrugator supercilli muscle or effect site concentration of rocuronium calculated by iPad application AnestAssist?

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**Background and Goal of Study:** Unlike other anesthetics, it is not common to use effect site concentrations (ESC) of rocuronium calculated by software. It may be difficult to predict patient's response by ESC of rocuronium because most patient characteristics like age, gender or BMI are not used in calculation. On the other hand, it is well known that the corrugator supercilli (CS) reflects rocuronium neuromuscular blockade at the laryngeal adductor muscles. Our aim was to investigate whether ESC of rocuronium is more useful to non-obese patients undergoing tracheal intubation than T1% of CS.

**Materials and methods:** 121 non-obese adult patients (BMI < 30) were randomly divided into 7 groups based on rocuronium dose (0.6,0.7,0.8,0.9,1.0,1.1,1.2 mg/kg). Anesthesia was induced by fentanyl 2 mcg/kg, propofol 2 mg/kg and rocuronium. We intubated 2 minutes after rocuronium was injected. Intubation condition was assessed by a guideline (GCRP). T1% of CS was recorded before intubation. ESC of rocuronium was calculated by iPad application AnestAssist.

Inter-group comparisons of patient characteristics were done using chi-square test and ANOVA. Univariate logistic regression was performed to find which factors affect intubation condition. We used whether the intubation condition is excellent as the dependent variable and the following factors as the predictors: T1% of CS, ESC of rocuronium, age, gender and BMI. Stepwise multivariate logistic regression was run to investigate whether ESC should be adjusted by patient characteristics.

**Results and discussion:** Patient characteristics were not significantly different. T1% of CS was not a significant predictor. ESC of rocuronium had a significant correlation with intubation condition. ED50% of ESC (95%CI) was 4605.43 (3894.90-5315.97) ng/ml. Stepwise multivariate logistic regression showed that we should adjust ESC by patient gender and BMI. The following equation gives the probability of excellent intubation condition.

$$p = 1 / (1 + \exp(5.473 + 0.7639 * \text{gender} - 0.1307 * \text{BMI} - 0.0005908 * \text{ESC}))$$

p: probability of excellent intubation condition

gender: male 1, female 0

BMI: kg/m<sup>2</sup>

ESC: ng/ml

#### Conclusions:

1. T1% of the corrugator supercilli is not useful to non-obese patients undergoing tracheal intubation.
2. Effect site concentration of rocuronium calculated by software is more useful than T1% of the corrugator supercilli.
3. Effect site concentration of rocuronium should be adjusted by patient gender and BMI.

### 3AP3-7

#### Neuromuscular transmission module versus tri-axial accelerometer for neuromuscular block monitoring

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**Background:** Neuromuscular blockade monitoring and detection of residual paralysis are essential to modern anesthetic practice. Available monitors within an institution may be different between the operating room and recovery room. In the absence of equivalence, begin monitoring by a device and continue by another can lead to errors of judgment. This study aims to compare a new tri-axial accelerometer (STIMPOD NMS-450 Teleflex®, Athlone, Ireland) and the Neuromuscular Transmission Module (NMT-M, GE Healthcare, Helsinki, Finland).

**Methods:** Prospective randomized study of patients undergoing vascular surgery under a standardized protocol of general anesthesia by propofol-remifentanyl TCI. Neuromuscular blockade was monitored by the response to the train of four (TOF) in the adductor pollicis. The upper limb equipped with the NMT-M was randomized; STIMPOD was installed on the contralateral limb. Both devices were set to the same supramaximal intensity sought before paralysis. Standardized atracurium dose (0.5mg.kg<sup>-1</sup>) was injected after loss of consciousness, and orotracheal intubation was performed when both monitors demonstrated no response. We measured the time between neuromuscular blockade injection and the disappearance of all responses on TOF, the reappearance of 1 response, 4 responses, getting a T4/T1 ratio  $\geq 60\%$ ,  $\geq 90\%$  and 100%. Statistical analysis was performed by linear regression.

**Results:** After approval of the local ethics board, 17 patients were included (age 69 $\pm$ 12). Average stimulation intensity was 44 $\pm$ 20mA. The reversal was spontaneous in 100% of cases. The results are expressed as mean  $\pm$  standard deviation in table 1. No complications potentially attributable to residual paralysis were found.

Mean time	NMT-M	STIMPOD	R <sup>2</sup> [CI 95%]	p
Intubation (s)	281 $\pm$ 161	266 $\pm$ 169	0.17 [-0.08-0.87]	0.103
1 response (min)	29 $\pm$ 13	34 $\pm$ 17	0.31 [-0.07-0.78]	0.021
4 responses (min)	48 $\pm$ 18	62 $\pm$ 22	0.37 [-0.13-0.83]	0.01
T4/T1 > 60% (min)	67 $\pm$ 20	64 $\pm$ 18	0.92 [-0.90-1.24]	<0.001
T4/T1 > 90% (min)	86 $\pm$ 23	83 $\pm$ 25	0.82 [-0.64-1.09]	<0.001
T4/T1 = 100% (min)	93 $\pm$ 25	85 $\pm$ 25	0.84 [-0.70-1.13]	<0.001

[Table 1: Comparison of neuromuscular block monitors]

**Conclusion:** Both devices have an excellent correlation in monitoring the reversal of neuromuscular blockade. However, the correlation is poor for the installation of the paralysis and the reappearance of responses. This suggests that they are not equivalent for the timing of intubation, or the possibility of pharmacological reversal. Comparisons with mechanomyography are needed to assess which of the two monitors is the most accurate.

### 3AP3-8

#### Temperature measurement during intraabdominal treatment with hypertherm chemotherapy - oesophagus thermometer vs. pulmonary artery catheter measurement

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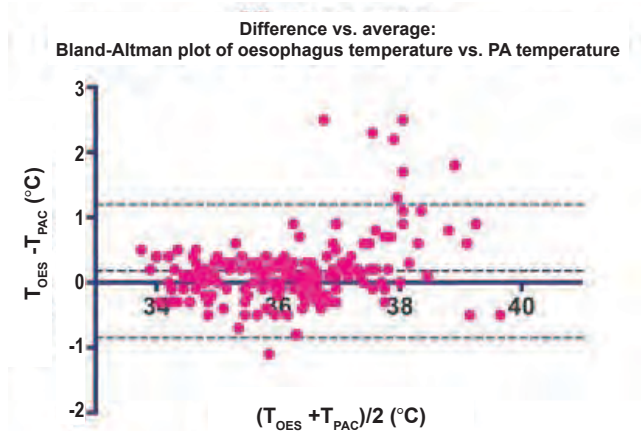
**Background and Goal of Study:** Cytoreductive surgery with hypertherm intra-abdominal chemotherapy (HIPEC) is a well established method to treat colorectal malignancy with peritoneal carcinosis. During the surgery the patient is exposed to 42 C° chemotherapy intraabdominally.

It is crucial to accurately measure and regulate the patients temp. during the operation, in particular during the hyperthermic treatment. In spite of preparatory cooling of the patient, sometimes the temperature of the inflowing chemotherapy has to be lowered to avoid overheating of the patient.

The goal of the study was to compare simultaneous peroperative measurements by oesophageal thermometer and a pulmonary artery (PA) catheter situated in the heart, mirroring the temp. of the circulating blood. Our hypothesis was that the PA catheter would register lower temp. during the HIPEC treatment phase than the oesophagus thermometer.

**Materials and methods:** 15 patients (ASA I-III), with mean age of 56 years (range 21-78), mean weight 75 kg (range 45-106) undergoing cytoreductive chemotherapy and HIPEC were included in the study. All patients received a PA catheter in the internal jugular vein and an esophagus thermometer. The temp. was recorded in intervals of 5-30 minuter from placement of the catheters until after the end of the HIPEC treatment. Statistics used were Bland-Altman and correlation analysis.

**Results and discussion:** The mean registered temperatures were 36.3 °C (range 33.5-39.8) and 36.1 °C (range 33.5-39.9) for oesophagus and PA catheter respectively. There was a high correlation ( $R=0.93$ ) between the temp. measurement methods. However, with higher temperature, more deviations could be seen.



[Bland-Altman plot of oesophagus vs. PA temperature]

To some extent this verifies our hypothesis that the oesophagus thermometer sometimes overestimates the temperature.

**Conclusion(s):** During hypothermia and normothermia, the temperatures measured by the esophageal thermometer and the PA catheter correlated well. However, during the hypertherm chemotherapy treatment, the oesophagus temp. in some cases diverge from the PA, showing higher temperatures.

### 3AP3-9

#### Comparison of acceleromyography and kinemyography monitoring methods during recovery period of neuromuscular block

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**Background and Goal of Study:** Postoperative residual curarization (PORC) after administration of neuromuscular blocking agents is an important factor in increased morbidity and mortality of patients. The only proposed objective method for detecting residual neuromuscular (NM) block is quantitative NM monitoring. In the current study, we compared acceleromyography (AMG), the most commonly used method of NM monitoring, with kinemyography (KMG) for the recovery parameters of NM block.

**Materials and methods:** After approval of our institutional ethical review board and obtaining written informed consents, 46 ASA status I - II patients aged 19-65, scheduled for elective surgery under general anaesthesia were included in the study.

After admission to the operating room each patient was monitored with electrocardiogram, pulse oximetry and non-invasive blood pressure. After induction using 0.07mg/kg midazolam, 2 mcg/kg fentanyl and 2-3 mg/kg propofol, the method of AMG (TOF-SX, Organon) was set up to the left arm and the method of KMG (Datex NMT, GE) was set up to the right arm of patients for NM monitoring. Rocuronium 0.6 mg/kg was administered under single twitch pattern of AMG monitoring. After attaining 95% twitch depression (T1/T0 5%) patients were intubated. After tracheal intubation NM monitoring continued with train of four (TOF) pattern every 15 seconds and the times for TOF neuromuscular recovery parameters of TOF 25, TOF 50, TOF 75, TOF 90 and TOF recovery index (TOF 25-75) were recorded with both AMG and KMG. The patients in whom additional use of NM blockers or reversal agents and in whom data acquisition was artefactual were excluded. All data were statisti-

cally analyzed utilizing paired samples t test and Bland Altman method for compatibility.

**Results and discussion:** Because of artifacts and additional drug use 29 cases were excluded from the study. The artifacts with AMG were more frequent than KMG ( $p < 0.0001$ ). Analysis by Bland Altman method revealed compatibility of TOF25( $r^2:-0.004$ ), TOF50( $r^2:-0.064$ ), TOF75( $r^2:-0.066$ ), TOF90( $r^2:-0.021$ ) parameters. There was no significant difference between two methods in terms of recovery index ( $p=0.265$ ).

**Conclusions:** In our study we concluded that for NM monitoring the methods of AMG and KMG are interchangeable for the recovery parameters of NM block. We believe that in addition to AMG, KMG can also be safely used to determine PORC.

### 3AP4-1

#### Near InfraRed Spectroscopy (NIRS) as an early indicator of free Deep Inferior Epigastric Perforator (DIEP) flap viability. A retrospective study

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**Background and Goal of Study:** NIRS is a useful technique for monitoring regional oxygenation, primarily in vascular and neurosurgery, as an indicator of cerebral perfusion. The aim of this study is to verify whether it could be a useful instrument to detect earlier a possible flap perfusion failure compared with classical clinical signs.

**Materials and methods:** We reviewed 96 DIEP flaps from breast reconstruction undertaken in our hospital since 2009. NIRS was used postoperatively together with clinical signs of flap failure in 59 cases, whereas 37 patients were monitored only by clinical signs. We have recorded data including regional saturation (SrO2) of both the operated and the native breast during the first 24h after surgery, local temperature of both breasts, need for reoperation and whether the first sign was a clinical sign (primarily breast congestion), a drop in temperature or a drop in SrO2.

**Results:** 9 patients (9.4%) underwent a second surgery because of a flap failure. Of those, 6 were monitored by NIRS, and in all those cases, a drop in SrO2 of the DIEP breast was the first data registered. None of the other 3 cases were reconnected to the operating theatre because of a drop in temperature, but for clinical signs of ischaemia.

In the reoperated group, Mean SrO2 prior to reoperation was 71 (93 in native breast) whereas in the control group, Mean SrO2 was 84 (91 in native breast). Mean times of primary surgery was 14h40 in the reoperated group compared to 9h29 in patients with good flap viability. 13 patients underwent a bilateral DIEP flap, and 3 out of those had to undergo a second surgery (23% vs. 8% in unilateral group).

	Length of primary surgery	SrO2 operated breast	SrO2 native breast	Temperature operated breast	Temperature native breast
Reoperated	14:40	71%	93%	36°C	37.5°C
Not reoperated	9:29	84%	91%	37°C	37.3°C

[Results]

**Discussion:** Our experience indicates that NIRS is a good instrument for early detection of DIEP flap vascular compromise. It is simple to use, non-invasive and avoids the patient being waken up many times during the first night after surgery for observation of the flap.

As a matter of fact, our experience shows that whereas in the beginning, NIRS was primarily used by the PACU medical team, it is actually demanded by the surgeons.

**Conclusion:** Although all the data shown in the study indicate that NIRS technology can be useful in flap viability, further research, ideally prospective studies, should be undertaken in order to establish NIRS as a gold standard in flap monitoring.

### 3AP4-2

#### Comparison of estimated continuous cardiac output and transesophageal echocardiography cardiac output for noninvasively measuring cardiac output in pediatric patients undergoing kidney transplant surgery

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**Background and Goal of Study:** Estimated continuous cardiac output (esCCO) is a new method for noninvasively and continuously estimating cardiac output (CO), which has rarely been evaluated in children. In the present study, we aimed to assess the accuracy and reliability of the esCCO system in pediatric patients.

**Materials and methods:** Cardiac index (CI) was determined simultaneously using esCCO (ClesCCO) and TEE (CITEE) as our reference method<sup>1)</sup> in 11 pediatric kidney transplant patients who were recruited prospectively. Hemodynamics undergo large changes after large volume fluid infusion in renal transplantation, making it suitable for examining esCCO trending ability in such cases. We then measured the CITEE; the first measurement thus obtained was used for calibration, and the esCCO was subsequently measured. After the initial calibration measurement, CITEE was measured three times (①) before volume loading, (②) after volume loading and (③) before completion of surgery).

**Results and discussion:** 33 paired readings from 11 pediatric patients were collected. CITEE was increased significantly from ① to ② ( $p < 0.05$ ). CITEE was decreased significantly from ② to ③ ( $p < 0.05$ ). The correlation coefficient between ClesCCO and CITEE was 0.75 ( $p < 0.001$ ). The difference in the CI value between ClesCCO and CITEE was  $0.21 \pm 1.01$  L/min/m<sup>2</sup> (95% confidence limits of -1.81 to 2.23 L/min). The percentage error was 44.5%. Changes in CITEE greater than 15% from ① to ② or ② to ③ were 16 points, and those lead to a change of ClesCCO in the same direction in 100%. A sensitivity and specificity that the changes in ClesCCO greater than 15% can detect the changes in CITEE greater than 15% were calculated using ROC analysis. ROC analysis showed a sensitivity of 87.5% and specificity of 100% (AUC 0.958 % CI 0.881-1.036).

**Conclusion(s):** esCCO is a new noninvasive and cost-effective method to estimate cardiac function continuously. We found a poor agreement between the two methods. However we found a good agreement of trend between the two methods. esCCO may be sufficient for trend monitoring.

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### 3AP4-3

#### Accuracy of continuous and noninvasive hemoglobin monitoring during prolonged surgery

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**Background:** Monitoring hemoglobin concentration during surgery currently requires repeated blood draws and a variable time delay to receive results. A new technology, Pulse CO-Oximetry, provides a continuous noninvasive estimate of hemoglobin concentration (SpHb) from a sensor placed on the finger. The clinical impact of SpHb monitoring has been reported during surgery (1) and in the ICU (2). However, there are no reports regarding intra-operative SpHb monitoring during prolonged surgery. We evaluated the accuracy of SpHb compared with laboratory CO-Oximetry measurements of total hemoglobin (Hb) during prolonged oral surgery.

**Materials and methods:** After obtaining approval from the ethics committee of our institution, 7 patients scheduled for prolonged oral surgery were enrolled in this study. Patients received general anesthesia and had arterial catheters in place for blood pressure monitoring and blood sampling. Additionally, patients had continuous, noninvasive hemoglobin monitoring by Pulse CO-Oximetry with a SpHb sensor (R2-25, rev G) connected to a Radical-7 (SET software 7.6.2.1, Masimo, Irvine CA, USA). The sensor was placed on either the index finger. Blood samples were taken at the discretion of attending anesthesiologists and analyzed for Hb with laboratory CO-Oximetry. When an arterial blood sample was drawn, the value of SpHb was recorded. To compare SpHb to Hb values, the correlation coefficient, bias and precision were calculated and a Bland-Altman graph was constructed to assess agreement between 2 methods of measurement (3). Additionally, the percent error

of SpHb measurements compared with Hb measurements was calculated by dividing 2 standard deviations of the bias of SpHb to Hb by the mean of the range of Hb.

**Results:** Seventy-three Hb values were compared to SpHb. The correlation coefficient was 0.74. Bias and precision were 0.86 g/dL and 1.17 g/dL, respectively. Percent error was 22.4%. Bland-Altman analysis showed limits of agreement of -1.43 to 3.15 g/dl. (Figure 1)

**Conclusion(s):** The accuracy of SpHb monitoring during prolonged surgery was clinically acceptable, as shown by the low bias, precision and moderate limits of agreement when compared to laboratory values, although percent error exceeded normal range slightly.

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### 3AP4-4

#### Inter-rater reliability of a non-invasive cardiac output monitor (USCOM) when using a passive leg-raise manoeuvre

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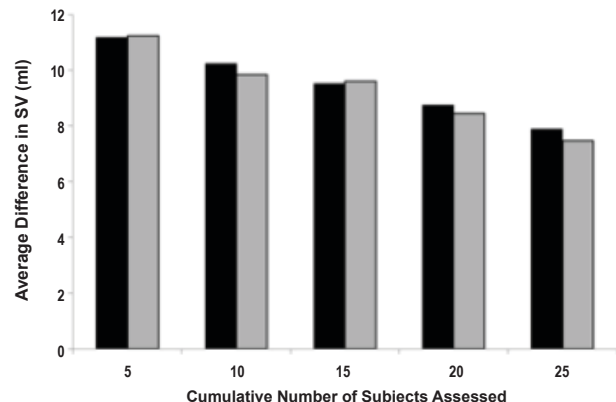
**Background and Goals of Study:** Clinical assessment & basic haemodynamic parameters are not reliable in detecting volume responsiveness. Passive leg raising (PLR) is a simple, reversible manoeuvre that mimics a rapid volume expansion of approximately 300-500mL. USCOM is a noninvasive doppler ultrasound cardiac output device, which in conjunction with a PLR has previously been shown to predict volume responsiveness. It has been suggested that the device is operator dependent with varying estimates of the duration of the learning curve to achieve competency. A small number of inter-rater studies using the USCOM have been published though none have used the PLR.

#### We investigated:

1. The learning curve of the device (new users compared to an experienced operator) on healthy volunteers before & after a PLR.
2. Inter-rater reliability once a new user had gone through the learning curve, again using a PLR.

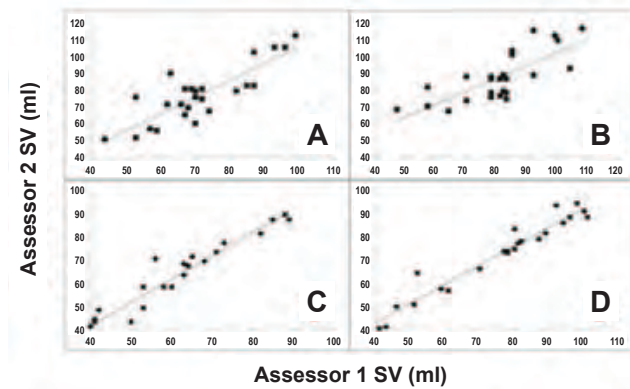
**Methods:** Single centre study with ethics approval & consent given. In a blinded fashion, 4 new operators each performed 50 scans (25 before & 25 after a PLR) at the same time as an experienced operator (providing 200 paired readings on 100 healthy volunteers). Subsequently one newly trained operator & the experienced operator performed 48 further paired blinded scans on hospitalised patients using a PLR.

#### Results:



[Figure 1. Learning curve: increasing cumulative trend in the ability of users to produce similar readings to an experienced operator (black bar = pre leg raise; grey bar = post leg raise)]





[Figure 2. Inter-rater variability]

A: pre-training pre leg raise ( $R^2 = 0.71$ )

B: pre-training post leg raise ( $R^2 = 0.59$ )

C: post-training pre leg raise ( $R^2 = 0.94$ )

D: post-training post leg raise ( $R^2 = 0.95$ )

**Discussion:** Over the course of training, SV inter-rater differences reduced (Fig 1). Fig 2 illustrates improved inter-rater agreement after an operator has completed training, with excellent correlation both before ( $R^2 = 0.94$ ) and after a PLR ( $R^2 = 0.95$ ). This close inter-rater agreement using a PLR is crucial to the utility of the device in clinical practice.

**Conclusion:** The USCOM monitor has a relatively short learning curve (< 50 scans) and once an operator has been trained, the device shows excellent inter-rater agreement when assessing a PLR manoeuvre on patients.

### 3AP4-5

#### Bispectral index for cerebral function monitoring in paediatric patients

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**Background:** Brain hypoxia and focal ischemia injury may be induced by a number of perioperative events such as global hypoperfusion-hypoxia, focal ischemia or tissue injury<sup>1</sup>. We present six case reports of global brain suffering of different aetiologies monitored by BIS in paediatric patients.

**Case report:** The first two cases occurred during a pulmonary and aortic transcatheter valvuloplasty, under general anaesthesia. Both children presented immediate decrease of BIS value and concomitant rate suppression (RS) ratio increase when a mechanical obstruction to pulmonary and systemic blood flux, respectively, occurred. BIS and SR returned to previous values at the end of the procedure. In the third case, a similar behaviour was seen in BIS and SR readings in parallel with two intra-operative tetralogy of Fallot cyanotic crises during pulmonary artery debanding carried out as a second-stage repair of coarctation of the aorta. Case four reports to a brain injured patient in whom an increase in intracranial pressure was accompanied by a decrease in BIS values and an increase in SR. In the fifth case, simultaneous fall in oxygen saturation reading and disappearing of pulse oximeter's waveform, along with sudden BIS decrease, served as alarm signs in the context of aorta puncture during elective laparoscopic Nissen fundoplication. The last case report describes the reperfusion of refractory intra-operative cardiogenic shock on the BIS reading, during spine surgery, in a patient with severe cardiomyopathy secondary to Duchenne's muscular dystrophy, and the following response during cardiopulmonary resuscitation manoeuvres.

**Discussion:** In these six cases, independently of the aetiology - hypoxia, ischemia, and intracranial hypertension - BIS monitoring proved to be a useful tool to predict the beginning and the end of brain injury. These suggest that BIS monitoring can be used as an "alarm signal" to detect reperfusion of hypoxic, ischemic or other nature injuries on cerebral function, when depth of anaesthesia is controlled. However, further studies are needed to validate the use of BIS for this purpose and address its potential applications and limitations.

#### References:

1. Bannister CF, et al. *Anesth Analg*. 2001;92(4):877-81.

#### Learning points:

- BIS monitoring proved to be a useful tool to predict the beginning and the end of brain injury.
- BIS monitoring can be used as an "alarm signal" to detect reperfusion on cerebral function.

### 3AP4-6

#### Accuracy of noninvasive hemoglobin measurement by Masimo Radical-7 Pulse CO-Oximeter in adult patients; comparison between revision C and revision K

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**Background and Objectives:** A novel Pulse CO-Oximetry system (Radical-7<sup>®</sup> or Rad-87<sup>™</sup> combined with R25<sup>®</sup>, Masimo Co., CA, USA) continuously provides hemoglobin measurement as noninvasive hemoglobin concentration (SpHb). R25<sup>®</sup> sensor is updated constantly to improve its accuracy and the newest revision K is available at present. The in vivo adjustment is also available and provides the option to adjust the patients SpHb bias from the laboratory reference device. We previously reported the accuracy of SpHb improved with in vivo adjustment measured by R25<sup>®</sup> of revision C [1]. We compared the accuracy of SpHb between revision C and K. We also analyzed the effect of in vivo adjustment on SpHb measured by revision K.

**Materials and methods:** After IRB approval, 11 adult patients scheduled for open abdominal surgery with ASA physical status 1-2 were enrolled. Two R25<sup>®</sup> sensors of revision K were attached to the index and middle finger contralateral to the radial arterial line. Each sensor was connected to Radical-7<sup>®</sup> and Rad-87<sup>™</sup>. General anesthesia was induced and maintained by our standardized protocol. A blood gas sample was drawn for in vivo adjustment just before the skin incision and SpHb bias was adjusted. The other samples were collected during the surgical procedure when the anesthetist needed. The total hemoglobin provided by blood samples (tHb) and the simultaneous SpHb by Radical-7<sup>®</sup> and Rad-87<sup>™</sup> were recorded. We also used the data from our former report and compared between revision C and K.

**Results and discussion:** 52 pairs of data were collected. Bland-Altman analysis showed the 95% limits of agreement (LOA) to be -0.89 to 1.85 g/dl, with a bias of -0.48 g/dl for the difference between SpHb and tHb without in vivo adjustment. The result obtained from our former report by revision C showed 95% LOA to be -2.82 to 3.14 g/dl, with a bias of 0.16 g/dl [1]. The accuracy of revision K improved compared with revision C. In vivo adjustment did not improve the accuracy of SpHb in revision K however. Revision K is enough accurate without in vivo adjustment. SpHb is reported to have relatively poor correlation in a dynamic situation such as massive bleeding, in which in vivo adjustment may have its efficacy and this is to be investigated further.

**Conclusion:** The sensor of revision K improved the accuracy of SpHb. SpHb measured by revision K is reliable without in vivo adjustment in relatively stable cases.

#### Reference:

1. Isosu T, et al. *J Clin Monit Comput* 2013; 27: 55-60

### 3AP4-7

#### Evaluation of near-infrared spectroscopy (NIRS) under apnea

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**Objectives and Goals:** Near infrared spectroscopy (NIRS) is an important non-invasive tool to measure intracranial venous oxygen saturation in real-time. Previous studies have shown that NIRS values correlate with central venous saturation and end-tidal CO<sub>2</sub>. We investigate the correlation between SpO<sub>2</sub> and NIRS in a dynamic clinical setting evoked by hypoxia under apnea in humans. In addition, we investigated, whether NIRS is more sensitive to assessed changes in oxygen saturation compared to SpO<sub>2</sub>.

**Materials and methods:** 10 experienced apneic divers performed maximal breath hold maneuvers under dry conditions. Peripheral oxygen saturation (SpO<sub>2</sub>) was measured by Massimo pulse oximeter (SHP ACC MCABLE-Masimo Set) and NIRS (SrO<sub>2</sub>) was measured by Nonin Medical's EQUANOX<sup>™</sup>, Model 7600 Regional Oximeter System with EQUANOX Advance<sup>™</sup> Sensor, Model 8004CA.

**Results and discussion:** Median NIRS values decreased from 74.5 to 54 during apnea. This difference was clearly significant ( $z = -2.807$ , exact  $p = 0.002$ ). SpO<sub>2</sub> significantly decreased from 100 to 79 during apnea ( $z = -2.805$ , exact  $p = 0.002$ ). The correlation between decreasing normalized SpO<sub>2</sub> and NIRS values was highly significant with  $P =$  (Pearson correlation coefficient) 0.893 (95% confidence interval: 0.882-0.902). After termination of apnea, NIRS values increased after a mean time delay of only 10.10 sec (std. dev = 3.573) whereas SpO<sub>2</sub> values increased after a mean time delay of 21.20 sec (std. dev. = 4.442) ( $t(9) = 7.703$ ,  $p < 0.0001$ ; R-squared = 0.868).

**Conclusion:** We showed a highly significant correlation between decreasing SpO<sub>2</sub> and NIRS values under voluntary apnea. However, desaturation was



identified earlier by peripheral SpO<sub>2</sub> monitoring compared to NIRS in the beginning of apnea; weather successful oxygenation following apnea is identified significantly earlier by NIRS compared to SpO<sub>2</sub> monitoring. NIRS monitoring may prove beneficial in situations such as difficult airway management, bronchospasm and resuscitation where dynamic changes in oxygenation can occur and where SpO<sub>2</sub> monitoring is sometimes impossible.

### 3AP4-8

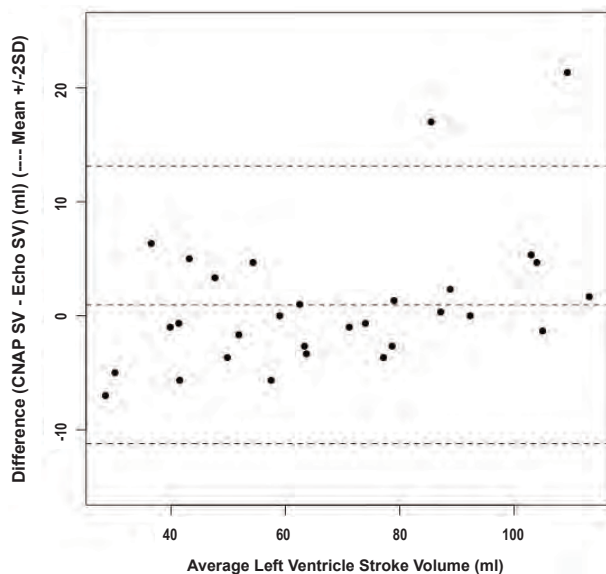
#### Evaluation of left ventricle stroke volumen with the new LiDCO rapidV2 monitor with CNAP module versus transthoracic echocardiography in post-operative critical care patients

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**Background and Goal of Study:** The new LiDCOrapidV2 monitor with the CNAP module(TM) (LiDCO Ltd, Sawston, Cambridge) is a device that provides continuous and noninvasive arterial blood pressure monitoring along with the left ventricle stroke volume (SV) measure. SV is calculated by computing the area under the curve of the continuous arterial pressure obtained non-invasively from the plethysmography of the digital arteries of the second and third fingers, after auto-calibration with a non-invasive arterial pressure measure. The goal of the study is to evaluate the accuracy and usefulness in measuring SV with this monitor compared to the traditional transthoracic echocardiography (TTE) measure.

**Materials and methods:** After oral informed consent, critically adult postoperative patients were recruited. We perform simultaneously serial measurements of the SV with the LiDCO monitor and with TTE. Left ventricle outflow tract (LVOT) distance to calculate LVOT area was obtained as long as velocity-time integral (VTI) of the flow in the LVOT by pulsed Doppler. The SV is calculated by multiplying LVOT area by aortic VTI. Three repeated measures were obtained from each method for averaging. Measurements of SV from LiDCO and TTE were correlated using the Pearson correlation coefficient. Bias and precision were also calculated. Bland-Altman plots were constructed of SV to value graphically the data for agreement between the two methods and to determine the 95% confidence limits. A two-tailed  $p < 0.05$  was considered significant.

**Results and discussion:** 30 stable patients were enrolled in the study. 90 measures were performed from each method. The Pearson correlations between both methods were significant for SV,  $r = 0.976$  ( $p < 0.0001$ ). The Bland-Altman plot [Figure 1]



[Figure 1 Bland-Altman plot for differences of SV values]

show us the mean difference for mean difference values (0.956 ml), and the interchangeability of both methods rely on the assumption of a 95% confident interval between  $\pm 12.171$  ml.

**Conclusion(s):** Both methods for SV monitoring can be used in this setting assuming the narrow confident interval that could be of clinical relevance. A continuous measure of SV and non-invasive pressure wave can be obtained as well.

### 3AP4-9

#### Evaluation of a novel near infra-red spectroscopy using time resolved spectroscopy comparing with INVOS

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**Background and Goal of Study:** Near Infra-Red Spectroscopy (NIRS) is a device for estimating the regional tissue hemoglobin oxygen saturation using near-infrared light. INVOS™ using spatially resolved spectroscopy (SRS) is widely used. However, evaluation of absolute value of oxygen saturation is difficult because variation in the measured value is large for each subject. Therefore the relative change from the initial value of oxygen saturation is used in many cases. TRS-NIRO™ (Hamamatsu Co., Japan) is developed, this is the first clinical monitor adopted the measurement principle of time resolved spectroscopy (TRS), which can be expected higher performance. The aim of this study is to evaluate the basic performance of the TRS-NIRO comparing to the INVOS.

**Materials and methods:** Ten healthy male adult volunteers participated in this study, average age was  $39.7 \pm 12.4$ . After the one pair measurement probes of TRS-NIRO are attached to left and right forehead of five volunteers, we recorded tissue oxygen saturation as StO<sub>2</sub> for 5 minutes sitting rest, and then recorded for 5 minutes supine. In the same way as the TRS-NIRO, regional oxygen saturation as rSO<sub>2</sub> were recorded by INVOS 5100C. The other five were measured in reverse order INVOS 5100C, TRS-NIRO. We used the average of the last minute of each measurement for the analysis. Values are expressed as mean  $\pm$  SD, using the F-test to examine the SD, the paired t-test and Wilcoxon signed-rank test to examine means.  $P < 0.05$  was considered statistically significant.

**Results and discussion:** There was no difference in the value of the left and right during the measurement of all devices and positions, so we compared by the average value of left and right. Average StO<sub>2</sub> was  $62.6 \pm 3.3\%$ , rSO<sub>2</sub> was  $72.0 \pm 8.6\%$  in sitting. StO<sub>2</sub> was  $65.4 \pm 3.6\%$ , rSO<sub>2</sub> was  $74.9 \pm 8.6\%$  in supine. Mean value and SD of StO<sub>2</sub> were smaller than rSO<sub>2</sub> in both sitting and supine. SO<sub>2</sub> values in supine were higher than sitting in both devices; the differences were  $2.8 \pm 1.1\%$  in StO<sub>2</sub>, and  $2.9 \pm 1.2\%$  in rSO<sub>2</sub>.

As variability of StO<sub>2</sub> measured by TRS-NIRO was small, StO<sub>2</sub> values were concentrated in a narrow range. This fact suggests that influence of other tissues, such as skin blood flow, is small in TRS-NIRO, and TRS-NIRO can correctly estimate the brain hemoglobin oxygen saturation.

**Conclusion(s):** TRS-NIRO presented small variability compared to INVOS. It suggests that TRS-NIRO can evaluate brain tissue hemoglobin oxygen saturation as an absolute value.

### 3AP4-10

#### Precision of cardiac output measurement obtained with the fourth generation FloTrac-Vigileo and LiDCOrapid at the time of systemic vascular resistance variation

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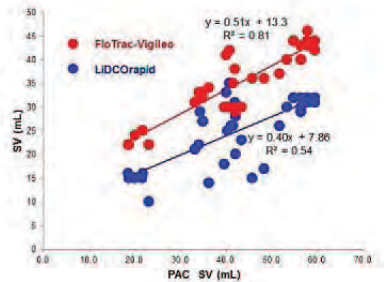
**Background and Goal of Study:** Cardiac output (CO) measurement obtained with arterial pressure waveform analysis is increasingly used in high risk surgery. The measurement affected by systemic vascular resistance (SVR) variation is well known. Recently, the fourth generation FloTrac-Vigileo (Edwards Lifesciences, Irvine, CA, USA) and LiDCOrapid (LiDCO, Ltd, Cambridge, UK) respond to SVR variation are used in clinical settings.

The aim of this study was to compare the accuracy of the CO obtained from FloTrac-Vigileo and LiDCOrapid at the time of SVR variation in cardiac surgery patients.

**Materials and methods:** Six adult patients undergoing coronary artery bypass grafting or valve replacement were enrolled. Stroke volume (SV) measured by continuous CO (CCO) with pulmonary artery thermodilution catheter (PAC) at stat mode is a gold standard method of measuring SV. At the decrease in blood pressure, SV were measured by PAC, FloTrac-Vigileo and LiDCOrapid, before administration of phenylephrine (0.05–0.2mg) and 1,2,3,4 and 5 minutes after administration. In addition, the changes of mean blood pressure (MBP) and SV from baseline were examined. Linear regression analysis and Pearson's correlation coefficient were calculated. A  $P$  value less than 0.05 was considered to be statistically significant.

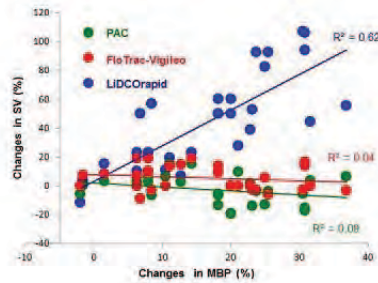
**Results:** After administration of phenylephrine, FloTrac-Vigileo was more correlated with PAC than LiDCOrapid (Figure 1). After administration of phenylephrine, the increase of SV was significantly correlated with the increase of MBP in LiDCOrapid, but was not correlated in PAC and FloTrac-Vigileo (Figure 2).

**Conclusion(s):** Precision of cardiac output measurement at the time of systemic vascular resistance variation was high obtained with the fourth generation FloTrac-Vigileo than with LiDCOrapid.



[Figure 1. Comparison of SV measured by two device with PAC after administration of phenylephrine]

FloTrac-Vigileo was significantly correlated with PAC in SV measurement ( $R^2 = 0.81$ ). LiDCOrapid was significantly correlated with PAC in SV measurement ( $R^2 = 0.54$ ). SV: stroke volume



[Figure 2. Relationship between Changes in SV and MBP after administration of phenylephrine]

After administration of phenylephrine, the increase of SV was significantly correlated with the increase of MBP in LiDCOrapid ( $R^2 = 0.62$ ), but not correlated in PAC ( $R^2 = 0.09$ ) and FloTrac-Vigileo ( $R^2 = 0.04$ ). SV: stroke volume, MBP: mean blood pressure

### 3AP4-11 Uncalibrated arterial pressure-based cardiac output obtained with LiDCOrapid in cardiovascular surgical patients

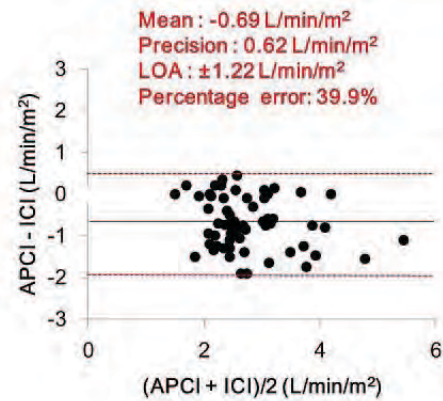
Harada H., Imabayashi T., Kakoi T., Nagaoka M., Matsunaga A., Kanmura Y. Graduate School of Medical and Dental Sciences, Kagoshima University, Dept of Anaesthesiology, Kagoshima, Japan

**Background and Goal of Study:** Thermodilution is a standard method of measuring cardiac index (CI). LiDCOrapid (LiDCO, Ltd, Cambridge, UK) is the newest monitor that estimates continuous CI from a peripheral arterial wave form analysis. Much remains to be learned about the accuracy of LiDCOrapid in cardiac surgery. The aim of this study was to compare the accuracy of the CI obtained from LiDCOrapid (APCI) with intermittent pulmonary artery thermodilution (ICI) in cardiac surgery patients.

**Materials and methods:** Eleven patients undergoing coronary artery bypass grafting or valve replacement were enrolled. APCI and ICI were measured during surgery, before Cardiopulmonary Bypass (CPB), and after CPB. Linear regression analysis and Pearson's correlation coefficient were calculated. A P value less than 0.05 was considered to be statistically significant. A Bland-Altman analysis was used to compare the accuracy, precision, the 95% limits of agreement, and a percentage error. Data were analyzed using the statistical system Prism version 6.0 (GraphPad Software, San Diego, CA).

**Results:** APCI was significantly correlated with ICI during surgery ( $n = 63$ ,  $r^2 = 0.49$ ,  $P < 0.0001$ ) and after CPB ( $n = 33$ ,  $r^2 = 0.60$ ,  $P < 0.0001$ ), but was not correlated before CPB ( $n = 30$ ,  $r^2 = 0.06$ ,  $P = 0.24$ ). Bland-Altman plots showed in Figure 1–3.

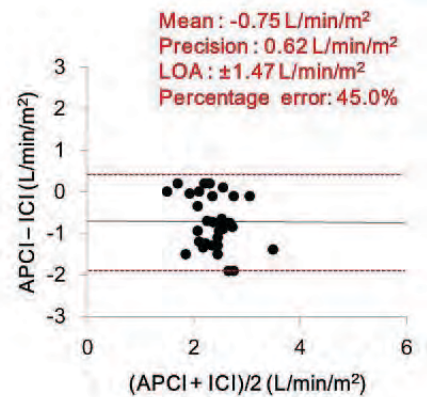
**Conclusion(s):** APCI was significantly correlated with ICI during surgery and after CPB, but was not correlated before CPB. The percentage error exceeds the acceptable threshold (30%).



[Figure 1. Bland-Altman plots (during surgery)]

APCI: CI obtained from LiDCOrapid

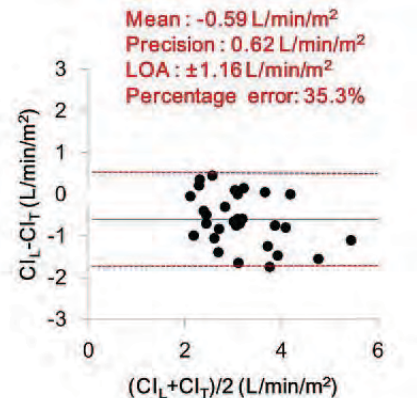
ICI: CI obtained from intermittent pulmonary artery thermodilution



[Figure 2. Bland-Altman plots (before CPB)]

APCI: CI obtained from LiDCOrapid

ICI: CI obtained from intermittent pulmonary artery thermodilution



[Figure 3. Bland-Altman plots (after CPB)]

APCI: CI obtained from LiDCOrapid

ICI: CI obtained from intermittent pulmonary artery thermodilution

### 3AP5-1

#### Stroke volume optimisation in elective abdominal surgery: a comparison between a non-invasive doppler device (USCOM) and the oesophageal doppler (CardioQ)

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**Background and Goal of Study:** Intra-operative goal-directed fluid therapy has been shown to improve outcome in major surgery. The oesophageal doppler method (ODM) is recommended internationally as a cardiac output monitor to help guide such goal-directed therapy. We evaluated the ability of a non-invasive device (USCOM) to predict fluid responsiveness as assessed by our standard ODM during major abdominal surgery.

**Materials and methods:** An observational study of 25 patients within an enhanced recovery protocol was performed after a favourable ethical opinion was given and written consent was provided by all patients. We compared stroke volume (SV) values measured simultaneously by USCOM and ODM in a blinded fashion intra-operatively.

**Results and discussion:** From 25 patients (age range 32-92), 137 paired readings were taken, with median SV values for USCOM 80mls (Inter-quartile range 65-94) and ODM 86mls (69-101).

	USCOM $\geq 10\%$ increase in SV	USCOM $< 10\%$ increase in SV
OED $\geq 10\%$ increase in SV	39	5
OED $< 10\%$ increase in SV	4	51

#### [Fluid Challenge Results]

99 Paired measurements were taken before & after a fluid challenge. ODM SV increased by  $\geq 10\%$  after a fluid challenge in 44 instances. In 39/44 of these positive responses, USCOM SV also increased by  $\geq 10\%$ . In 4 instances USCOM SV increased by  $\geq 10\%$  when the ODM did not. Using the ODM as the standard, the ability of the USCOM to predict a significant change in SV with fluid showed a sensitivity of 89%, specificity 93%, positive predictive value 91% & a negative predictive value of 91%.

**Conclusion(s):** The USCOM device was able to predict fluid responsiveness as assessed by the ODM intra-operatively with good sensitivity and specificity. The device has potential for a future role in perioperative goal-directed therapy or intra-operatively when the ODM cannot be used.

### 3AP5-2

#### Early goal-directed therapy based on endotracheal bioimpedance cardiography: a prospective, randomized controlled study in coronary surgery

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CHU de Caen/Université de Caen Basse-Normandie, Dept of Anaesthesiology & Intensive Care, Caen, France

**Background and Goal of Study:** New mini-invasive cardiac output devices have been developed over the last decade. Easy to use, they could help the practitioners in promoting early goal-directed therapy in high-risk patients, in an attempt to improve postoperative outcome. This pragmatic study compared the impact of an early goal-directed hemodynamic therapy based on Endotracheal Cardiac Output Monitor (ECOM) with a standard of care on postoperative outcome following coronary surgery.

**Materials and methods:** This prospective, controlled, parallel-arm trial randomized 100 elective primary coronary artery bypass grafting patients to a study group (ECOM; n=50) or a control group (control; n=50). In the ECOM group, hemodynamic therapy was guided by respiratory stroke volume variation and cardiac index given by the ECOM system. A standard of care was used in the control. Goal-directed therapy was started immediately after induction of anesthesia and continued until arrival in the intensive care unit. The primary endpoint was the time when patients fulfilled discharge criteria from hospital (possible hospital discharge). Secondary endpoints were the true hospital discharge, the time to reach extubation, the length of stay in intensive care unit, the number of major adverse cardiac events, and in-hospital mortality. An intention-to-treat analysis was performed on all randomized patients.

**Results:** Patients in the ECOM group received more often fluid loading and dobutamine. No significant differences were found between both groups for possible hospital discharge (Hazard Ratio=0.96 [95% CI: 0.64-1.45]) and true hospital discharge (Hazard Ratio=1.20 [95% CI: 0.79-1.81]). The time to

reach extubation was significantly reduced in the ECOM group: 510 min [extremes: 360-1110] vs. 570 min [extremes: 320-1520],  $P=0.005$ . No significant difference was found between the two groups in the total number of major adverse cardiac events and noncardiac complications, the length of stay in ICU and in-hospital mortality.

**Conclusions:** A simple and mini-invasive early goal-directed hemodynamic therapy based on ECOM can reduce the time to reach extubation but fails to significantly reduce the length of stay in hospital and the rate of major cardiac morbidity following coronary surgery.

### 3AP5-3

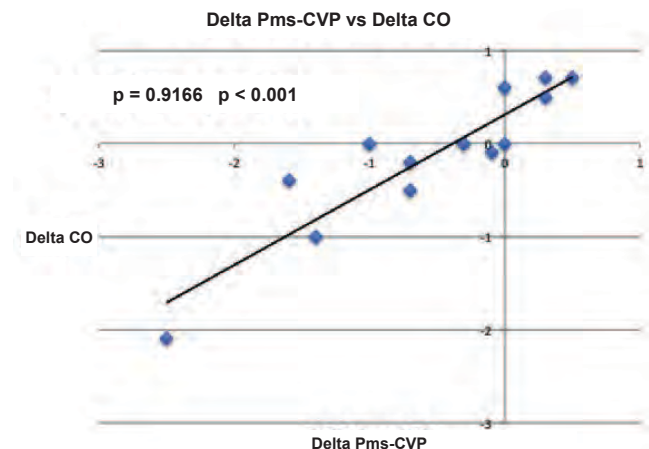
#### Assessment of determinants of venous return using Navigator®

Witters L., Bouchez S., Wouters P, De Hert S.  
University Hospital Ghent, Dept of Anaesthesiology, Ghent, Belgium

**Background and Goal of Study:** The difference between the mean systemic filling pressure ( $P_{ms}$ ) and central venous pressure (CVP) is the pressure gradient of venous return (VR).<sup>1</sup> Navigator® software (Applied Physiology, Sydney, Australia) provides an estimation for  $P_{ms}$  and thus may help to assess the pressure gradient of VR.<sup>2</sup> Though nitroglycerin (NTG) always lowers CVP, its effect on cardiac output (CO) and VR varies in function of the cardiovascular status. We hypothesize that assessment of the determinants of the pressure gradient of VR will allow to better understand the effects of NTG.

**Methods:** After ethical approval and informed consent, 13 CABG patients were included. In addition to standard monitoring, Navigator® was used to determine  $P_{ms}$  and  $E_n$ . Hemodynamic variables were collected at baseline and during administration of 0.5  $\mu\text{g}/\text{kg}/\text{min}$  NTG.  $P_{ms}$  is calculated by the following equation:  $P_{ms} = 0.96(\text{CVP}) + 0.04(\text{MAP}) + c(\text{CO})$  where c has the dimension of resistance and is a function of the patient's height, weight and age. Global cardiac efficiency  $E_n$  is calculated as following:  $E_n = (P_{ms} - \text{CVP})/P_{ms}$ . Data before and after administration of NTG were compared using paired Student's t-test. Pearson correlation was used to assess the relation between changes in the  $P_{ms}$ -CVP gradient and the changes in CO.

**Results:** CVP decreased after the administration of NTG from  $10 \pm 3$  to  $6 \pm 2$  mm Hg ( $p < 0.001$ ) while CO remained unchanged. Simultaneously  $E_n$  increased from  $0.39 \pm 0.10$  to  $0.50 \pm 0.10$  ( $p < 0.001$ ). Changes in VR and CO were not related to the change in CVP but to the change in gradient between  $P_{ms}$  and the CVP, the driving pressure for VR (Figure).



[Figure: Delta  $P_{ms}$ -CVP versus delta CO. Delta  $P_{ms}$ -CVP = change in gradient between  $P_{ms}$  and CVP (baseline-NTG) and delta CO = change in CO (baseline-NTG)]

**Conclusion:** Navigator® allows a more detailed physiological understanding of the determinants of cardiac efficiency.

#### References:

- Guyton AC. Determination of cardiac output by equating venous return curves with cardiac response curves. *Physiol Rev* 35: 123-129, 1955.
- Parkin and Leaning. Therapeutic control of the circulation. *J Clin Monit Comput* (2008) vol. 22 (6) pp. 391-400.



### 3AP5-4

#### Prediction of fluid responsiveness with plethysmographic variability index in cardiac surgery patients: a comparison of three anatomical sites

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**Background and Goal of Study:** Digital plethysmographic variability index (PVI) has been shown to predict fluid responsiveness in high-risk surgical patients and in critically-ill patients. However, alterations in finger perfusion can markedly decrease the accuracy of measurements.

We tested the hypothesis that cephalic PVI sensors placed on the ear (PVI<sub>ear</sub>) and the forehead (PVI<sub>forehead</sub>) would be more discriminant than usual digital PVI (PVI<sub>digital</sub>) to predict fluid responsiveness in cardiac surgery patients.

**Materials and methods:** Consecutive patients scheduled for fluid loading (500 mL hydroxylethyl starch 6% 130/0.4 over 15 min) were included postoperatively. Patients with left and/or right ventricular dysfunction were excluded. Three anatomical sites of PVI measurement (PVI<sub>digital</sub>, PVI<sub>ear</sub>, PVI<sub>forehead</sub>) were simultaneously assessed and compared with the respiratory arterial pulse pressure variation (PPV). A positive response to fluid loading was defined as a 15% increase in cardiac index (bolus transpulmonary thermodilution). Relationships among all dynamic indices and between baseline PVI and changes in cardiac index after fluid loading were analyzed with linear regression. The area under the receiver operating characteristic curves (ROCAUC) for PVI<sub>digital</sub>, PVI<sub>ear</sub>, PVI<sub>forehead</sub> and PPV to predict fluid responsiveness were calculated.

**Results and discussion:** Eighty-one consecutive patients were enrolled in the study. Thirty-one patients were excluded and the remaining 50 patients were analyzed. Due to the absence of signal, PVI<sub>digital</sub> and PVI<sub>forehead</sub> could not be obtained in one and three patients, respectively. Forty-three (86%) patients were responders and seven (14%) patients were non-responders to fluid loading. A positive significant relationship was found between PPV and PVI<sub>digital</sub> ( $r=0.58$ ,  $P < 0.001$ ), PVI<sub>ear</sub> ( $r=0.68$ ,  $P < 0.001$ ) and PVI<sub>forehead</sub> ( $r=0.60$ ,  $P < 0.001$ ). PVI<sub>forehead</sub> at baseline only was significantly correlated with changes in cardiac index after fluid loading ( $r=0.38$ ,  $P=0.008$ ). ROCAUC were 0.84 (95%CI: 0.70-0.92), 0.70 (95%CI: 0.55-0.82), 0.78 (95%CI: 0.64-0.88) and 0.84 (95%CI: 0.70-0.93) for PPV, PVI<sub>digital</sub>, PVI<sub>ear</sub> and PVI<sub>forehead</sub>, respectively.

**Conclusion(s):** PVI<sub>forehead</sub> was more discriminant than PVI<sub>digital</sub> and similar to PPV in predicting fluid responsiveness following cardiac surgery.

### 3AP5-5

#### Pleth variability index as a tool for volume optimization during open abdominal surgery

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**Background and Goal of Study:** Stroke Volume Optimization using Esophageal Doppler (ED) is an established method to optimize preload during abdominal surgery (1). The technique is costly and sensitive to interference, requires training and is not possible in prone position or at limited access to the head. We studied if volume optimization using the simpler pulse oximetric technique Pleth Variability Index (2) would lead to similar fluid treatment.

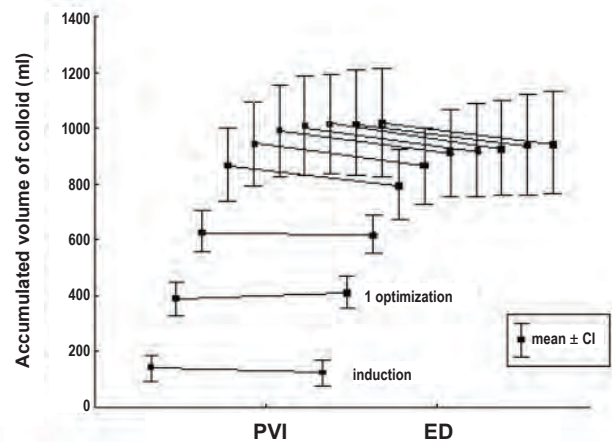
**Materials and methods:** After ethical permission 75 adult patients ASA 1-3 scheduled for elective open abdominal surgery with an expected duration of at least 2 hours were randomized to volume optimization guided by ED or PVI. Exclusion criteria were amongst others hepatic resection and severe cardiac arrhythmias.

All patients received a baseline infusion of 2 ml/kg/h dextrose solution. Pre-operative dehydration was corrected with Ringer-acetate. All patients were ventilated with a tidal volume of 7 ml/kg ideal bodyweight.

In the ED group stroke volume was maximized using 3 ml/kg boluses of colloids (1) while simultaneously acquired PVI measurements were concealed. In the PVI group boluses of colloids were administered when  $PVI \geq 10\%$  (3) and the parallel ED readings were concealed. Bleeding was substituted 1:1 with additional colloids including blood products.

**Results and discussion:** Thirty-five patients were analyzed in the PVI group and 39 in the ED group. Surgical time was mean(SD) 373(270) min for PVI and 348(329) min for ED ( $p=0.73$ ). There was no difference in colloid volume given in connection with induction and the following volume optimizations during surgery between the two groups ( $p=0.38$ ; repeated measures ANOVA) (Fig 1). The total volume of fluids given during surgery was mean(SD) 2663(1730)

ml for PVI and 2809(1938) ml for ED group ( $p=0.71$ ). Lactate level at the end of surgery was 1.8(0.9) and 1.7(0.9) mmol/L, respectively ( $p=0.71$ ).



[Fig 1]

**Conclusion(s):** Fluid optimization during open abdominal surgery guided by PVI seems to result in equal amounts of fluid administered compared to guidance using ED technique.

#### References:

1. J Am Coll Surg 2008;207(6):935-41
2. Anesth Analg 2010;111:910-4
3. Anesth Analg 2011;113:1058-63

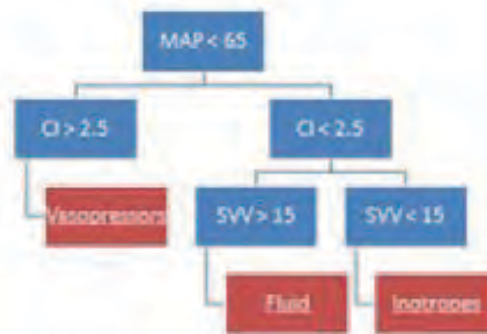
### 3AP5-6

#### Fluid responsiveness using left ventricular end-diastolic volume measured by TEE in high risk surgical patients

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**Background and Goal of Study:** Left ventricular end-diastolic volume (LVEDV) could be easily estimated by left ventricular short diameter of axle using M type echocardiographic measurement. This study was to evaluate the validity of fluid responsiveness measurement obtained using the transesophageal echocardiography (TEE) in comparison to stroke volume variation (SVV) obtained with the FloTrac/Vigileo monitor in goal direct therapy.

**Materials and methods:** After obtaining IRB approval and informed consent, we used SVV according to an algorithm to manage intraoperative hypotension in adult ASA III - IV patients undergoing craniotomy.



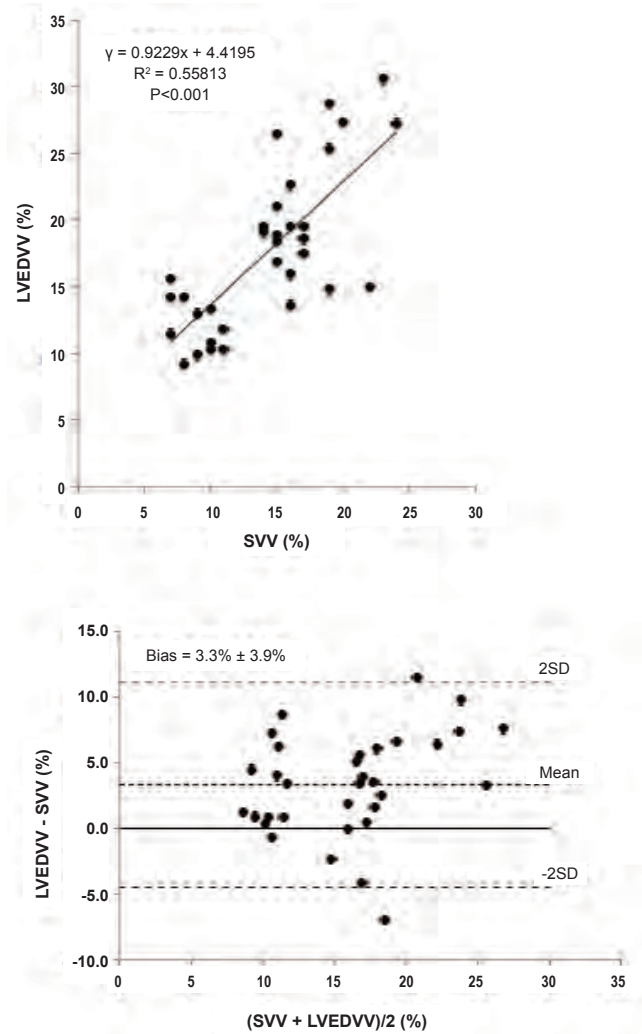
[Fig 1. Volume expansion protocol]

The variations of LVEDV (LVEDVV) were measured by TEE through the changes of left ventricular short diameter of axle simultaneously. Comparisons were then made between the two devices after bolus of 200ml colloid given when  $CI \leq 2.5$  and  $SVV \geq 15\%$ .

**Results and discussion:** Ten patients referred for craniotomy were enrolled in our study. Thirty-three pairs of data were obtained. Mean SVV and LVEDVV were  $20.3 \pm 3.3\%$  and  $21.3 \pm 5.4\%$  before volume expansion respectively, and were  $12.0 \pm 3.8\%$  and  $14.2 \pm 5.6\%$  after volume expansion respectively ( $p < 0.05$ ). There was a significant relationship between Vigileo-SVV and TEE-LVEDVV



( $r^2 = 0.55$ ;  $p < 0.001$ ). The agreement between Vigileo-SVV and TEE-LVEDV was  $3.3\% \pm 3.9\%$  (Bland-Altman).



[Fluid responsiveness measurement]

Trending analysis found an 88% concordance between changes in both devices after bolus of 200ml colloid given.

**Conclusion(s):** LVEDV measured by left ventricular short diameter of axle using M type echocardiographic measurement seems an acceptable monitoring indicator for fluid responsiveness in ASA III-IV patients during craniotomy. This accessible method has potential clinical applications for situations in which volume and cardiac function monitoring during surgery is important.

### 3AP5-7

#### Comparing opinions regarding cardiac output monitoring in a district general hospital and teaching hospital in the United Kingdom (UK)

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**Background and Goal of Study:** Monitoring cardiac output is common practice in anaesthesia & critical care. The pulmonary artery catheter (PAC) has, for many years, been considered the gold standard for cardiac output monitoring (COM). However, it is an invasive technique with potential complications and morbidity. This has led to the development of many new devices, each with their own specific applications & limitations.

**Materials and methods:** A survey of anaesthetic opinions regarding COM was conducted at a large London tertiary referral centre, Kings College Hospital, London (KCH) & a district general NHS hospital trust, East Kent NHS

Hospital Trust (EKHT). Questionnaires looked at anaesthetists' experience with different COMs, opinions & barriers to their use. Data was collected & the findings between teaching & district general hospitals compared.

**Results and discussion:** Response rate was over 50% from both hospitals. 41% of consultants at KCH never used COM. Almost twice as many as at EKHT (25%). Anaesthetists at KCH use COM two times a month (mean). Trainees used COMs more frequently than consultants, 3x a month (mean) compared to once a month. At EKHT this phenomenon was reversed. Both groups of anaesthetists felt that pulse contour analysis was more accurate than Oesophageal Doppler Monitor (ODM). Opinion regarding submission to a fixed COM interventional protocol was divided between the two sites. EKHT was very much in favour, whereas KCH preferred to incorporate COM findings into their own cardiovascular management. The major barriers to use across both sites (KCH/ EKHT) were availability (58%, 55%), time (30%, 30%) & familiarity (30%, 17.5%). At EKHT 32.5% of anaesthetists felt that COMs did not have enough evidence to support their use. There is much research into finding the most accurate COM. However, there is very little evidence that any one is better than the other, even the previously heralded gold standard technique using Fick's Principle via a PAC. The ODM was endorsed by NICE in 2010 for use in goal directed therapy. Studies have since suggested that there are other more accurate COMs available.

**Conclusion:** Our study has showed that there remains an uncertainty regarding the usefulness of COM in patient care, in both large tertiary centres & district general hospitals. This appears to be reinforced by the lack of familiarity with equipment and the confusion associated with the many different types of COMs available on the market.

### 3AP5-8

#### Assessment of a novel non-invasive subcutaneous perfusion monitor in an animal model of graded hemorrhage and re-transfusion

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**Background and Goal of Study:** Current protocols used for the treatment of hypovolemic shock in the prehospital period are usually based on standard vital signs which have proven to be of limited value in detecting the need to implement an intervention before cardiovascular collapse. In this study the ability of a novel non-invasive technology named mDLS (miniature Dynamic Light Scattering, Elfi-Tech, LifeBEAM, Israel), which measures peripheral subcutaneous perfusion, to detect hypovolemic shock was evaluated. The mDLS technology is based on the DLS technology that provides data on the size and shape of particles by temporal speckle analysis and can acquire very high temporal resolution pulse signals, senses the derivative of red blood cells velocities and thus can monitor very slow and shallow blood flow non-invasively.

**Materials and Methods:** Heart rate (HR), mean arterial pressure (MAP) and cardiac output (CO) were measured using a PICCO (PULSION, Germany) monitor in 11 pigs following 4 steps of graded hemorrhage, each consisting of 10% of the estimated blood volume, followed by 4 steps of re-transfusion of the shed blood. Red blood cells flow velocities reflecting trends of changes of subcutaneous perfusion were measured using mDLS probe positioned on the animal legs and data were presented as percent of pre-bleeding value.

**Results and discussion:** Results (mean, SD) are presented in the table. All parameters changed significantly during bleeding ( $p=0.011$  for HR,  $p=0.000$  for others) and re-transfusion ( $p=0.023$  for HR,  $p=0.000$  for others). Changes of MAP and CO between sequential measurement points were significant, while changes of peripheral perfusion were significant following 1<sup>st</sup>, 3<sup>rd</sup> and 4<sup>th</sup> bleeding and following 1<sup>st</sup> and 2<sup>nd</sup> re-transfusion steps. Pearson correlation between peripheral perfusion and CO demonstrated r value of 0.917 during bleeding and 0.965 during re-transfusion.

	Baseline	-10%	-20%	-30%	-40%	10%	20%	30%	40%
HR	95±8	92±10	93±12	97±16	97±36	*94±16	*88±11	*82±12	82±11
MAP	72±7	*61±6	*49±3	*39±8	*28±6	*45±11	*71±13	*81±13	83±14
CO	3.5 ±0.6	*2.5 ±0.4	*2.1 ±0.4	*1.6 ±0.7	*1.2 ±0.2	*2.1 ±0.3	*2.9 ±0.4	*3.3 ±0.4	*3.8 ±0.7
mDLS	1.0 ±0	*0.82 ±0.26	0.79 ±0.07	*0.69 ±0.09	*0.58 ±0.12	*0.85 ±0.23	*1.18 ±0.23	1.26 ±0.11	1.28 ±0.15

[Changes in hemodynamic parameters]

**Conclusion:** This preliminary animal study demonstrated the feasibility of a novel DLS based perfusion measurement to detect changes in CO during hypovolemic shock and re-transfusion.

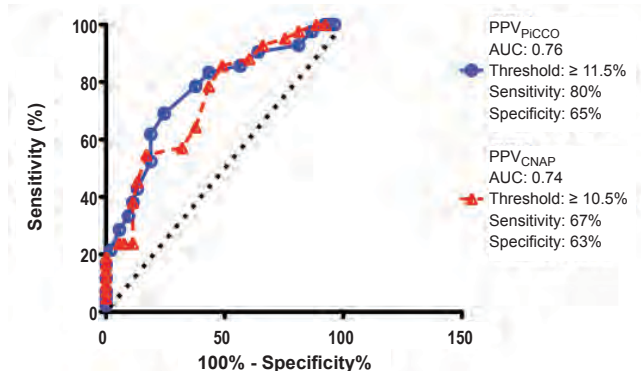
### 3AP5-9

#### Non-invasive prediction of fluid responsiveness using CNAP-PPV in major abdominal surgery

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**Background and Goal of Study:** It has been shown repeatedly that appropriate perioperative fluid administration reduce morbidity after major surgery and the length of stay on the intensive care unit. Over the years the surgical procedures have changed to less invasive approaches in order to reduce the surgical trauma. Simultaneously, today non-invasive monitoring technologies such as the CNAP™ device are available offering for example the ability to non-invasively assess pulse pressure variation (PPV), a dynamic variable of fluid responsiveness (FR). The value of dynamic variables in the context of FR is over the years beyond doubt (1). The aim of the present investigation was to evaluate the accuracy regarding prediction of FR of the non-invasively assessed CNAP-PPV in comparison to the clinical gold standard, the PICCO-PPV. **Materials and methods:** After institutional ethics committee approval and informed consent 50 patients (ASA II, III) scheduled for elective major abdominal surgery were studied after induction of anaesthesia. Each patient was monitored with the PICCO monitoring technology and the non-invasive CNAP monitor based on finger cuff technology. After induction of anaesthesia the protocol was started with a passive leg raising manoeuvre (PLR). Additional data pairs were gained, whenever the attending anesthesiologist decided to perform a fluid challenge. Responders due to volume load were defined to increase their stroke volume index obtained by transpulmonary thermodilution SVITPTD > 15%.

**Results and discussion:** Overall we observed 42 responding data pairs and 53 non-responding data pairs. Receiver operating characteristic analysis showed an area under the curve (AUC) for PICCO-PPV 0,76 (p-value < 0,00001), yielding threshold value of 11,5% helping to discriminate between responder and non-responder with a sensitivity of 80% and a specificity of 65%. In comparison, CNAP-PPV showed and AUC 0,74 (p < 0,0001), a threshold value of



[Figure 1: Receiver Operating Characteristic analysis showing the ability of pulse pressure variation (PPV) assessed by different technologies to discriminate between responder and non-responder due to volume load.]

10,5%, with a sensitivity of 67% and a specificity 63% in order to predict FR (Fig. 1).

**Conclusion(s):** These preliminary data show that non-invasive estimation of FR using the CNAP technology in this patient population is comparable to the clinical gold standard, the PICCO-PPV. However, both technologies in this specific setting potentially cause a misinterpretation rate of almost 30%.

#### References:

1. *Critical Care Med* 2009; **37**: 2642-7

### 3AP6-1

#### Using a laser unit during ultrasound-guided is facilitating radial artery cannulation

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**Background:** Ultrasound guidance can raise success rate with radial artery cannulation. Accurate cannulation is optimized with both clear radial artery visualization and fine adjustment of the needle tip at target area. Both good needle alignment and good radial artery alignment with the same ultrasound beam are required during ultrasound-guided radial artery cannulation. But it is difficult to master this technique. In-plane laser guide may improve the alignment of cannulation needle with ultrasound beams in order to promote the first success rate of cannulation.

**Method:** Attaching the laser line unit onto the ultrasound probe at the probe's midline allows alignment of Ultrasound beams and laser line projections. The laser line illuminate the needle shaft when the needle shaft is in-plane to the combined laser-probe plane. Thirty-two patients who underwent surgical operation in need direct measurement of arterial pressure were randomly assigned to receive either using laser line unit (L-Group, n=16), or freehand(C-group, n=16). We count the times of puncture until cannulation and the first success rate.

**Result:** The average times of puncture was significantly less in the L-group than the C-Group. (L-Group mean=1.375 C-Group mean=2.5 p< 0.01) The first success rate was significantly better in the laser group than the control group. (L-Group 0.75 C-Group 0.375 p< 0.05)

**Conclusion:** There is a possibility to improve the first success rate during ultrasound-guided radial artery cannulation and to reduce the times of punctures by using a laser-line unit to assist with in-plane needle alignment with the ultrasound plane.

#### Reference:

Facilitating Needle Alignment In-Plane to an Ultrasound Beam Using a Portable Laser Unit *Regional Anesthesia and Pain Medicine* Volume 32, Issue 1, January 2007, Pages 84-88

### 3AP6-2

#### Prediction of the optimal depth of the superior vena cava cannular using cardiac computed tomography in minimally invasive cardiac surgery

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**Background and Goal of Study:** Determining an adequate depth of the superior vena cava (SVC) cannular in the patient undergoing minimally invasive cardiac surgery is important to warrant venous drainage and to prevent complications during cardiopulmonary bypass. We investigated whether preoperative cardiac computed tomography (CT) is useful to predict the optimal length for SVC cannula insertion.

**Materials and methods:** Forty-six patients undergoing robot (DaVinci®)-assisted minimally invasive cardiac surgery requiring SVC cannulation were evaluated. The distance between the upper border of clavicular sternal head and SVC-right atrium (RA) junction was measured in cardiac CT. Equivalence test of the difference between the distance measured on cardiac CT and the distance verified by surgeon's direct inspection in surgical field was performed. An interval from -1 cm to 1 cm was predefined as a range of equivalence.

**Results and discussion:** The distance between the upper border of clavicular sternal head and SVC-RA junction measured on cardiac CT was  $11.1 \pm 1.4$  cm and that verified by surgeon's inspection was  $11.4 \pm 1.4$  cm. The length measured on cardiac CT and that verified by surgeon's inspection proved to be equivalent, in that 95% confidence interval (CI) for the mean difference was within the equivalence region (95% CI for the mean difference 0.05-0.52,  $P < 0.0001$ ).

**Conclusion(s):** Preoperative cardiac CT might be valuable to predict the optimal depth of the SVC cannular, suggesting supplementary use of cardiac CT in the patient undergoing minimally invasive cardiac surgery.

### 3AP6-3

#### Influence of electrode position on spectral edge frequency 95% during isoflurane anesthesia combined with epidural anesthesia

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**Background and Goal of Study:** Spectral edge frequency 95% (SEF95) indicates the dominance of slow wave and it is commonly used to assess the level of hypnosis during anesthesia. It is known that an SEF95 less than 14 Hz is suggested as clinically adequate anesthesia. Commonly used EEG monitors, such as BIS monitor, got EEG signals from hemi-frontal lead. However, some researchers tend to use bi-frontal lead for EEG measurement, because it is known that bi-frontal lead is more resistant to electromyogram. However, the shape of raw EEG depends on the electrode position. The goal of this study to know the difference between SEF95 obtained from hemi-frontal lead and that obtained from bi-frontal lead. Here we compared SEF95 obtained from Fp1-A1 leads (hemi-frontal) with that simultaneously obtained from Fp1-Fp2 leads (bi-frontal) during isoflurane anesthesia combined with epidural anesthesia.

**Materials and methods:** We analyzed a set of previously published EEG data, obtained from 20 patients who underwent elective abdominal surgery under isoflurane anesthesia combined with epidural anesthesia. Approval of local ethical committee and informed consent from the participants had been obtained. In the previous study, we only used EEG signals obtained from Fp1-A1 lead. In the current study, we used EEG signals obtained from Fp1-Fp2 lead as well as Fp1-A1 lead. Artifact-free 1-minute EEG segments at different end-tidal isoflurane concentration (0.3%, 0.5%, 0.7%, 0.9%, 1.1%, 1.3% and 1.5%) were extracted and SEF95 values were calculated. Data were excluded when "burst and suppression" was observed. Data were analyzed by two-way repeated measure ANOVA, and *p* values of less than 0.05 were considered significant.

**Results and discussion:** Results were shown in Table 1. In both group, SEF95 values were decreased with increase of isoflurane concentration. SEF95 values obtained from bi-frontal lead were significantly greater than those obtained from hemi-frontal lead regardless of isoflurane concentration. The average difference was 2.1 Hz. The current result indicated that we should pay attention on the electrode position when we interpret the published data.

**Conclusion(s):** SEF95 obtained from bi-frontal lead was greater than that obtained from hemi-frontal lead by about 2 Hz.

Isoflurane (%)	0.3	0.5	0.7	0.9	1.1	1.3	1.5
Hemi-frontal	19.5 ±3.3	19.0 ±2.9	16.7 ±2.8	14.6 ±2.3	13.3 ±2.0	11.8 ±2.2	11.7 ±1.7
Bi-frontal	21.5 ±3.0	20.3 ±2.9	18.7 ±2.8	17.2 ±2.4	15.9 ±2.4	13.9 ±2.3	13.4 ±1.7

[Table 1: SEF95]

### 3AP6-4

#### Routine USG disposal during central venous catheterization: is it really applicable? Or mandatory?

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**Background and Goal of Study:** Ultrasonographic (USG) guidance enhances the accomplishment of the intervention while decreasing the incidence of adverse events during central venous catheterization. However it is considered for only anticipated difficult intervention and not for routine use since time for preparation and intervention is thought to be long and thus it is in vain for routine. In this study, the applicability and necessity of routine USG use for venous catheterization is evaluated

**Materials and methods:** Three technical methods were described for localization of jugular vein. In first group (n:50) anatomical landmarks (Picture 1), in second group (n:50) arterial and venous marking over skin after identification with USG (Picture 2), and in the third group (n:50) simultaneous USG imaging techniques (Picture 3) were used for the intervention. Comparisons were done between groups regarding preparation time, puncture time, number of punctions, and adverse events like arterial puncture and hematoma.

**Results and discussion:** Time for preparation was similar for all the groups. Puncture time and total times were similar in groups 1 and 3 while they were found shorter in group 2. Arterial puncture and hematoma formation was found more in the first group.

**Conclusion(s):** Routine USG use seems to be applicable during central venous catheterization. It does not prolong the preparation and intervention time, rather it shortens them. Moreover USG disposal even does not seem to bring about any burden. It decreases the incidence of adverse events like arterial puncture and hematoma as well as the number of puncture. USG use must be a routine application during central catheterization as it increases the success rate while decreasing the complications.

### 3AP6-5

#### Acute alcohol intoxication and brain function monitoring

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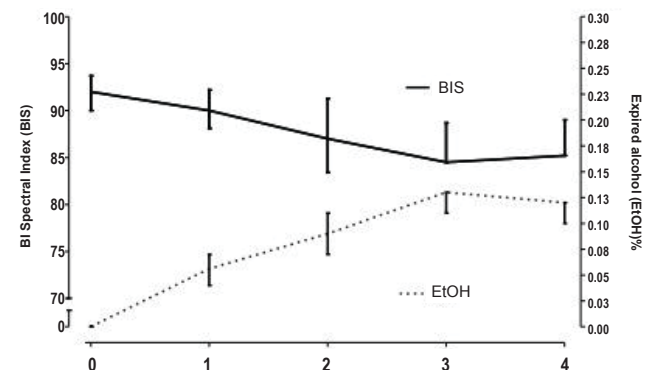
**Background:** Bispectral index (BIS) monitoring is commonly used to decrease the risk of awareness during anaesthesia. The aim of this study was to determine the relationship between blood alcohol concentration and brain function (as measured by BIS) in healthy adults. We hypothesised that there would be an inverse relationship between blood alcohol concentration and BIS.

**Method:** In this prospective observational study, 21 anaesthetic registrars self regulated alcohol consumption over a 3 hour period. Participants were asked to predict their blood alcohol concentration which was then measured along with BIS hourly for a 4-hour period. The main outcome measures were the correlation between blood alcohol and brain function as measured by BIS and the change in BIS from baseline ( $\Delta$ BIS) at four hours. The Pearson Correlation Coefficient was used to describe the relationship between blood alcohol and both BIS and  $\Delta$ BIS.

**Results and discussion:** The median number of standard drinks consumed during the study period was 9.1 (IQR 7.7-12.3), range 5.4-17. At the conclusion of the study period, there was a moderate inverse correlation between BIS and blood alcohol ( $r=-0.49$ ,  $P=0.029$ ) and between  $\Delta$ BIS and blood alcohol ( $r=-0.46$ ,  $P=0.043$ ). Participants exhibited very poor ability to predict their breathalyser readings ( $P=0.77$ ).

We found that in healthy young adults there is a moderate correlation between brain function as measured by BIS and venous blood alcohol concentration. This is an important clinical finding as there are no previous data describing the impact of alcohol intoxication, a common problem in many trauma patients requiring urgent surgery, on BIS. BIS has also been shown to be lower in patients with head injuries. Given trauma patients with acute brain injury are often intoxicated, our findings reveal that another reason for a low BIS in this population may be the effects of alcohol.

**Conclusion:** Acute alcohol consumption decreases BIS. This knowledge may assist anaesthetic management of intoxicated patients requiring urgent or time-critical surgery. A low preoperative BIS in such patients does not necessarily signify brain injury.



[Changes in bispectral index and expired alcohol]



### 3AP6-6

#### Influence of body position on hemodynamic parameters assessed by impedance cardiography during anorectal surgery under low dose spinal anaesthesia

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**Background and Goal of Study:** Patient position affects cardiac function and hemodynamic parameters (1). The goal was to compare hemodynamic changes assessed by impedance cardiography during anorectal surgery under low-dose spinal anaesthesia in lithotomy and jack - knife position.

**Materials and methods:** Approved by local Ethics Committee, the randomized controlled study included 104, ASA I-II adult patients admitted for elective anorectal surgery, randomly assigned to be performed in lithotomy (group L, n=51) or jack-knife position (group J, n=53) using the envelope method. After arrival to OR and standard monitoring, impedance cardiography device niccom<sup>TM</sup> was connected to the patient, and the following variables were recorded: cardiac output (CO), systemic vascular resistance (SVR), systolic index (SI), cardiac index (CI), acceleration index (ACI) measured at times of arrival to OR, placement for, start and end of surgery, placement to bed. Spinal block was made in the sitting position with 4 mg of 0.5% hyperbaric bupivacaine+10 mkg of fentanyl injected over 2 min. After sitting for 10 min level of blockade was assessed, patient was placed to one of the two positions and surgery was started. Comparison was based on hemodynamic changes between and inside groups over time.

**Results and discussion:** Data are presented as mean±SD, \*p< 0.05 considered as statistically significant group J vs group L:

Variable	Group	Baseline OR	Laid for surgery	Start of surgery	End of surgery	Placed to bed
CO	L	6.9±1.8	6.9±1.8	6.7±1.9	6.2±1.8	6±1.7
CO	J	7.4±1.6	4.9±1.2*	4.7±1.2*	4.7±1.2*	6.7±1.6
SI	L	51.1±10.7	48.7±11.1	49.7±9.8	47.6±12.2	46.6±11.1
SI	J	54.2±10.9	33.6±10.1*	32.2±8.7*	33.6±9.7*	51.7±16.1
CI	L	3.6±0.7	3.6±0.8	3.5±0.8	3.2±0.8	3.1±0.7
CI	J	3.9±0.8	2.6±0.7*	2.4±0.6*	2.4±0.6*	3.4±0.7

[Data of CO, SI & CI]

Variable	Group	Baseline OR	Laid for surgery	Start of surgery	End of surgery	Placed to bed
SVR	L	1240±447	1122±386	1085±398	1158±425	1224±443
SVR	J	1080±338	1483±479*	1523±481*	1525±545*	1044±404
ACI	L	94.5±39.2	84.6±37.4	88.7±37.9	80.9±38.1	76.7±33.6
ACI	J	100.5±51.7	67.2±36.8*	61.8±32.4*	63.2±31.8*	80.8±40.1

[Data of SVR & ACI]

Changes of all hemodynamic variables over time were statistically significant inside group J.

**Conclusion(s):** According to impedance cardiography, jack - knife position after low-dose spinal anaesthesia produces transitory, but statistically significant reduction of CO, CI and SI with increase of SVR and ACI, compared to insignificant changes in lithotomy position.

**References:**

1. Edgcombe H et al. Anaesthesia in the prone position. BJA 2008;100(2):165-83.

### 3AP6-7

#### A compact and rapid hematologic coagulation monitoring system COAG2N is helpful during cardiac surgery

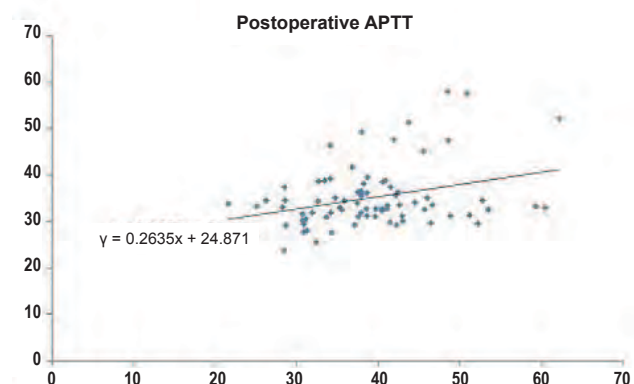
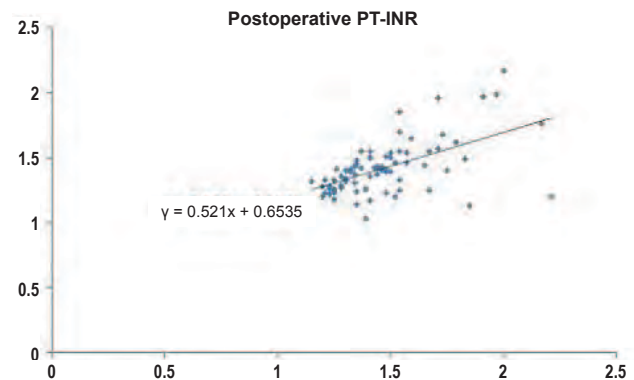
Sakamoto H., Akiyama M., Harasawa K.  
 Cardiovascular Center Hokkaido Ohno Hospital, Dept of Anaesthesiology, Sapporo, Japan

**Background and Goal of Study:** Perioperative hemorrhage in patients undergoing cardiac surgery is a major cause of morbidity and mortality. Monitoring coagulation parameters during cardiac surgery is useful for prediction and treatment of hemorrhage. COAG2N (A&T Corporation, Fujisawa, Japan) is based on DRIHEMATO<sup>®</sup> system and easily measures prothrombin time (PT) including prothrombin time-international normalized ratio (PT-INR), activated partial thromboplastin time (APTT) and fibrinogen in 8 minutes. COAG2N is quite small. Its dimensions are 146 (W) x 265 (D) x 177 (H) mm and 2.8 kg. We compared data of PT-INR and APTT measured by COAG2N with data obtained from clinical laboratory at the end of surgery to evaluate the accuracy.

**Patients and methods:** With IRB approval and informed consent obtained from each patient, 79 adult patients undergoing scheduled cardiac surgery were enrolled in this study. Anesthesia was induced and maintained with propofol, remifentanyl and rocuronium. Blood transfusion was done as needed. At the end of surgery, blood samples were taken for COAG2N and clinical laboratory test. Correlation coefficient (r) of PT-INR and APTT were calculated and correlation analysis was done by StatView<sup>®</sup> 5.0 to calculate p.

**Results and discussion:** Results were shown in figures and table. Correlation analysis shows both PT-INR and APTT have correlation. According to correlation coefficients, PT-INR showed relatively strong correlation but APTT showed weak correlation. Laboratory results were obtained in about 50 minutes.

**Conclusion:** Although correlation is weak to relatively strong, it is great advantage that COAG2N gives coagulation parameters on the spot in less than 10 minutes instead of 50 minutes.



[Figures. Scatter plots and regression lines]

	COAG2N	Laboratory	r	p
PT-INR	1.46 ± 0.22	1.41 ± 0.20	0.566	<0.001
APTT (sec)	39.1 ± 8.1	34.9 ± 6.4	0.319	0.004

[Table. Data are expressed as mean ± SD]



### 3AP6-8

#### The use of cardiac output monitoring aids diagnosis and treatment of anaphylaxis during radical parotidectomy and neck dissection

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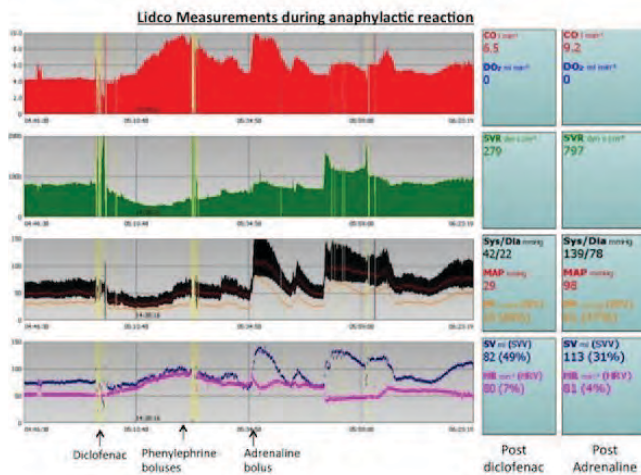
**Background:** Anaphylactic reactions are life threatening emergencies causing massive haemodynamic changes and significant mortality if not treated promptly. We present a case of anaphylactic shock during head and neck surgery where *LidCOplus™* cardiac output (CO) monitoring was used to aid diagnosis and treatment.

**Case report:** A 59 year old man with a background of Diabetes and hypertension was admitted for radical parotidectomy and modified neck dissection. After a routine awake fiberoptic intubation anaesthesia was induced with TCI propofol and remifentanyl and maintained at 2ug/ml propofol and 0.5ug/kg/min remifentanyl. Surgery proceeded uneventfully for 6 hours with stable MAPs of 55-60 mm Hg and CO of 6 l min<sup>-1</sup>.

Five minutes after a 75mg IV Diclofenac dose there was a rapid drop in blood pressure and increasing tachycardia. CO monitoring showed a massive increase in CO and a large drop in Systemic Vascular Resistance (SVR) and hence an allergic reaction was suspected (see figure).

This was initially treated with phenylephrine boluses 100-200µg up to a total of 2mg in 10 minutes. Airway pressures increased markedly with audible wheeze and desaturation and a diffuse erythematous rash noted. A 50µg bolus of Adrenaline was given and the clinical picture improved. A noradrenaline infusion was started and surgery proceeded uneventfully.

After 12 hours on ITU the patient made a full recovery and was discharged home. Mast cell tryptase taken at time of event was 22 confirming true anaphylaxis.



[Lidco™ CO data during anaphylactic reaction]

**Discussion:** The CO data demonstrates the hyperdynamic nature of anaphylaxis with a rapid drop in SVR and a large rise in CO. A falling MAP alone has many differential diagnoses but when combined with CO data allowed us to identify and treat the problem quickly.

NSAID anaphylaxis is uncommon. No patch or antigen testing is available for NSAIDs and Immunologist advice was class avoidance. If NSAIDs were indicated, a supervised challenge test can be performed.

#### Learning points:

- 1.CO monitoring can provide vital haemodynamic information which can be invaluable in the critically ill patient.
- 2.Complications can occur at any time during long cases and constant vigilance is essential.

### 3AP6-9

#### Alternative sensor position for monitoring of depth of anesthesia

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**Background:** Bispectral Index (BIS), a widely validated parameter of depth of anesthesia, is based on EEG data obtained from electrodes placed on the scalp according to a standardized pattern<sup>1</sup> (such as the 10/10 system). However, the conventional sensor position recommended by the manufacturer may be inappropriate when the location of the sensor coincides with the surgical field.<sup>2</sup> The purpose of this case report was to present an alternative position based on the 10/10 system, in which the primary function of each electrode remains the same as in the conventional position.

**Case report:** A 23-year old female patient (ASA P1; 60kg; 1.64 m) was admitted to breast reduction surgery. Total intravenous anesthesia was achieved with propofol and remifentanyl (both target-controlled infusion) and 18 mg rocuronium. The orotracheal intubation was uneventful. Monitoring included noninvasive blood pressure, cardioscopy, pulse oximetry and 2 BIS sensors: one in the conventional location (right side) and one in the alternative location (left side). The position was changed by moving electrode 1 to reference point A1 (left ear), electrode 2 (virtual ground) to FT11, electrode 4 to F11 (orbicularis oculi), and electrode 3 to FT9. At 20-min intervals, the burst suppression rate, BIS, SEF95% and EMG were registered. Anesthesia lasted 120 min.

**Discussion:** Conventionally, electrodes are placed along a line from nasion to inion, including the points FPz, AFz, Fz, FCz, Cz, CPz, Pz, POz and Oz, in addition to the reference points A1 and A2 (left and right ear, respectively). Electrode 2 (virtual ground) may be placed in any location. Electrode 4 should be in a location related to the orbicularis oculi. Electrode 3 should be in a location with low frequencies (as specified by the manufacturer). The alternative position fulfilled these requirements. In conclusion, the results were similar for the two positions (conventional and alternative) with regard to all study parameters.

#### References:

1. Nunes RR et al. - Rev Bras Anesthesiol,2012;62:111-117.
2. Dahaba AA et al.-Anesthesiology,2010;112:645-51.

**Learning points:** Electrodes may be placed in alternative locations provided their primary function remains the same as in the conventional position.

## Clinical and Experimental Circulation

### 4AP1-1

#### Humoral factors released by remote ischaemic preconditioning (RIPC) protect in-vitro cultivated endothelial cells from hypoxia-induced cell damage

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**Background and Goal of Study:** Several studies demonstrated that short repeated cycles of peripheral ischaemia/reperfusion (I/R) can protect distant organs (e.g. the heart, kidney or brain) from subsequent prolonged I/R injury; a phenomenon known as Remote Ischaemic Preconditioning (RIPC) [1]. A RIPC-mediated release of humoral factors might play a key role in this protection [2,3]. We hypothesised that the human endothelium, as the primary target of any secreted factor, is essentially involved in conferring the protective signal. In the present translational study, RIPC-plasma obtained from healthy male volunteers was tested for its ability to protect human umbilical vein endothelial cells (HUVEC) from hypoxia-induced cell damage.

**Materials and methods:** With approval of the ethics committee 10 healthy male volunteers

(25.2 ± 3.4 years) were subjected to a RIPC-protocol consisting of 4 x 5 min inflation/deflation of a blood pressure cuff located at the upper arm. Blood was collected and plasma was retrieved before (T0; controls), directly after (T1) and 1 h after (T2) RIPC. 1 h prior, during and after an enzymatically-elicited 24 h hypoxic period HUVEC were incubated with 5% of the respective RIPC-plasma. Hypoxia-induced cell damage was evaluated by colorimetric lactate dehydrogenase (LDH)-measurements. Using Western blotting the protein expression of Hypoxia-Inducible-Factor-1alpha (HIF1alpha) and of phosphorylated Extracellular Signal Regulated Kinase (p-ERK) was investigated.

**Results:** Cell-incubation with plasma T2 had no significant influence on LDH-levels after 24h of hypoxia (One-Sample t-Test; T2: 1.04 ± 0.1-fold versus T0; T0=1; p=0.15). However, conditioning with plasma T1 significantly impaired LDH-release after 24 h of hypoxia (One-Sample t-Test; T1: 0.89 ± 0.1-fold versus T0; T0=1; p=0.02). This effect was accompanied by an augmentation of the amount of HIF1alpha (Paired t-Test; T1: 0.79 ± 0.6 arbitrary units [a.u.] versus T0: 0.43 ± 0.4 a.u.; p=0.01) and p-ERK (Wilcoxon signed rank test; T1: 0.66 ± 0.9 a.u. versus T0: 0.29 ± 0.2 a.u.; p=0.03) in cells after hypoxia.

**Conclusion:** RIPC-plasma (T1) obtained from healthy male volunteers protects HUVEC from hypoxia-induced cell-damage. In this in-vitro model HIF1alpha and p-ERK might contribute to the underlying mechanisms of RIPC.

#### References:

1. J Cardiovasc Pharmacol Ther. 2011;16:304-12;
2. J Surg Res. 2008;150:304-30;
3. Nat Rev Cardiol. 2011;8:619-29.

### 4AP1-2

#### Effects of helium on adhesion molecule expression after TNFα-induced damage in human umbilical vein endothelial cells

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**Background:** Helium induces preconditioning in human endothelium in vivo(1). Intermittent treatment with the noble gas xenon decreased intracellular adhesion molecule-1 (ICAM-1) and vascular cell adhesion molecule-1 (VCAM-1) expression after TNF-α stimulation(2). The preconditioning protocol plays a major role and alterations of duration and repetition of the stimulus may cause differences in protection(3). We hypothesised that helium pretreatment decreases adhesion molecule expression after TNFα stimulation and investigated different protocols.

**Materials and methods:** HUVEC were isolated from umbilical cords and grown upon confluence. Three independent experiments were performed, and cells were subjected to starving medium (M199, 10%FCS, Pen/Strep, Amfo, L-glutamine) without addition of growth factors for 12 hours before the

experiment. Cells were treated for either 3x5 minutes or 1x30 minutes with either Helium (5%CO<sub>2</sub>, 25%O<sub>2</sub>, 70%Helium) or control gas (5%CO<sub>2</sub>, 25%O<sub>2</sub>, 70%N<sub>2</sub>) in a specialised gas chamber and subsequently stimulated with TNFα (10ng/ml for 2 hours) or left untreated. Afterwards ribo nucleic acid (RNA) was isolated and messenger RNA for ICAM-1, VCAM-1 and E-selectin was determined using real-time quantitative polymerase chain reaction. Target genes were normalised to housekeeping gene 28S. Data are (mean±SD).

**Results:** Stimulation with TNF-α resulted in a significant increased mRNA production of ICAM-1 0.4±0.06 (p< 0.0001), VCAM-1 3.3±0.3 (p< 0.0001) and E-Selectin 0.6±0.3 (p=0.03 all with student's t-test) compared to unstimulated controls (0.02±0.01), (0.1±0.03), and (0.01±0.01) respectively. Helium alone (3x5 minutes and 1x30 minutes) had no effect on mRNA expression of the three adhesion molecules ICAM-1 (0.03±0.03 and 0.05±0.01), VCAM-1 (0.08±0.02 and 0.15±0.02) and E-selectin (0.02±0.2 and 0.03±0.01). Helium pretreatment of the cells (either 3x5 minutes or 1x30 min did not affect mRNA levels of ICAM-1 (0.5±0.02, 0.3±0.08) VCAM-1 (3.7±1.0, 1.8±0.8) and E-Selectin (0.9±0.2, 0.5±0.2) after TNF-α stimulation.

**Conclusion:** Pretreatment with helium for 3x5 min and 1x30 min does not affect mRNA levels of ICAM-1, VCAM-1 and E-selectin after stimulation with TNFα (10ng/ml) in HUVEC. Furthermore, there is no effect of helium pretreatment with 3x5min or 1x30min on mRNA levels of ICAM-1, VCAM-1 and E-selectin without stimulation.

#### References:

1. Smit et al. Anesthesiology 2013; 118
2. Weber et al. Anesthesiology 2008; 108
3. Bein et al. Anaesthesia 2008;63

### 4AP1-3

#### Study of the effects of bupivacaine toxicity in transmural dispersion of repolarization and triggered ventricular arrhythmias and its reversion with the intralipid administration. Study in a porcine experimental model

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**Background and Goal of Study:** Bupivacaine, may induce lethal arrhythmias due to inadvertent intravascular injection. Intralipid is an effective antidote to treat bupivacaine toxicity. An increase of ventricular transmural dispersion of repolarization, a major arrhythmogenic marker, is reflected by the Tpeak-to-Tend in the ECG. The main goal is to determine the effect of bupivacaine on dispersion repolarization parameters such as QT and Tpeak-to-Tend intervals and to explore the impact of intralipid on these parameters.

**Materials and methods:** 14 mini-pig were studied. After instrumentation a 4 mg.kg-bolus of bupivacaine was administrated followed by an infusion of 100 µg.kg<sup>-1</sup>.min<sup>-1</sup>. Heart rate: HR, PR, QRS, QTc: corrected by HR and Tpeak-to-Tend were determined in a sequential fashion: after bupivacaine (at 1 min, 5 min and 10 min) and after intralipid (1.5 ml.kg<sup>-1</sup> over 1 minute followed by an infusion of 0.25 ml.kg<sup>-1</sup>.min<sup>-1</sup>). A t-student test was used.

**Results and discussion:** Bupivacaine prolonged PR, QRS and QTc intervals (at 1, 5 and 10 min), and increases dispersion of repolarization (Tpeak-to-Tend). Intralipid significantly decreased PR, QRS, QTc and Tpeak-to-Tend. Table. Dispersion of repolarization was related to lethal arrhythmias (3 events, including asystole, sustained ventricular tachycardia) and repeated non-sustained ventricular arrhythmias (NSVA) (4/14, 28%). A Brugada-like ECG pattern was visualized at V1-4 leads in 5/14 pigs (35%). Intralipid significantly decreased the alterations induced by bupivacaine, with the termination of VA within 10 minutes. Intralipid administration and resuscitation maneuvers allowed for the recovery from cardiac arrest in 2 specimens.

	Baseline	Bupi 1 min	Bupi 5 min	Bupi 10 min	p value	IL 10 min	P value
PR (ms)	104±22	195±52	186±43	231±113	0.05	123±6	0.05
QRS (ms)	55±6	127±37	143±25	170±27	0.01	63±15	0.05
QTc (ms)	501±48	518±60	558±80	599±91	0.05	525±74	0.05
Tpeak-to-Tend (ms)	59±13	132±65	160±67	163±77	0.05	81±58	0.05

[Bupi: bupivacaine. IL: intralipid]

**Conclusion(s):** Bupivacaine toxicity in this porcine model is associated with an increase of transmural dispersion of repolarization (Tpeak-to-Tend in the ECG), the occurrence of Brugada-like pattern and malignant ventricular arrhythmias. Intralipid reverses changes in dispersion of repolarization favoring the disappearance of Brugada-like pattern and ventricular arrhythmias.

**4AP1-4**

**Remote ischemic preconditioning induces cardioprotection in patients undergoing cardiac surgery with cardiopulmonary bypass**

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**Background and Goal of Study:** Remote ischemic preconditioning (RIPC) is a phenomenon in which brief ischemia of one organ or tissue such as limb confers protection of other organs or tissues such as heart, kidney and brain. Sevoflurane induces pharmacologic conditioning after myocardial ischemia-reperfusion. Cardiac surgery with cardiopulmonary bypass (CPB) can cause myocardial ischemia-reperfusion injury. We hypothesized that the employment of RIPC in cardiac surgery with CPB would decrease postoperative myocardial and renal damage. We also compared RIPC with sevoflurane postconditioning (SPoC).

**Patients and methods:** With IRB approval and informed consent obtained from each patient, 42 adult patients undergoing scheduled simple aortic valve replacement (AVR) were enrolled in this study. Patients were randomly allocated to RIPC, SPoC or Control group. Anesthesia was induced and maintained with propofol, remifentanyl and rocuronium. In RIPC group, after anesthesia induction, RIPC comprised four cycles of 5-minute left upper arm ischemia induced by inflating a cuff to 180 mmHg with an intervening 5 minutes reperfusion. In SPoC group, patients received 1 MAC of sevoflurane for 20 minutes after weaning from CPB. In Control group, a cuff was placed around the left upper arm and left uninflated. The postoperative level of serum creatine kinase isoenzyme MB (CK-MB) and glomerular filtration rate (GFR) and the postoperative peak level of creatine kinase (maxCK) were recorded. Data were compared using ANOVA followed by Fisher's PLSD. A p-value < 0.05 was considered statistically significant.

**Results and discussion:** Demographic data showed no significant difference. The results are shown in table. RIPC group showed significantly lower CK-MB than Control group at the arrival in ICU. GFR showed no significant difference. In AVR, almost no myocardial incision is done. Myocardium is mainly damaged by ischemia-reperfusion. Renal injury is mainly caused by hypoperfusion. Our result shows RIPC is more cardioprotective than SPoC. But sufficient renal perfusion may hide the renal protective effect of RIPC and SPoC. **Conclusion:** RIPC induces better cardioprotection than SPoC.

AVR		RIPC	SPoC	Control	p-value
maxCK (IU/l)		644 ± 530	437 ± 188	672 ± 298	0.4719
CK-MB (ng/ml)	POD0	24.9 ± 15.5	34.7 ± 10.2	65.5 ± 55.5	0.0304
	POD1	21.8 ± 15.1	29.6 ± 5.4	43.9 ± 30.3	0.0567
	POD2	8.3 ± 4.8	9.7 ± 5.7	16.0 ± 17.3	0.2899
	POD3	3.4 ± 2.0	2.8 ± 0.6	13.3 ± 17.3	0.0568
	POD4	2.5 ± 1.9	2.0 ± 0.7	6.3 ± 7.4	0.2382
GFR (ml/min/1.73m <sup>2</sup> )	POD0	64.9 ± 17.2	45.9 ± 22.1	56.4 ± 19.1	0.1277
	POD1	50.1 ± 12.8	40.6 ± 25.1	49.3 ± 19.3	0.5374
	POD2	55.6 ± 15.4	41.9 ± 24.9	59.5 ± 24.5	0.2498
	POD3	62.1 ± 22.2	51.3 ± 29.9	67.6 ± 26.4	0.4406
	POD4	69.2 ± 18.6	60.5 ± 35.7	72.1 ± 23.6	0.6430

[Table. Data are expressed as mean ± SD. POD stands for postoperative day and POD0 means "at the arrival in ICU"]

**4AP1-5**

**Remifentanyl postconditioning has cross-talk with adenosine receptors**

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**Background and Goal of Study:** Although there is a possibility of cross-talk between opioid and adenosine signaling pathways in the ischemic-reperfused myocardium, it is not clear that an ultra-short-acting opioid receptor (OPR) agonist remifentanyl-induced postconditioning (RPC) has cross-talk with adenosine receptor (ADR).

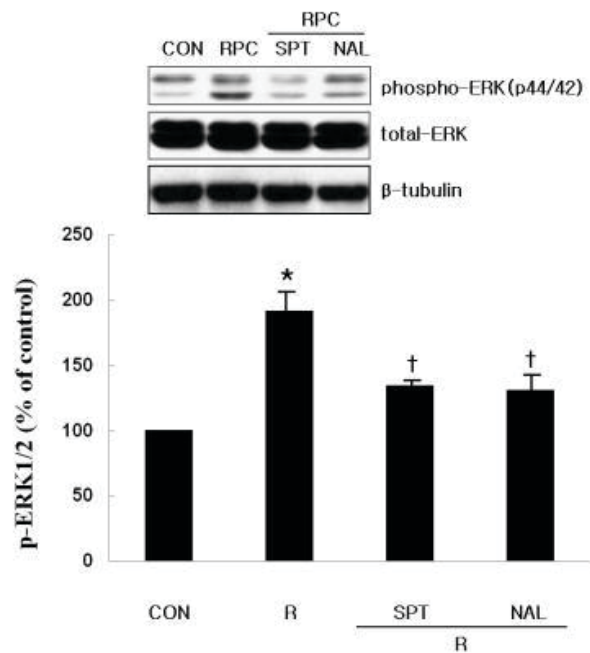
The aim of this study is to determine whether there is cross-talk with ADR in RPC.

**Materials and methods:** Isolated rat hearts were subjected to 30 min of regional ischemia and 2 hr of reperfusion through Langendorff heart perfusion apparatus. RPC was induced by 100 ng/mL of remifentanyl perfusion, 5 min before reperfusion followed by 5 min of reperfusion. The nonspecific OPR antagonist naloxone and the nonspecific ADR antagonist 8-(p-sulphonyl) theophylline hydrate (8-SPT) were perfused for 20 min period, 10 min before RPC to the end of RPC. At the end of experiment, the ischemic area at risk (AR) and necrotic area (AN) were measured.

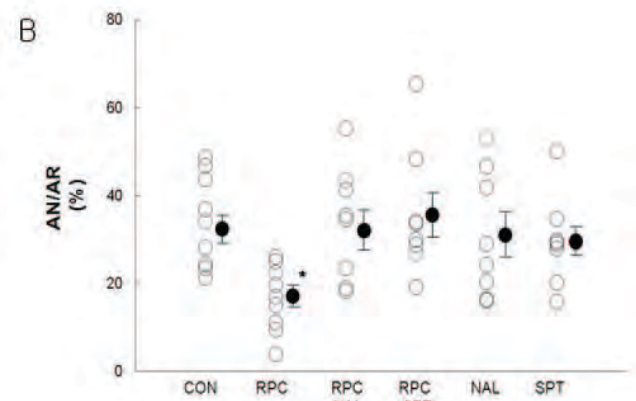
Western blot analysis was performed to detect phospho-ERK1/2 in cultured adult rat cardiomyocytes.

Data analysis was performed with SPSS program. Data were analyzed using t-test and one-way ANOVA with Dunnett post-hoc test. Differences were considered to be statistically significant when p values were < 0.05.

**Results and discussion:** In isolated cardiomyocytes, remifentanyl incubation significantly increased the phosphorylation of ERK1/2 and this effect was blocked by both naloxone and 8-SPT. RPC significantly reduced infarct size over ischemic area at risk. The infarct-limitation effect of RPC was reversed by both naloxone and 8-SPT.



[Figure 1. Western immunoblotting analysis]



[Figure 2. Area of necrosis and area at risk]

**Conclusion(s):** Taken together, our data strongly implies that the cardioprotection by RPC has cross-talk with ADR.



#### 4AP1-6

##### Protective effect of remote ischemic postconditioning in patients undergoing cardiac surgery with cardiopulmonary bypass: possible relation with the HIF-1 $\alpha$

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**Background and Goal of Study:** Previous studies have reported that remote ischemic preconditioning induced by brief ischemia and reperfusion of the arm reduces myocardial injury in patients undergoing cardiac surgery with cold-blood cardioplejia<sup>1,2</sup>. The aim of this study is to evaluate whether the remote ischemic postconditioning (RIPC) is also protective against the myocardial injury in patients undergoing cardiac surgery with cold-blood cardioplejia and if there is a correlation with the levels of HIF1 $\alpha$  (Hypoxia Induced Factor 1-alpha).

**Materials and Methods:** Prospective, randomized, double blind study, still not finalized. 34 patients undergoing cardiac surgery (15 CABG and 19 valves) were studied: 20 controls (Control) and 14 postconditioned (RIPC). RIPC consisted of three 5-min cycles of ischemia by a blood pressure cuff placed on the right upper arm and inflated to 200 mmHg with an intervening 5 min of reperfusion, carried out after pump. Serum HIF1 $\alpha$ , Troponin T, CK-MB levels were measured in arterial blood: preoperative, 8 h, 24 h, 36, 48 h. Data expressed as mean  $\pm$  SD. Mann-Whitney U test and the Wilcoxon test were used (P values < 0.05).

**Results and Discussion:** Two groups were similar on sex, age and ASA. Preliminary and not final results (planned 30 patients/group)

	Preoperative	8h	24h	36h	48h
<b>HIF-1<math>\alpha</math></b>					
Control, n=20	119 $\pm$ 31	127 $\pm$ 29*	166 $\pm$ 5*	137 $\pm$ 21	140 $\pm$ 32
RIPC, n=14	107 $\pm$ 30	161 $\pm$ 2*¶	182 $\pm$ 87*	196 $\pm$ 87*	226 $\pm$ 95*
<b>Troponin T</b>					
Control, n=20	20 $\pm$ 14	381 $\pm$ 295*	444 $\pm$ 367*	354 $\pm$ 352*	260 $\pm$ 188*
RIPC, n=14	107 $\pm$ 30	259 $\pm$ 125*	225 $\pm$ 117*¶	191 $\pm$ 109*	150 $\pm$ 71*¶
<b>CK-MB</b>					
Control, N=20	2 $\pm$ 2	25 $\pm$ 23*	23 $\pm$ 20*	15 $\pm$ 12*	7 $\pm$ 6*
RIPC, n=14	2 $\pm$ 1	19 $\pm$ 5*	18 $\pm$ 15*	7 $\pm$ 4*¶	3 $\pm$ 1*¶

[Preliminary results]

(\*) preoperative vs 8h-72h (p < 0.05);

(¶) control vs RIPC (p < 0.05)

**Conclusion(s):** RIPC is associated to a decrease of Trop T, CK-MB and an increase of HIF-1 $\alpha$  blood levels.

##### References:

1. Hisato Takagi, et al. Am J Cardiol (2008); 102: 1487-1488.
2. Daniel Brevoort, et al. PLoS ONE (2012); 7 (7) e42179.

**Acknowledgements:** ISC III to JGDLA (PI07/0836)

#### 4AP1-7

##### Short-term esmolol therapy reverts coronary artery dysfunction in spontaneously hypertensive rats through increased nitric oxide bioavailability and superoxide dismutase activity

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**Background and Goal of Study:** The risk of fatal cardiovascular events is associated with adverse structural and functional vascular remodelling. Our group of research has previously demonstrated that esmolol produces early morphological regression in SHR (1). The aim of this study now was to assess the effect of esmolol therapy on vascular function in SHR.

**Material and methods:** Six rats from each group were analysed. Fourteen-month-old male SHR were treated for 48 hours with esmolol (SHR-E, 300 mg/kg/min). Age-matched placebo-treated male SHR and Wistar Kyoto rats (WKY) were used as hypertensive and normotensive control groups, respectively. After 48 hours of intervention, left anterior descending artery sections were isolated and precontracted with 5-hydroxytryptamine (5-HT, 3x10<sup>-7</sup>

mol/l). Dose-response curves of acetylcholine were studied (ACh, 10<sup>-9</sup> to 10<sup>-4</sup> mol/l) as well as several plasmatic oxidative stress biomarkers: nitrites, superoxide scavenging activity (SOSA) and total antioxidant capacity (TAC). Some of the results were expressed as differences between the area under the concentration-response curve (dAUC) from the three experimental groups. All the data were expressed as mean  $\pm$  standard error of the mean and analysed using one-way ANOVA and Bonferroni correction tests. P < 0.05 was considered significant.

**Results and discussion:** Esmolol treatment normalized endothelium-dependent relaxation with high concentrations of ACh (10<sup>-8</sup> to 10<sup>-4</sup> mol/l) in coronary arteries of SHR. AUC was significantly larger in WKY rats than in SHR (AUC<sub>WKY</sub> = 265.9 $\pm$ 27 vs AUC<sub>SHR</sub> = 97.5 $\pm$ 21, P = 0.0002). SHR-Es had significantly lower AUC than SHRs (AUC<sub>SHR-E</sub> = 201.2 $\pm$ 33 vs AUC<sub>SHR</sub> = 97.5 $\pm$ 21, P = 0.027), showing no differences with the WKY rats. Plasma nitrite and SOSA levels were significantly higher in SHR-E than in SHR, and there were no differences in TAC levels between both groups.

**Conclusion:** According to our results, esmolol normalizes coronary artery function in SHR by increasing nitric oxide bioavailability and superoxide dismutase activity.

**Acknowledgements:** This work was supported by FIS 10/02831, and FIS 13/01261, Spain.

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#### 4AP1-8

##### Influence of gender and sex hormones on blood coagulation and fibrinolysis after normothermic cardiopulmonary bypass in rats

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**Background and Goal of Study:** Female gender is known as independent risk factor within the cardiac surgery setting whenever cardiopulmonary bypass (CPB) is involved. The following study investigated the effects of gender and hormonal status on blood coagulation and fibrinolysis after 120 min of normothermic CPB in intact and neutered female and male rats.

**Materials and methods:** With institutional review board approval animals were assigned to 2 groups, CPB and sham operation. Each group was further divided into 4 subgroups: female-intact, female-neutered, male-intact, male-neutered. At 12 weeks of age, all animals were neutered or sham-neutered (female-intact, male-intact) according to group assignment. After 28 days to allow for elimination of sex hormones, all rats were anesthetized, surgically cannulated and the CPB group exposed to 120 min of normothermic CPB. Blood samples were taken at 60 min after cessation of CPB for analysis of D-dimers and Prothrombin fragment 1 + 2, using an enzyme-linked immunosorbent assay. Platelets were counted. Data were analysed with Kruskal-Wallis and post hoc Mann Whitney U (p < 0,05).

**Results and discussion:** As expected, CPB affected blood coagulation and fibrinolysis, resulting in a lower platelet count in all 4 CPB groups (fig. A). D-dimers were upregulated independent of gender and hormonal status (fig. B). Only prothrombin fragment 1 + 2 showed a gender and hormone specific increase in the female-intact group (fig. C), suggesting a more prominent disposition for thromboembolism in this group (1).

**Conclusions:** CPB reduces platelets independent of gender and hormonal status in our particular setting. Higher prothrombin fragment 1 + 2 values in the female intact group could indicate a higher incidence of thromboembolic events. Whether this correlates with histomorphologic findings in relevant organs such as heart and brain will be the aim in subsequent investigations.

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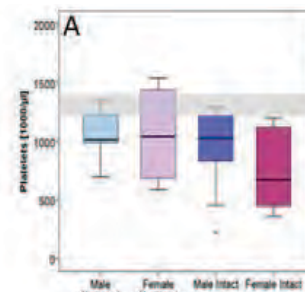
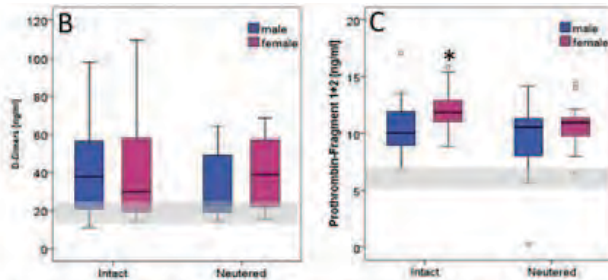


Figure A shows platelets at 4 days after normothermic cardiopulmonary bypass in the 4 subgroups female-intact, female-neutered, male-intact, male-neutered. The grey bar depicts the 95 % confidence interval of sham operated groups (p < 0,05 vs. CPB).





**Figure B** shows D-dimers at 1 hour after normothermic cardiopulmonary bypass in the 4 subgroups female-intact, female-neutered, male-intact, male-neutered. The grey bar depicts the 95 % confidence interval of sham operated groups ( $p < 0,05$  vs. CPB).

**Figure C** shows prothrombin fragment 1+2 at 1 hour after normothermic cardiopulmonary bypass in the 4 subgroups female-intact, female-neutered, male-intact, male-neutered. The grey bar depicts the 95 % confidence interval of sham operated groups ( $p < 0,05$  vs. male intact and female neutered).

[Coagulation\_2]

#### 4AP1-9

##### Anesthetic preconditioning with sevoflurane in diabetic patients with increased cardiac risk, undergoing elective abdominal surgery

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**Objective:** Evaluation of cardioprotective effects of sevoflurane in diabetic patients with cardiac risk undergoing elective abdominal surgery, by analyzing cardiac biomarkers: troponin I (TnI), creatine kinase (CK), myocardial creatine kinase (CKMB), the precursor of brain natriuretic peptide (proBNP).

**Material and Method:** Prospective clinical study enrolling 63 patients, undergoing abdominal surgery with sevoflurane balanced general anesthesia. The study analyzes the perioperative ischemic cardiac events in patients with and without diabetes.

The patients were divided in two groups: group A - 30 patients with type 2 diabetes and group B - 33 patients without diabetes. The perioperatively collected data included: hemodynamic parameters, electrocardiographic changes, variation of cardiac and inflammatory markers and glycemia.

**Results:** The patients had a mean age of  $71 \pm 6,45$  years, predominantly male gender. Acute perioperative cardiac events were present in 12 patients in group A and in 9 patients in group B. TnI was significantly increased in group A compared to group B at 12 h, 24 h and 48 h postoperative ( $0,65 \pm 0,76$  ng/ml vs.  $0,24 \pm 0,32$  ng/ml,  $p = 0,0273$ ). ProBNP and CKMB recorded increased postoperative levels in both groups ( $p < 0,005$ ). Interleukin 6 was increased in group A at 12 h postoperative ( $628,25 \pm 504,26$  pg/ml vs.  $198,19 \pm 229,2$  pg/ml,  $p < 0,05$ ). Postoperative glycemia values were maintained below 180 mg/dl in both groups using insulin therapy (48 h).

During the first 12 months we recorded 10 cardiac deaths - 7 in group A and 3 in group B.

**Conclusions:** The incidence of postoperative ischemic cardiac events was higher in patients with diabetes. TnI was the only cardiac biomarker that showed significantly increased values in the group of patients with diabetes. The number of cardiac deaths in the first 6 months was higher in diabetic patients and survival at 1 year did not differ between the two groups.

#### 4AP1-10

##### Involvement of increased protein arginine methyltransferases 2 and decreased dimethylarginine dimethylaminohydrolases in impaired NOS activity in pulmonary hypertension in rats

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**Background and Goal of Study:** Impairment of endogenous release of nitric oxide (NO), which causes vascular vasodilation and inhibition of smooth muscle cell proliferation, is well known to play a critical role in developing pulmonary hypertension (PH). We reported that increase in endogenous nitric oxide synthase (NOS) inhibitor, asymmetric dimethylarginine (ADMA) in the lung was involved in the decrease in NOS activity and NO production in PH. Elevated ADMA also has been reported to be associated with a variety of cardiovascular, renal and metabolic diseases.

The goal of study is to explore the mechanism to increase ADMA and impair NOS activity in the lung in PH.

**Materials and methods:** Male rats were divided into following two groups: Group M was given 60mg/kg of MCT 4 weeks before experiments. Group C was control. Rats were anesthetized for hemodynamic studies. The lungs and pulmonary arteries were isolated for following experiments. We explored protein arginine methyltransferases (PRMTs) which catalyze methylation of arginine residues in proteins resulting in increase in ADMA and dimethylarginine dimethylaminohydrolases (DDAHs), catabolizing enzyme of ADMA in PH induced with monocrotaline (MCT) in rats.

We also examined arginase which shares L-arginine as a common substrate with NOS. Protein expression of PRMT1, PRMT2, DDAH1, DDAH2, arginase, and eNOS were measured by western blot analysis. ADMA content in the lung was measured by ELISA. Activities of NOS, PRMTs, and DDAHs in the lung were also measured. Isometric tension was measured using ring samples of pulmonary arteries to evaluate endothelium-dependent relaxation (EDR). EDR was induced with acetylcholine precontracted with phenylephrine.

**Results and discussion:** Four weeks after MCT administration, increased right ventricular pressure was accompanied with impaired endothelium-dependent relaxation, NOS activity and increased ADMA in pulmonary artery in group M. PRMT2 but not PRMT1 expression was significantly increased in group M, whereas DDAH1 and DDAH2 were decreased. In addition, arginase was increased in group M.

**Conclusion:** Increase in PRMT2 and decrease in DDAH1 and DDAH2 were associated with increased ADMA contents and consequent impairment of NOS activity. These results may be potentially useful to lower ADMA level for therapeutic benefit.

#### 4AP1-11

##### Does continuous or intermittent use of desflurane has effects on brain natriuretic peptide (BNP) levels in patients undergoing coronary artery bypass graft surgery

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**Background and Goal of Study:** During coronary artery bypass grafting (CABG) operations with cardiopulmonary bypass (CPB), the use of desflurane continuously or intermittently may have effects on serum brain natriuretic peptide (BNP) levels that have been shown to influence myocardial dysfunction.(1)

**Materials and methods:** One hundred patients with left ventricular ejection fraction greater than 50% were investigated in a prospective, randomized and double-blinded study. In Group 1 of 51 patients, continuous and in Group 2 of 49 patients intermittent desflurane inhalational anesthesia was used. Minimum alveolar concentration of desflurane at 1 to 4 % was used in addition to intravenous fentanyl, midazolam and rocuronium during maintenance. Mean arterial pressure was maintained above 50 mmHg throughout the procedure. The pre-operative and postoperative BNP levels at 24, 48 and 72 hours after surgery were collected. Transthoracic echocardiography was performed preoperatively and postoperatively on day 1. Adverse events were recorded.

**Results and discussion:** Basal characteristics were similar between the two groups ( $p > 0,05$ ). Repeated measurements of serum BNP levels showed no significant differences between groups. Mortality was one patient (2 %)

in each group ( $p > 0.05$ ). Prolonged mechanical ventilation ( $> 48$  hours) was observed 6 patients (11.8 %) in Group 1 and 5 patients (10.2%) in Group 2. Reintubation was recorded in 3 patients (6 %) in each group ( $p > 0.05$ ). Preoperative serum BNP median level was 44 pg/mL (min-max 18.0-298.0). A correlation between preoperative BNP level and prolonged mechanical ventilation and prolonged intensive care unit (ICU) stay ( $> 3$  days) ( $p = 0.0001$  and  $p = 0.0001$ , respectively) was observed. Serum BNP levels of 151 pg/ml was determined to predict prolonged mechanical ventilation with a sensitivity of 91 % and a specificity of 88% (area under curve (AUC) of 0.925). The preoperative and postoperative transthoracic echocardiography values were similar between groups ( $p > 0.05$ ).

**Conclusion(s):** During CABG operations with continuous or intermittent desflurane anesthesia, serum BNP values did not differ between these groups however, preoperative serum BNP threshold value above 151 pg/mg is associated with prolonged mechanical ventilation and prolonged ICU stay.

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## 4AP2-2

### Is it possible the fast track in ascending aorta surgery?

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**Background and Goal of Study:** The fast-track protocols in off-pump coronary surgery are widely used in many centers. However, little has been published about the surgery of the ascending aorta. We intend to evaluate the application of fast track in complex surgery of the ascending aorta.

**Materials and methods:** In a two-year period, 54 patients underwent surgical replacement of the aortic root, ascending aorta or arch. Without any exclusion criteria, in all patients ultra fast-track protocols were applied. The main goal was extubation in the operating room and early mobilization in intensive care unit. All data were collected prospectively.

**Results and discussion:** A total of 54 patients underwent surgery of the ascending aorta. In 20 patients (37%), circulatory arrest was performed with moderate hypothermia (28°C) and antegrade cerebral perfusion. 11 of them (24.4%) had previous cardiac surgery. The additive EuroSCORE was 7.5 (range 5-12). 51 patients were extubated in the operating room (94.4%), all of them in the first 15 minutes after skin closure. Three of these patients (5.88%) were re-intubated within the first 24 hours because of excessive bleeding reoperation. The causes of premature reintubation were hemodynamic instability and the high rate of bleeding at the intensive care unit. The hospital mortality was 1.8% ( $n=1$ ). No respiratory complications were observed. The mean ICU stay was 26.5 hours (range 16-72 hours). The use of circulatory arrest was not a significant predictor of prolonged mechanical ventilation. To achieve good results with the use of intraoperative extubation in complex cardiac surgery, the key technical factors are prevent overdosing muscle relaxant at the end of surgery, maintain body temperature above 35 °C and no evidence of significant postoperative bleeding.

**Conclusion(s):** Immediate extubation in patients undergoing surgery of the ascending aorta is feasible and safe, even in patients treated with circulatory arrest. The need for reintubation is rare, and is associated with postoperative bleeding. The fast track facilitates early mobilization and decreases the length of stay in intensive care unit, even in complex cardiac surgery.

## 4AP2-3

### Predictive factors associated with the development of arrhythmia after reperfusion in liver transplantation

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**Background and Goal of Study:** It is well known that arrhythmia can induce hemodynamic instability during surgery leading to adverse effect on prognosis. Although various arrhythmias are detected frequently during liver transplantation (LT), there are few studies about arrhythmia newly developed after reperfusion. This study aimed to investigate the incidence of arrhythmia after reperfusion and identify predictive factors associated with its occurrence. Morbidity of ischemic heart disease (IHD) and mortality associated with arrhythmia were also evaluated.

**Material and method:** A total of 220 adult patients who underwent LT from July 2010 to December 2011 were retrospectively analyzed. The arrhythmia

was defined as what newly developed and lasted for at least 1 minute within 30 minutes after reperfusion. Preoperative variables of demographic data, medical history, model for end-stage liver disease (MELD), and echocardiographic findings, intraoperative variables of anhepatic laboratory data, ischemic time, graft versus recipient weight ratio (GRWR), postreperfusion syndrome (PRS), and amount of transfusion, and postoperative outcomes of IHD (troponin I  $> 1.5$ ) and mortality until 30 and 90 days after surgery were investigated. All variables and outcomes were analyzed by univariate statistics. Independent predictors of arrhythmia were determined by multivariate logistic regression analysis.

**Result and discussion:** Arrhythmia occurred in 26 recipients (11.8%). MELD scores ( $p=0.02$ ), ejection fraction ( $p=0.03$ ), GRWR ( $p=0.04$ ), PRS ( $p=0.002$ ), and the amount of cryoprecipitate ( $p=0.04$ ) were higher in patients with arrhythmia. But the incidence of postoperative IHD and mortality were not different. In a multivariable analysis, PRS was independent predictor for the development of arrhythmia (odds ratio = 4.859,  $p=0.02$ ).

PRS may decrease perfusion of heart, which induce ischemia/reperfusion injury. Ischemia subsequently causes accumulation of reactive oxygen species, anaerobic glycolysis, and intracellular acidification. These changes may affect electrophysiologic properties and contribute to arrhythmogenesis. In addition, abrupt influx of cold, hyperkalemic and acidic components into the systemic circulation at the time of reperfusion can trigger the development of arrhythmia.

**Conclusion:** Our results suggest that PRS increases risk for the development of arrhythmia after reperfusion in adult LT. However, the arrhythmia does not affect outcomes of IHD and mortality.

## 4AP2-4

### Creatine kinase and myoglobin elevation after prolonged orthognathic surgery under controlled hypotension in healthy young patients

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**Background:** Orthognathic surgery is performed in young, healthy patients to treat aesthetic and functional maxillofacial abnormalities or severe obstructive sleep apnea syndrome. To improve operative field exposure and limit blood loss, controlled hypotension is required<sup>1</sup>. Consequent peripheral hypoperfusion may induce muscle damage related to ischemia-reperfusion, as diagnosed by the elevation of plasma levels of creatine kinase (CK) and myoglobin (Mb)<sup>2</sup>. CK values above 1000U/l are suggestive of rhabdomyolysis, which can be complicated by acute renal failure<sup>3</sup>. This observational study aims to identify whether perioperative muscle injury occurs during orthognathic surgery and its correlation with the duration of surgery.

**Material and methods:** We studied 17 patients in whom the following data were assessed: demographics, CK and Mb serum levels, renal function (urea/creatinine), electrolytes, pH, lactate, perioperative fluids, and surgery duration. Controlled hypotension was defined as systolic arterial pressure  $< 100$ mmHg, or mean arterial pressure 50-60mmHg. Data are presented as mean  $\pm$  standard deviation. Pearson's test verified the correlation of CK and Mb with surgery duration.

**Results:** Patients included 9 male and 8 female patients, aged  $29 \pm 7$ ; 13 ASA I and 4 ASA II score. Mean BMI was  $22 \pm 4$  kg/m<sup>2</sup>. Serum CK levels peaked at  $1623 \pm 1950$  U/l between 10-15 hours after surgery and Mb levels peaked at  $349 \pm 241$  ng/ml 5 hours postoperatively. Both markers decreased after the second postoperative day. Surgery lasted  $6.7 \pm 1$  hours. Pearson's correlation between CK ( $p=0.2286$ ), Mb ( $p=0.1809$ ) and surgery duration, although positive, was not significant. Perioperative fluid infusion was  $2250 \pm 1284$  ml for crystalloids and  $551 \pm 205$  ml for colloids. Diuresis during surgery was  $809 \pm 802$  ml, representing a urinary output of 2 ml/kg/h  $\pm 1.4$ . None of the patients presented altered renal function, metabolic acidosis or clinical signs of rhabdomyolysis.

**Conclusion:** Increase of CK and Mb levels during long orthognathic surgery indicates muscle injury. Although suggestive of rhabdomyolysis, no clinical complications were observed. Causes could be the combination of surgical trauma, prolonged immobilization, and muscle hypoperfusion due to controlled hypotension. In this study, CK and Mb levels were not correlated to surgery duration.

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#### 4AP2-5

##### The effects of the menstrual cycle on the hemodynamic response to laryngoscopy and tracheal intubation

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**Background and Goal of Study:** Previous studies have shown that hormonal changes during the normal menstrual cycle affect anesthesia and analgesia (1). Our goal was to find more suitable conditions in menstrual periods for intubation of patient (2).

**Materials and methods:** A prospective cohort study was designed and conducted. Levels of sex hormones and hemodynamic conditions during surgery in patients candidate for elective surgery under general anesthesia with tracheal intubation were recorded and statistical analysis was performed.

**Results and discussion:** In 77 patients, 38 women were in the luteal phase (49.4%) and 39 women were in the follicular phase (50.6%). The women's age was  $31.5 \pm 7$  years. Systolic blood pressure after intubation in the follicular phase ( $138.4 \pm 20$  mm Hg) was significantly higher vs. the luteal phase ( $127.7 \pm 18$  mm Hg) ( $p < 0.01$ ), as well as the women's heart rate after intubation in the luteal phase ( $90.7 \pm 12$  beats per minute), was significantly higher than in the follicular phase ( $85.3 \pm 11$  beats per minute) ( $P = 0.05$ ). Heart rate was higher in the luteal group than the follicular group so that the women's heart rate after intubation in the luteal phase ( $90.7 \pm 12$  bpm) was significantly greater than the follicular phase ( $85.3 \pm 11$  bpm) ( $P = 0.05$ ).

**Conclusion(s):** Reviewing and comparing the results show that elective surgeries (2) are better to be done in the luteal phase because of stable hemodynamic conditions.

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#### 4AP2-6

##### Neoadjuvant chemoradiotherapy but not chemotherapy impairs cardiac function in patients with cancer in the esophagus or gastroesophageal junction - a prospective randomized study

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**Background and Objectives:** Neoadjuvant therapy for cancer of the esophagus or gastroesophageal (GE)-junction is well established. The pros and cons of chemoradiotherapy and chemotherapy alone are currently debated. Radiotherapy could impair cardiac function which might enhance postoperative morbidity. Our aim was to study acute changes of left ventricular function after chemoradiotherapy or chemotherapy.

**Methods:** Subjects (n=41) with esophageal and junction cancer participating in a multicenter trial comparing neoadjuvant chemoradiotherapy and chemotherapy concerning histological response and scheduled for surgery at Karolinska University Hospital were enrolled. Subjects were randomized to receive Cisplatin and 5-fluorouracil with 40 Gy of concurrent radiotherapy (chemoradiotherapy, n=17), or without (chemotherapy, n=24) before surgery. Left ventricular function was evaluated using echocardiography and plasma NT-proBNP before and after neoadjuvants.

**Results:** Intention to treat analysis by linear mixed models showed an isolated decrease of global strain in the chemotherapy group ( $p=0.04$ ). No change of ejection fraction or global strain was found in the chemoradiotherapy group but Mitral annular plane systolic excursion (MAPSE) of the ventricular septum ( $p=0.003$ ), E-velocities ( $p=0.002$ ) and E/A ratio ( $p=0.005$ ) decreased significantly after chemoradiotherapy. We also found a trend towards a significant difference in change between the groups for MAPSE sept and E ( $p=0.09$  and  $p=0.09$ ). NT-proBNP increased from chemoradiotherapy ( $p=0.009$ ) but not from chemotherapy ( $p=0.53$ ) and there was a trend toward a difference in change between the groups ( $p=0.07$ ). Repeated echocardiography mea-

surements was acquired from 20 subjects, (chemotherapy n=10, chemoradiotherapy n=10). Analysis of repeated measurements only confirmed decrease of MAPSE sept, E, E/A and increase of NT-proBNP in the chemoradiotherapy group ( $p=0.05$ ,  $p=0.01$ ,  $p=0.02$  and  $p=0.05$  respectively). No significant changes were found in the chemotherapy group.

**Conclusions:** Neoadjuvant chemoradiotherapy before surgery for cancer of the esophagus or GE-junction have acute negative effects on both systolic and diastolic left ventricular function, whereas chemotherapy does not.

#### 4AP2-7

##### Relationship between NT-proBNP and extravascular lung water during complex valve surgery

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**Background and Goal of Study:** Valve surgery can be complicated by heart failure and pulmonary edema. Our goal was to evaluate the relationship between N-terminal pro-B-type natriuretic peptide (NT-proBNP), which is released by cardiac myocytes in response to ventricular dysfunction, and accumulation of lung fluid during the perioperative period of complex valve surgery.

**Materials and methods:** Eighty adult patients with acquired valve diseases requiring complex surgical correction (replacement or repair  $\geq 2$  valves) were enrolled into an observational one-center prospective study. The patients received hemodynamic monitoring using pulmonary artery catheter (LifeScope, Nihon Kohden, Japan) and transpulmonary thermodilution (PiCCO<sub>2</sub>, Pulsion Medical Systems, Germany) with measurement of extravascular lung water index (EVLWI). All hemodynamic variables were measured after induction of anaesthesia, at the end of surgery, and during 24 hrs postoperatively. NT-proBNP plasma concentrations were assessed before intervention and at 24 hrs after surgery. The statistical analysis was performed using t-test or Mann-Whitney U-test and Pearson's or Spearman's correlation coefficients depending on data distribution. The data are presented as mean  $\pm$  SD or as median (25<sup>th</sup>-75<sup>th</sup> percentiles).

**Results and discussion:** The plasma concentration of NT-proBNP rose from 692 (175 - 2355) pg/ml preoperatively to 1931 (1195 - 3529) pg/ml at 24 hrs after the intervention ( $p=0.002$ ). Extravascular lung water index (EVLWI) was increased as compared to normal values before valve surgery ( $12 \pm 4$  ml/kg) and reduced to  $10 \pm 3$  ml/kg at 24 hrs postoperatively ( $p=0.001$ ). By contrast to pulmonary arterial pressures, EVLWI correlated with NT-proBNP before surgery ( $r=0.396$ ;  $p=0.011$ ). Thus, the patients were divided into the high EVLWI group ( $\geq 10$  ml/kg) and the low EVLWI group ( $< 10$  ml/kg). The high EVLWI group demonstrated significantly increased NT-proBNP levels: 1443 (499 - 2587) vs. 215 (88 - 480) pg/ml ( $p=0.013$ ). NT-proBNP plasma concentration of 328 pg/ml was identified as the optimal cut-off value to detect EVLWI  $> 10$  ml/kg, with sensitivity of 79% and specificity of 70% ( $AUC=0.77$ ;  $p=0.013$ ).

**Conclusion(s):** Increased plasma concentration of NT-proBNP before complex valve surgery correlates with lung fluid accumulation. NT-proBNP value exceeding 328 pg/ml preoperatively can predict EVLWI  $> 10$  ml/kg.

#### 4AP2-8

##### Characterization of myocardial damage in major elective orthopedic surgery

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**Background and Goal of Study:** Myocardial injury has been described in vascular surgery to identify two different troponin elevation profiles: early moderate elevations of troponin I (cTnI) and late major increases suggesting a different pathophysiology (1). We studied myocardial damage in major elective orthopedic surgery of the hip and knee.

**Materials and methods:** After approval of the local ethics board, we conducted a prospective observational study of all patients undergoing total hip (THA) or knee (TKA) arthroplasty in a teaching hospital, over a period of four years. Postoperative cTnI measurements on day 1, day 3 and day 5 after surgery were analyzed in terms of absolute value of the cTnI peak and postoperative day occurrence of the peak. Myocardial damage was defined by an increase of cTnI  $> 99^{\text{th}}$  percentile (cTnI  $> 0.05$  ng mL<sup>-1</sup> for our laboratory; Access AcuTni, Beckman Coulter, Roissy, France). Data are presented in median [interquartile range] or number of occurrences (%).



**Results:** 1636 patients were included. 98 patients (6%) had postoperative myocardial damage as defined. Median value of cTnI peak was 0.11 [0.08-0.22] ng.mL<sup>-1</sup>. It was a single cTnI increase for 70 patients (71% of myocardial damages) and a prolonged elevation (over two successive measurements) for 30 patients (29%). When a single high cTnI value was noted, there was a rise in the first quartile (29 patients) or second quartile (17 patients), occurring at day 3 (51%), day 5 (28%) and day 1 (21%). Prolonged cTnI increase was noted in 28 patients of which 26 (93%) were in the third and fourth quartiles.

	1 <sup>st</sup> quartile (<0.09ng.mL <sup>-1</sup> )	2 <sup>nd</sup> quartile [0.09-0.11]ng.mL <sup>-1</sup>	3 <sup>rd</sup> quartile [0.12-0.22]ng.mL <sup>-1</sup>	4 <sup>th</sup> quartile (>0.22ng.mL <sup>-1</sup> )
Single peak	46		24	
Day 1	9 (9%)	1 (1%)	2 (2%)	0
Day 3	11 (11%)	12 (12%)	7 (7%)	5 (5%)
Day 5	9 (9%)	4 (4%)	7 (7%)	3 (3%)
Prolonged increase	2		26	
Day 1 to Day 5	0	0	4 (4%)	5 (5%)
Day 1 to Day 3	1 (1%)	0	0	0
Day 3 to Day 5	1 (1%)	0	5 (5%)	12 (12%)

[Table 1. Myocardial damage characterization]

**Conclusion:** This study suggests the existence of two populations of patients with postoperative myocardial damage. Patients with isolated low cTnI elevation and patients with sustained cTnI elevation, whose cTnI values are highest. Additional data integrating in-hospital and long term outcomes must be analyzed. Risk factors that may motivate cTnI measuring remain to be studied.

#### References:

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## 4AP2-9

### Risk stratification by high-sensitivity troponin T and NT-proBNP prior to major noncardiac surgery

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**Background and Goal of Study:** Recent reports (1,2) described the prognostic impact of elevated high-sensitivity troponin (hsTNT) concentrations before noncardiac surgery. We aimed to evaluate the incremental value of hsTnT for risk stratification prior to noncardiac surgery when combined to the Revised Cardiac Risk Index (RCRI). Further, we assessed the reclassification improvement when combining elevated hsTnT and NT-proBNP to the RCRI.

**Materials and methods:** This prospective, international multicentre cohort enrolled 979 patients undergoing major noncardiac surgery. HsTnT and NT-proBNP concentrations were sampled within 7 days prior to the procedure. The primary endpoint was a composite of in-hospital mortality, acute myocardial infarction, cardiac arrest, cardio-pulmonary resuscitation, and acute decompensated heart failure. We calculated the likelihood ratio (LR) of elevated biomarkers for the composite endpoint. Further, we assessed the net reclassification improvement when combining hsTnT to the RCRI and both biomarkers to the RCRI.

**Results and discussion:** Twenty-five patients (2.6%) died and 36 (3.7%) of the patients experienced the combined endpoint. Preoperatively, 128 patients (13%) had hsTnT concentration exceeding 14 pg/mL and NTproBNp concentrations > 440 ng/L, 211 patients (23%) had an elevation in either hsTnT or NTproBNP. The positive and negative LR for preoperative hsTnT and for NT-proBNP were 2.73 and 0.29 ( $p < 0.001$ ), and 2.10 and 0.51 ( $p < 0.001$ ), respectively. The interval LR for no elevation, either hsTnT or NT-proBNP elevation and for both elevated hsTnT and NTproBNP were 0.26, 1.86, and 2.96 ( $p < 0.001$ ), respectively. The combination of information from hsTnT to the RCRI resulted in a NRI of 0.32 ( $p < 0.05$ ). The combination of data on hsTnT and NTproBNP to the RCRI was associated with a NRI of 0.39 ( $p < 0.05$ ).

**Conclusion(s):** The prognostic information by preoperative hsTnT and NT-proBNP measurements significantly improved risk stratification prior to major noncardiac surgery compared to the RCRI.

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- Weber M, Luchner A, Seeberger M et al. Incremental value of high-sensitive troponin T in addition to the revised cardiac index for perioperative risk stratification in non-cardiac surgery. Eur Heart J 2013; 34: 853-862

## 4AP2-10

### Risk stratification by high-sensitivity troponin T prior to major noncardiac surgery-impact on noninvasive testing results

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**Background and Goal of Study:** The prognostic impact of elevated high-sensitivity troponin T (hsTnT) before noncardiac surgery was recently described (1). We evaluated the impact on use and results of noninvasive testing by a preoperative risk stratification approach including preoperative hsTnT concentration informations in addition to risk factors.

**Materials and methods:** We conducted a model-based analysis. The model compared a preoperative risk stratification approach in patients with limited functional capacity before noncardiac surgery based on the number of risk factors as currently recommended by the American Heart Association guidelines with a preoperative risk stratification combining preoperative hsTnT information with risk factors. Reclassification data were generated in 979 patients undergoing major noncardiac surgery enrolled in a multicenter cohort study (1). Resource utilization and preoperative testing yield in terms of coronary revascularization were obtained from literature (2,3).

**Results and discussion:** Assuming a volume of 1000 patients, a risk stratification strategy including hsTnT information resulted in a reduction of non-invasive testing (-5.55) and of false negative noninvasive testing (-1.0). It also allowed for an increased yield of noninvasive testing in terms of PCI (+0.56) and CABG (+0.97). However, it resulted in an increase of coronary angiograms without subsequent revascularization (+0.51) and in 3.06 patients being misclassified as low risk, i.e. suffering a major cardiovascular event after surgery in spite of a low risk classification.

**Conclusion(s):** hsTnT information to guide preoperative risk stratification in patients with limited functional capability resulted in a reduction of noninvasive testing and improved the revascularization yield of preoperative noninvasive cardiac testing. These preliminary results need to be completed by extensive sensitivity and scenario analyses and by cost estimates.

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## 4AP3-1

### Cardiac function improvement after simultaneous pancreas-kidney transplant

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**Background:** Candidates for simultaneous kidney-pancreas (SPK) transplant frequently present with associated diabetic cardiomyopathy (DCM).<sup>1</sup> SPK transplant shows positive effects on survival and cardiac function.<sup>2</sup>

**Case report:** 54 year-old man. ESRD due to Type 1 DM, hemodialysis since 2005. Initially refused for SPK/kidney transplant due to high cardiac risk. Myocardial Perfusion Scintigram (MPS) in 2007 showed dilated LV and inferior MI. EF at rest was 0.23, 0.20 on stress. Reassessed two years later, sent to our centre for a second opinion. MPS in August 2009 showed a dilated LV with mild dysfunction (LVEF 0.40), mild global hypokinesia with infero-lateral MI. The coronary angiogram showed normal coronary arteries and a heavily calcified aortic valve (small gradient across). Assessed by surgeon and anaesthetist in November 2009, according to his exercise tolerance and functional capacity it was thought he was suitable for SPK transplant. The transplant was performed successfully in January 2010. Currently, his DM and ESRD are cured, his quality of life is very good and the last echocardiography showed a LVEF=68% with a moderate calcified aortic stenosis.

**Discussion:** DCM can partially respond to conventional heart failure treatment and better fluid management on dialysis, which explain the improvement observed in EF pre-transplantation. Dilated cardiomyopathy with absence of myocardial ischaemia is common in diabetics and its pathophysiology is



poorly understood. This case strongly implies it is due to impaired myocardial metabolic function and is reversible, but decreased EF is a contraindication for SPK transplant. There may be several reasons for a reduced EF in the candidates. How to discern which patients will benefit from the transplant? Functional capacity and an individual assessment based on a MDT, will make the difference.

**References:**

1. Bell DSH. Diabetic Cardiomyopathy. *Diabetes Care* 2003; 26: 2949-50.
2. La Rocca E, Fiorina P, Di Carlo V, et al. Cardiovascular outcomes after kidney-pancreas and kidney alone transplantation. *Kidney Int* 2001; 60: 1964-71.

**Learning Points:** Several reasons can reduce EF in SPK transplant candidates, high-lighting the importance of a careful individual assessment based on a MDT comprising named anaesthetists, cardiologists and surgeons. Assessing thoroughly candidate's functional capacity is crucial as the increased risk would be off-set by restoring normal cardiac function as an adjunct to the more direct benefits.

**4AP3-2**

**Can goal-directed hemodynamic management improve renal outcome after major non-cardiac surgery?**

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**Background and Goal of Study:** Aim of this study was to assess whether intra- and postoperative goal-directed hemodynamic therapy can improve renal function after major non-cardiac surgery.

**Materials and methods:** With institutional ethics board approval 180 patients were randomly assigned to one of two groups: In group GDT (goal-directed) fluid and catecholamines were administered according to a published algorithm (1) using the PiCCO monitor, in group C (control) according to the clinic's standard operating procedure protocol. In group C the anesthetist was blinded to the PiCCO measurements. To rule out negative effects on kidney function only half of the patients received hydroxyethyl starch (HES) 130/0.4 (up to 50 ml per kg bodyweight) for hydration. The other patients received Ringer acetate (RA) only. Primary end point was absolute change in serum-creatinine and creatinine-clearance within 7 days. Secondary end points were acute kidney injury, pulmonary or cardiovascular complications, delirium, surgical re-intervention and sepsis. Changes in creatinine and creatinine-clearance were analysed using t-test for means. Odds ratios of postoperative complications were calculated by generalized linear modelling of a binary logistic regression model.

**Results and discussion:** The two groups were comparable with regard to baseline creatinine (80±27 vs. 80±27 µmol/l) and pre-existing medical conditions. The use of goal-directed hemodynamic management did not influence the absolute change in serum-creatinine or creatinine-clearance, while HES showed a detrimental effect on these renal outcomes. (see Table) The incidence of postoperative complications were comparable. In the subgroup of patients receiving HES the incidence of sepsis was higher (13% vs 3%; odds ratio (95%-CI): 4.4 (1.2 to 16.7); p=0.026).

**Conclusions:** The goal-directed hemodynamic management used herein showed neither an effect on renal function nor on the incidence of complications after major non-cardiac surgery. With this study we firstly demonstrated a detrimental effect of HES on renal function for patients undergoing surgery. An effect, which has been just shown in critically ill patients to date.

**Reference:**

1. Goepfert MS; Intensive Care Med 2007; 33: 96-103.

	Control (N = 88) mean (SD)		GDT (N=92) mean (SD)		Mean-difference (95% CI)	Significance	Mean-difference (95% CI)	Significance
	RA	HES	RA	HES				
Increase in serum creatinine (µmol/l)	14 (31)	22 (46)	7.4 (23)	26 (55)	1.6 (-10 to 13)	n.s.	-13 (-1.2 to -25)	p=0.03
Decrease in creatinine-clearance (ml/min/1.73m2)	8 (17)	16 (29)	6 (21)	14 (26)	2 (-5 - 9)	n.s.	-8 (-15 to -1)	p=0.02

[Change in creatinine and creatinine-clearance]

**4AP3-3**

**Does intravenous atropine affect stroke volume variation in man?**

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**Background and Goal of Study:** Stroke volume variation (SVV) is affected by many factors. We hypothesised that SVV values can be changed by intravenous atropine and if so, SVV values might be overestimated or misinterpreted. This prospective study aimed to investigate changes in heart rate (HR) and SVV caused by administration of intravenous atropine.

**Materials and methods:** The 10 patients who completed the study had an average age of 57 years, body weight (BW) of 59 kg, and height of 157 cm. The male:female ratio was 6:4. After induction of anaesthesia, the patient's lungs were mechanically ventilated. Controlled ventilation was set at 10 breaths/min with a tidal volume of 8 mL/kg and inspiratory:expiratory ratio of 1:2. Later, the effect-site concentration of propofol was adjusted to achieve a target BIS between 40 and 60 and stable circulatory variables. If HR was < 65 bpm, the patient was chosen as a subject. Baseline values were recorded, and then atropine was administered at a dose of 0.01 mg × BW (maximum dose: 0.5 mg). The values were then recorded once each min for the next 5 min after administration.

**Results and discussion:** Administration of intravenous atropine significantly increased HR at the 1- to 5-min time points, mean arterial pressure (MAP) at the 1- to 4-min time points, and cardiac output (CO) at the 1- to 3-min time points compared with baseline values, but it did not significantly change SVV, stroke volume (SV) index, pressure of end-tidal CO<sub>2</sub>, and systemic vascular resistance (Table). SVV did not change with administration of intravenous atropine because SV index does not change after atropine injection. SVV is defined as SVV (%) = 100 × (SV<sub>max</sub> - SV<sub>min</sub>) / [(SV<sub>max</sub> + SV<sub>min</sub>) / 2], where SV = stroke volume (1, 2). It is very important to note that SVV is not an indicator of volume status or a marker of cardiac preload but is an indicator of the position on the Frank-Starling curve (3), and we think that intravenous atropine does not shift the Frank-Starling curve upward, which indicates an increase in myocardial contractility, although both MAP and CO increased after intravenous atropine, and this is another possible mechanism of the main finding of this study.

	Baseline	1 min	2 min	3 min	4 min	5 min
SAP, mmHg	104.2 (12.0)	106.5 (12.7)	109.7 (14.3)***	110.2 (14.9)	109.2 (14.5)	109.4 (16.1)
MAP, mmHg	73.4 (8.4)	76.4 (9.9)*	78.6 (10.8)***	78.3 (10.0)**	77.8 (10.7)*	76.7 (10.8)
DAP, mmHg	56.1 (4.5)	58.6 (5.8)*	60.7 (6.4)***	60.4 (7.5)*	60.5 (6.5)**	59.7 (5.8)*
HR, beats/min	61.5 (3.6)	66.7 (6.6)*	69.5 (7.8)**	68.8 (7.6)*	68.7 (7.4)*	68.8 (7.4)*
P <sub>ET</sub> CO <sub>2</sub> , mmHg	36.3 (4.7)	36.4 (4.8)*	36.1 (5.0)	36.2 (4.9)	36.1 (5.2)	36.2 (4.8)
SVV, %	12.8 (4.0)	13.1 (6.3)	13.3 (5.1)	14.3 (6.2)	14.0 (6.2)	14.0 (4.9)
CO, L/min	3.6 (0.4)	4.2 (0.7)	4.3 (0.7)***	4.0 (0.5)*	3.9 (0.5)	3.9 (0.5)
SVL, ml/beat/m <sup>2</sup>	38.0 (4.2)	39.9 (4.7)	39.4 (4.7)	37.0 (4.2)	36.3 (4.6)	36.1 (4.3)
SVR, dynes/sec/cm <sup>2</sup>	1578.5 (260.6)	1441.0 (260.0)	1464.6 (303.4)	1556.4 (290.5)	1581.0 (314.5)	1560.0 (239.0)

[Table: Results]

Values are mean (SD). SAP, systolic arterial pressure; MAP, mean arterial pressure; DAP, diastolic arterial pressure; HR, heart rate; P<sub>ET</sub>CO<sub>2</sub>, pressure of end-tidal CO<sub>2</sub>; SVV, stroke volume variation; CO, cardiac output; SVI, stroke volume index; SVR, systemic vascular resistance. \*P<0.05 vs baseline; \*\*P<0.01 vs baseline; \*\*\*P<0.005 vs baseline.

**Conclusion:** The present study showed that administration of intravenous atropine does not change SVV.

**References:**

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2. Wajima Z, et al. *J Clin Monit Comput* 2010;24:385-9
3. Michard F, et al. *Crit Care* 2007;11:131

#### 4AP3-5

##### Association of preoperative uric acid and acute kidney injury following cardiovascular surgery

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**Background and Goal of Study:** Recent studies suggested that elevated serum uric acid(UA) levels may be associated with the risk of acute kidney injury (AKI) in several settings. Recent studies suggest that even a slight increase in serum UA levels without intrarenal crystal deposition could be associated with an increased risk of renal dysfunction. However, the effect of uric acid on the risk of AKI after cardiovascular surgery remains uncertain. We hypothesized that the risk of postoperative AKI increases in patients with preoperative hyperuricemia.

**Materials and methods:** We retrospectively assessed preoperative and perioperative data in 1019 consecutive adult patients who underwent cardiovascular surgery. The prevalence of preoperative hyperuricemia was defined as a UA concentration  $\geq 6.5$  mg/dL (the average threshold of the gender-based definition of 6.0 mg/dL in women and 7.0 mg/dL in men). AKI was defined and staged as Acute Kidney Injury Network criteria, based on changes in serum creatinine concentration within 48 hours after surgery. Univariate and multivariable logistic regression analyses were conducted to evaluate the association between preoperative hyperuricemia and postoperative AKI..

**Results and discussion:** The mean preoperative uric acid concentration was  $5.8 \pm 1.8$  mg/dL (range, 1.3-14.0 mg/dL), with 319 of the 1019 patients (31.3%) having serum uric acid concentrations  $\geq 6.5$  mg/dL. Preoperative elevated uric acid ( $\geq 6.5$  mg/dL) was independently associated with AKI after cardiovascular surgery (odds ratio [OR] 1.46; 95% confidence interval [CI] 1.04-2.06,  $P = 0.030$ ). Results were the same in male patients, patients with hypertension, preoperative renal insufficiency, low ejection fraction, or who underwent cardiovascular surgery with cardiopulmonary bypass. Preoperative elevated uric acid ( $\geq 6.5$  mg/dL) was also associated with higher incidence of prolonged ICU and hospital stay.

**Conclusion(s):** Preoperative elevated serum UA is an independent risk factor for AKI in patients undergoing cardiovascular surgery. Furthermore, preoperative hyperuricemia was related to poor outcomes after cardiovascular surgery. This finding suggests that preoperative measurements of serum uric acid concentration may help stratify risks for AKI in these patients.

#### 4AP3-6

##### Urinary liver type fatty acid-binding protein detects perioperative acute kidney injury after open abdominal aortic surgery

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**Background and Goal of Study:** Measurement of serum creatinine (SCr) is a gold standard in the diagnosis of kidney injury. However, SCr does not reflect the degree of renal injury and is unreliable when the glomerular filtration rate (GFR) is rapidly changing. Urinary liver type fatty acid-binding protein (L-FABP) is a novel biomarker for acute kidney injury (AKI) and reflects the presence of renal tubular injury.

We evaluated the perioperative changes in urinary L-FABP during and after open abdominal aortic replacement (OR).

**Materials and methods:** The study was approved by the Institutional Review Board. Informed consent was obtained from each patient. We measured urinary L-FABP, estimated GFR (eGFR) and SCr during the perioperative period in 23 patients who underwent OR from September 2012 to November 2013. Urinary L-FABP was measured before surgery, after induction of anesthesia, at 1 hour (h) and 2h after aortic cross clamping (AXC), at the end of surgery, and 6 h after surgery, and on post-operative day (POD) 1, POD 2 and POD3. SCr and eGFR were measured before surgery, immediately after surgery, and on POD 1, POD 2 and POD3. AKI was defined by AKIN criteria. Data were analyzed with Mann-Whitney test, analysis of variance, and chi-square test.  $P < 0.05$  was considered significant.

**Results and discussion:** In this prospective study, 7 patients (33%) developed postoperative AKI (stage 1: 5 patients, stage 2: 2patients). Patient demographics, preoperative renal function, fluid volume, blood loss, duration of procedure and duration of AXC were not significantly different between the AKI and Non-AKI groups. Urinary L-FABP increased to a maximal level at 2h after AXC in AKI group. On the other hand, eGFR decreased and SCr

increased to a maximal level on POD 2 in the AKI group. In the Non-AKI group, urinary L-FABP, eGFR and SCr did not change significantly.

Time	before	after induction	2h after AXC	6h after surgery	POD 1	POD 2	POD 3
AKI group (µg/gCr)	9 (2-16)	21 (4-89)	2653* (7-8410)	376 (34-176)	237 (27-669)	53 (7-155)	40 (6-94)
Non-AKI group (µg/gCr)	9 (1-45)	11 (1-78)	444 (3-4220)	175 (3-1040)	88 (5-469)	31 (3-151)	31 (3-194)

[Table 1 Change of urinary L-FABP]

Median and range are shown. \*:  $p < 0.05$  vs. Non-AKI group.

Time	before	after surgery	POD 1	POD 2	POD 3
AKI group (ml/min/1.73m <sup>2</sup> )	56.2 (35-69)	48.0* (37-65)	41.9* (31-57)	39.0* (29-46)	45.4* (30-64)
Non AKI group (ml/min/1.73m <sup>2</sup> )	65.7 (32-98)	64.8 (35-112)	66.4 (35-114)	63.2 (28-122)	68.1 (32-134)

[Table 2 Change of eGFR]

Median and range are shown. \*:  $p < 0.05$  vs. Non-AKI group.

**Conclusion(s):** We conclude that urinary L-FABP is a sensitive biomarker of AKI during abdominal aortic surgery.

#### 4AP3-7

##### Does chronic statin therapy in non-cardiac surgery improve postoperative outcomes?

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**Background and Goal of Study:** Statin therapy has been associated with better postoperative outcome in patients undergoing non cardiac surgery. Some recent studies suggest that statins are independently associated with decreased mortality. The aim of this study is to measure the prevalence of chronic statin therapy in moderate-high risk non-cardiac surgery and to assess the relationship between statin therapy with postoperative complications and mortality.

**Material and methods:** Prospective, observational, multicenter study of 23 hospitals in Catalonia in which clinical data was collected for all patients over 40 years old scheduled on moderate - high risk surgery (according to the ACC/AHA surgery risk ), in 6 random weeks during 2007-2009. The unadjusted and adjusted relationship between statin therapy and postoperative complications were evaluated using logistic regression analysis and by the propensity score-based matching of statin use.

**Results and discussion:** We included 3381 adult patients. The prevalence of statin therapy was 21.5%. Patients with statin therapy were older, had more co-morbidity, worse functional class and the surgical complexity was significantly higher.

Postoperative complications were 16.2% compared to 11.1% in non-statin patients and in-hospital mortality was also significantly higher in statin population. Table 1 shows statin related complications, mortality and length of stay before and after adjustment for most potential confounder factors.

	Entire sample			Propensity matched sample		
	No statins, 2653	Statins, 728	P-value	No statins, 220	Statins, 220	P-value
Postoperative complications	295(11.1)	118(16.2)	<0.0001	27 (12.3)	25 (11.4)	0.883
Cardiovascular complications	93(3.5)	53(7.3)	<0.0001	10 (4.5)	12 (5.5)	0.670
Respiratory complications	52 (2.0)	17(2.3)	0.0554	3 (1.4)	6 (2.7)	0.503
Acute kidney injury	23 (0.9)	6(0.8)	1.000	1 (0.5)	1 (0.5)	1.000
Postoperative infection	82(3.1)	24 (3.3)	0.810	6(2.7)	3 (1.4)	0.503
In-hospital mortality	40 (1.5)	23(3.2)	0.008	0(0)	7(3.2)	0.015
Length of stay (days, mean SD)	8.1 (8.9)	9.1(9.4)	0.012	7.7(6.1)	8.8 (10.2)	0.167

[Statin related complications and mortality]

**Conclusions:** Preoperative statin use is highly prevalent in moderate-high-risk surgery and it's associated with higher co-morbidity and the need for more aggressive surgery. Chronic statin therapy is not an independent protective factor of postoperative complications or mortality.

#### 4AP3-8

##### Passive leg raising induced-changes in blood pressure predict fluid responsiveness following cardiac surgery

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**Background and Goal of Study:** Passive leg raising (PLR) induced-changes in cardiac output has been shown to predict fluid responsiveness with a good accuracy. The clinical utility of simultaneous changes in blood pressure ( $\Delta$ BP) is more controversial. We tested the hypothesis that  $\Delta$ BP could be discriminant to predict fluid responsiveness following cardiac surgery.

**Materials and methods:** After approval by the local Ethics Committee, 86 consecutive adult patients scheduled for fluid loading (500 mL hydroxylethyl starch 6% 130/0.4 over 15 min) were prospectively included during the postoperative period and investigated at baseline, during PLR, and after fluid challenge. After calibration of pulse contour analysis cardiac index ( $CI_{pc}$ ) with bolus transpulmonary thermodilution, PLR was started and the highest values of systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), pulse pressure (PP) and  $CI_{pc}$  during the first minute following the manoeuvre were performed.

Differences between baseline and highest values of  $\Delta$ BP ( $\Delta$ SAP,  $\Delta$ DAP,  $\Delta$ MAP,  $\Delta$ PP) and  $\Delta$  $CI_{pc}$  were used to calculate the discrimination of all variables in predicting fluid responsiveness. Responders to fluid loading were defined by an increase of more than 15% of recalibrated  $CI_{pc}$ . The diagnosis error tolerance for  $\Delta$ BP and  $\Delta$  $CI_{pc}$  was fixed at 10% on the ROC curves and inconclusive responses were calculated.

**Results and discussion:** Sixty-four (74%) patients were responders and twenty-two (26%) patients were non-responders.  $ROC_{AUC}$  were 0.78 (95%CI: 0.68-0.89), 0.66 (95%CI: 0.55-0.78), 0.75 (95%CI: 0.64-0.86), 0.77 (95%CI: 0.66-0.88) and 0.65 (95%CI: 0.51-0.79) for  $\Delta$ SAP,  $\Delta$ DAP,  $\Delta$ MAP,  $\Delta$ PP and  $\Delta$  $CI_{pc}$ , respectively. Differences were significant between  $\Delta$ SAP and  $\Delta$ DAP (Difference=0.118 [95%CI:0.017-0.219],  $P=0.022$ ) and between  $\Delta$ MAP and  $\Delta$ DAP (Difference=0.089 [95%CI:0.003-0.175],  $P=0.042$ ), while a trend was observed between  $\Delta$ SAP and  $\Delta$  $CI_{pc}$  (Difference=0.134 [95%CI:-0.010-0.278],  $P=0.068$ ). The proportion of inconclusive responses were 33%, 54%, 44%, 45% and 73% for  $\Delta$ SAP,  $\Delta$ DAP,  $\Delta$ MAP,  $\Delta$ PP and  $\Delta$  $CI_{pc}$ , respectively.

**Conclusion(s):** Changes in SAP during PLR is discriminant in predicting fluid responsiveness following cardiac surgery and could provide a convenient alternative to calibrated pulse contour analysis.

#### 4AP3-9

##### “Goal directed fluid management” based on pleth variability index or pulse pressure variations during abdominal surgery

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**Background and Goal of Study:** Goal-directed fluid therapy has been shown to reduce postoperative morbidity in major surgery<sup>1</sup>. Pulse pressure variation induced by mechanical ventilation (DeltaPP) is one of the best methods to predict fluid responsiveness<sup>2</sup>. Pleth variability index (PVI) has been proposed as a noninvasive alternative to predict fluid responsiveness during mechanical ventilation.

We compare both monitoring to guide intraoperative fluid management in patients undergoing elective abdominal surgery.

**Materials and methods:** After IEC approval and written informed consent, 72 ASA I-II patients were randomized according to the monitoring used to guide intraoperative fluid therapy (DeltaPP group: N=36, PVI group:N=36). Anaesthetic technique and mechanical ventilation (end-tidal volume: 8ml/kg) were standardized in all patients. Muscle relaxation was provided with rocuronium bromide and was continuously monitored during the procedure. After induction of general anaesthesia, patients were equipped with a radial artery catheter or a Massimo radical 7 pulse oximeter. Basal balanced crystalloid infusion rate was set at 2 ml/kg/h and boluses of 250 ml of 3% modified fluid gelatin were administered if the DeltaPP was >13% or the PVI >15% in the respective groups for more than five minutes.

Statistical analysis included Mann-Whitney-U test and Chi-square. A  $p < 0,05$  was considered significant.

**Results and discussion:** Twenty-nine patients in the DeltaPP group and 31 in the PVI group underwent laparoscopic surgery. Laparoscopy was converted to laparotomy in 4 patients of the PVI group. Twenty-five patients in the DeltaPP group and 28 in the PVI group received at least 1 bolus of colloid.

	DeltaPP group	PVI group	p
Age (years)	47 [42-57]	43 [34-67]	0.142
Weight (kg)	61 [55-73]	70 [61-81]	0.050
Duration of surgery (min)	125 [89-154]	109 [75-160]	0.682
Total amount of cristalloide (ml)	450 [350-550]	388 [273-678]	0.420
Total amount of colloide (ml)	500 [250-750]	500 [250-750]	0.383
Hospital length of stay (days)	4 [2-6]	3[2-4]	0.105
incidence of complication	2/36 (5%)	3/36 (8%)	0.621

[Results]

**Conclusion(s):** In the conditions of our study, the type of monitoring does not influence significantly the volume of fluid administered in the intra-operative period. Further studies are requested to assess the usefulness of these monitoring in laparoscopic surgery.

#### References:

1. Hamilton M and al. Anesth Analg 2011; 112:1392-402
2. Marik PE and al. Crit Care Med 2009; 37:2642-7

#### 4AP3-10

##### Impact of intraoperative oliguria on acute kidney injury after major non-cardiac surgery

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**Background and Goal of Study:** The development of acute kidney injury (AKI) is associated with prolonged hospital stay and increased morbidity and mortality. AKI occurs in approximately 1 to 7.5% of patients who have major non-cardiac surgery. Multiple studies have shown no correlation between urine volume and postoperative renal dysfunction. However, these studies were conducted decades ago, with various definitions for AKI used. In these days, anesthesiology including anesthetic and monitoring techniques has been dramatically developed. Furthermore, during the last decade, several consensus criteria for definition and classification of AKI have been published. We therefore investigated the relationship between perioperative AKI and intraoperative urine volume as well as duration of oliguria.

**Materials and methods:** In this single-center, retrospective observational study, we screened 26,984 patients undergoing elective or emergency surgery between September 2008 and October 2011 at Jikei University Hospital. This study was approved by the institutional review board at Jikei University School of Medicine. Exclusion criteria were less than 18-year-old patients, less than 2 nights of hospital stay, under only local anesthesia, urologic and cardiac surgery, absence of serum creatinine measurement before and after surgery, absence of intraoperative urine volume data, coexisting end-stage kidney disease, and absence of intraoperative drug use. The criteria of surgical AKI were based on KDIGO guideline. Univariate analysis was performed using the one-way analysis of variance and Chi-square test. The logistic regression model with backward elimination stepwise approach was used for multivariate analysis.

**Results and discussion:** After exclusion, 6,631 patients remained for this study. The incidence of surgical AKI was 4.3% in these patients. In univariate analysis, duration of oliguria was positively ( $p < 0.001$ ), and average urine volume was negatively ( $p=0.048$ ) correlated with the development and the severity of surgical AKI. In multivariate analysis, duration of oliguria (per minute; OR=1.004, 95%CI; 1.003-1.006,  $p < 0.001$ ), and average urine volume (per ml/kg/h; OR=0.863, 95%CI; 0.780-0.955,  $p=0.004$ ) were independent risk factors for the development of surgical AKI.

**Conclusion:** Contrary to old knowledge, we found that intraoperative duration of oliguria and average urine volume were significant risk factors for the development of AKI after major non-cardiac surgery.



#### 4AP3-11

##### Hemodynamic effects of lung recruitment in morbidly obese patients

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**Background and Goal of Study:** Anesthesia-induced atelectasis is more pronounced in morbidly obese patients. The alveolar recruitment strategy (ARS) eliminates such atelectasis, reinstating normal lung function without collapse. The high intrathoracic pressures reached during the maneuver could potentially compromise hemodynamics, especially in morbidly obese patients, because of their predisposition for cardiovascular diseases. The objective of this prospective study was to analyze the hemodynamic consequences of ARS and PEEP in anesthetized morbidly obese patients.

**Materials and methods:** Twenty morbidly obese patients (BMI > 40 kg/m<sup>2</sup>) scheduled for LAGB were included into study. The hemodynamic monitoring was conducted with HemoSonic 100 - transesophageal Doppler. The recruitment manoeuvre was: 50-60 cm H<sub>2</sub>O of plateau pressure for 10 breaths for 1 min with PEEP of 15 cm H<sub>2</sub>O. The measured hemodynamic parameters were: CO, SV, HR and MAP. The measurements were recorded in 3 time points: T1 - before ARS, T2 - during ARS, T3 - after ARS.

**Results and discussion:** Demographic data: 18 female/2 male; age 39.6 ± 9.8 yrs; weight 135.7 ± 21.7 kg; height 169.7 ± 6.3 cm; BMI 47.4 ± 7.2 kg/m. The measured parameters were: CO 6.53 ± 1.4 vs 5.1\* ± 1.1 vs 6.5 ± 1.2 l/min; SV 85.8 ± 17.7 vs 77.9\* ± 22.6 vs 86.5 ± 21.4; HR 78.4 ± 12.8 vs 73.8 ± 14.8 vs 77.1 ± 11.7 bpm; MAP 90.2 ± 8.4 vs 78.6\* ± 8.9 vs 90.1 ± 9.5 mmHg in T1, T2 and T3 respectively (\* p < 0.05).

The number of studies on hemodynamic effect of ARS in morbidly obese is scarce. Bohm et al. in their study concluded that: Recruitment and high PEEP did not cause significant disturbances in any hemodynamic variable measured by systemic and pulmonary artery catheters [1]. In our study we observed significant drop in CO, SV and MAP during ARS. After ARS all hemodynamic parameters returned to initial values. Other researchers basing only on MAP and HR measurements assumed that ARS do not compromise hemodynamics in morbidly obese [2,3,4,5].

**Conclusion:** We assume that ARS influences hemodynamics in morbidly obese and this manoeuvre should be performed carefully in patients with cardiovascular disturbances.

##### References:

1. Bohm et al. Anesth Analg 2009;109:160-3;
2. Erlandsson et al. Acta Anaesthesiol Scand 2006;50:833-9;
3. Almarakbi et al. Br J Anaesth 2009;102 (6): 862-8

#### 4AP4-1

##### Superior vena cava collapsibility measurement by transesophageal echocardiography to predict hypotension related to lung recruitment maneuvers in mechanically ventilated surgical patients

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**Background and Goal of Study:** Lower tidal volumes, higher levels of PEEP and recruitment manoeuvres (RM) could reduce the incidence of postoperative pulmonary complications. RM induce significant changes in ventricular loading conditions and may cause severe hypotensive episodes.

In this study we evaluated whether respiratory variations in superior vena cava vein diameter (dSCV) measured by transesophageal echocardiography (TEE) predict hypotensive episodes during RM in mechanically ventilated surgical patients.

**Materials and methods:** The study was performed in patients undergoing elective surgery in which according to standar clinical practice RM was indicated. After anesthesia induction dSVC was measured in a midesophageal ascendent aortic short axis view usin mode M. The SVC collapsibility index (SVC-CI) was calculated as follows  $(SVC-CI) = (dSVC_{max} - dSVC_{min}) \times 100 / dSVC_{max}$

Before the start of surgery, RM was performed using pressure control ventilation with a driving pressure of 15 cm H<sub>2</sub>O by increasing peep in increments of 10 cm H<sub>2</sub>O from 0 to 20 cm H<sub>2</sub>O. Hemodynamics and respiratory parameters were recorded before and during RM.

Variables are presented as mean ± sd. The relationship between SVC-CI and

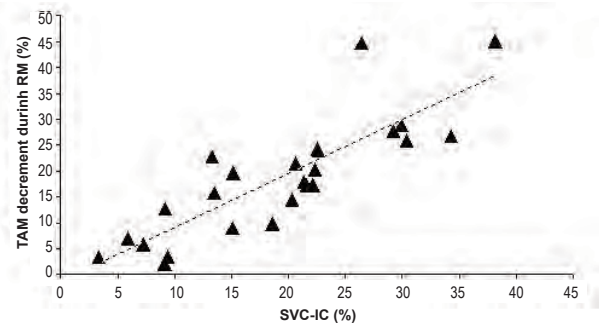
the decrease in mean arterial pressure during RM was analyzed by simple linear regression and Pearson correlation.

**Results and discussion:** Twenty five patients (aged 86 to 35 years old; 21 men, 4 women) undergoing different surgery were enrolled in the study (10 coronary artery bypass graft surgery; 6 laparoscopic radical resection for rectal cancer surgery; 5 abdominal aortic aneurysm surgery; 4 laparoscopic bariatric surgery).

Table 1 shows the measured variables. Figure 1 shows the correlation between the collapsibility of the superior vena cava and the decrease in mean arterial pressure during RM ( $r=0,84$ ;  $SVC-CI(\%) = (1,0409 \times TAM \text{ decrement during RM}(\%)) - 1,3416$ );  $p > 0,05$ )

dSVCmax (cm)	dSVCmin (cm)	SVC-CI (%)	TAM pre-RM (mmHg)	TAM during RM (mmHg)	TAM decrement during RM (%)
1,76±0,4	1,4±0,4	19,3±9,1%	81±12,4	65,8±14,8	18,7±11,2%

[Table 1]



[Figure 1]

**Conclusion(s):** Measuring the collapsibility of the superior vena cava by TEE is useful for predicting hypotensive episodes associated with lung recruitment maneuvers in mechanically ventilated surgical patients.

#### 4AP4-2

##### Does pneumoperitoneum really affect stroke volume variation in man?

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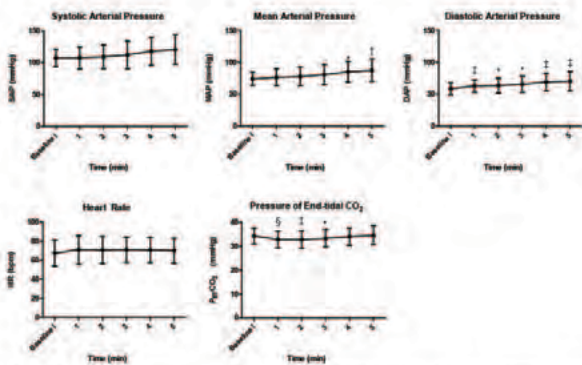
**Background and Goal of Study:** Although elevated intra-abdominal pressure (IAP) and/or pneumoperitoneum have been shown to increase SVV in animals (1, 2), Hoiseith et al. (3) recently showed that SVV did not change as pneumoperitoneum was established. However, we considered the results of Hoiseith et al. (3) questionable, and we therefore attempted to study whether SVV changes both before and after pneumoperitoneum in man.

**Materials and methods:** 19 patients were examined. After induction of general anaesthesia, the patient's lungs were mechanically ventilated. Immediately before pneumoperitoneum, baseline registrations of variables were obtained (baseline I), and these variables were measured every min for 5 min after pneumoperitoneum started. Furthermore, immediately before pneumoperitoneum was released, baseline II registration of variables were then obtained, and these variables were obtained every min for 5 min after release of pneumoperitoneum.

**Results and discussion:** After pneumoperitoneum started, there were significant increases in mean arterial pressure (MAP) at the 4- to 5-min time points, diastolic arterial pressure (DAP) at the 1- to 5-min time points, SVV at the 2- to 5-min time points, and systemic vascular resistance (SVR) at the 1- to 5-min time points compared with baseline I values. There were significant decreases in stroke volume index (SVI) at the 1-min time point and in pressure of end-tidal CO<sub>2</sub> (P<sub>ET</sub>CO<sub>2</sub>) at the 1- to 3-min time points compared with baseline I. Other values were unchanged. After release of pneumoperitoneum, there were significant increases in SVI at the 4- to 5-min time points and in P<sub>ET</sub>CO<sub>2</sub> at the 1-min time point compared with baseline II. There were significant decreases in DAP at the 1- to 3-min time points, in HR at the 2-min time point, in SVV at the 1- to 5-min time points, and in SVR at the 1- to 5-min time points compared with baseline II. SAP, MAP, and CO were unchanged. Pneumoperi-

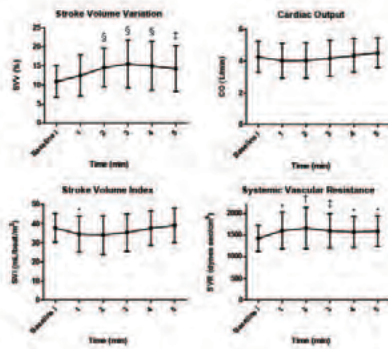
toneum increased SVV, whereas upon release of pneumoperitoneum, SVV decreased significantly. In all animal studies (1, 2), SVV increased after elevation of IAP and/or pneumoperitoneum, similar to our results, but our results were not similar to those reported by Høiseith et al. (3).

Fig. 1



Sequential changes in systolic arterial pressure, mean arterial pressure, diastolic arterial pressure, heart rate, and pressure of end-tidal CO<sub>2</sub> at baseline I and after pneumoperitoneum. Data are expressed as mean ± standard deviation. \*P<0.05 vs baseline I; †P<0.01 vs baseline I; ‡P<0.005 vs baseline I; §P<0.001 vs baseline I.

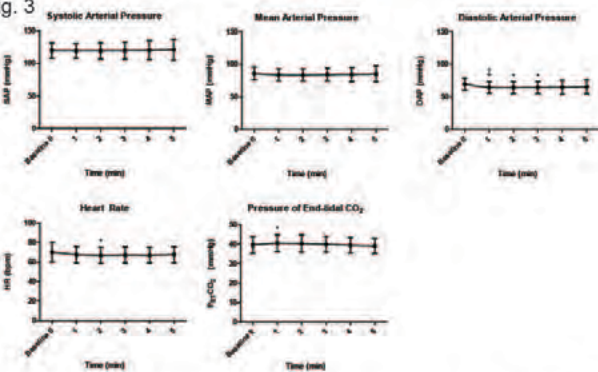
Fig. 2



Sequential changes in stroke volume variation, cardiac output, stroke volume index, and systemic vascular resistance at baseline I and after pneumoperitoneum. Data are expressed as mean ± standard deviation. \*P<0.05 vs baseline I; †P<0.01 vs baseline I; ‡P<0.005 vs baseline I; §P<0.001 vs baseline I.

[Figs. 1, 2]

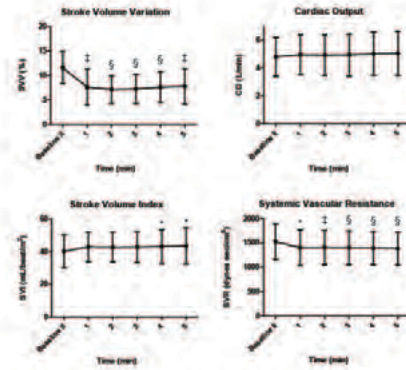
Fig. 3



Sequential changes in systolic arterial pressure, mean arterial pressure, diastolic arterial pressure, heart rate, and pressure of end-tidal CO<sub>2</sub> at baseline II and after stopping pneumoperitoneum. Data are expressed as mean ± standard deviation. \*P<0.05 vs baseline II; †P<0.005 vs baseline II.

[Figure 3]

Fig. 4



Sequential changes in stroke volume variation, cardiac output, stroke volume index, and systemic vascular resistance at baseline II and after stopping pneumoperitoneum. Data are expressed as mean ± standard deviation. \*P<0.05 vs baseline II; †P<0.005 vs baseline II; §P<0.001 vs baseline II.

[Figure 4]

**Conclusions:** We believe that the mechanism for the increase in SVV after pneumoperitoneum in man is a decrease in preload caused by the pneumoperitoneum.

**References:**

1. Crit Care Med 2009;37:781-3
2. Crit Care 2011;15:R33
3. Acta Anaesthesiol Scand 2012;56:777-86

**4AP4-3**

**Impact of thiopental anesthesia induction on myocardial performance in low-risk patients as measured by intraoperative transthoracic Doppler tissue imaging**

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**Background and Goal of Study:** Hemodynamic variations are common during anesthesia induction. Intraoperative tissue Doppler monitoring is helpful to provide immediate insight into hemodynamic changes as well as myocardial performance. The aim of our study was to examine the impact of anesthesia induction using bolus thiopentol on myocardial performance using tissue Doppler imaging.

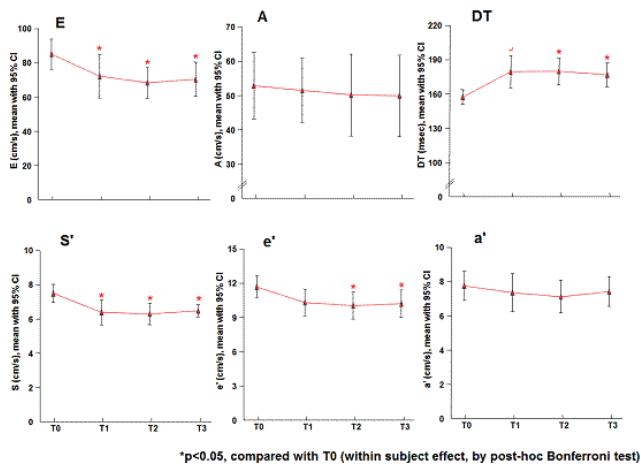
**Materials and methods:** In 11 patients with normal sinus rhythm and normal left ventricular function undergoing non-cardiac surgery (female, 38-46 years), bolus thiopental sodium (5.0 mg/kg) was administered intravenously for anesthesia induction. Tissue Doppler-derived indices of septal mitral annular velocity during systole (S'), early diastole (e'), and atrial contraction (a') were determined by intraoperative transthoracic echocardiography before and 1, 3, and 5 minutes after bolus thiopental injection (T0, T1, T2, and T3, respectively).

**Results and discussion:** Doppler analysis was successful in 9 out of 11 consecutive patients. The mean peak velocity of early filling mitral inflow at T1, T2, and T3 were decreased from T0 (72.5, 68.6, and 70.7 vs. 85.3 cm/s, p< 0.05), without changes of the mean peak velocity of late filling mitral inflow (p=1.00). The mean septal S' velocity at T1, T2, and T3 were significantly less in magnitude than at T0 (6.41, 6.31, and 6.49 vs. 7.51 cm/s, p< 0.05). The mean e' velocity at T2 and T3 also decreased compared with T0 (10.05, and 10.04 vs. 11.73 cm/s, p< 0.05). However, the mean a' velocity did not significantly change (7.38, 7.14, and 7.16 vs. 7.77 cm/s, p=0.36).

**Conclusion(s):** A clinical dosage of thiopental anesthesia induction revealed a decline of systolic annular downward motion but no impact on atrial contraction. Further studies are needed to understand the clinical implication.

**References:**

- Yang, et al. Impact of Propofol Anesthesia Induction on Cardiac Function in Low-Risk Patients as Measured by Intraoperative Doppler Tissue Imaging. J Am Soc Echocardiogr 2013;26:727-35.



[Fig. 1 Changes in Doppler Profiles]

#### 4AP4-4

##### The McGRATH MAC is useful when inserting a probe for transesophageal echocardiography

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**Background and Goal of Study:** A transesophageal echocardiography (TEE) probe is often inserted blindly. However, it is desirable to insert it under visual guidance<sup>1</sup> because the blind technique sometimes causes difficulty and may contribute to serious, but rare, complications.<sup>2</sup> This prospective study compared the usefulness of TEE insertion between a brand-new McGRATH MAC (McGRATH) video laryngoscope and a Macintosh laryngoscope (Macintosh).

**Materials and methods:** This study was approved by the hospital ethics review committee. The subjects were 65 patients undergoing cardiovascular surgery in the hospital, who were randomly assigned into 2 groups according to the laryngoscope used for the TEE insertion; the McGRATH group (MG group: n=33) and the Macintosh group (MC group: n=33). Before starting the TEE insertion, the subjects of both groups underwent tracheal intubation using a Macintosh laryngoscope. The procedures of tracheal intubation and TEE insertion were performed by 5 anesthesiologists with 2 to 5 years of experience. When the insertion took 240 seconds or more, another device was attempted. The endpoints included each patient's demographics, Mallampati class (MP), interincisor distance (IID), thyromental distance (TMD), sternomental distance (SMD), upper lip bite test (ULBT), Cormack grade at direct laryngoscopy (CM), time for TEE insertion, and resistance during insertion (5 grade from 1 to 5). All statistical analyses were performed with SPSS using an unpaired t-test and Mann-Whitney test with a significance level of  $p < 0.05$ .

**Results and discussion:** There were no differences in the patient's demographics, MP, IID, TMD, SMD, ULBT or CM between the two groups. There was no significant difference in the time for TEE insertion between the groups. However, as the insertion took 240 seconds in one subject of the MC group, the device was changed to the McGRATH laryngoscope, and the insertion was successful. Resistance during insertion was significantly lower in MG group than in the MC group (median: MG group 1 vs. MC group 2).

**Conclusion(s):** The time for TEE insertion was similar for both the McGRATH MAC and Macintosh laryngoscopes, but resistance during insertion was lower using the McGRATH MAC compared with the Macintosh laryngoscope.

##### References:

1. Anesthesiology 2009; 110:38-40
2. Echocardiography 2013; 30:977-83

#### 4AP4-5

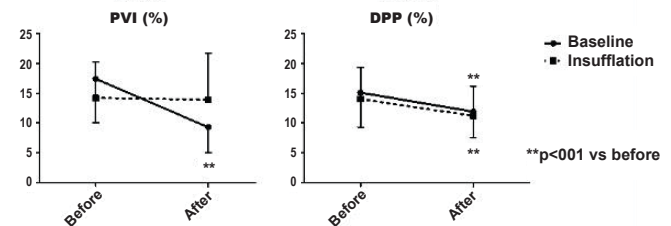
##### Effect of the pneumoperitoneum on dynamic variables Delta PP and PVI during Trendelenburg position

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**Background and Goal of Study:** Arterial pulse pressure variation induced by mechanical ventilation (Delta PP) is considered one of the best parameter to predict fluid responsiveness in patients under general anaesthesia<sup>1</sup>. Pleth Variability Index (PVI) has been proposed as a less invasive alternative. However, the pneumoperitoneum was recently seen as a limitation to their interpretation<sup>2</sup>. The aim of this observational study was to compare changes in DeltaPP and PVI related to autotransfusion associated with Trendelenburg position before and after abdominal insufflation in patients undergoing elective laparoscopic surgery.

**Materials and methods:** After IEC approval and written informed consent, 52 ASA I-II patients were studied. All patients were equipped with a radial artery catheter and a PVI probe (Masimo Radical 7 pulse oximeter). After obtaining a stable signal with both DeltaPP and PVI, baseline values were recorded, before and after head-down tilts of 10°, with or without abdominal insufflation (10-12 mmHg). All these measurements were made before any fluid challenge under standardized anaesthesia, while patients were paralyzed and mechanically ventilated with 8 ml/kg tidal volume. Statistical analysis included one way analysis of variance followed by pairwise comparison using Bonferroni correction. A  $p < 0,05$  was considered significant.

**Results and discussion:** The studied population included 49 women and 3 men. During abdominal insufflation mean arterial pressure and peak airway pressure increased but the heart did not change. The head-down tilts position resulted in a significant decrease in both Delta PP and PVI before abdominal insufflation but only in DeltaPP after abdominal insufflation (figure 1).



[DeltaPP and PVI at baseline and after insufflation]

**Conclusion(s):** In the conditions of our study, pneumoperitoneum did not alter response of DeltaPP to autotransfusion associated with the Trendelenburg position, which was not the case for the PVI. This latter monitoring appears to be of limited use to predict fluid responsiveness in patients undergoing laparoscopic procedures.

##### References:

1. Michard F and al. Am J Respir Crit Care Med 2000;16:134-138
2. Hoiseith L and al. Acta Anaesthesiol Scand 2012;56:777-786

#### 4AP4-6

##### Continuous central venous oxygen saturation assisted intraoperative hemodynamic management during major abdominal surgery improves outcome

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**Background and Goal of the Study:** Goal directed therapy may result in better outcome in high risk surgical patients (1). Our aim was to investigate the effects of continuous central venous oxygen saturation (ScvO<sub>2</sub>) assisted intraoperative management on outcome.

**Materials and methods:** In a prospective randomized clinical study patients undergoing major abdominal surgery were randomized into a control group receiving conventional treatment, and into an ScvO<sub>2</sub> group. All patients received routine anaesthetic management, including central venous pressure, and invasive arterial blood pressure monitoring. In the ScvO<sub>2</sub>-group, ScvO<sub>2</sub> was continuously monitored by a CeVOX catheter (Pulsioflex, PULSION, Germany). Hemodynamic and blood gas parameters were recorded intraopera-



tively and on day 1 and 2. Postoperative complications (as primary outcome) were recorded, and patients were followed up for 28 days. Statistical analysis was performed with the statistical program for social sciences (SPSS-20®), data are presented as mean±standard deviation or median(minimum-maximum).

**Results and discussion:** There was no significant difference in the demographics among the CeVOX (n=38) and the control group (n=41). Both groups received similar amount of crystalloid (1126±470 vs. 1049±431 ml/hour; p=0.460) and norepinephrine [7.1(3.2-86.8) vs. 9.3(2.1-289.9) mcg/hour; p=0.740]. However in the CeVOX-group more colloid was administered [279.2(0-833) ml/hour vs. 107.1(0-470.5) ml/hour; p< 0.001] and more patients received blood transfusion (CeVOX-group: 63% vs. CONT-group: 37%; p=0.018). The number of complications (18 vs. 37, p=0.020) and the 28 day mortality (2.6 vs. 19.5% p=0.018) were lower in the CeVOX-group.

**Conclusion:** Our data provides further evidence that advanced hemodynamic monitoring guided/assisted intraoperative anaesthetic management is beneficial in high risk patients undergoing major surgery. To our knowledge this is the first study to test a continuous ScvO<sub>2</sub>-measurement based protocol to show reduced postoperative complications and improved outcome.

**References:**

1. Salzwedel et al, Crit Care 2013; 17:R191

**4AP4-7**

**Analysis of the influence of terms of last dose of antihypertensive drugs in preoperative period for intraoperative blood pressure**

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**Introduction:** The question of the application of RAAS antagonists (particularly angiotensin-converting enzyme (ACE) in the preoperative period is ambiguous and presented in the literature fundamentally opposing views.

**Objective:** to compare the systolic blood pressure (sBP) in patients with laparoscopic cholecystectomy under different terms of receiving preoperative ACE inhibitors.

**Materials and Methods:** A prospective study involving 43 patients, average age of 54 years, treated Regional Hospital with a diagnosis of "Cholelithiasis. Chronic calculous cholecystitis", who underwent laparoscopic cholecystectomy under general anesthesia based on sevoflurane and opioid analgesics. All patients had hypertension of II degree, requiring receiving ACE inhibitors for more than 6 months. Target level of sBP determined anamnestic as the most comfortable for the patient. Significant deviations of sBP considered deviations 20 % of the target.

Depending on the timing of the last dose of ACE inhibitors, patients were divided into two groups:

group 1 - less than 10 hours before surgery (22 patients),  
 group 2 - more than 10 hours prior to surgery (21 patients). sBP control study included four stages :

- 1) before induction,
- 2) immediately after the induction of anesthesia,
- 3) on the main stage of the operation, and
- 4) after extubation the patient.

**Results:** Both groups had preoperative hypertension (see table). In the first stages of the research group 2-4 sBP deviation did not exceed 20% of the target level, whereas in the second group there was a significant deviation of sBP throughout surgery with a maximum at the 2nd stage. However, statistically significant differences were not found.

Stages	sBP, mm Hg, M±SD		p	Deviation from target level, %		
	1 group	2 group		1 group	2 group	p
Target sPB	130 ± 16,8	120 ± 13,6	>0,05			
1	171 ± 22,4	172 ± 19,8	>0,05	31,5 ± 4,2	43,3 ± 4,6	>0,05
2	143 ± 15,3	177 ± 20,1	>0,05	10,2 ± 2,5	47,5 ± 5,0	>0,05
3	117 ± 9,1	163 ± 18,4	>0,05	10,1 ± 1,9	35,8 ± 4,8	>0,05
4	120 ± 11,1	152 ± 16,2	>0,05	7,7 ± 1,5	26,7 ± 3,1	>0,05

[sBP in the study groups]

**Conclusions:**

1. In patients with hypertension of II degree, regardless of the time of the last dose of ACE inhibitors, there was preoperative hypertension.

2. The last dose of ACE inhibitors more than 10 hours before the operation leads to a substantial increase sBP during anesthesia and surgery.
3. We need to continue research on this issue with a larger sample of patients.

**4AP4-8**

**Arterial tone a predictor of orthostatic intolerance in patients undergoing posterior lumbar spine fusion**

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Patients undergoing orthopedic surgery frequently experience symptoms of orthostatic intolerance (OI), representing an obstacle to early ambulation and contributing to an increased fall risk. Augmentation index (AI) measures late systolic reflection waves measurement of large arterial tone); a reduction in AI therefore represents vasodilatation. This study aims to assess perioperative changes in arterial tone and its relation to clinical signs of OI.

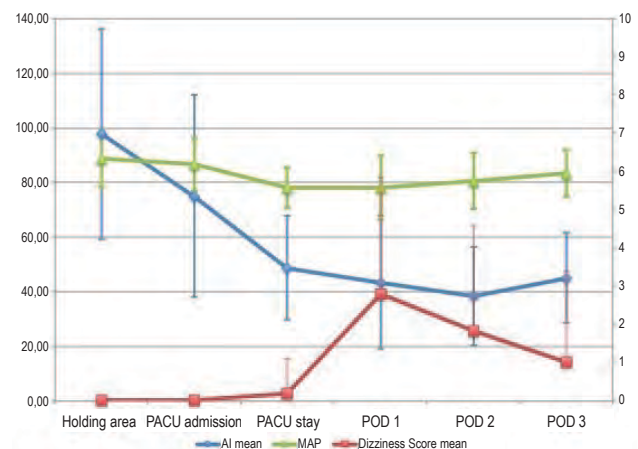
**Methods:** After IRB approval, patients undergoing posterior lumbar spine fusion (PLF) under general anesthesia were enrolled. Hemodynamic parameters and AI were measured using a novel sphygmomanometer at the following time points:

- (1) holding area prior to surgery (baseline),
- (2) upon admission to the post-anesthesia care unit (PACU),
- (3) 2-3 hours after PACU admission and
- (4) and every 24 hours thereafter (POD1, 2, 3).

Mean arterial blood pressure (MAP) and mean AI were analyzed. Symptoms of OI were measured using the Orthostatic Hypotension Symptom Assessment section of the Orthostatic Hypotension Questionnaire at each time point.

**Results:** Preliminary analysis of 26 patients showed a significant reduction in mean AI (SD) for the different time points from baseline (Fig1). The drop in AI became significant upon PACU admission (p=0.01) and lasted through POD3 (P< 0.001, nadir POD2). Changes in MAP did not reach significance upon PACU admission vs baseline (P=0.064), but for the following time points: PACU stay vs baseline P=0.002; POD1/POD2 vs baseline p< 0.001, Fig1). Concomitantly, a significant difference in mean values for dizziness compared to baseline was seen (peak POD1).

**Discussion:** This study shows a significant change in AI after PLF. The drop in AI reaches significance during PACU stay and lasts through POD3. Dizziness reaches its peak on POD1, indicating a possibly metabolite injury related cause rather than a direct relationship with the anesthetic technique. At this time, analysis of our data continues to investigate if AI can be used as a predictor for signs of OI. This is important as it could be used as a tool to potentially identify patients at risk for OI associated complications after surgery.



[Figure 1]

	Augmentation Index (SD)
<b>Holding Area</b>	97.75 (38.73)
<b>PACU admission</b>	75 (37.01)
<b>PACU stay</b>	48.65 (19.09)
<b>POD1</b>	43.38 (24.33)
<b>POD2</b>	38.32 (17.96)
<b>POD3</b>	45.06 (16.45)

[Table 1: Augmentation Index for various time point]

#### 4AP4-9

##### Modifications of stroke volume variation and stroke volume index during thoracic surgery with one-lung ventilation

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**Background:** Nowadays emphasis is placed in goal directed therapy to optimize patients hemodynamic status to improve their prognosis. Parameters based on the interaction between heart and lungs to evaluate volume response have been questioned in low tidal volume (TV) ventilation or during open chest surgery. The goal of our study was to analyse the changes that one lung ventilation (OLV) can produce over the parameters recommended for hemodynamic optimization: stroke volume variation (SVV) and systolic volume index (SVI). Furthermore, we wanted to assess the possible impact of airway pressures and lung compliance over SVV and SVI.

**Materials and methods:** This was a prospective study, approved by the Ethics Committee. 104 patients undergoing open chest surgery with OLV periods were included. Fluid therapy with crystalloids was set at 2 ml/kg/h. Hypotension episodes (MAP <60mmHg) were treated with vasoconstrictive drugs boluses. In two lung ventilation a TV of 8 ml/kg was set and OLV was managed with 6 ml/kg. Hypoxemia episodes were treated increasing FIO<sub>2</sub>, CPAP in surgery lung and recruitment manoeuvres. Invasive blood pressure was monitored with a Flow-Trac system (Vigileo). We analysed the hemodynamic and respiratory parameters in 3 times during the procedure: right after the lung collapse (T1), 30 min after initiating OLV(T2) and after two-lung ventilation was restored (T3). Statistical analysis was conducted by SPSS. Pair-wise ranking was used between T1 and T2, and between T2 and T3 in order to analyse the different hemodynamic and respiratory parameters. In addition, a bivariate correlation was used to determine the increase between the pressures at T1, the compliance decreasing and the SVV increasing.

**Results:** Between all the hemodynamic parameters evaluated, the only one influenced by lung collapse or after restoring two-lung ventilation was SVV. Also, we observed a significant weak correlation between the increase of SVV and the rise of Peak pressure ( $r=0.283$  with  $p=0.004$ ) and Plateau pressure ( $r=0.291$  with  $p=0.003$ ), as well as lung compliance decreases ( $r=-0.233$  with  $p=0.018$ ) during OLV.

**Conclusion(s):** Lung collapse induced significant modifications in SVV values, while the rest of hemodynamic parameters were not affected. SVI monitoring should be recommended for hemodynamic optimization during OLV. The intensity of changes in airway pressures and compliance at the beginning of OLV would overestimate SVV during that period.

#### 4AP4-10

##### The effect of left ventricular diastolic function evaluated by mitral inflow pattern (E/A ratio) during surgical repair of abdominal aortic aneurysm

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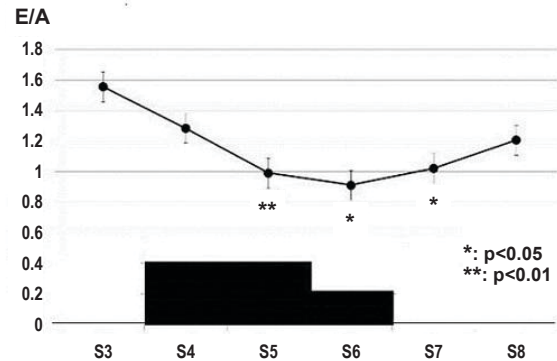
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**Background and Goal of Study:** The great change of cardiac load for aortic cross clamping (AoCC) and aortic unclamping (AoUC) during surgical repair of abdominal aortic aneurysms (AAA) is the most serious in anesthesia management. Most patients of AAA have a lot of complications, so we have to be carefully enough for perioperative period. Therefore, we hypothesized the evaluation of E/A ratio reduce incidence of congestive heart failure during repair of abdominal aortic aneurysms.

**Materials and methods:** After ethical committee approval and informed consent, 9 patients (ASA I ~ II) undergoing surgical repair of abdominal aortic aneurysms were included. They were maintained General anesthesia (Sevoflurane and remifentanyl) with Epidural anesthesia. The main endpoint were E/A ration, left ventricular ejection fraction (LVEF) and left ventricular end-diastolic volume (LVEDV) evaluated by transthoracic echocardiography (TEE). In addition, Cardiac Index(CI), Stroke Volume Index(SVI) and Systemic Vascular Resistance Index (SVRI) were measured by Swan-Ganz Catheter. The time of assessment were S1 (before operation), S2(5min after starting operation), S3(right before AoCC), S4(right after AoCC), S5(30min after AoCC), S6(after on side unclamping of common iliac artery), S7(right after AoUC), S8(30min after AoUC). Statistical comparisons were made by non-parametric methods with Wilcoxon matched-pairs signed-ranks test for paired data, and

Mann-Whitney's U-test for unpaired data. A P-value of <0.05 was considered statistically significant.

**Results and discussion:** In the CI and LVEF, there weren't significant difference between S1~S8. E/A ratio significantly reduced in the S5, S6 and S7 compared with S3.(Fig) Moreover, there were correlations of  $r^2=0.36$ , 0.28, 0.15 between E/A ratio and Heart Rate(HR), LVEDV, SVI( $P<0.01$ ). On the other hand, the correlation between E/A ratio and SVRI was  $r^2=0.001$ . We guessed the systolic performance didn't change in AoCC because CI and LVEF weren't changed significantly in this study. In the results of E/A ratio, the performance of cardiac dilatation might decrease after AoCC.



[Sato 2014ESA]

**Conclusion(s):** The evaluation of E/A ratio by TEE might be able to prevent congestive heart failure during surgical repair of abdominal aortic aneurysms.

#### 4AP5-1

##### Decrease in cerebral oxygen saturation with phenylephrine indicates a functional cerebral autoregulation mechanism

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**Background and Goal of Study:** Recent data have demonstrated that phenylephrine (PE) treatment may negatively affect cerebral oxygen saturation (S<sub>c</sub>O<sub>2</sub>). The mechanism of this phenomenon is still unknown. It has been proposed that when cerebral autoregulation is intact, the PE-induced increase in perfusion pressure might provoke autoregulatory vasoconstriction of the cerebral arterioles to prevent cerebral hyperperfusion.<sup>1</sup> This induces a smaller contribution of arterial versus venous blood, resulting in decreased S<sub>c</sub>O<sub>2</sub> when measured with near-infrared spectroscopy (NIRS). The objective of the present study was to investigate the hypothesis that S<sub>c</sub>O<sub>2</sub> decrease with administration of PE indicates a functional cerebral autoregulation mechanism.

**Materials and methods:** After ethical committee approval and informed consent, 31 patients undergoing elective cardiac surgery on cardiopulmonary bypass (CPB) were included. Patients with history of cerebrovascular disease or significant carotid artery stenosis (>60%) and patients necessitating vasopressor or inotropic therapy before surgery were excluded. Bilateral frontal S<sub>c</sub>O<sub>2</sub> was recorded continuously with NIRS. When the patient was on CPB, 20% increase of pressure was accomplished with a PE bolus, while maintaining pump flow constant. Depth of anaesthesia, temperature, pCO<sub>2</sub>, pO<sub>2</sub> and haematocrit were also kept constant during the measurements. Cerebral autoregulation was measured by calculating the correlation coefficient between mean arterial blood pressure and S<sub>c</sub>O<sub>2</sub> (cerebral oximetry index (COx)). COx >0.30 was previously defined as impaired autoregulation.<sup>2</sup> Data are expressed as mean ± standard deviation and were compared using the paired t-test.

**Results and discussion:** Eleven patients (35%) had baseline COx >0.30 (0.64±0.08), which remained >0.30 after PE (0.57±0.13), p=0.19. Twenty patients (65%) had COx <0.30 at baseline. In 4 of these patients, COx did not change after PE (-0.02±0.08 to -0.01±0.03, p=0.98). In the other 16 patients, COx became negative after PE (0.02±0.14 to -0.50±0.17, p<0.001). These results indicate that PE-induced decrease in S<sub>c</sub>O<sub>2</sub> occurs exclusively in patients with baseline COx <0.30, suggesting contribution of the intact cerebral autoregulation.

**Conclusion:** S<sub>c</sub>O<sub>2</sub> decrease with PE-induced increase in blood pressure might be related to a functional cerebral autoregulation mechanism.

##### References:

- Meng L et al. Br J Anaesth 2012;108:815-22
- Ono M et al. Crit Care Med 2013;41:464-71

#### 4AP5-2

##### Cerebral autoregulation influences effects of sodium nitroprusside on cerebral oxygen saturation

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**Background and Goal of Study:** Previous work has demonstrated that the effect of sodium nitroprusside (SNP) on cerebral oxygen saturation ( $S_{cO_2}$ ) is inconsistent. We hypothesized that this variable effect might be related to functionality of the cerebral autoregulation mechanism. The use of the near-infrared spectroscopy (NIRS)-derived cerebral oximetry index (COx) has been validated as a measure to assess cerebral autoregulation.<sup>1</sup>

The aim of the present study was to evaluate the influence of a bolus of SNP on COx.

**Materials and methods:** After ethical committee approval and informed consent, 34 patients undergoing elective cardiac surgery on cardiopulmonary bypass (CPB) were included. Bilateral frontal  $S_{cO_2}$  was recorded continuously with NIRS. When the patient was on CPB, 20% decrease of pressure was accomplished with a SNP bolus, while maintaining pump flow constant. Depth of anaesthesia, temperature,  $pCO_2$ ,  $pO_2$  and haematocrit were also kept constant during the measurements. COx values were computed by calculating the correlation coefficient between mean arterial blood pressure and  $S_{cO_2}$ . Data are expressed as mean  $\pm$  standard deviation and were compared using the paired t-test.

**Results and discussion:** Twelve patients (35%) had baseline COx  $>0.30$  ( $0.64 \pm 0.08$ ), which remained  $>0.30$  after SNP ( $0.56 \pm 0.19$ ),  $p=0.14$ . COx  $>0.30$  was previously defined as impaired autoregulation.<sup>2</sup> In 22 patients (65%), COx at baseline was  $<0.30$ , indicating intact autoregulation. In 6 of these patients (27% of patients with intact baseline autoregulation), COx increased to  $>0.3$  after SNP ( $0.1 \pm 0.06$  to  $0.43 \pm 0.09$ ,  $p < 0.001$ ), suggesting SNP-induced disruption of cerebral autoregulation. In the other 16 patients, COx remained unchanged ( $n=6$ ) ( $0.01 \pm 0.08$  to  $0.07 \pm 0.15$ ,  $p=0.28$ ), or became negative after SNP ( $n=10$ ) ( $-0.03 \pm 0.15$  to  $-0.64 \pm 0.22$ ,  $p < 0.001$ ). The latter implies that SNP-induced decrease in blood pressure is associated with an increase in  $S_{cO_2}$ . This phenomenon occurs exclusively in patients with baseline COx  $<0.30$ , suggesting contribution of the functional cerebral autoregulation.

**Conclusions:** These data demonstrate that in some patients SNP disrupts an originally intact autoregulation. The  $S_{cO_2}$  increase observed with SNP-induced decrease in blood pressure might be related to a functional cerebral autoregulation mechanism.

##### References:

1. Brady K et al. Stroke 2010;41:1951-6
2. Ono M et al. Crit Care Med 2013;41:464-71

#### 4AP5-4

##### Propofol inhibits wound closure of human endothelial cells in-vitro

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**Background and Goal of Study:** The intravenous anesthetic propofol is widely used for the induction and maintenance of anesthesia in various clinical scenarios. Although propofol is regarded as a relatively safe anesthetic, it might interact with endothelial cells, thereby influencing their behavior and responsiveness to external stimuli. Aim of the study was to investigate the effects of clinically relevant concentrations of propofol on cell proliferation, cell death, barrier function and wound healing capacity of human endothelial cells cultured in-vitro.

**Materials and methods:** Human umbilical vein endothelial cells (HUVEC) were cultured with or without the addition of propofol (10, 30 and  $100\mu M$ ). Cell death was measured using lactate dehydrogenase (LDH) assays and cell proliferation was quantified by colorimetric MTS assays. To evaluate the influence of propofol on the permeability of a HUVEC cell monolayer, insert based FITC-dextran measurements were performed. Wound healing capacity was estimated by using in-vitro scratch assays.

**Results and discussion:** Propofol did not influence proliferation ( $P > 0.05$ ) or cell death of HUVEC cells ( $P > 0.05$ ). Moreover, the permeability of a confluent monolayer of HUVEC cells was not affected by any of the employed propofol concentrations ( $P > 0.05$ ). However, wound healing assays showed a dose dependent inhibition of wound closure after the addition of propofol (percentage of wounded area closed after 10h: control,  $88.1 \pm 8.0$ ; propofol  $10\mu M$ ,  $67.3 \pm 3.8$ ; propofol  $30\mu M$ ,  $53.5 \pm 8.7$ ; propofol  $100\mu M$ ,  $45.7 \pm 2.7$ ; control vs. propofol  $100\mu M$ ,  $P < 0.05$ ).

**Conclusion(s):** Clinically relevant concentrations of propofol inhibit the wound closure of endothelial cells in-vitro. Further in-vivo studies have to be performed to evaluate the clinical relevance of our findings.

#### 4AP5-5

##### Analysis of the temporal regression of the QRS widening induced by bupivacaine after intralipid administration: study in an experimental porcine model

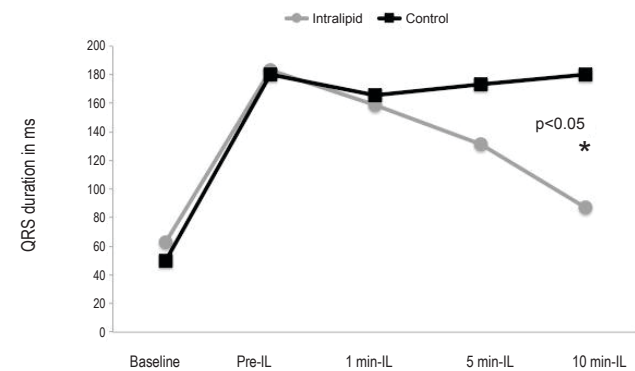
Callejo D.<sup>1</sup>, Sevilla R.<sup>2</sup>, González J.<sup>1</sup>, Quintela O.<sup>3</sup>, De Diego C.<sup>3</sup>, Zaballos M.<sup>3</sup>

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**Background and Goal of Study:** The principal mechanism of cardiac toxicity of bupivacaine relates to the blockade of myocardial sodium channels, which leads to an increase in the QRS duration. Recently, experimental studies suggest that lipid emulsion is effective in reversing bupivacaine cardiac toxicity. We aimed to evaluate the temporal evolution of the QRS widening induced by bupivacaine with the Intralipid administration.

**Materials and methods:** Six pigs were premedicated with ketamine and anesthetized with intravenous sodium thiopental 5mg/kg. The anesthetic maintenance was performed with sevoflurane 1 CAM (2.6%). Femoral artery and vein were cannalized for invasive monitoring, analytical blood gas samples and bupivacaine levels determinations. After instrumentation and motorization, a bupivacaine bolus of  $4 \text{ mg}\cdot\text{kg}^{-1}$  was administered in order to induce a 150% increase in QRS duration (defined as the toxic point). The Electrocardiographic parameters were recorded and blood samples were taken after bupivacaine and 1, 5 and 10 minutes after Intralipid administration ( $1.5 \text{ mL/kg}$  over 1 minute followed by an infusion of  $0.25 \text{ mL/kg/min}$ ). Three additional animals served as a control group, saline infusion was administered instead of Intralipid. Statistical analysis: Mann-Whitney test.

**Results and discussion:** The baseline QRS was  $63 \pm 7.4 \text{ ms}$  in IL group, and  $50 \text{ ms}$  in control group. Bupivacaine induced similar electrocardiographic changes in both groups, the maximum QRS widening was  $183 \pm 39 \text{ ms}$  and  $180 \pm 35 \text{ ms}$  in IL and control group respectively. After IL administration the QRS enlargement was reversed as shown in Figure 1, ( $p < 0,05$ ). At 10 min of the IL administration, the QRS interval was 84% of baseline value.



[QRS-IL]

**Conclusion(s):** Intralipid reversed the lengthening of QRS interval induced by the injection of bupivacaine. Time to normalization of electrocardiographic parameters can last more than 10 min. While the phenomena of cardiac toxicity persist, resuscitation measures and adequate monitoring should be continued until adequate heart conduction parameters were restored.



#### 4AP5-6

##### The effects of sevoflurane on the cardiac action potential in pigs

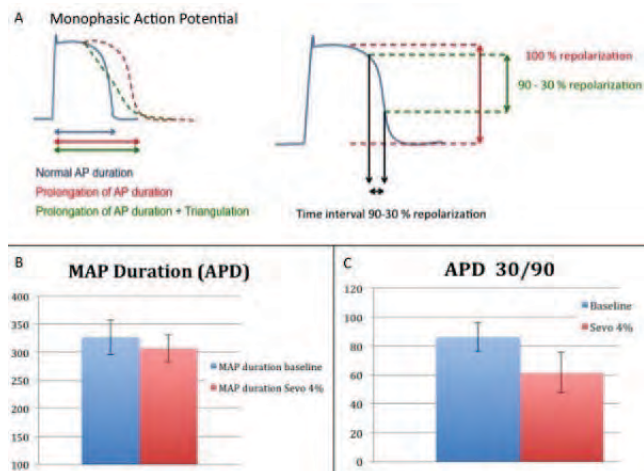
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**Background:** Prolonged QT-interval renders the heart susceptible for “torsade de pointes” (TDP). However, prolongation of the QT-interval or action potential (AP) is not sufficient to induce TDP<sup>1</sup>. Assessment of triangulation allows for better understanding of intraventricular conduction abnormalities. It defines the change in AP shape as a result of slowing of repolarization with an increase of the time interval between 30% and 90% of repolarization of the monophasic action potential (MAP) (Fig.1a). Triangulation may be accompanied by either shortening or lengthening of the total action potential duration (APD). The presence of triangulation can therefore discriminate hearts prone to develop TDP from those that are not. Some reports have associated sevoflurane anaesthesia with the development of TDP.

The present study investigated the effect of sevoflurane on the APD and its effect on triangulation.

**Methods:** After approval by the local Ethical Committee for experimental animal research the effects of sevoflurane 4% on the duration of MAP's were examined in 5 pigs. Right ventricular MAP's were acquired using a percutaneously introduced MAP-catheter (Harvard Apparatus, United States) during pacing at a fixed heart rate. MAP's were recorded and analysed with the use of the EP-Tracer (CardioTek B.V., Netherlands). MAP analysis in baseline and during the administration of sevoflurane 4%, allowed the measurement of APD and triangulation of repolarization. APD was measured as the time interval from the start until the end of the AP. Triangulation was determined using the recorded AP's by measuring the time interval between 30% and 90% of repolarization.

**Results:** Sevoflurane 4% did not alter APD ( $326 \pm 30$  vs  $307 \pm 24$  msec;  $p = 0.06$ ) (Fig.1b) but decreased repolarization time (APD 30/90) from 86 to 62 msec ( $p < 0.001$ ) (Fig.1c).



[Figure]

**Conclusion:** Triangulation, a proarrhythmic factor which slows repolarization, is reduced when using 4% of sevoflurane. In this experiment, triangulation is not the causative mechanism by which sevoflurane in higher concentrations induces TDP.

##### References:

1. Hondeghem LM (2008). *Acta Cardiologica*, 63(1), 1-7.

#### 4AP5-7

##### The recovery profile of baroreflex sensitivity after desflurane or sevoflurane anesthesia in humans

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Arterial baroreflex function is an important, short-term mechanism for cardiovascular stability, and is depressed by volatile anesthetics. Desflurane possesses shorter recovery characteristics compared with sevoflurane. In this study, we tested the hypothesis that patients anesthetized with desflurane would exert more rapid recovery of cardiovascular baroreflex function than sevoflurane.

We studied 12 ASA physical status I patients, scheduled to undergo general anesthesia for elective surgeries including maxillofacial or breast surgeries. The protocol was approved by IRB, and informed consent was obtained from each patient. Baroreflex sensitivity (BRS) was determined by the spontaneous sequence method using spontaneously changing pulse intervals and systolic blood pressure measured with Finometer<sup>®</sup> for 10 min.

Up- and down-sequences were defined as continually increasing and decreasing sequences, respectively. Baseline determination was made before the induction of general anesthesia in the supine position. The patients were then randomly assigned to either the desflurane or sevoflurane group. They were anesthetized with IV propofol 2 mg/kg, remifentanyl 0.3  $\mu$ g/kg/min, and tracheal intubation was facilitated with IV rocuronium 0.6 mg/kg. Patients' lungs were mechanically ventilated to maintain normocapnia. Anesthesia was maintained with remifentanyl 0.2  $\mu$ g/kg/min and end-tidal desflurane 6.0% or sevoflurane 2% in air and oxygen throughout anesthesia. The measurements were performed in a similar manner before and 30 min after the start of surgery.

At the completion of surgery, all anesthetics were discontinued. BRS measurements were repeated at 30, 60, 120, and 180 min after tracheal extubation. All data are presented as mean  $\pm$  SD. BRS data were analyzed by repeated-measures ANOVA and unpaired *t*-test, and a *P* value  $< 0.05$  was considered statistically significant.

Demographic data were comparable between groups.

BRS were similarly depressed during anesthesia and surgery in both groups. During the recovery period, however, up-sequence BRS of the sevoflurane group returned to the awake value 30 min after recovery, while that was still significantly depressed compared with the awake baseline value at 120 min after recovery in the desflurane group. No difference in the profile of down-sequence BRS was seen between groups.

Our results suggest that sevoflurane may be more preferable, when a rapid recovery of autonomic control of circulation is anticipated after surgery.

#### 4AP5-8

##### Melatonin improves gastric mucosal microcirculatory perfusion and maintains intestinal barrier function during haemorrhagic shock in dogs

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**Background and Goal of Study:** Melatonin improves hepatic perfusion after haemorrhagic shock [1]. Additionally, melatonin is produced in the gastrointestinal tract and exerts regional protective effects [2]. The aim of this study was to analyze whether melatonin likewise improves gastric mucosal microcirculatory perfusion ( $\mu$ flow) and if this affects oxygenation ( $\mu$ HbO<sub>2</sub>) and intestinal barrier function (via xylose absorption [3]) during physiological and haemorrhagic conditions.

**Material and Methods:** With approval of the local animal care and use committee five foxhounds were repeatedly anaesthetized (randomized cross-over design) and received 100  $\mu$ g/kg melatonin or vehicle (ethanol 5%) intravenously. In additional experiments, the animals received either melatonin or vehicle followed by haemorrhagic shock (loss of 20% of the estimated blood volume, 60 min) and retransfusion of shed blood. Systemic haemodynamic variables, gastric mucosal microvascular perfusion (Laser Doppler) and oxygenation (reflectance spectrophotometry) were recorded continuously. Arterial blood was sampled intermittently for blood gas analysis, and calculation of systemic oxygen delivery (DO<sub>2</sub>) and measurement of xylose plasma levels (gas chromatography) were performed.

Data are presented as means  $\pm$  SEM. 2-way ANOVA+Bonferroni for multiple comparisons,  $p < 0.05$ .

**Results and Discussion:** Under physiological conditions, melatonin had no effect on systemic haemodynamic variables, microcirculation or xylose plasma levels. Under haemorrhagic shock,  $\mu$ flow decreased by  $-43 \pm 10$  aU, which was attenuated by melatonin application ( $-19 \pm 9$  aU,  $p < 0.05$ ). In contrast,  $\mu$ HbO<sub>2</sub> decreased during haemorrhage without differences between the groups. Xylose plasma levels increased during haemorrhagic shock from  $8 \pm 1$  to  $13 \pm 2$  AUC ( $p < 0.05$ ), but remained unchanged during haemorrhage after melatonin application ( $6 \pm 1$  and  $8 \pm 2$  AUC). These effects were independent of DO<sub>2</sub> and cardiac output, which were equally reduced in both groups.

**Conclusion:** Melatonin improves  $\mu$ flow during haemorrhagic shock without affecting  $\mu$ HbO<sub>2</sub>. Thus, melatonin improves regional oxygen delivery and increases regional oxygen consumption. This might provide a mechanism for the observed protection of the intestinal barrier function by melatonin during haemorrhagic shock.

#### References:

1. Mathes AM et al., Shock 2008; 29: 112-8
2. Konturek SJ et al., J PhysiolPharmacol 2007; 6: 23-52
3. Wang YB et al., World J Gastroenterol 2011; 17: 657-61

## 4AP5-9

### The evaluation of the sensitivity of the peripheral chemoreceptors in predicting of hemodynamic instability during anesthesia in patients with chronic heart failure

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**Background and Goal of Study:** Increased sensitivity of peripheral chemoreceptors (SPCR) reflects the degree of progression and severity of chronic heart failure (CHF), as well as the degree of activation of the sympathetic nervous system and the degree of changes in cardiorespiratory reflex regulation. These disorders can be a cause of hemodynamic instability and potential perioperative anesthetic complications. The goal of the study was to evaluate the role of SPCR in predicting of hemodynamic instability in patients with CHF during propofol-fentanyl anesthesia.

**Materials and methods:** We conducted a prospective study in 116 patients with CHF (II NYHA functional class). All patients received a laparoscopic cholecystectomy under propofol-fentanyl anesthesia. In a day before surgery SPCR was evaluated using breath-holding test (maximal voluntary breath-holding duration (BHD) after deep inspiration). Hemodynamic instability was determined as a decrease in mean arterial pressure below 70 mmHg or the need for vasopressors. We compared the incidence of complications, the length of stay in hospital between patients with stable or instable hemodynamics. ROC-analysis was used to assess the predictive value of the model. The study was approved by the Internal Review Board of the Kuban State Medical University, Krasnodar, Russian Federation.

**Results and discussion:** The frequency of hemodynamic instability was 38.8% (45 patients). The mean BHD was  $29.1 \pm 5.5$  sec. in stable group vs.  $44.5 \pm 9.3$  in unstable ( $p < 0.001$ ). ROC-analysis showed that the assessment of SPCR is a useful test in predicting of hemodynamic instability with a cut-off point for BHD of  $\leq 38$  sec (94.1% sensitivity, 73.1% specificity). Area under curve was 0.92 (95% CI, 0.806-0.984,  $p < 0.001$ ). The patients in unstable group showed a higher incidence of postoperative nausea and vomiting (32% vs. 19.6%,  $p < 0.001$ ) and hypoxemia (38% vs. 25%,  $p < 0.001$ ). No differences in other complications were noted. The length of stay in the hospital was 10 (6-12) days in unstable group vs. 8 (6-9) in stable group ( $p < 0.001$ ).

**Conclusion:** CHF patients with high sensitivity of peripheral chemoreceptors (breath-holding duration  $\leq 38$  sec.) have a risk of hemodynamic instability during anesthesia and risk of postoperative complications, which can increase the length of stay in the hospital.

## 4AP5-10

### Most effective therapy for new intraoperative atrial fibrillation during thoracic operations: electrical cardioversion, not anti-arrhythmic drugs

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**Background and Goal of Study:** Atrial fibrillation (AF) is a common perioperative complication during thoracic surgery[1-3]. The objective of the study was to retrospectively evaluate the intraoperative outcome of patients undergoing general thoracic operations and presenting with onset of AF. The intraoperative course of AF was also evaluated in relation to different anti-arrhythmic agents.

**Materials and methods:** Medical records of 18,477 patients including 16,292 patients who underwent lung operations and 2,185 patients who underwent esophageal operations from January 1, 2006, to December 31, 2012, at the Shanghai Chest Hospital were reviewed. The occurrence, the time and disappearance of intraoperative AF were recorded. All anti-arrhythmic drugs using and other measurements taken for the new AF were recorded after AF occurring throughout operations.

**Results and discussion:** The overall incidence of intraoperative AF was 3.49% (646 of 18,477), including 3.4% (555 of 16,292) in lung operations and 4.07% (89 of 2,185) in esophageal operations. In 41.47%, 25.63% and 23.88% of lung operations, intraoperative AF respectively occurred during lymph node dissection, hemostasis, and targeted lung resection. In 78.65% of esophageal operations occurred during targeted esophageal resection. In 23.83% of AF patients heart rate (HR) was higher than 100 bpm, in 1.24% with HR less than 50 bpm, in 7.12% with mean blood pressure (MBP) less than 50 mmHg, in 5.88% with HR more than 100 bpm and MBP less than 50 mmHg. Among 646 AF patients, the ratio of sinus rhythm recovery was 20.46% (53 of 259) in patients treated with different anti-arrhythmic drugs and 20.93% (81 of 387) in patients without anti-arrhythmic drugs. Among 259 patients treated with various anti-arrhythmic drugs, Beta-blockers drug showed more effective to return to sinus rhythm with 34.69% (17 of 49) compared with others (Amiodarone, Propafenone, Digoxin, Diltiazem, and Lidocaine,  $P < 0.05$ ). There were 157 AF patients treated with electrical cardioversion in postanesthesia care unit and 154 patients succeed to return to sinus rhythm with the ratio of 98.09%.

**Conclusion(s):** Beta-blockers showed limited effect, electrical cardioversion was the most effective therapy for new intraoperative AF during thoracic operations.

#### References:

1. Wu DH, Xu MY, Mao T, et al. Risk Factors for Intraoperative Atrial Fibrillation: A Retrospective Analysis of 10,563 Lung Operations in a Single Center. Ann Thorac Surg. 2012, 94 (1):193-197.

## 4AP6-1

### Pulmonary artery catheter detected in the coronary sinus on intraoperative transoesophageal echocardiogram. What is the possible diagnosis?

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**Background:** Isolated persistent left superior vena cava is a very rare anomaly in the general population. We report the intraoperative suspicion of an unknown isolated persistent left superior vena cava associated to absent right superior vena cava, through transoesophageal echocardiography detection.

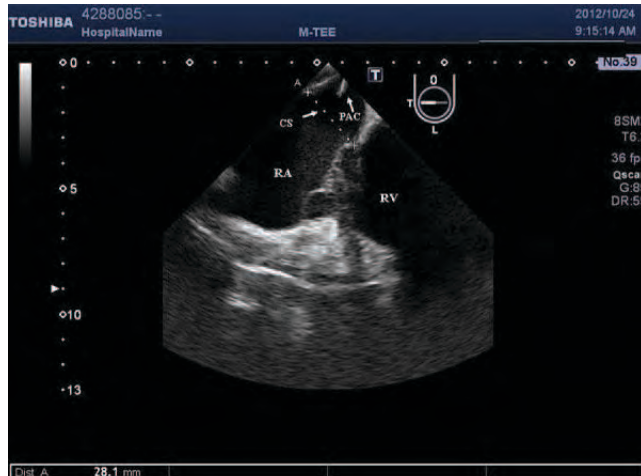
**Case report:** A 58-year-old man diagnosed of severe mitral regurgitation, severe tricuspid regurgitation and ascending aorta aneurysm was scheduled for mitral valve replacement, tricuspid valve repair and ascending aorta repair (supracoronary ascending aorta graft).

After anaesthetic induction and tracheal intubation, a pulmonary artery catheter (PAC) was placed through the right internal jugular vein until hemodynamic data (pulmonary artery blood pressures) were obtained.

Before median sternotomy a transoesophageal echocardiography probe was inserted and intraoperative imaging revealed the PAC traversing an enlarged coronary sinus (Fig. 1). What is the diagnosis?

**Discussion:** Persistent left superior vena cava has an incidence of 0.3-0.5% in the general population; eighteen percent of individuals with persistent left superior vena cava possess agenesis of the right superior vena cava, this becomes a very rare anomaly namely isolated persistent left superior vena cava.

The persistent left superior vena cava drains into the right atrium via the coronary sinus in 92% of cases and in these cases the coronary sinus is dilated but coexistent agenesis of the right superior vena cava renders the coronary sinus further dilated. Persistent left superior vena cava associated to absent right superior vena cava were not preoperatively suspected nor diagnosed as well the presence of a dilated coronary sinus. The implications of these anomalies in cardio-thoracic surgery are well described and the recognition and management of anormal systemic venous drainage is crucial to avoid complications during central venous catheterization.<sup>1</sup>



[Fig 1. Multiplane 0° angle of the modified midesophageal 4-chamber view. The pulmonary artery catheter was noticed at the dilated ostium of the coronary sinus. RA: right atrium; RV: right ventricle; PAC: pulmonary artery catheter; CS: coronary sinus]

#### References:

1. Neema PK, Manikandan S, Rathod RC. Absent right superior vena cava and persistent left superior vena cava: the perioperative implications. *Anesth Analg* 2007; 105: 40-2.

**Learning Points:** Our case report emphasizes the importance that in the presence of an isolated enlarged coronary sinus, revealed by echocardiography, in order to rule out other abnormalities of venous drainage; a contrast-enhanced magnetic resonance or a venous angiography must be performed.

### 4AP6-2

#### Anterior cervical discectomy complicated by postoperative stroke

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**Background:** Anterior cervical discectomy is a common procedure for degenerative spine disease<sup>1</sup>. Although major vascular complications are rare, some reports describe postoperative stroke presumably caused by a cardiac or vascular embolus.

**Case report:** - ♂, 62-year-old, with obesity (IMC >35 Kg/m<sup>2</sup>) and arterial hypertension, with a history of paresthesia and reduced strength of all four limbs (mainly upper) for 14 months. As the magnetic resonance imaging (MRI) revealed prolapsed intervertebral discs at C<sub>4</sub>-C<sub>5</sub>-C<sub>6</sub>, a cervical discectomy was planned by left anterior approach.

His initial blood pressure (BP) was 150/80 mmHg. A rapid sequence induction was performed using fentanyl (5 ug/Kg), propofol (2 mg/kg) and succinylcholine (1 mg/Kg); sevoflurane and a remifentanyl infusion were used for maintenance. 10 and 70 minutes after incision BP decreased to 80/40 mmHg and lasted 5 minutes, improving with fluids and infusion rate adjustments. At the post-anesthesia care unit the patient was awake but had aphasia and didn't move the right limbs. A magnetic resonance imaging (MRI) confirmed left middle cerebral artery stroke, most likely of embolic nature, and the etiologic postoperative study clarified the existence of a 50% stenosis of the left carotid artery.

**Discussion:** The incidence of postoperative stroke is around 0.08% and 0.4% for non-cardiac non-vascular surgery. Both the presence of an atherosclerotic vessel on Doppler ultrasound and the stroke's imagiologic features raised the hypothesis of plaque displacement as its etiologic factor. Nevertheless it is important to note that carotid artery diameter reduces significantly after retractor application, namely when surgeries last more than 2 hours, as in our case.

#### References:

1. Bijker JB., Persoon S., Peelen LM et al. Intraoperative Hypotension and Perioperative Ischemic Stroke after General Surgery. A Nested Case-control Study. *Anesthesiology* 2012; 116:658-642.

**Learning Points:** Due to stroke's multifactorial nature a careful and multidisciplinary perioperative approach is mandatory to sidestep complications. For patients with cardiovascular disease, carotid bruit or age >65 years, selective screening with Doppler ultrasound or MRI may alter the disease's natural course and reduce treatment costs. Further studies are required to determine if specific BP strategies might diminish hypoperfusion contribution to these events<sup>1</sup>.

### 4AP6-3

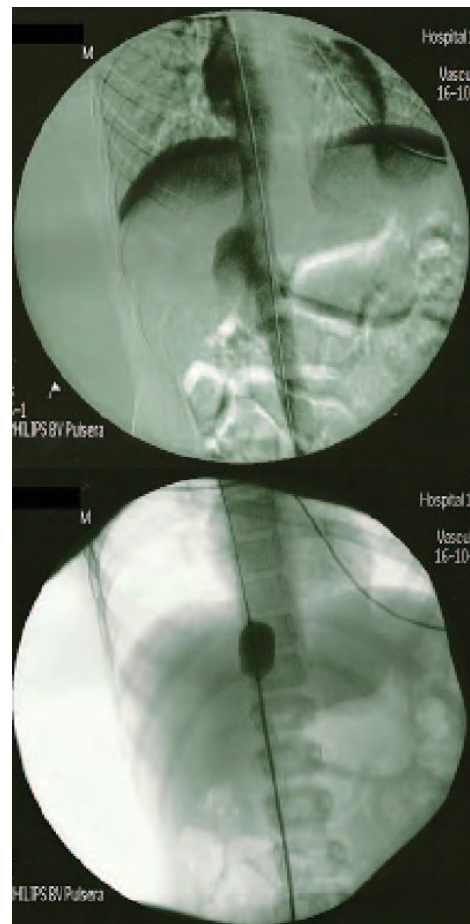
#### An intraoperative simulation of decrease in cardiac preload to establish hemodynamic viability of the surgery: a case report of suprarenal inferior cava vein aneurysm resection

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**Background:** Aneurysms of the ICV are extremely rare with less than 50 cases described in the literature. The hemodynamic monitoring and balloon clamping give valuable information for intraoperative patient management.

**Case report:** A 9 years old boy that was diagnosed with an inferior cava vein aneurysm (ICVA) with initial measures of 30x40mm on the Doppler ultrasound. When growth was observed, surgical treatment was indicated. An AngioTC was performed which revealed a grand ICVA (35x51x78mm) with the right renal vein opening into the aneurysmal sack. General anesthesia was induced, the hemodynamic state was monitored with a Vigileo flotrac® and the renal protection was realized. A Reliant® balloon catheter was progressed using a continuous radioscopy through the right internal saphenous vein to the retrohepatic portion of the ICV and inflated in order to assess the hemodynamic state after the fall in cardiac preload.



[Radioscopic image of ICVA and balloon]



After the hemodynamic stability was confirmed the surgery has begun with the balloon catheter deflated and maintained in the initial position. A resection of the aneurysm with a PTFE patch® angioplasty was performed and the right renal vein was reimplanted into the patch. He was extubated and passed to PACU where no haematological, renal or hepatic complication occurred.

**Discussion:** Anaesthesiologist should be familiar with the ICVA pathology and the hemodynamic changes that patients could present during the surgery. Invasive monitoring should be used in order to treat changes in cardiac output or major bleeding. Initial clamping with intravenous balloon provides useful information about patient's tolerance of decreased preload. The use of continuous radioscopy assures a correct placement of the balloon and prevents complication due to obstruction of the hepatic or renal vein.

#### References:

1. Davidovic L et al. Aneurysm of the inferior vena cava: case report and review of the literature. *Phlebology*. 2008;23(4):184-8.

**Learning Point:** 1. Intravascular balloon catheter allows us to observe and prepare for patient's hemodynamic response (by invasive monitoring) to a decreased preload that may happen during the surgery.

### 4AP6-4

#### Anaesthesia for decompensating cardiac function secondary to a rare large left ventricular tumour

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**Background:** A 21-year-old female required urgent open-heart surgery due to decompensating cardiac function secondary to a rare large left ventricular (LV) tumour.

**Case report:** Our patient had a background of acute lymphoblastic leukaemia, whole body radiotherapy and a bone marrow transplant.

She presented with an acute history of chest pain, breathlessness and palpitations. Electrocardiogram revealed infero-lateral ST depression and T-wave inversion in V3-V6. Transthoracic echocardiography revealed severe LV impairment, a large LV mass attached to the inferior, septal and anterior walls, filling 85% of the chamber. There was also moderate-severe mitral regurgitation. Computed tomography suggested localised cardiac sarcoma.

Anaesthesia was required for tumour debulking. Cautious induction with invasive monitoring was performed with a high dose opiate-based technique. Intraoperative dissection was difficult with gelatinous lesions arising from multiple areas. Mitral valve replacement was performed due to unsuccessful repair.

Inotropic support was required prior to separation from cardiopulmonary bypass in the form of dopamine, adrenaline and enoximone.

Tissue biopsy revealed a high-grade sarcoma for which the patient received Paclitaxel chemotherapy.

**Discussion:** This is an extremely rare case of cardiac sarcoma, presenting late with decompensating features. Induction of anaesthesia was very high risk, with support of cardiopulmonary bypass immediately available. The incidence of cardiac tumours varies between 0.0017% and 0.33% [1]. Patients have a very poor prognosis of 9-11 months, which is compounded by presentation with non-specific symptoms, lack of knowledge and experience due to their rarity and often advanced tumour stage at presentation [2]. Surgical resection is the mainstay of treatment, with chemotherapy playing a smaller role in lengthening prognosis [3]. Therefore, as anaesthetists we need to develop skills to support such high-risk anaesthesia.

#### References:

1. Amano J, Nakayama J, Yoshimura Y, et al. *Gen Thorac Cardiovasc Surg*. 2013;61:435-447

2. Shanmugam G. *Eur J Cardiothorac Surg*. 2006;29(6):925-932

3. Devbhandari MP, Meraj S, Jones MT, et al. *J Cardiothorac Surg*. 2007;2:34

**Learning Points:** Experience of rare urgent clinical scenarios is by their very nature seldom. It highlights the importance of rapid decision-making, a multi-disciplinary approach, careful planning and execution of anaesthesia.

### 4AP6-5

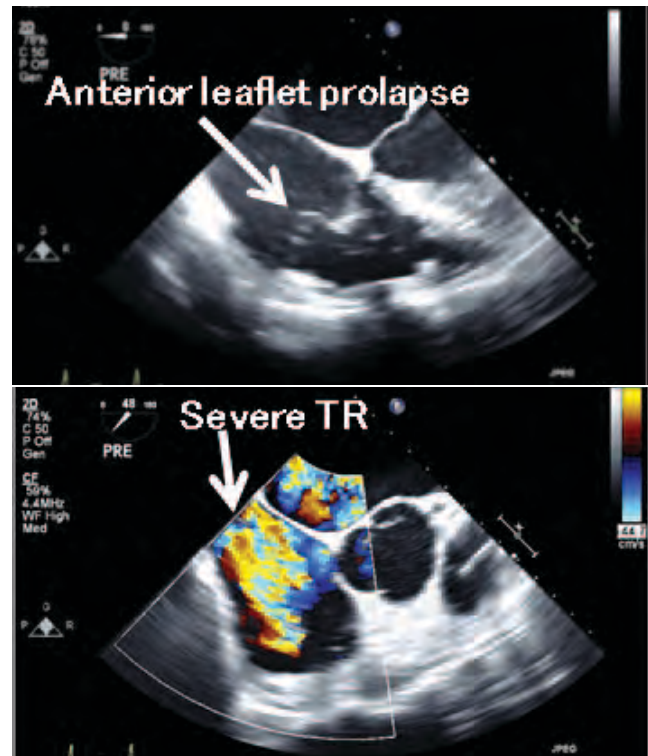
#### Congestive hepatic cirrhosis and acute kidney injury resulting from mitral and tricuspid valve prolapse: a case report

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**Background:** Tricuspid valve prolapse is a rare cause of tricuspid regurgitation (TR).<sup>1</sup> We anesthetized a patient with congestive hepatic cirrhosis and acute kidney injury (AKI) resulting from mitral and tricuspid valve prolapse.

**Case report:** A 60-year-old, 172-cm, 68-kg man diagnosed 8 months earlier with chronic heart failure, Af, and mitral valve regurgitation (MR) was admitted with progressive dyspnea. TTE revealed severe MR from prolapse (P2, A2) and severe TR. Laboratory data included Hb 15.5 g/dl, platelets  $9.9 \times 10^5/\mu\text{l}$ , AST 74 IU/L, ALT 113 IU/L, T-bil 3.2 mg/dl, BUN 19.0 mg/dl, and Cr 1.48 mg/dl, indicating hepatic cirrhosis (Child-Pugh B) and AKI (stage 1). Intraoperative TEE showed moderate MR mainly due to P2 and severe TR with dilation (51 mm) due to anterior and posterior leaflet prolapse (Figure). Sliding plasty of the posterior mitral leaflet was performed with a 34-mm Physio II ring™ to the MR. Anteroposterior and anteroseptal commissure plasty were performed with a 32-mm MC<sup>3</sup> ring™ to the TR. Maze cryoablation and left atrial plication were also completed. Ten days after surgery the patient's data had improved, including his platelet count  $37.4 \times 10^5/\mu\text{l}$ , AST 48 U/L, ALT 42 IU/L, T-bil 1.1 mg/dl, and Cr 0.89 mg/dl.



[Figure. 2D and Color Doppler image showing severe TR with dilation due to anterior leaflet prolapse]

**Discussion:** There are several causes of TR, including organic and functional dysfunction. Organic dysfunction includes rheumatic heart disease, carcinoid heart disease, injury, Ebstein's anatomy, endocarditis, and radiation exposure. Functional dysfunction includes increased right ventricular systolic pressure (left ventricular valvular disease, ASD, PH) and right ventricular dilation (right ventricular infarction, myocarditis).<sup>2</sup> This case does not fall into any of the above categories.

#### References:

1. *J Cardiothoracic and Vascular Anesthesia* 2011; 25:753-4.

2. Clinical manual and review of transesophageal echocardiography 2<sup>nd</sup> ed. McGraw Hill.2010; 223-225

#### Learning Points:

1. TR with severe prolapse and secondary hepatic cirrhosis and AKI is rare.
2. It can be difficult to diagnose the accurate prolapsed portion of the tricuspid valve by 2D-TEE.

## 4AP6-6

### Management of anaphylaxis under general anaesthesia following morphine administration

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**Background:** Anaphylactic reactions during general anaesthesia are not uncommon but if they are not suspected and treated in time they can result in significant morbidity and mortality. We report a case of anaphylactic reaction following intravenous administration of morphine during general anaesthesia. **Case report:** 45 year old female scheduled for Hip Arthroscopy. Her past medical history includes an allergic reaction to codeine in the form of stomach cramps, vomiting and sweating. She was anaesthetised using Midazolam 2mg, Fentanyl 100 µg, Propofol 200mg and Rocuronium 50 mg. Following endotracheal intubation anaesthesia was maintained with O<sub>2</sub>, N<sub>2</sub>o and Sevoflurane.

Two hours after induction, anaesthesia was supplemented with Morphine 10 mg and 20 mg of rocuronium intravenously, as patient required increased depth of anaesthesia. Within 5 minutes the patient became tachycardic (110bpm), hypotensive (50/20mmHg) and the O<sub>2</sub> saturation dropped to 86%. She developed a rash over her body and had a swollen face. The hypotension was unresponsive to metaraminol and Glycopyrrolate and required Ephedrine, adrenaline and fluids to correct it. She was also treated with hydrocortisone, chlorpheniramine maleate and dexamethasone. Since she had a swollen face Chlorpheniramine maleate and prednisolone were continued for 5 days. Mast cell tryptase - (Normal range 2- 14 µg/ml) was elevated to: 32.8 µg/ml at 6 Hours and to 3.9 µg/ml at 24 Hours. Intradermal skin testing for allergy confirmed that the patient developed a very positive response to morphine and is also sensitive to suxamethonium.

**Discussion:** The prevalence of anaphylaxis during anaesthesia has been reported to vary between 1 in 3,500 to 1 in 20,000\*. The mortality from these reactions is in the range from 3- 6%, and additional brain damage in another 2% of patients\*. A reaction under general anaesthesia requires a multidisciplinary approach with prompt recognition and treatment of the acute event, as well as subsequent determination of the responsible agent(s), and strictly avoiding administering them and all incriminating and/or cross-reacting compounds\*.

#### References:

\*Anaphylaxis during anaesthesia: diagnostic approach; D. G. Ebo1, et al Allergy 2007; 62: 471-487

**Learning Points:** Severe hypotension unresponsive to routine vasopressor and fluid therapy, in the presence of any other systemic manifestation, following administration of any drug during anaesthesia should be strongly viewed in terms of anaphylaxis.

## 4AP6-7

### Perioperative epinephrine-induced Takotsubo cardiomyopathy

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**Background:** Takotsubo Cardiomyopathy consists on transient left-ventricle dysfunction and ST abnormalities mimicking acute myocardial infarction in the absence of coronary artery disease. Ventricular arrhythmias are estimated to occur in 3.4% of TC cases and are the presenting event in 1.1%<sup>1</sup>. We report a case of intraoperative epinephrine injection complicated by ventricular tachycardia as the triggering event of TC.

**Case report:** A 44-yr-old ASA II woman was admitted for elective uterine myomectomy. The surgeon infiltrated the base of a subserous myoma with 1mg epinephrine and seconds after the patient developed self-limited ventricular tachycardia with pulse followed by sinus rhythm with ST-elevation and mild hypotension. The surgery was concluded and the patient uneventfully extubated. An urgent EKG showed discrete ST elevation in DI, DII and aVL with the patient asymptomatic. She then progressively developed cardiogenic shock and an echocardiogram revealed a severe akinesia of the apical portion of the left ventricle and severe systolic dysfunction. Supportive treatment with dopamine and dobutamine was employed and the cardiac function progressively normalized over 7 days. Troponin I peaked at the 14<sup>th</sup> h (10,2ng/ml) and BNP at the 36<sup>th</sup> h (1285,4pg/ml). A cardiac catheterization on the 7<sup>th</sup> day showed normal coronary arteries and left ventricular function and the patient was discharged on the 11<sup>th</sup> day asymptomatic.

**Discussion:** TC is a rare cause of cardiovascular morbidity in the perioperative setting where the absence of typical clinical signs poses a particular

challenge to the diagnosis. Epinephrine solutions used to improve surgical hemostasis have been previously associated with TC<sup>2</sup> thus highlighting the importance of patient safety measures in the perioperative period. Reports of TC recurrence and high complication rate<sup>2</sup> pose a challenge in the subsequent anesthetic management of these patients.

#### References:

1. Syed F, A. S., Francis J, Arrhythmia occurrence with takotsubo cardiomyopathy: a literature review. *Europace* 2011, 13, 780-788.
2. Hessel E, L. M., Takotsubo (stress) cardiomyopathy and the anesthesiologist: enough case reports. Let's try to answer some specific questions! *Anesth Analg* 2010, 110 (3), 674-679

**Learning points:** TC is a rare cause of cardiovascular morbidity in the perioperative setting that can lead to life-threatening complications. Epinephrine solutions for surgical hemostasis must be employed safely to prevent iatrogenic adverse events.

## 4AP6-9

### Intraoperative spinal cord ischemia during thoracic endovascular aortic repair under epidural anesthesia

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**Background:** Spinal cord ischemia (SCI) after thoracic endovascular aortic repair (TEVAR) is one of the devastating complications. Early detection and proper treatment of SCI may be important. We present a case that developed intraoperative paraplegia during TEVAR under epidural anesthesia (EDA).

**Case report:** A 76-year-old man underwent ascending aortic aneurysm repair and thoracoabdominal aortic aneurysm repair (TAAAR) when he was 72 years old. The proximal and distal anastomosis areas of TAAAR have enlarged. He was scheduled for TEVAR using three stent grafts (SG). Preoperative three dimensional computed tomography (3DCT) identified that the presumed origin of the artery of Adamkiewicz (AKA) was Th9 and left vertebral artery (LVA) was originated directly from aortic arch. The risk of SCI was considered to be high because of the number of SG and location of AKA and LVA. Lumbar cerebrospinal fluid (CSF) drainage tube and an epidural catheter were placed in the L4/5 and L2/3 respectively. The operation was performed under EDA with local anesthesia to assess leg movement intraoperatively. The patient had no symptoms when two SG covered the areas of the origin of AKA. Third SG for aortic arch was placed to zone 0. A few minutes after the placement of the third SG, he lost his sensation and developed paralysis of both legs. He was diagnosed to have SCI and CSF drainage was performed immediately for spinal cord protection less than 10 cmH<sub>2</sub>O. His blood pressure (BP) decreased and catecholamine was administered to keep mean BP more than 80 mmHg. The administration of steroid, naloxon and prostaglandin E, was also started. Two hours after these treatments, he started to move his ankles. These medications and CSF drainage were continued for three days and he completely recovered. Postoperative 3DCT revealed that LVA was occluded with SG and collateral vessels were identified.

**Discussion:** Occlusion of LVA might cause paraplegia in this case because VA is supplier of the anterior spinal artery. Lumbar CSF drainage can be spinal cord protection although there are some risks associated with its use (1). Management of BP is important, because sufficient spinal cord perfusion is provided to keep collateral network pressure with sufficient mean BP (2).

#### References:

1. *Anesth Analg* 2010; 111:46-58 (2) *Ann Thorac Surg* 2007;83:S865-9

**Learning points:** Early detection of SCI and immediate treatment of SCI with CSF drainage and BP control contribute to recovery in this case.

## 4AP6-10

### Perioperative management of a patient with carcinoid syndrome for pulmonary & tricuspid valve replacement and coronary artery bypass graft: anaesthetic considerations

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**Background:** Carcinoid tumours are rare neuroendocrine tumours, about 5% of patients with carcinoid tumours develop the carcinoid syndrome. Hepatic metastases cause systemic secretion of hormones which can precipitate a carcinoid crisis, characterized by flushing, hypotension and bronchospasm.<sup>1</sup>

**Case report:** We discuss the case of a 74yr-old 75kg man, with carcinoid tumour, secondary hepatic metastases, tricuspid and pulmonary valve involve-

ment, on long term octreotide therapy. Co-morbidities included hypertension and ischaemic heart disease.

#### *Anaesthetic technique:*

After placement of a radial arterial catheter, anaesthesia was induced with midazolam, fentanyl and propofol. After administering pancuronium, the trachea was intubated and anaesthesia maintained with sevoflurane, and a fentanyl infusion for analgesia. Further monitoring was placed; a central venous catheter, pulmonary artery catheter and transesophageal echocardiography (TOE). An octreotide infusion at 50mcg/hr was commenced, and was available as bolus in the event of refractory hypotension. Antifibrinolytic therapy consisted of aprotinin administered intravenously and into the cardiopulmonary bypass (CPB) circuit. The patient was weaned off CPB with vasopressin and milrinone infusions with no evidence of carcinoid crisis throughout.

**Discussion:** The aim of the anaesthetic technique is minimising factors that may precipitate a carcinoid crisis, its prompt recognition, and pharmacological management of a low cardiac output state. It is vital to establish monitoring to predict the onset of haemodynamic instability. The mainstay of perioperative treatment is with octreotide, which is effective in managing manifestations of carcinoid activity and stabilizing haemodynamics. The use of agents that precipitate histamine release or exacerbate catecholamine secretion should be avoided. Aprotinin is used to reduce blood loss, but may also reduce carcinoid tumour effects through actions on the kallikrein-kinin system.

#### **References:**

1. Castillo JG et al. Management of patients undergoing multivalvular surgery for carcinoid heart disease: the role of the anaesthetist. *British Journal of Anaesthesia* 2008; **101**(5): 618-26

**Learning points:** Cardiac surgery for carcinoid heart disease can be complicated by haemodynamic instability secondary to carcinoid crises and cardiovascular dysfunction. We highlight the importance of acknowledgement of potential challenges, preoperative preparation, and appropriate drug therapy.

## 4AP6-11

### Valsalva like maneuver with ventilator to treat supraventricular tachycardia

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**Background:** Life-threatening cardiovascular events under anaesthesia are uncommon. However, intra-operative dysrhythmias affect many patients undergoing non-cardiac surgery<sup>1</sup>. We report a successful intraoperative treatment of a regular supraventricular tachycardia (SVT) with a Valsalva like maneuver carried on by ventilator.

**Case report:** Female patient, 42 years old, 60kg, ASA I, was admitted for elective tympanoplasty. The patient was pre-treated with 2mg of midazolam and monitored according to ASA standards. We performed a balanced anaesthesia with fentanyl (3µg/kg), propofol (3mg/kg) and rocuronium (0.6mg/kg) as induction. Anesthetic maintenance with sevoflurane. Fifteen minutes after induction and before surgical incision the patient developed a regular SVT with a maximum heart rate of 155 bpm without changes in blood pressure. A Valsalva like maneuver was performed using the ventilator with mechanical ventilation initially applying PEEP 30cmH<sub>2</sub>O and maintained for about 15 seconds. When it was suddenly withdrawn PEEP and heart rate decrease to 130bpm. After this, we switched to spontaneous ventilation, placing the APL valve at 40 cm H<sub>2</sub>O and sustained the balloon compressed for about 15 seconds. After this maneuver there was a gradual decline in heart rate up to 88 bpm. The patient maintained hemodynamic stability (rhythmic and blood pressure) and therefore was decided to proceed with the surgery, which took place without any complications.

**Discussion:** If the patient is haemodynamically stable, the initial management of regular SVT should include vagal maneuvers<sup>2</sup>. In anesthetized patients, without access to the carotid sinus, pharmacological treatment is often the first choice in SVT. However, the Valsalva maneuver induces a temporary slowing of sino-atrial nodal activity and atrio-ventricular nodal conduction by stimulating baroreceptors in the aorta, which triggers a reflex increase in vagus nerve activity and sympathetic withdrawal. With increasing PEEP and balloon compression we can stimulate aortic baroreceptors simulating a Valsalva maneuver. Additionally, we believe that Bainbridge reflex took place too, with initial high PEEP applied.

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**Learning points:** A Valsalva like maneuver using the ventilator in anesthetized patients may be effective in treating regular SVT in the intraoperative setting.

## 4AP7-1

### Xenon anaesthesia in patients undergoing off-pump coronary artery bypass graft surgery: a prospective, randomized controlled clinical trial (EudraCT 2012-002316-12)

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**Background and Goal of Study:** Xenon anaesthesia has been repeatedly shown to exhibit a favourable and unique haemodynamic profile. Moreover, xenon conveys remarkable cardio- and neuroprotective effects in animal experiments. These properties could render xenon an attractive anaesthetic agent in off pump coronary artery bypass surgery (OPCAB).

We hypothesized that xenon anaesthesia is non-inferior to sevoflurane anaesthesia with regard to haemodynamic stability during OPCAB surgery.

**Materials and Methods:** After obtainment of ethical committee approval and written informed consent, 42 patients undergoing elective OPCAB surgery were enrolled. Patients were randomized to receive balanced anaesthesia with either xenon (50-60 vol.-%) or sevoflurane (1.1-1.4 vol.-%). Anaesthesia was titrated to maintain a bispectral index value between 40-60. Primary outcome parameter was the intraoperative use of vasopressors that were required to achieve pre-defined haemodynamic goals. Secondary outcomes included feasibility and safety criteria, including the incidence of postoperative delirium (POD). Haemodynamics were continuously monitored using a pulmonary artery catheter. While it was technically impossible to blind the attending anaesthesiologist, research staffs blinded to treatment allocation performed pre- and postoperative visits.

**Results and Discussion:** Groups did not differ with respect to baseline characteristics and surgical parameters. In addition, intraoperative fluid balance, respiratory profile, depth of anaesthesia and heart rate were similar in both groups.

However, in order to maintain a mean arterial blood pressure of >65mmHg, patients in the sevoflurane group required significantly higher norepinephrine doses (median (IQR): 0.07(0.06) vs. 0.02(0.01) µg•kg<sup>-1</sup>•min<sup>-1</sup>, p<0.0001). Area under the curves for intraoperative cardiac index (2.9(0.9) vs. 2.4(0.8) L•min<sup>-1</sup>•m<sup>-2</sup>, p<0.033) and stroke volume index (45.4(14.4) vs. 40.2(12.2) mL•m<sup>-2</sup>, p<0.014) were significantly higher in the xenon- than in the sevoflurane group. Patients in the sevoflurane group had a significantly higher incidence of POD (38% vs. 9.5%, p<0.044). No differences were noticed with respect to intraoperative safety parameters.

**Conclusion(s):** Xenon-anaesthesia is safe and feasible in patients undergoing OPCAB-surgery. In addition, xenon anaesthesia was associated with a superior haemodynamic profile in these high-risk patients and with a lower incidence of POD.

## 4AP7-2

### The predictors of hemodynamic recovery after rapid pacing for valve deployment in transcatheter aortic valve implantation

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**Background and Goal of Study:** Transcatheter aortic valve implantation (TAVI) is favored as a low invasive treatment for high-risk patients with severe aortic stenosis (AS). However some procedures during TAVI, including rapid pacing (RP), cause hemodynamic instability. We aimed to identify the predictors of the prolonged hemodynamic compromise after RP for valve deployment in TAVI.

**Population and Methods:** The patients with severe AS who underwent TAVI with SAPIEN/SAPIEN XT bioprosthesis (Edwards Lifescience, USA) between October 2009 and August 2013 in our institute were enrolled into the study. The preoperative demographic data, comorbidities, echocardiographic data and the hemodynamic parameters before and after valve deployment were reviewed retrospectively. Time after the end of RP until systolic arterial pressure (SAP) and mixed venous oxygen saturation (SvO<sub>2</sub>) recover (SAP>90mmHg and SvO<sub>2</sub>>65% simultaneously) was defined as the recovery time (RT).

We classified the population into two groups by 75% quartile of RT in all patients: the early recovery group (ER) and the delayed recovery group (DR), and investigated the predictors of delayed hemodynamic recovery by multivariate logistic regression model.



**Results and discussion:** 44 patients were classified into two groups according to 75% quartile of RT(85.5sec): ER (RT < 85.5 sec, n=33) and DR (RT > 85.5sec, n=11). The DR group had significantly smaller body surface area ( $p < 0.05$ ) and left ventricular diameter ( $p < 0.05$ ), and more complicated with intraventricular outflow obstruction, and lower SvO<sub>2</sub> immediately before RP. The multivariate logistic regression model identified SvO<sub>2</sub> as an independent predictor of the delayed recovery after RP (OR 0.767, CI 0.483- 0.928). During TAVI, maintaining systemic oxygen supply-demand balance during surgery may overcome the preoperative disadvantageous factors.

	Univariate			Multivariate		
	Odds Ratio	95% Confidence Interval	P-Value	Odds Ratio	95% Confidence Interval	P-Value
LV diameter of diastolic	0.826	0.707-0.931	0.001	0.794	0.332-1.812	0.572
LV diameter of systolic	0.808	0.662-0.940	0.003	0.927	0.157-2.056	0.902
Intraventricular Outflow Obstruction	5.524	1.007-34.043	0.049	0.399	0.005-13.741	0.616
Central Venous Pressure	1.338	1.082-1.774	0.005	1.593	0.991-3.957	0.056
Mixed Venous Oxygen Saturation	0.831	0.727-0.916	< 0.001	0.767	0.483-0.928	<b>0.001</b>

[Univariate and Multivariate Analyses]

**Conclusion(s):** In TAVI, low SvO<sub>2</sub> immediately before rapid pacing is associated with the prolonged hemodynamic compromise after valve deployment.

#### 4AP7-3

##### Transcatheter aortic valve implementation (TAVI): short- and long-term outcomes with respect to the type of procedure and the anaesthetic management

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**Background and Goal of Study:** Little is known about long-term outcomes following TAVI. We compared the short- and long-term outcomes between 3 types of TAVI: Transfemoral with general anaesthesia (GA) or Local Anaesthesia/Sedation (LASedation) and Transapical.

**Materials and methods:** 176 patients undergoing TAVI between January 2009 and June 2013 were retrospectively analyzed. Follow-up (FU) was completed in November 2013. Nonparametric tests were applied to compare the 3 groups. Survival was analyzed with Kaplan-Meier method. All data are expressed as median (IQR).

**Results and discussion:** 4 patients in the LAS group were converted to GA (2 subjects were not cooperative and in other 2 vascular complications required surgical repair). 5 subjects in the Transapical group required postoperative dialysis vs no patients in the other groups ( $P < 0.001$ ). The overall median survival rate at the maximum FU (55 months) is estimated at 32% (95% CI: 25%-38%). Survival between groups was not significantly different.

	GA(N=51)	LASedation(N=66)	Transapical(N=59)
Age; Y	86(83-89)	85(82-88)	84(80-88)
EuroSCOREII	5,4(1,9-8,9)	5,1(2,1-8,1)	8,1(4-12,2)*
Creatinine; mg/dL	1.2(0.9-1.6)	1.1(0.8-1.4)	1.3(0.9-1.7)

[Preoperative characteristics]

	GA(N=51)	LASedation(N=66)	Transapical(N=59)
ICU stay; days	1(1-2)	1(1-2)	2(1-3)*
Postoperative hospital stay; days	9(6-12)	7(5-10)*	14(10-18)
Total RBC transfusion; units	2(1-3)	0(0-1)*	2(1-3)
Major cardiac events; N	2*	6	15
Peak troponin concentrations; ng/mL	0.69(0.25-1.13)	0.84(0.3-1.37)	6.8(3.09-10.37)*
Neurologic events including transient ischemic attacks; N	2	2	7
Major vascular complications; N	15*	5	5
Infectious complications; N	11	0*	18
Intrahospital death; N	1	2	9*

[Postoperative data]

\* $P < 0.05$  compared with other groups.

**Conclusion(s):** Although the short-term outcome of Transapical group is worse, their long-term survival is not different compared with Transfemoral TAVI. Our results in line with others' data show the better short-term outcome of LASedation vs GA group. This might be biased by the retrospective nature of the study and the initial learning curve applied on GA group.

#### 4AP7-4

##### Predictors of postoperative delirium after transcatheter aortic valve implementation (TAVI)

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**Background and Goal of Study:** Postoperative cognitive dysfunction and delirium are frequent complications after cardiac surgery. Several risk factors have been identified including age > 65 years. Patients undergoing TAVI are often very old. We therefore sought to determine risk factors predicting postoperative delirium in this population.

**Materials and methods:** 176 patients undergoing TAVI between January 2009 and June 2013 under general anaesthesia (GA) or local anaesthesia/sedation (LAS) were retrospectively analyzed. Backward stepwise logistic regression analysis was used with  $P < 0.05$  to include and  $P > 0.10$  to exclude from the model. Variables included were: age; creatinine; history of neurologic events; EuroSCOREII; history of delirium, confusion or dementia; living alone in the preoperative period; preoperative antidepressant/benzodiazepine use; preoperative Mini Mental State Examination; premedication and use of Sufentanil, Ketamine, Midazolam, Etomidate, Propofol, Sevoflurane and N<sub>2</sub>O as anaesthetic agents.

**Results and discussion:** 26% of patients developed delirium. There was no significant difference ( $P = 0.25$ ) between TAVI under GA (29%) vs LAS (21%). The final predicted model contained 4 variables and was reached in 16 steps. The model was statistically significant but accounted only for 15% of the variance of delirium ( $R^2 = 0.15$ ).

	N=176
Age; Y	85(82-89)
EuroSCOREII	6(2.4-9.6)
History of cerebrovascular accidents and/or transient ischaemic attacks; N	35
Diabetes; N	35
Creatinine; mg/dL	1.2(0.88-1.5)

[Preoperative characteristics]

All data are expressed as median (IQR).

Model	Standardized Beta coefficient	Significance
History of confusion	0.208	0.032
History of delirium	0.221	0.020
Etomidate	0.200	0.040
Propofol	0.174	0.079

[Final predictive model]

**Conclusion(s):** Our results show that a history of confusion or delirium and intraoperative use of Etomidate were independent risk factors of postoperative delirium. However, these data should be interpreted with caution because of low Standardized Beta coefficients in the model. Moreover, no objective tests were used to report delirium. Its incidence could have been undervaluated.

### 4AP7-5

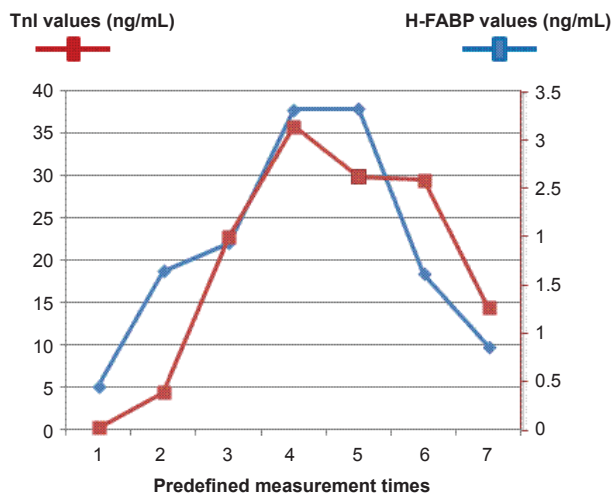
#### Evaluation of postoperative myocardial injury by heart type fatty acid-binding protein in off-pump coronary artery bypass grafting surgery

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**Background and Goal of Study:** Postoperative myocardial infarction is a serious and frequent complication of cardiac surgery. Nonetheless, diagnosis in this context it is occasionally challenging. We sought to evaluate the diagnostic accuracy of the new biomarker "heart-type fatty acid binding protein" (H-FABP) in the early detection of myocardial injury in patients undergoing off-pump coronary artery bypass grafting (op-CABG), compared with classical biomarkers.

**Materials and methods:** We prospectively studied 15 consecutive patients who underwent op-CABG during two months. Blood samples were drawn for measurement of myocardial ischemic injury biomarkers (H-FABP, troponin -TnI-, creatin kinase -CK- and CK-MB) at baseline (T1), immediate post-CABG (T2), on ICU admission (T3) and after 4 (T4), 8 (T5), 24 (T6) and 48 hours (T7).

**Results and discussion:** Earlier biomarkers peak plasma values occurred at T4 with TnI (2.9±5.2 ng/mL) and at T5 with H-FABP (37.9±55.5 ng/mL). Maximum values of CK and CK-MB were later, both in T6 (741±779 and 37±51 U/L, respectively). Optimized cut-off obtained for H-FABP was 19 ng/mL, providing a sensitivity and specificity of 77% and 75% respectively for diagnosis of perioperative ischemic injury, with an area under the ROC curve for H-FABP of 0.83 (0.6-1.0) vs. 0.63 (0.33-0.83) for TnI. This cut-off value for H-FABP is reached on average at T2 (mean value of H-FABP at T2: 18.9 ± 21.5 ng/mL) (Figure 1).



[Plasma values of H-FABP / TnI in predefined times]

**Conclusion(s):** This is the first study evaluating the kinetic of H-FABP biomarker in perioperative op-CABG, and the cut-off value established could help to extend earlier detection of myocardial ischemia in this context.

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### 4AP7-6

#### Impact of acute normovolemic hemodilution and cardiopulmonary bypass on serum-creatinine level during cardiac surgery

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**Background and Goal of Study:** Serum-creatinine level (s-Cr) is an important factor for predicting perioperative patient's outcome regarding acute kidney injury. Although s-Cr can be affected by the essential procedures diluting patient's blood components during cardiac surgery, possible impact of applying acute normovolemic hemodilution (ANH) using hydroxyethyl starch and cardiopulmonary bypass (CPB) on s-Cr has not been well investigated.

**Materials and methods:** In patients undergoing cardiac surgery employing moderate hypothermic CPB (age 20-71 years, n=32), ANH was randomly applied to 15 patients (Group-ANH) and was not in 17 patients (Group-C) before initiating CPB. For ANH procedure consisting of 5 ml/kg of blood salvage and administering 5 ml/kg of balanced hydroxyethyl starch (HES, Volulyte™, Fresenius-Kabi, Germany) for 15 min was started at 30 min after anesthesia induction and before CPB application for surgery. In both groups, moderate hypothermic CPB was initiated by using 1600-1800 ml of bloodless priming solution. The changes of hematocrit (Hct), Na<sup>+</sup>, K<sup>+</sup>, HCO<sub>3</sub><sup>-</sup>, Ca<sup>2+</sup>, osmolality, s-Cr were determined before ANH (T0), after the first ANH of 2.5 ml/kg (T2), and after the second ANH of 2.5 ml/kg (T3), and 30 sec and 60 sec after the initiation of CPB (T4 and T5). S-Cr was determined by using a point-of-care test device (StatSensor™ Creatinine, Nova Biomedical, USA).

**Results and discussion:** S-Cr and Na<sup>+</sup> did not show significant change during the entire study period in both groups. Hct at T3 and T4 and osmolality at T4 were significantly reduced compared to those at T0 in both groups. K<sup>+</sup> at T4 was significantly increased compared to those at T0 in both groups. There was no significant inter-group difference in all parameters. (Table 1).

	Group	T0	T1	T2	T3	T4
s-Cr (mmol/L)	Control	0.8±0.2(0.8)	0.8±0.3(0.8)	0.8±0.3(0.8)	0.7±0.3(0.6)	0.7±0.3(0.7)
	ANH	0.8±0.2(0.8)	0.8±0.2(0.8)	0.8±0.2(0.8)	0.7±0.2(0.7)	0.8±0.2(0.8)
Hct (%)	Control	38.2±4.2(38)	37.6±4.2(37)	37.9±4.6(38)	27.6±8.4(30)*	26.9±6.8(27)*
	ANH	37.1±4.4(3.7)	36.3±3.7(36)	34.9±4.4(35)	24±6.7(23)*	22.8±5.0(22)*
Na <sup>+</sup> (mmol/L)	Control	139±3(140)	140±3(140)	140±4(140)	138±4(139)	138±3(138)
	ANH	138±2(139)	138±3(140)	139±3(140)	136±2(137)	137±2(137)
K <sup>+</sup> (mmol/L)	Control	3.6±0.3(3.5)	3.7±0.3(3.6)	3.8±0.4(3.8)	3.9±0.6(3.9)*	4.1±0.6(3.9)*
	ANH	3.7±0.3(3.7)	3.7±0.2(3.7)	3.8±0.3(3.9)	3.9±0.4(4.0)	4.1±0.3(4.1)*
Ca <sup>2+</sup> (mmol/L)	Control	1.1±0.1(1.2)	1.1±0.1(1.1)	1.1±0.1(1.2)	0.9±0.2(0.9)	0.9±0.1(0.9)
	ANH	1.2±0.1(1.2)	1.1±0.1(1.1)	1.1±0.1(1.1)	0.8±0.2(0.8)	0.8±0.1(0.9)
HCO <sub>3</sub> <sup>-</sup> (mmol/L)	Control	24.8±1.5(25.2)	25.0±1.9(25.5)	25.2±1.6(25.2)	20.4±5.2(22.7)*	20.3±3.1(20.1)*
	ANH	24.5±1.7(24)	24.1±2.1(24.7)	24.4±2.0(24.8)	18.0±2.9(18)*	18.6±2.3(18.9)*
Osmolality (mOsm/kg)	Control	280±7(280)	281±5(283)	281±6(282)	275±8(275)	273±10(275)*
	ANH	277±6(277)	276±7(278)	278±5(279)	274±12.8(272)	272±4(271)*

[Table 1. Changes in s-Cr and Hct]

Data are mean ± SD (median), \*: p<0.05 vs. T0; †: p<0.05 in intergroup comparison

**Conclusion(s):** S-Cr is not affected by the intraoperative application of ANH of 5 ml/kg and CPB which producing significant hemodilution.

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#### 4AP7-7

##### Assessment of cardiopulmonary bypass-induced vascular dysfunction with peripheral NIRS: a pilot study after conventional cardiac surgery

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**Background and Goal of the Study:** While occurring frequently after conventional cardiac surgery, the cardiopulmonary bypass (CPB)-induced vascular dysfunction remains difficult to identify at the bedside. Near-infrared spectroscopy (NIRS) is a continuous and noninvasive technology that measures regional tissue oxygen saturation ( $rSO_2$ ) and could help to assess the microcirculatory response to an ischemic stress [1]. We hypothesized that peripheral NIRS parameters in combination with a vascular occlusion test (VOT) would be reliable to detect and quantify postoperative vascular dysfunction in cardiac surgical patients.

**Material and methods:** Ten resting healthy volunteers and twenty patients undergoing conventional cardiac surgery with CPB were prospectively investigated at the Teaching University Hospital of Caen (France) during a VOT including 4 experimental steps: baseline, ischemia, reperfusion, and return to baseline. For cardiac surgical patients, NIRS parameters during the VOT were assessed the day before surgery (T0), at the arrival in the Intensive Care Unit following surgery (T1), and on postoperative day 1 (T2) and day 2 (T3). NIRS optodes were placed on the upper limb, at the forearm level. Data are expressed as median [extremes].

**Results:** No significant difference was found in baseline  $rSO_2$  values between healthy volunteers and cardiac surgical patients (65% [57-73] vs. 69% [51-81],  $P=0.193$ ). In patients, baseline  $rSO_2$  values were significantly increased at T1 and T2 when compared with T0: 68% [64-72] vs. 78% [75-81] vs. 75% [73-78],  $P < 0.001$  (Figure 1). No significant difference was found in NIRS parameters during the VOT at any postoperative time when compared with T0:  $\Delta rSO_2$  11% [7-14] vs. 8% [4-12] vs. 7% [4-11],  $P=0.309$ ; desaturation rate 0.14%.sec<sup>-1</sup> [0.10-0.17] vs. 0.11%.sec<sup>-1</sup> [0.08-0.14] vs. 0.15%.sec<sup>-1</sup> [0.08-0.22],  $P=0.233$ ; and resaturation rate 0.79%.sec<sup>-1</sup> [0.61-0.97] vs. 0.76%.sec<sup>-1</sup> [0.41-1.11] vs. 0.77%.sec<sup>-1</sup> [0.53-1.07],  $P=0.453$ . The use of postoperative norepinephrine did not change NIRS parameters.

**Conclusions:** Peripheral NIRS in combination with a VOT showed changes in postoperative baseline  $rSO_2$  values but failed to detect CPB-induced vascular dysfunction.

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#### 4AP7-8

##### Impact of adrenaline and levosimendan guided by the left ventricle myocardial performance index measure on outcome of patients undergoing on-pump coronary artery bypass: a randomized controlled clinical trial

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**Background and Goal of Study:** The myocardial performance index (MPI) or the TEI index can guide the use of inotropic drugs and volemic repositioning during the removal of CPB. The objective was to compare the impact of adrenaline and levosimendan guided by the left ventricle myocardial performance index (LVMPI) measure on outcome of patients undergoing on-pump coronary artery bypass (CABG).

**Materials and methods:** 81 patients were randomly divided into 2 groups: Epinephrine Group (EG) and Levosimendan Group (LG). General anaesthesia with etomidate, cisatracurium, fentanyl, and sevoflurane, and tracheal intubation was performed. A 8MHz multiplane transesophageal echocardiogram probe was introduced and the echocardiographic study began. The LVMPI was performed evaluated 30 minutes after tracheal intubation (T0) and 10 minutes after the end of protamine infusion (T1). All drugs were prepared in 0.9% saline solution with a final volume of 100 ml (epinephrine 0.06 mcg.kg<sup>-1</sup>.min<sup>-1</sup> or levosimendan 0.2 mcg.kg<sup>-1</sup>.min<sup>-1</sup>). The data were analyzed by Student's test or the inter-group proportion test ( $p < 0.05$  was considered significant).

The outcomes studied are shown in table 1.

**Results and discussion:** After exclusions, 73 patients (37 in the EG and 36 in the LG) were analyzed. The LVMPI in the EG at T1 ( $0.26 \pm 0.1$ ) was significantly lower than that of the LG ( $0.39 \pm 0.1$ ) ( $p=0.0013$ ). There were no differences between the groups in terms of postoperative complications and mortality within 30 days, except the need for norepinephrine ( $p=0.005$ ), time use of drugs in ICU ( $p=0.03$ ) and use of recovery drugs ( $p=0.001$ ) (Table 1).

	Epinephrine group	Levosimendan group	p
Venous hydration with crystalloids (ml)	2278 ± 367.3	2292 ± 420	0.93
Blood package n(%)	6 (16)	5 (14)	1.0
Perioperative acute myocardial infarction n (%)	7 (18)	4 (11)	0.51
Acute perioperative renal injury n(%)	3 (8)	4 (11)	0.71
Perioperative atrial fibrillation n(%)	3 (8)	9(25)	0.06
Tracheal extubation time in the intensive care unir (hours)	12.6 ± 20.7	8.8 ± 7.2	0.34
Recovery drug (milrinone) n (%)	2 (5)	6 (16)	0.001*
TICU = time stayed at the intensive care unir (days)	3.5 ± 2.1	3.8 ± 3.3	0.43
Time on drugs in the ICU (hours)	6.9 ± 9.1	3.8 ± 3.3	0.03*

[Clinical outcomes ( $p < 0.05$ )\*]

**Conclusion(s):** The necessity to use of rescue medication was higher in the levosimendan group and duration of use of inotropic agent was higher in the epinephrine group.

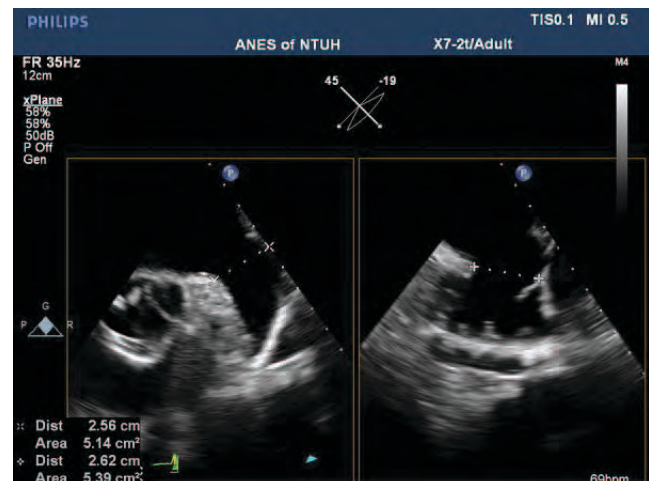
#### 4AP7-9

##### Real-time 3D transesophageal echocardiography assisted the percutaneous transcatheter left atrial appendage closure

Cheng H.-L., Chou W.-H., Wang Y.-C., Huang C.-H.  
National Taiwan University Hospital, Dept of Anaesthesiology, Taipei, Taiwan, Republic of China

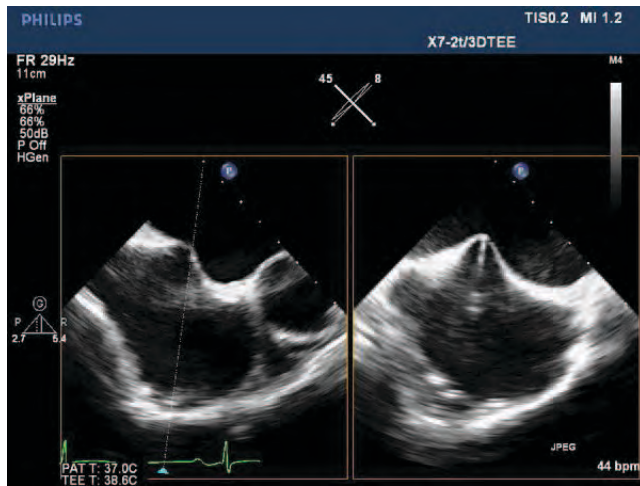
**Background and Goal of Study:** Percutaneous transcatheter left atrial appendage (LAA) closure is a new technique to prevent stroke in patients with atrial fibrillation. This study is to evaluate the incremental value of real-time 3D transesophageal echocardiography (RT-3D TEE) in the implantation of the new device.

**Materials and methods:** We reviewed the medical records and TEE images of all patients underwent LAA closure in 2013. The device used was Amplatzer™ Cardiac Plug (ACP) and the RT-3D TEE was Philips IE33 system with X7-2t Live 3D probe (2-7 MHz). The stored images were analyzed offline with Philips QLAB 9 software. All patients signed informed consent for LAA closure, general anesthesia, and TEE. The research ethics committee waived further consent of our review and analysis.

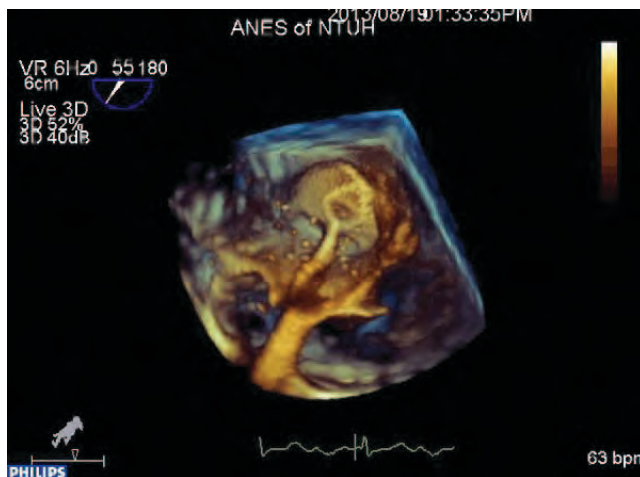


[Figure 1]





[Figure 2]



[Figure 3]

**Results and discussion:** Eight patients received successful LAA closure. RT-3D TEE helped the measurement of LAA size, the evaluation of LAA shape, the selection of intra-atrial septum (IAS) puncture site, and the assurance of occluder implantation. The most valuable ability of RT-3D TEE over other image modalities is it could select IAS puncture site fast, precisely, and conveniently. In this study we preferred to puncture IAS more posteriorly and inferiorly, instead of the center of IAS. All patients had no or trivial flow into LAA after the occluder implantation. One patient had significant pericardial effusion thus pigtail drainage and transfusion were required, after LAA closure he was hemodynamically stable and discharged without permanent complications or any significant discomfort.

**Conclusion:** RT-3D TEE is a helpful guidance tool and monitor in percutaneous transcatheter LAA closure with great convenience and safety, especially in the selection of IAS puncture site.

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## 4AP7-10

### Troponin T and brain natriuretic peptide after on-pump cardiac surgery: impact on 12-month mortality and major cardiac events after adjustment for postoperative complications

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**Background and Goal of Study:** The independent predictive value of troponin T (TNT) after on-pump cardiac surgery was established in several studies. However, adjustment was limited to preoperative risk factors without considering perioperative complications. Data on the prognostic value of postoperative B-type natriuretic peptide (BNP) after onpump cardiac surgery are scarce. Our aim was to assess independent value of TNT and BNP to predict 12-month outcome after cardiac surgery after adjustment considering preoperative risk estimates and postoperative complications and to report risk stratification gains when considering the EuroSCORE combined with postoperative biomarkers.

**Materials and methods:** This prospective cohort study included consecutive patients undergoing on-pump cardiac surgery between 2007 and 2010 in a single tertiary centre. We evaluated postoperative peak TNT and BNP, the EuroSCORE, and postoperative complications, i.e. sepsis, sternal infection (without sepsis), respiratory infections, acute kidney injury as predictors of adverse events using Cox regression. The primary endpoint was death or major adverse cardiac events (MACE) within 1 year after surgery. We calculated the net reclassification index (NRI) of TNT and BNP in addition to the EuroSCORE.

**Results and discussion:** We enrolled 1559 patients. Follow-up was completed in 1545 patients (99.1%); the remaining 14 patients were censored at last contact date. Within the first year after surgery, 176 patients (11.3%) suffered an event. Eighty-three events (5.3%) occurred within 30 days of surgery, of which there were 58 deaths (3.7%). The adjusted hazard ratio (HR) of peak TNT >0.8 µg/L was 2.13 (95% CI, 1.47-3.15), of peak BNP >790 ng/L 2.44 (95% CI, 1.65-3.62). The NRI of the addition of TNT and BNP to the EuroSCORE was 0.276 (95% CI, 0.195-0.348). A model fitted to predict 30-day events showed similar results.

**Conclusion(s):** Postoperative TNT and BNP are strong predictors of 1-year events after on-pump cardiac surgery independent of preoperative risk factors and postoperative complications. Updating the preoperative EuroSCORE risk with postoperative TNT and BNP after surgery allows for improved prediction of 1-year death or MACE

## 4AP7-11

### Cardioprotective effect of sevoflurane vs. propofol during anaesthesia and postoperative period in off-pump coronary artery bypass graft surgery

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**Background and Goal of Study:** Experimental and clinical studies have shown that sevoflurane (SEV) protect against myocardial ischemia and reperfusion injury compared with propofol (PRO) in cardiovascular surgery. N-terminal pro-brain natriuretic peptide (NT-proBNP) is a myocardial damage biomarker. We evaluated the perioperative cardio protective effect of sevoflurane vs. propofol using the NT-proBNP quantification in patients undergoing off-pump coronary artery bypass graft surgery.

**Materials and methods:** A prospective, longitudinal, double-blind, randomised and controlled clinical trial was done in ASA class II-IV patients undergoing elective off-pump coronary artery bypass graft (CAGB) surgery and general anaesthesia. Exclusion criteria were Euroscore scale value >7, combined surgery, hemodynamic instability, heart failure and need for vasoactive drugs before surgery. Patients were randomized to receive anaesthesia and sedation during intensive care unit (ICU) hospitalization in three groups: SEV intraoperative+postoperative (SEV), SEV intraoperative+PRO postoperative (SP), or PRO intraoperative+postoperative (PRO). Clinical and surgical parameters, cardiopulmonary function were checked perioperatively and during the ICU hospitalization follow-up. Cardiac troponin I and NT-proBNP (by electroluminescence immunoassay) and inotropic drugs use were determined

preanesthesia induction and 12 h, 24 h and 48 h after surgery.

**Results and discussion:** 60 Patients, 48.3% male, aged 61-74 years old, were enrolled and randomized into the three groups (n=20/group). The groups were comparable at the initial evaluation. At 24 h of following the troponin 1 ranking order was: i): SEV  $0.5 \pm 0.4$  ng/mL\* < < SP  $1.61 \pm 1.30$  ng/mL < PRO  $2.27 \pm 1.5$  ng/mL (p < 0.05). At 24 h of following the NT-proBNP ranking order was: SEV  $501 \pm 280$  pg/mL\* < < SP  $1270 \pm 498$  pg/mL =PRO  $1775 \pm 527$  pg/mL (p < 0.05). The patients (in percentage) under at least one inotropic drug

treatment were: i) At 24 h SEV 10%\* =SP 19% < < PRO 51%; and ii) At 48 h: SEV 5%\* < < SP 34% < PRO 47% (p < 0.05). Lower postoperative troponin 1 and NT-proBNP release plus lesser inotropic drug requirements associated to SEV as unic or combined treatment with respect to PRO demonstrated the higher cardioprotective effect of sevoflurane anaesthesia.

**Conclusion:** Sevoflurane exert higher cardioprotective effect than propofol in patients undergoing off-pump coronary artery bypass graft, in the operating room and the intensive care unit.

## Respiration

### 5AP1-1

#### Effects of peritoneal oxygenation and hemodynamics during intro-peritoneal jet ventilation at different frequencies in pigs

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**Background and Goal of Study:** The technique of peritoneal oxygenation has been investigated to be as a supplement oxygen delivery of non-pulmonary pathway for these patients with pulmonary insufficiency. This study was to assess the effects of peritoneal oxygenation and hemodynamic responses to intro-peritoneal jet ventilation at different frequencies in pigs.

**Materials and methods:** Thirty-six pigs were divided into six groups (n=6): Group C, Group F<sub>20</sub>, Group F<sub>40</sub>, Group F<sub>80</sub>, Group F<sub>120</sub> and Group F<sub>160</sub>. Ten minutes after all pigs who received general anesthesia and surgical procedure had a stable hemodynamics, then all pigs were ventilated with 100 % oxygen at a rate of 5 L/min for 5 minutes to remove the nitrogen in the pulmonary completely as far as possible. Two tubes were places in the abdominal cavity for the inflow and outflow of intra-peritoneal jet ventilation (IRJV), we recorded the start of peritoneal ventilation as T<sub>0</sub>. Pigs in Group C were not treated while other groups were ventilated with 100 % oxygen at the rate of 20, 40, 80, 120 and 160 times per minute. Arterial blood gas values were monitored every 30 seconds until the oxygen saturation (SaO<sub>2</sub>) descended to less than 90 %. The duration of safe apnea (DSA, time recorded from T<sub>0</sub> to the time when PaO<sub>2</sub> decreased to less than 60 mmHg initially). Throughout the experiment, BP, CVP, HR and intro-abdominal pressure (IAP) were all recorded.

**Results and discussion:** The DSA increases gradually with the increasement of the frequency of IRJV. Compared with Group C, DSA in Group F<sub>40</sub>, Group F<sub>80</sub>, Group F<sub>120</sub> and Group F<sub>160</sub> were much longer (P < 0.05). The DSA in Group F<sub>80</sub>, Group F<sub>120</sub> and Group F<sub>160</sub> were longer than that in Group F<sub>20</sub> (P < 0.05). DSA in the Group F<sub>80</sub> and Group F<sub>120</sub> were the longest (P < 0.05), and there was not significant difference between the two groups. Our results showed that IRJV with the frequency between 80 and 120 times per minute can provide favourable peritoneal oxygenation and prolong DSA in pigs.

**Conclusion(s):** The IRJV with the frequency between 80 and 120 times per minute can provide favourable peritoneal oxygenation and prolong DSA in pigs.

#### References:

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### 5AP1-2

#### Gene expression profiles in healthy and lung injured rats ventilated with conventional or variable volume controlled ventilation

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**Background and Goal of Study:** Variable ventilation may induce different gene expression profiles in the lungs. This study aimed at investigating the effects of conventional and variable volume controlled ventilation on the gene expression profile of healthy as well as rats with acute and chronic lung injury.

**Materials and methods:** Healthy animals were ventilated for 4h with non-variable or variable tidal volumes (healthy; n=8 each). Acute effects were investigated after intratracheal instillation of hydrochloric acid and 4h of me-

chanical ventilation with non-variable or variable tidal volumes (acute injury; n=8 each). Chronic effects were assessed 14d after acid instillation following 4h of mechanical ventilation with both strategies (chronic injury; n=8 each). Non-ventilated healthy and chronically injured rats served as controls (n=8 each). Mean tidal volume was 6 ml/kg, PEEP was 5 cmH<sub>2</sub>O and FiO<sub>2</sub> was 0.35. The coefficient of variation of tidal volume during variable ventilation was 30% (normal distribution). Gas exchange, hemodynamics and respiratory mechanics were assessed. Post-mortem, histological analysis as well as transcriptomwide RNA sequencing were performed. Major biological pathways were described by Ingenuity Pathway Analysis.

**Results and discussion:** Variable ventilation was associated with improved gas exchange and respiratory mechanics, as well as attenuated inflammatory response, in healthy, as well as acute and chronic lung injury. Comparing conventional and variable ventilation in healthy, acutely injured and animals with chronic lung injury we found 871, 2061 and 140 differentially expressed genes, respectively. 498 genes were differentially expressed in both healthy and acutely injured animals, when comparing conventional and variable ventilation. 25 genes, including cell adhesion, prostaglandin signaling or cell cycle regulation genes, were differentially expressed between conventional and variable ventilation regardless of lung injury, suggesting they play a key role in mediating the effects of variable ventilation on the molecular level.

**Conclusion(s):** Using next generation RNA sequencing, we could identify distinct gene regulation patterns associated with the application of variable tidal volumes during mechanical ventilation in healthy and lung injured rats.

### 5AP1-3

#### Matching tidal volume to stress index in an open lung condition optimizes ventilation and prevents VILI in an experimental model of lung injury and intra-abdominal hypertension

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**Background and Goal of Study:** During lung protective ventilation, plateau pressure (P<sub>plat</sub>) ≤ 30cmH<sub>2</sub>O should be used to minimize alveolar distension but alveolar distension depends on transpulmonary pressure (P<sub>t</sub>). Consequently, the same P<sub>plat</sub> with higher pleural pressures may result in a lower P<sub>t</sub>. Stress index (SI) indicates tidal overdistension. Ventilatory parameters adjusted to SI decreases lung inflammation. Goal: to show that individualizing tidal volumen (VT) to SI in an open lung condition in lung injury with low chest wall compliance (C<sub>cw</sub>) avoids hypoventilation while prevents lung damage despite a P<sub>plat</sub> > 30.

**Materials and methods:** Experimental model was done in 16 pigs. In control group (C): VT was adjusted to P<sub>plat</sub> = 30cmH<sub>2</sub>O and in the study group (S) to 0.9 < SI > 1.1. Measures of SI, P<sub>plat</sub>, P<sub>t</sub>, compliance, arterial gases and cardiac index were taken. Bronchoalveolar and plasma cytokines were measured at baseline and at the end. The histopathology of the lung tissue was analysed. The Kolmogorov-Smirnov and Levene's tests were performed to determine normality and homogeneity. When the homogeneity was rejected, the Mann Whitney U test was performed. For multiple comparisons, the Bonferroni correction was used. Data are presented as the mean (standard deviation, SD) if normally distributed.

**Results and discussion:** PaCO<sub>2</sub> was significantly higher in the C group, resulting a lower pH (7.19 vs 7.34). Significant differences were found for RR and P<sub>plat</sub>. No differences were found for SI, PaO<sub>2</sub>/FiO<sub>2</sub>, end inspiratory P<sub>t</sub>, ELWI values, pro-inflammatory cytokine and histopathology analysis.

Despite the P<sub>plat</sub> was higher in the S group, the T<sub>i</sub> biological and histological markers of lung injury and edema were similar between groups. SI appears to be a useful alternative for optimizing VT during lung protective ventilation.

**Conclusions:** Setting VT to a targeted SI in an open lung condition improves alveolar ventilation without increasing lung injury in a model of lung injury with low C<sub>ow</sub>.

	Control group	Study group	p-value
PaCO <sub>2</sub> (mmHg)	82 (19)	53 (7)	0,01
VT(ml kg <sup>-1</sup> )	5,4 (0,8)	7,3 (0,7)	0,002
Pplat(cmH <sub>2</sub> O)	30 (1)	35 (2)	0,001
SI	1,03 (0,12)	0,99 (0,07)	0,42
PO <sub>2</sub> /FIO <sub>2</sub>	220 (82)	230 (78)	0,73
PL EI (cmH <sub>2</sub> O)	17 (1)	18 (3)	0,42
ELWI(ml kg <sup>-1</sup> )	15 (4)	18 (4)	0,27
TNFalpha (pg-1 ml)	1070(1024-2644)	972(574-2820)	0,42
IL-8 (pg-1 ml)	3516(1157-3708)	624(509-2554)	0,09

[Results Table]

## 5AP1-4

### Respiratory heat loss as a potential monitor of ventilation-perfusion matching

Fleming N.<sup>1</sup>, Rose D.<sup>1</sup>, Brodtkin I.<sup>2</sup>

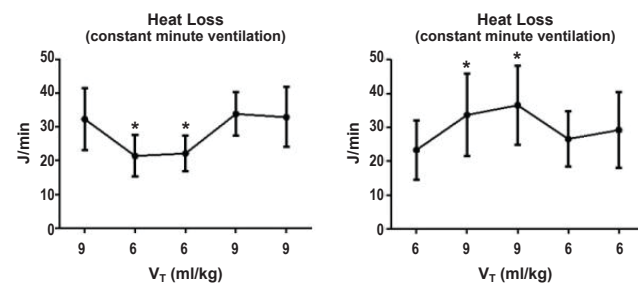
<sup>1</sup>University of California, Davis, Dept of Anaesthesiology & Pain Medicine, Sacramento, United States, <sup>2</sup>University of British Columbia, Dept of Anaesthesiology, Vancouver, Canada

**Background and Goal:** Optimizing ventilation-perfusion matching (V/Q) benefits patients in acute and critical care settings, but clinical assessment of V/Q remains indirect. The primary source of heat in exhaled gases (exhalation enthalpy) is alveoli that are perfused with blood at body temperature. Dynamic changes in exhalation enthalpy have been used to characterize cardiac function, but its clinical utility as a monitor of V/Q has not been explored. Exhalation enthalpy can now be measured easily using the VQm™ monitor.

**Materials and methods:** This was a prospective, non-blinded, non-randomized, study evaluating the effect of changes in alveolar minute ventilation on respiratory heat loss (enthalpy). Adult patients without cardio-vascular or respiratory disease having elective surgery were studied.

Following induction of anesthesia and endotracheal intubation, airway heat loss was measured continuously. Baseline ventilation was established at 9 ml/kg IBW. After stabilization of the heat content measurements, tidal volume (V<sub>T</sub>) was decreased to 6ml/kg with the rate increased to maintain constant minute ventilation. Heat content measurements were taken 5 and 15 min after this change. V<sub>T</sub> was then returned to 9 ml/kg. In a second group, baseline ventilation was established at 6ml/kg, changed to 9ml/kg and then back to 6 ml/kg.

**Results and discussion:** Following human subjects research committee approval, written informed consent was obtained from 20 patients. Age 43 ± 12.5; IBW 63±11.8 kg. (mean ± SD) Values for analysis were the average during the preceding 3 minutes. The baseline respiratory heat loss (9 ml/kg) of 32±9.1 J/min decreased to 21±6.2 with a V<sub>T</sub> of 6 ml/kg and returned to 34±6.4 with the return in V<sub>T</sub>. Conversely, the baseline respiratory heat loss (6 ml/kg) of 23±8.9 J/min, increased to 34±12.1 with a V<sub>T</sub> of 9 ml/kg and returned to 27±8.2 with the return in V<sub>T</sub>.



[Fig 1]

**Conclusions:** The observed changes support the hypothesis that changes in respiratory heat measurements reflect changes in V/Q matching.

**Acknowledgements:** Materials used for this study were provided by Rostrum Medical Innovations, Vancouver, BC, CA

## 5AP1-5

### Antibacterial activity of TiO<sub>2</sub> nanoparticle coated endotracheal tubes: an in vitro study on *Pseudomonas aeruginosa* and *Staphylococcus aureus*

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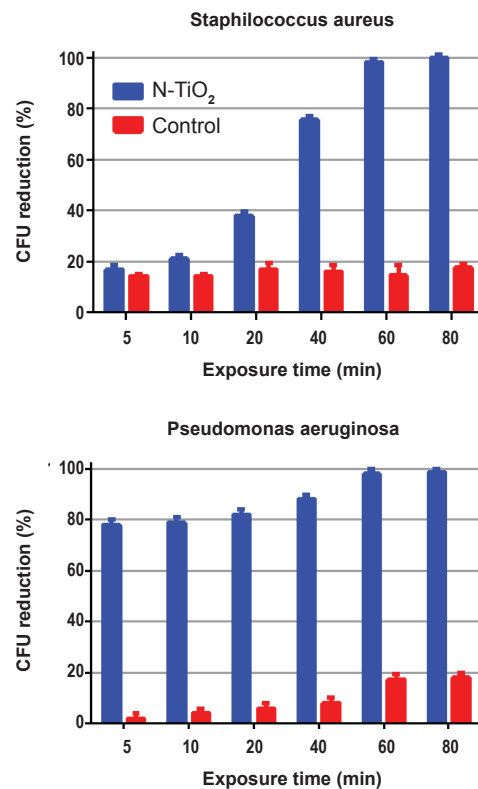
<sup>1</sup>University of Genova, Department of Surgical Sciences and Integrated Diagnostics, Genova, Italy, <sup>2</sup>University of Genova, Department of Chemistry and Industrial Chemistry, Genova, Italy

**Background and Goal of Study:** Non-pharmacological strategies to improve the control of bacterial infections in intensive care units are warranted. The aim of this study was to assess the photocatalytic inactivation of wild-type strains of *Pseudomonas aeruginosa* and *Staphylococcus aureus* under conventional neon light irradiation of nitrogen-doped TiO<sub>2</sub> (N-TiO<sub>2</sub>) nanoparticles deposited inside commercially available endotracheal tubes.

**Materials and methods:** N-TiO<sub>2</sub> nanoparticles, synthesized using the sol-gel method as previously described<sup>1,2</sup>, were deposited inside silicon endotracheal tubes, adsorbed on a cellulose acetate filter (pore size 0.45 μm). Tubes were inoculated with 120±20 colony-forming units (CFUs) of tested bacteria and placed under common neon light.

Six different exposure times were investigated ranging from 5 to 80 min. The photocatalytic bacterial inactivation was estimated quantifying CFUs reduction after irradiation, and data analyzed by two-way ANOVA with Sidak post-hoc test.

Results are illustrated for both bacterial strains in Figure 1.



[Figure 1]

**Results and discussion:** N-TiO<sub>2</sub> demonstrated a bactericidal activity against *P. aeruginosa* higher than 77% after only 5 min exposure. In the case of *S. aureus* similar results were achieved after 40 min of light exposure. For exposure times ≥80 min the inactivation of bacteria was nearly 100% (99.31±0.41) in all conditions. Comparisons with control were all significant (p < 0.001) except for *S. aureus* at 5 min exposure time (p=0.11).

**Conclusion(s):** Photocatalysis with N-TiO<sub>2</sub> under fluorescent lamp may be a practical method for surface colonization prevention for *P. aeruginosa* e *S. aureus* with potential applications in medical devices, such as parts of the respiratory circuit.

#### References:

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## 5AP1-6

### ENPP2 induced lysophosphatidic acid generation by pulmonary NKT cells exacerbates hyperoxic lung injury

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**Introduction:** Inhaled oxygen in high concentrations is still broadly used in clinical practice in order to assure organ oxygenation in critically ill patients albeit the toxic effects of high concentrations of inhaled oxygen are well known. We have recently shown that pulmonary NKT cell activation is a key component of severe lung injury and death in a murine model of hyperoxia<sup>1</sup>. In this present study we hypothesize that pro-proliferatory lysophosphatidic acid (LPA) mediates NKT cell activation NKT cell induced hyperoxic lung injury in a mouse model of hyperoxic lung injury. The ethics committee for animal experimentation of BIDMC, Boston MA, USA approved the study.

**Methods:** *In vitro* experiments were conducted using wild type pulmonary NKT cells that were exposed to hyperoxia for 72 hours and the induction of ecto-enzymes was examined using RT-PCR. Wild type animals were exposed to 100% oxygen for 72 hours and lungs were harvested for histochemistry and FACS analysis. Pulmonary NKT cells were then cultured again in a hyperoxic environment and production of lysophosphatidic acid (LPA) was measured via TLC analysis *in vitro*. We then validated the method by measuring LPA levels in sera of oxygen exposed wild type animals. Pulmonary NKT cells were then incubated with the LPA antagonist Brp-LPA during oxygen exposure. *In vivo* wild type mice received Brp-LPA prior to oxygen exposure.

**Results:** Autotaxin (ATX, ENPP2) was significantly upregulated on pulmonary NKT cells after hyperoxia *in vitro*. In addition LPA levels were significantly increased in supernatants of hyperoxia exposed pulmonary NKT cells. Pro-proliferatory LPA levels could be significantly reduced by incubating NKT cells with LPA-BrP during oxygen exposure *in vitro*. *In vivo* experiments confirmed the *in vitro* data: Hyperoxia exposed wild type animals showed significantly increased serum levels of LPA as well as increased pulmonary NKT cell numbers. BrP-LPA injection significantly improved survival as well as significantly decreased lung injury and lowered pulmonary NKT cell numbers.

**Conclusion:** We conclude that NKT cell induced hyperoxic lung injury is mediated by pro-inflammatory LPA generation, at least in part, secondary to ENPP2 upregulation on pulmonary NKT cells. BrP-LPA a potent LPA antagonist prevents LPA induced injury and could present a treatment option of hyperoxic injury in the future.

#### References:

1. Nowak-Machen et. al AJRMB 2013

## 5AP1-7

### Repercussion in extravascular lung water (EVLW) of alveolar recruitment maneuvers, in an experimental model of ARDS

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**Background and Goal of Study:** To demonstrate the Extravascular lung water (EVLW) changes in the different conducted maneuvers of alveolar recruitment, in 17 Landrace pigs with ARDS, caused experimentally.

**Materials and methods:** Study was carried out in 17 Landrace pigs with ARDS evoked through multiple broncho-alveolar lavages with saline serum. Three groups of Study were established, according to the maneuvers of alveolar recruitment (AR) made after the development of the ARDS:

**A Group** (total AR), realizing maneuvers of recruitment to obtain PaO<sub>2</sub>>60 = 90% of the basal value with various maneuvers of rapid AR and one maneuver of sustained insufflation.

**B Group:** simple maneuver of rapid AR without objective of oxygenation.

**C Group:** Control group. The EVLW Study was calculated at basal time and at 15, 60, 180 and 360 minutes after the provocation of ARDS. The PiCCO monitor was used to determine the hemodynamic parameters and calculate EVLW. The Statistical analysis was made using Anova Study, t-Student, X<sup>2</sup>, and exact test of Fisher.

**Results and discussion:** Overall in the three groups of this study, extravascular lung water (EVLW) increased significantly between baseline and ARDS. Subsequently the trend in the three groups was to decrease EVLW with Al-

veolar recruitment maneuvers (ARM). The mean values of EVLW, in our study varied in the different groups,

Group A:

(Total AR) between: EVLW: 256 ml at baseline, EVLW: 409.6 ml in ARDS, EVLW: 338.6 ml at 360 minutes.

Group B:

between EVLW: 270.4 ml at baseline, EVLW: 466 ml EVLW in ARDS and 345 ml at 360 minutes.

Group C:

between EVLW: 203.8 ml at baseline; EVLW: 383 ml EVLW in ARDS and 247 ml at 360 minutes.

These values coincided with the exposed by different investigators.

**Conclusion(s):** The association of Pulmonary Protection with maneuvers of Total (A Group) or Simple alveolar Recruitment (B Group) and a value of PEEP inferior to the LIP is an effective method to improve oxygenation and decrease EVLW in experimental ARDS. There are numerous publications in ARDS using PEEP and Alveolar Recruitment for decrease EVLW.

#### References:

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## 5AP2-1

### Influence of different modes of mechanical ventilation on the development of acute lung injury in patients with severe combined traumatic brain injury

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**Background:** Numerous experimental studies have shown that inadequate ventilation selected parameters lead to the development of ventilator- inducing lung injury. Goal of Study: to study the influence of different ventilation modes on the development of acute lung injury in the acute period of severe associated injuries.

**Materials and methods:** Results of randomized, prospective, comparative study of 412 patients in the department of neurosurgery intensive care department conducted for 4 year period. The criteria of selection were patients with severe traumatic brain injury, multiple trauma and without severe concomitant chest trauma who received mechanical ventilation for more than 48 hours. Age of the patients was 18 to 80 years (33.6 ± 10.1), female - 66 (16 %) men - 346 (84 %). Patients on admission were 18.3 ± 3.4 points on the APACHE II. Patients were divided into two groups: I - «traditional» ventilator mode to specify the CMV with 10-12 ml/kg BMI and PEEP 5 cm H<sub>2</sub>O. II - «the protective» ventilation mode with CMV to 6ml/kg /BMI and PEEP 10 cm H<sub>2</sub>O. In both groups, in a controlled manner to a given set we calculated per kg BMI. During assisted ventilation (SIMV + PS/CPAP + PS) pressure support (PS) was adjusted so as to achieve a given to (I - 14 PS group 18 cm H<sub>2</sub>O, II group PS - 6 10 cm H<sub>2</sub>O). PEEP in both groups at 35 - 40 cm H<sub>2</sub>O, PaO<sub>2</sub> more 60 mmHg, SaO<sub>2</sub> more than 92 %. We avoided Inverted ratio of inspiration time to expiration in order to avoid auto- PEEP

**Results and discussion:** In patients of group I have developed acute lung injuries in 2 times more often. In addition, during the period from 2 to 5 days in 54 patients developed ARDS, which was not noted in group II. The comparing the severity of acute lung injury scale LIS patients with «traditional» ventilator average have shown no more than 2.5 points, and in group II did not exceed 0.5 points. Ventilator-associated pneumonia (VAP) occurs on day 3 and on day 5 the incidence of VAP in group I reached 74 %, and in group II 23%. Severe course of VAP have reported after ten days in I group only. Duration of respiratory support in group I was 18.5 ± 5.2 days, and in group II 11.8 ± 3.1 days.

**Conclusion(s):** «The protective» ventilation in patients with severe concomitant injury pursued small volumes and high PEEP, rarely leads to acute lung injury, and reduces the number cases of pneumonia.

## 5AP2-2

### Incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery

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**Background and Goal of Study:** This is an update of a Cochrane Review first published in *The Cochrane Library*, Issue 3, 2008. Upper abdominal surgical procedures are associated with a high risk of postoperative pulmonary complications. The risk and severity of postoperative pulmonary complications can be reduced by the judicious use of therapeutic manoeuvres that increase lung volume.

Our objective was to assess the effect of incentive spirometry (IS) compared to no therapy, or physiotherapy including coughing and deep breathing exercises (DBE), on all-cause postoperative pulmonary complications and mortality in adult patients admitted for upper abdominal surgery.

**Materials and methods:** We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2013, Issue 8), MEDLINE, EMBASE, and LILACS (from inception to August 2013). There were no language restrictions. We included randomized controlled trials (RCTs) of IS in adult patients admitted for any type of upper abdominal surgery, including patients undergoing laparoscopic procedures. Two authors independently assessed trial quality and extracted data.

**Results and discussion:** We included 12 studies with a total of 1834 participants in this updated review. The methodological quality of the included studies was difficult to assess as it was poorly reported. Four trials (152 patients) compared the effects of IS with no respiratory treatment.

We found no statistically significant difference between the IS group and those who had no respiratory treatment for clinical complications (RR 0.59, 95% CI 0.30 to 1.18).

Two trials (194 patients) compared IS with DBE. There were no differences between the participants receiving IS compared to those receiving DBE in the meta-analysis for respiratory failure (RR 0.67, 95% CI 0.04 to 10.50). Two trials (946 patients) compared IS with other chest physiotherapy.

We found no differences between the IS group compared to those receiving physiotherapy in the risk of developing a pulmonary condition. There was no evidence that IS is effective in the prevention of pulmonary complications.

**Conclusion:** There is low quality evidence regarding the effectiveness of IS for prevention of postoperative pulmonary complications in patients after upper abdominal surgery. This review underlines the urgent need to conduct well-designed trials in this field.

## 5AP2-3

### Effects of non invasive ventilation for hypoxemic thoracic trauma patients

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**Background and Goal of Study:** Determine whether non invasive ventilation (NIV) reduces intubation in thoracic trauma with hypoxemia related to pulmonary contusion.

**Materials and methods:** This prospective randomized study concerned all patients, victims of trauma of the chest, admitted in a intensive care unit (ICU) over a period of 1 year. Patients with pulmonary contusion and hypoxemia ( $\text{PaO}_2/\text{FiO}_2 < 200\text{mmHg}$ ), were included in the study. All patients received Thoracic epidural analgesia with Bupivacaine and Fentanyl. Patients were allocated randomly to remain on high-flow oxygen mask (control group, n=12) or to receive NIV (NIV group, n=13) using pressure support ventilation with positive end expiratory pressure (PEEP) by face mask.

**Results and discussion:** Demographic characteristics of two groups were comparable on admission. Compared with controls, NIV patients needed intubation less frequently than control group. Lengths of ICU and hospital stay were shorter in NIV patients, but no differences were observed in mortality rate or pneumonia (Table).

	NIV Group (n=13)	Control Group (n=12)	P
PaO <sub>2</sub> /FiO <sub>2</sub> at 24h	196,46±29,7	170,0±28,2	0,03*
PaO <sub>2</sub> /FiO <sub>2</sub> at 72h	255,61±42,2	206,08±50,1	0,0126*
intubation	1(7,69%)	5(41,6%)	0,04*
pneumonia	2(15,3%)	6(50%)	0,063
mortality	1(7,63%)	3(25%)	0,23
ICU Stay (days)	9,3±3	16,3±5,1	0,0004*
Hospital stay (days)	11,4±2,9	19,3±5,1	0,0001*

[Comparative datas between NIV and control groups]

**Conclusion(s):** NIV reduced need of intubation compared with oxygen therapy in thoracic trauma with pulmonary contusion and hypoxemia.

## 5AP2-4

### Postoperative atelectasis prevention by application of PEEP and pressure support ventilation

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**Background and Goal of Study:** General anaesthesia is known to promote atelectasis formation which will persist in the postoperative period<sup>1</sup>. A vital capacity manoeuvre (VCM) performed a few minutes before extubation followed by the use of 40% O<sub>2</sub> will prevent atelectasis formation. This is not the case if VCM is followed by application of 100% O<sub>2</sub><sup>2</sup>. However the use of 100% O<sub>2</sub> before tracheal extubation is still recommended for safety reason. Application of PEEP associated with pressure controlled ventilation before intubation prevents atelectasis formation despite the use of 100% O<sub>2</sub><sup>3</sup>.

The goal of our study is to show that performing a VCM 15 minutes before arousal followed by application of PEEP and pressure support ventilation (PSV) before and after tracheal extubation will prevent the recurrence of atelectasis despite the use of 100% O<sub>2</sub>.

**Materials and methods:** After ethical approval, we randomly assigned 16 non-obese patients scheduled for a gynaecological laparoscopic surgery in two groups. At the end of surgery we performed a VCM (40 cmH<sub>2</sub>O applied for 12 seconds; procedure of Aisys®), then O<sub>2</sub> was increased to 100% in both groups. In the study group, a PEEP of 6 cmH<sub>2</sub>O was applied associated with a PSV of 8 cmH<sub>2</sub>O. This was continued after extubation for 3 minutes. The O<sub>2</sub> was then decreased to 40% and when the expired oxygen saturation was < 50%, PEEP and PSV were removed.

For the control group, no positive pressure was applied during spontaneous ventilation (PEEP=0 and no PSV). The atelectasis were then measured by computed tomographic scanning.

**Results and discussion:** The proportion of atelectasis in all lung was 1.79 ± 0.23% in the control group compared to 1.28 ± 0.23% (p=0.14) in the study group. Our study shows that application of PEEP and PSV during arousal and extubation allows prevention of postoperative atelectasis recurrence. Statistical significance was not reached probably due to the few patients included. Moreover, the head down position for the duration of laparoscopic surgery promotes atelectasis in the lower part of the right lung and in the apex which is not commonly seen in other studies performed during general anaesthesia.

**Conclusion:** PEEP and pressure support ventilation before and after extubation prevents recurrence of atelectasis in the immediate postoperative period.

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## 5AP2-6

### Impact of an altered preoperative pulmonary function on the postoperative evolution in liver transplanted patients

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**Background and Goal of Study:** Previous studies have established that pneumonia is the most frequent postoperative complication after liver transplantation (LT). Pulmonary spirometric testing is part of the standard pretransplant evaluation in several centers but the correlation between the preoperative lung function and the complications developed after the LT has been insufficiently evaluated. Our goal was to assess the impact of pulmonary dysfunctions (particularly measured spirometric patterns) on the postoperative outcome.

**Materials and methods:** This study included 342 patients transplanted between July 2008 and May 2010 in two centers specialised in LT. We integrated in this retrospective analysis all patients who had spirometric tests in their preoperative evaluation. The mean age was  $51 \pm 12$  years and 68% of these patients were male. The main indications for LT were: cirrhosis (42%), hepatocellular carcinoma (30%) and familial amyloid neuropathy (11%). A total of 30 patients (8.7%) were transplanted in emergency because of acute liver failure.

**Results and discussion:** A restrictive lung pattern (defined by a total lung capacity of less than 80%) was found in 21% of the patients evaluated for LT (71/342). Among these 71 patients, 67% presented ascities and 62% a pleural effusion that may have been implicated in the etiology of the restrictive pattern. An obstructive respiratory disease was found among 23% of patients (79/342).

Patients presenting a restrictive lung pattern had a longer hospital and ICU stay ( $40 \pm 32$  vs.  $31 \pm 18$  days,  $p=0.04$  and  $15 \pm 29$  vs.  $9 \pm 10$ ,  $p=0.03$ ) as well as a higher lung infection risk (29% vs. 18%,  $p=0.04$ ). However, neither the restrictive pattern, nor the obstructive one were associated with a higher mortality.

**Conclusion(s):** Pretransplant restrictive lung pattern is associated with a higher risk of postoperative pneumonia in patients undergoing a LT. Specific management of these patients may diminish the postoperative pulmonary dysfunction rate.

## 5AP2-7

### Lung protective ventilation during general anesthesia in non-cardiothoracic surgery: a preliminary study

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**Background and Goal of Study:** Mechanical ventilation (MV) has the potential to cause so-called ventilator-associated lung injury (VALI) from overdistension of lung tissue. Recent meta-analysis suggest that MV with lower tidal volumes (VT) prevents VALI in short-lasting MV. Except for cardiothoracic surgery, differences in alveolar overdistension when comparing different  $VT < 10 \text{mlKg}^{-1}$  are not known. A novel ventilatory parameter, the stress index (SI) has been shown to detect alveolar overdistension when calculated values are  $> 1.1$ . The primary endpoint was to describe the incidence of alveolar overdistension evaluating the SI with different VT ( $6.8, 10 \text{mlKg}^{-1}$  of PBW) during general anesthesia.

**Materials and Methods:** 15 patients scheduled for general anesthesia were included. Exclusion criteria: cardiothoracic surgery. After induction, randomized 6, 8, 10 VT, during 7 min each one were administered in volume control ventilation. After that, a recruitment maneuver (RM) with maximal Paw of  $40 \text{cmH}_2\text{O}$  was realized and the randomized VT were administered again. In all procedures:  $50\% \text{FiO}_2$ , PEEP  $5 \text{cmH}_2\text{O}$  and RR 12. Peak airway (Paw), mean airway pressure (PAM), compliance (CrS) and SI were continuously monitored. The Kolmogorov-Smirnov test was performed. T student test for paired samples was used.

**Results and Discussion:** Paw significantly increased with higher VT but none of the VT studied pre and postRM showed overdistension. Ventilation with 6 vs  $10 \text{mlKg}^{-1}$  pre or postRM did not show differences in SI and CrS. RM significantly decreased Paw and increased CrS with 8 and  $10 \text{mlKg}^{-1}$  nevertheless the SI was not affected.

	Pre	Post	p value
SI6	0,91±0,06	0,88±0,04	0,08
SI8	0,92±0,04	0,91±0,07	0,5
SI10	0,93±0,05	0,89±0,04	0,003
Paw6	15,5±2,56	10,57±6,15	0,004
Paw8	19,38±3,23	12,63±8,25	0,004
Paw10	22,38±3,97	14,46±10,13	0,005
CrS6	61±21	64±21	0,51
CrS8	59±19	66±22	0,006
CrS10	60±19	66±20	0,01

[Descriptive analysis]

	Pre SI6-SI10	Post SI6-SI10	Pre CrS6-CrS10	post CrS6-CrS10
Mean of diffe	0,01 (0,06)	0,006 (0,03)	4,69 (1,21)	1,60 (5,4)
p value	0,32	0,49	0,19	0,26

[Comparative analysis]

**Conclusions:** In patients with healthy lungs during short-lasting mechanical ventilation,  $VT \leq 10 \text{mlKg}^{-1}$  do not produce alveolar overdistension.  $VT \leq 10 \text{mlKg}^{-1}$  could be considered lung-protective ventilation in non-cardiothoracic surgery.

## 5AP2-8

### Postoperative pulmonary complications in cardiac surgery patients: a prospective cohort, single-centre study

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**Background and Goal of Study:** Postoperative pulmonary complications (PPC) in cardiac surgery increase morbidity and mortality. However, few reports have evaluated pre-, intra- and post-operative independent risk factors (IRF) for PPC. We aimed to determine the incidence of PPC and peri-operative independent risk factors for PPC in cardiac surgery patients.

**Materials and methods:** We performed a single-centre, prospective, cohort study of patients undergoing cardiac surgery at our centre from January to December 2012. Main outcome was the development of at least one of the following: respiratory failure, respiratory infection, bronchospasm and atelectasis. (Table 1) Data were obtained through descriptive and logistic regression analysis.

OUTCOME MEASURES	DEFINITION	DETERMINATION
Respiratory failure	PaO <sub>2</sub> <60mmHg in room air, a ratio of PaO <sub>2</sub> to FiO <sub>2</sub> <300.	Arterial blood gases was determined daily in the UCI.
Respiratory infection	When a patient received antibiotics for a suspected respiratory infection and met at least one of the following criteria. New or changed sputum, new or changed lung opacities, fever, leukocyte count $> 12000/\mu$	Complete blood count (CBC) was determined every 24-48 hours in ICU and every 72 hours in the ward. Chest radiographs was taken every 24-48 hours during ICU stay.
Atelectasis	Detection of atelectasis by chest radiograph or lung ultrasound.	Radiography of the chest was taken every 24-48 hours during ICU stay. Ultrasonography at least once during their stay in the ICU.
Bronchospasm	Newly emerging expiratory wheezing.	Daily auscultation by ward physician.

[Table 1]

**Results and discussion:** A total of 393 patients underwent cardiac surgery. We excluded 33 patients who required urgent surgery or reoperation, had massive bleeding, or was lost to follow-up. Of the remaining 357 patients, 191 (53%) developed PPC following cardiac surgery. Significant independent risk factors for PPC were: age  $> 80$  years (OR=2.52, 95%CI 1.06 - 5.94), obesity  $> 30$  BMI (OR= 3.06, 95%CI 1.78-5.28), preoperative SpO<sub>2</sub>  $< 96\%$  (OR=2.2, 95%CI 1.21-4.11), and OSAS (OR=5.24, 95%CI 1.18-23.41).

**Conclusion(s):** The incidence of PPC after cardiac surgery was high in our centre. Modifiable IRF should be optimized before cardiac surgery, and non-modifiable IRF could be treated with prophylactic measures.



## 5AP2-9

### Intraoperative pneumoperitoneum effects on lung function compared with extraperitoneal pneumoperitoneum effects in anesthetized adults

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**Background and Goal of Study:** General anesthesia causes alveolar collapse, atelectasis and decrease in functional residual capacity (FRC). Laparoscopic procedures in abdominal surgery participate to decrease in FRC due to mechanical compression of the diaphragm induced by pneumoperitoneum (PP). However, little is known about the compared effects of intraoperative PP (IPP) versus extraperitoneal PP (EPP) on lung respiratory mechanics. We aimed to evaluate the effects of IPP on lung function compared with EPP.

**Materials and methods:** We included 35 adult patients. Anesthetic management was standardized. All patients were mechanically ventilated with a tidal volume of 8 mL/kg. FRC was measured using an Engström Carestation ventilator with a built-in modified nitrogen washout/washin technique (GE Healthcare). End expiratory lung impedance (EELI) was measured by electrical impedance tomography (EIT, Pulmovista 500, Dräger medical). Measures were performed before PP, during PP with a PEEP of 0 cmH<sub>2</sub>O, 5 cmH<sub>2</sub>O and of 10 cmH<sub>2</sub>O.

**Results and discussion:** 10 patients underwent extraperitoneal laparoscopic procedures (EPP group), and 26 intraoperative laparoscopic procedures (IPP group). PP significantly decreased the FRC from 2115 mL to 1779 mL in the EPP group and from 1710 mmHg to 1275 mmHg in the IPP group. In contrast, a PEEP of 5 cmH<sub>2</sub>O significantly increased the FRC in the EPP and in the IPP group ( $p < 0.05$ ). A PEEP of 10 cmH<sub>2</sub>O also increased the FRC in the EPP and in the IPP group

( $p < 0.05$ ), and FRC actually went back to baseline values. PP significantly increased the EELI of 2,92 units (+/- 4) in the IPP group and of 0,47 units (+/- 1,6) in the EPP group. In the IPP group, EELI was mostly increased in the non-dependent gravity quadrants and in this group thoracopulmonary compliance was significantly decreased after PP.

In our study, PP led to decrease in FRC both in extraperitoneal and intraoperative laparoscopic procedures. One interesting finding was increase of EELI in non-dependent lung quadrants during IPP despite marked decrease in FRC and thoracopulmonary compliance. This demonstrated distribution of the tidal volume during IPP mostly in non-dependent quadrants and a lung inflation in these regions due to PP in relation with compression of the diaphragm.

**Conclusion(s):** PP induced decrease in the FRC, increased by a PEEP of 5 and 10 cmH<sub>2</sub>O. During IPP, the reduction in FRC was associated with inflation of non-dependent lung regions.

## 5AP2-10

### Noninvasive ventilation after bariatric laparoscopic surgery

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**Background and Goal of Study:** Obese patients have a higher risk of peri-operative complications. Non-invasive ventilation (NIV) has been suggested to reduce the risk of adverse respiratory events (ARE). The aim of this study was to determine the impact of continuous positive airway pressure (CPAP) on the incidence of post-operative complications after bariatric laparoscopic surgery (BLS).

**Materials and Methods:** After obtaining ethics committee approval and consent, we carried out a prospective study for 3 months. Exclusion criteria were inability to give consent or previous history of pulmonary disease. Sixty-five patients were included and randomized for the use of CPAP (n=32) during 2 hours in the Post-Anaesthesia Care Unit (PACU). Arterial blood gases (ABG) sampling was collected pre-operatively, at PACU admission and discharge. In PACU we evaluate ARE (polypnea, bradypnea, airway obstruction, hypoxia), adverse cardiac events (ACE) (arrhythmias, angina, cardiac arrest), pain, post-operative nausea and vomiting (PONV) and residual neuromuscular blockade (RNMB). Variables with normal distribution were analysed with T Student test and the remaining variables with Mann Whitney test.

**Results and Discussion:** Both groups are similar in demographic characteristics, ASA physical status classification, co-morbidities, type and duration of laparoscopic procedure, intra-operative drugs and ventilatory parameters. At PACU admission, ABG, RNMB, PONV and pain were similar in both groups. Forty five patients (69%) had ARE and no ACE occurred. In the control group, two patients needed transfer to an intensive care unit, whereas no patient

needed transfer in the CPAP group. Bradypnea was less frequent in the CPAP group (6% vs. 14%,  $p=0.041$ ). Comparing ABG values at PACU admission and at PACU discharge, in the CPAP group there was a higher rise in pH ( $0.04 \pm 0.03$  vs.  $0.02 \pm 0.03$ ,  $p=0.009$ ) and a greater decrease in pCO<sub>2</sub> ( $4 \pm 3$  vs.  $2 \pm 4$  mmHg,  $p=0.004$ ). Pain was assessed by visual analogical scale and the observed scores were lower in the CPAP group (median 1,5 vs. 3,6,  $p=0.004$ ). There were no differences in vital signs, sedation scale scores, PONV, or analgesic consumption between groups. Only 5 patients (16%) referred NIV was uncomfortable while 84% assumed little or no discomfort.

**Conclusions:** NIV after BLS was associated with less ARE and a better post-operative pain control. The majority of patients found CPAP to be well tolerated.

## 5AP3-1

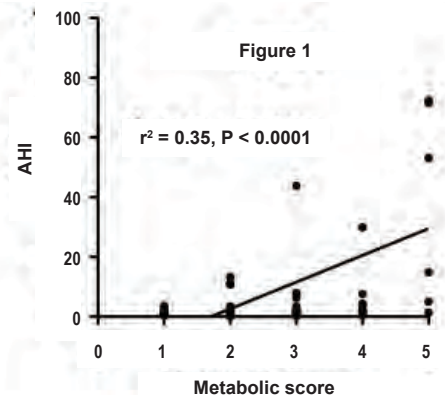
### The metabolic syndrome is a risk factor for postoperative obstructive apnoea and hypoxaemia in morbidly obese patients

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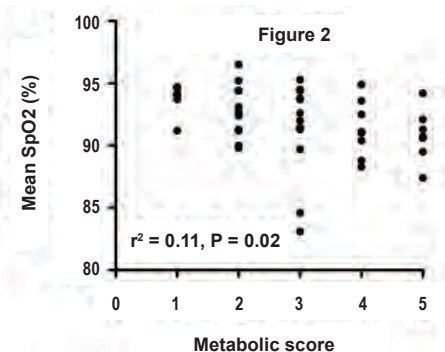
**Background and Goal of Study:** Sleep apnoea obstructive syndrome (SAOS) and the metabolic syndrome (MS) are prevalent disorders in morbidly obese (MO) patients (1). SAOS may be also independently associated with MS (2). We investigated the correlation between the severity of MS on one hand and the STOP BANG risk score and postoperative hypoxaemia on the other hand in MO patients.

**Materials and Methods:** After IRB approval and informed consent 50 MO patients with a BMI > 35kg/m<sup>2</sup> scheduled for laparoscopic gastric by-pass under standardized general anaesthesia were included in this study. Severity of the MS was calculated on a 0-5 scale (3). Postoperative oxygen saturation and obstructive apnoea (OA = apnoea hypopnoea index [AHI]) were recorded the first postoperative night using a Somnolter® (Nomics, Angleur, Belgium). Linear regression was used to evaluate the association between MS score on one hand and STOP BANG score, AHI, and OA on the other hand.  $P < 0.05$  = statistically significant.

**Results and Discussion:** Patient data were: BMI =  $41.5 \pm 3.8$ , age =  $36.6 \pm 13.3$ , H/F = 15/35. There were significant correlations between MS score and STOP BANG ( $r^2=0.35$ ,  $P < 0.0001$ ), AHI ( $r^2=0.26$ ,  $P=0.0003$ ; Fig 1), and mean SpO<sub>2</sub> ( $r^2=0.11$ ,  $P=0.02$ ; Fig 2). There was no correlation between MS score and BMI in our MO patients ( $P=0.48$ ).



[Figure 1]



[Figure 2]

**Conclusion(s):** This study confirms that the metabolic syndrome is a risk factor for postoperative SAOS and hypoxaemia.

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## 5AP3-2

### How do anesthesiologist apply intra-operative ventilation? The International Survey on Ventilation Practice (iVENT)

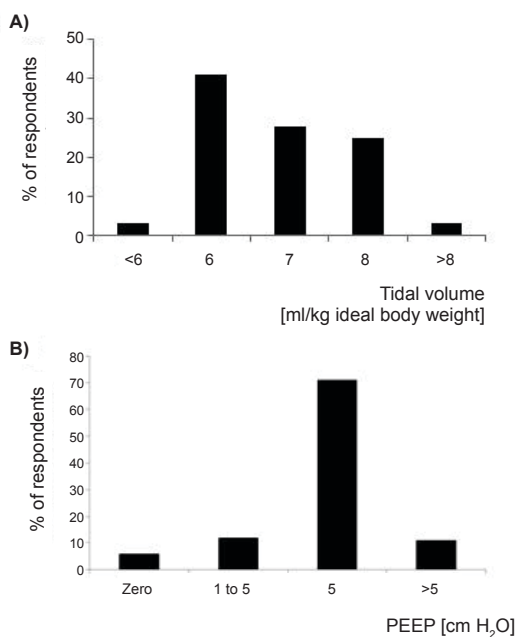
Treschan T.<sup>1</sup>, Werth A.<sup>1</sup>, Hemmes S.N.T.<sup>2</sup>, Gama de Abreu M.<sup>3</sup>, Pelosi P.<sup>4</sup>, Schultz M.J.<sup>5</sup>

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**Background and Goal of Study:** Intraoperative mechanical ventilation might pose a risk on our patients. Thus, intra-operative lung protection is gaining interest<sup>1</sup>. Evidence is evolving that lower tidal volumes with positive end-expiratory pressure (PEEP) and recruitment maneuvers are beneficial in patients who need intra-operative ventilation during general anesthesia for surgery<sup>2</sup>. Knowledge about ventilation practice is surprisingly small. Therefore, we queried anesthesiologists to depict their practice as typically applied for initial intra-operative ventilation of intubated adults with healthy lungs.

**Materials and methods:** An online survey was distributed via email using the network of PROVENet and the results of an internet search covering the German county North-Rhine Westphalia. Data was collected anonymously using Survey Monkey software and downloaded to SPSS IBM 21.0 statistic software for descriptive analysis.

**Results and discussion:** From August to November 2013 a total of 1046 answers was collected, of which 952 from all continents qualified for analysis: Europe 92%, Africa 1%, Asia 0,5%, Australia 1%, North-America 4% and South-America 1,5%. Respondents came from university hospitals (65%), secondary care clinics (30%) and private practice (5%). The vast majority of respondents (80%) quoted to set the initial tidal volume with reference to the patients' ideal body weight. These tidal volumes are depicted in figure 1A. Of respondents who referred to an absolute tidal volume, 53% specified to use 401 to 500 ml, 34% chose 501 to 600 ml. The routine use of initial PEEP is depicted in figure 1B.



[Figure 1. Intraoperative ventilation practice. A) Initial volume, B) Initial positive end-expiratory pressure (PEEP) as stated by the respondents of the iVENT survey.]

Recruitment maneuvers were mentioned to be used routinely by 16% of respondents, 80% indicated to use it when clinically indicated.

**Conclusion(s):** Our data suggest that anesthesiologists use low tidal volumes with PEEP for intra-operative ventilation in healthy adults and that recruitment maneuvers are not applied routinely.

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## 5AP3-3

### Changes in transpulmonary pressure during mechanical ventilation in patients on prolonged jackknife position: a physiological preliminary study

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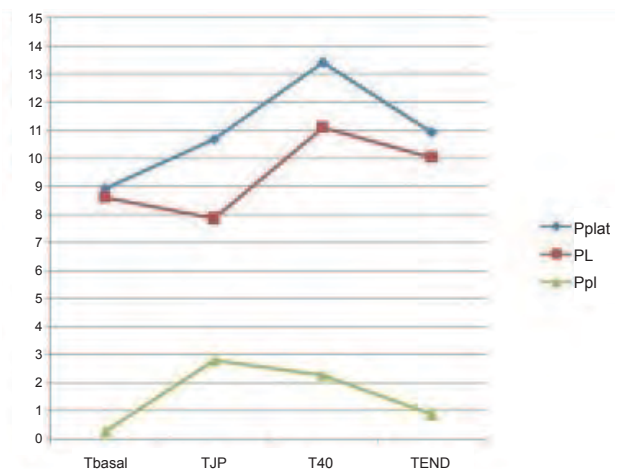
**Background and Goal of Study:** The purpose of this study was to evaluate the physiological changes in Transpulmonary Pressure ( $P_{tp}$ ) in patients on prolonged "jackknife position" (JP) during laparotomic radical prostatectomy (LRP).

**Materials and methods:** Ethical Committee approval was obtained. Inclusion criteria were: age  $\geq 18$ , ASA I-III and LRP Exclusion criteria were: several arrhythmia, severe valvular disease, severe sepsis, septic shock, pulmonary emphysema, heart failure and absence of informed consent. In all patients the esophageal pressure was used for partitioning respiratory mechanics between lung and chest wall.

Patients were studied before JP ( $T_{Basal}$ ), after JP ( $T_{JP}$ ), 40 minutes after JP ( $T_{40}$ ) and at the end of surgery in supine position ( $T_{END}$ ). Pleural pressure ( $P_{pl}$ ) was calculated as  $P_{pl} = P_{plat} * E_{c,w}/E_{r,s}$ , and  $P_L = P_{plat} - P_{pl}$  ( $P_{plat}$  = Plateau Pressure,  $E_{c,w}$  = Chest Wall Elastance,  $E_{r,s}$  = Respiratory System Elastance) as already published<sup>1</sup>.

The data were analyzed with analysis of variance ANOVA and post-hoc Fisher. A p value  $<0.05$  was considered statistically significant. The data were expressed as mean  $\pm$  SD.

**Results and discussion:** Ten consecutive patients undergoing LRP were included. On  $T_{JP}$   $P_{pl}$  increased ( $2,8 \pm 0,9$  vs  $0,3 \pm 0,7$  cmH<sub>2</sub>O on  $T_{Basal}$ ;  $p < 0.05$ ) while  $P_L$  decreased ( $7,8 \pm 2,8$  vs  $8,6 \pm 2,1$  cmH<sub>2</sub>O on  $T_{Basal}$ ;  $p < 0.05$ ). On  $T_{40}$   $P_L$  and Airway Resistances (Raw) increased ( $11,1 \pm 3,8$  vs  $7,8 \pm 2,8$  cmH<sub>2</sub>O on  $T_{JP}$  and  $17,3 \pm 5,5$  vs  $11,9 \pm 3,4$  cmH<sub>2</sub>O/L/s on  $T_{Basal}$  respectively;  $p < 0.05$ ).



[Pplat, PL, Ppl Trend]

**Conclusion(s):** Our preliminary results suggest that the JP induces an increase in  $P_{pl}$  and a reduction in  $P_L$  immediately after patient's positioning in JP; prolonging the JP induces an increase of  $P_L$  and Raw. These data suggest the need of further studies to clarify the possible role of Positive End Expiratory Pressure (PEEP) and/or alveolar recruitment maneuvers in such conditions.

**References:**

1. Cinnella G., Grasso S., Spadaro S. et al. Effects of Recruitment Maneuver and Positive End-expiratory Pressure on Respiratory Mechanics and Transpulmonary Pressure during Laparoscopic Surgery. Anesthesiology 2013; 118:114-22.

### 5AP3-4

#### Use of BIS-monitoring for quality assessment of medicamental synchronization in prolonged mechanical ventilation

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**Background and Goal of Study:** One of the most urgent problems of modern mechanical ventilation (MV) is the problem of synchronization of artificial breathing with spontaneous breathing of patient. The aim of research is to determine the effectiveness of BIS as a criterion of adequate medicamental synchronization in prolonged MV.

**Materials and methods:** There were analyzed 78 cases of prolonged MV in 12 patients with ALI who underwent MV (>48 hours). There were registered the parameters of MV, the indices of respiratory monitoring, the doses of sedative drugs and analgesics, and the points on the Ramsay scale. All cases of MV were divided into 4 groups: the 1<sup>st</sup> group (n=15) - sedative and analgesic drugs were not used; the 2<sup>nd</sup> group (n=27) - narcotic analgesics were used (phentanyl, morphine); the 3<sup>rd</sup> group (n=12) - diazepam and thiopental sodium were used; the 4<sup>th</sup> group (n=24) - the mentioned narcotic analgesics and sedative drugs were used in different combinations.

**Results and discussion:** The higher values of BIS were registered in the 1<sup>st</sup> and the 2<sup>nd</sup> groups (89,1±10,6 and 75,0±16,1 respectively (p>0,05, Mann-Whitney test). In the 3<sup>rd</sup> and the 4<sup>th</sup> groups BIS differed from the values of the 1<sup>st</sup> and the 2<sup>nd</sup> groups (37,2±11,6 and 43,2±18,1 respectively (p< 0,001). There was revealed the inverse correlation between the BIS indices and the index according to the Ramsay scale (Spearman correlation coefficient, R=-0,8, p=0,0001). There was revealed the direct correlation between the BIS numerical values and the volume of spontaneous breathing (R=0,4, p=0,0001). It was revealed that in the groups 3 and 4 including the cases with the stronger sedation there were observed more expressed oxygenation disorders and alteration of mechanical properties of the lungs.

**Conclusion:** BIS-index is an objective criterion of effective medicamental synchronization in a prolonged MV. Deep medicamental sedation was necessary in patients with more expressed oxygenation disorders, the disorders of mechanical properties of the lungs and "hard" parameters of respiratory support.

### 5AP3-5

#### Alveolar recruitment maneuver during cesarean section and after delivery improves lung compliance

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**Background and Goal of Study:** In pregnant women the supine position, during cesarean section, reduces Functional Residual Capacity (FRC) and worsen lung compliance. The investigators tested the hypothesis that alveolar recruitment maneuver (RM) during cesarean section, and after delivery, in women under general anesthesia improves lung compliance.

**Materials and methods:** 44 women undergoing cesarean section were prospectively assigned to one of two groups. In group 1 (24 patients) one minute after delivery the investigators applied RM: The ventilator switched to pressure control mode (from volume control) and the inspiratory time increased to 50%. The Positive End Expiratory Pressure (PEEP) increased up to 15 cmH<sub>2</sub>O and the Positive End Inspiratory Pressure (Ppeak) progressively increased up to 45cmH<sub>2</sub>O. The whole RM lasted 2 minutes. Then volume control ventilation was used again and PEEP step wise decreased to 8 cmH<sub>2</sub>O. In the 2<sup>nd</sup> group (20 patients) the investigators did not use lung RM at all. In both groups lung compliance was measured (both dynamic and static compliance) as  $dV/dP$  (ml/cm H<sub>2</sub>O). Measures were assessed before recruitment (BR) but after delivery, 3 minutes after delivery and after recruitment, 10 and 20 minutes after recruitment. At all time points Ppeak, Pplateau, blood pressure, beats per minutes, oxygen saturation and end-tidal CO<sub>2</sub> were measured too.

**Results and discussion:** Results are presented in figures 1 and 2. Data are presented as mean while p< 0.05 is considered significant. There was no significant difference in lung compliance between groups before RM (p>0.05). In group 1 (RM) there is a significant increase in lung compliance (both in dynamic and static) after RM compared to group 2 where RM was not applied (p< 0.001). In group 1 lung compliance (both dynamic and static) was significantly higher (p< 0.001) at all time points (3 minutes, 10 and 20 minutes)

compared to baseline compliance or compliance before recruitment (BR). In group 2 there was no significant difference in lung compliance (dynamic or static) at different time points. There were no significant demographic differences between groups while there were no significant differences in oxygen saturation, end-tidal CO<sub>2</sub>, Ppeak, Pplateau, and women hemodynamic.

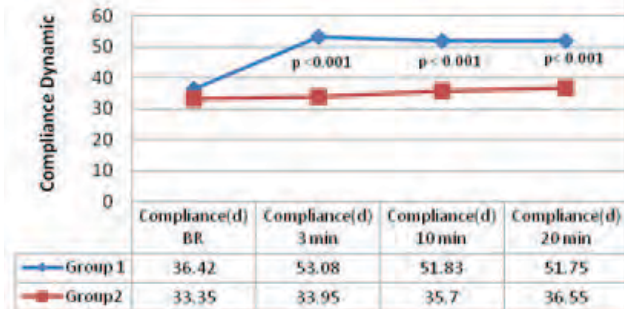


Figure 1: Dynamic Compliance in Group 1 (recruitment maneuver) vs Group 2 (without recruitment maneuver). p=difference between Groups, Compliance(d)=dynamic compliance, BR=before recruitment.

[Figure 1]

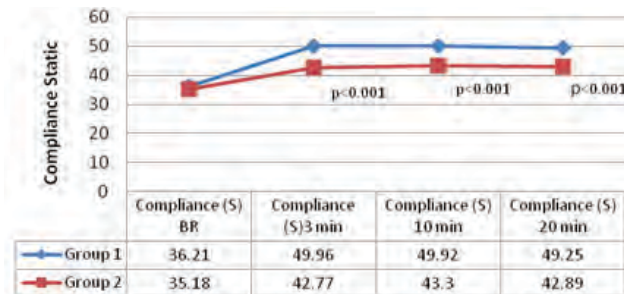


Figure 2: Static Compliance in Group 1 (recruitment maneuver) vs Group 2 (without recruitment maneuver). p=difference between Groups, Compliance (s)=static compliance, BR=before recruitment

[Figure 2]

**Conclusion(s):** In pregnant women, during cesarean section under general anesthesia, the application of recruitment maneuver followed by the application of PEEP led to significant increase in lung compliance.

### 5AP3-6

#### Influence of airway obstruction and ventilation frequency on lung volume and gas exchange during SHFJV

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**Background:** Superimposed high frequency jet ventilation (SHFJV) provides adequate oxygenation and CO<sub>2</sub> removal even in patients with stenotic airways. There are no in-vivo studies that systematically have investigated the influence of the degree of obstruction and the ventilation frequency on lung volumes and gas exchange.

We hypothesised that higher degrees of stenosis would decrease tidal volume (V<sub>T</sub>), increase end-expiratory chest wall volume (EEV<sub>CW</sub>), and impair gas exchange. We further hypothesised that these effects would be stable over a wide range of frequencies.

**Methods:** Custom made stents (inner diameter 8, 6, 4 and 2mm, length 2cm) were inserted into the tracheae of 10 anaesthetised piglets (25-32kg). Subsequently, the piglets were ventilated with SHFJV using 7 frequencies (f<sub>HF</sub>=50-600 min<sup>-1</sup>, combined with a constant low frequency component of f<sub>L</sub>=16min<sup>-1</sup>). All obstructions and all f<sub>HF</sub> were applied in each piglet, and jet ventilation was applied for 5 minutes for each condition.

Primary outcome variables were V<sub>T</sub> and EEV<sub>CW</sub> as measured by Opto-electronic plethysmography and secondary outcome variables were p<sub>a</sub>O<sub>2</sub> and p<sub>a</sub>CO<sub>2</sub>.

We report here observed values for each outcome at the commonly used f<sub>HF</sub> of 600min<sup>-1</sup>. Additionally, we used mixed model analysis to describe the dependence of each outcome on the independent variables obstruction and frequency.



**Results:** Parts of this data have already been presented at Euroanaesthesia2012.

Increasing the degree of obstruction from 8mm to 2mm led to a marked decrease in  $V_T$  (269 [95% CI: 235-308] ml to 122 [96-156] ml) an increase in  $EEV_{CW}$  (157 [117-196] ml to 253 [202-303] ml) as well as a decrease in  $p_aO_2$  (28.2 [25.1-31.7] kPa to 19.6 [13.9-27.7] kPa) and an increase in  $p_aCO_2$  (5.9 [5.0-6.9] kPa to 10.7 [8.8-13.0] kPa).

At the 2mm obstruction, all outcomes were independent of frequency. For all obstructions >4mm, each outcome was significantly different from those at 2mm (all  $p < 0.05$ ). At 8mm, increasing frequency led to a reduction of  $V_T$ , an increase in  $EEV_{CW}$  and a slight increase in  $p_aCO_2$  (all  $p < 0.05$ ). At the same obstruction,  $p_aO_2$  was frequency-independent.

**Conclusion:** Despite increasing  $EEV_{CW}$  with increasing obstruction, there was no hazardous amount of air trapping. SHFJV with clinically common frequencies ( $f_{HF}=600\text{min}^{-1}$  combined with  $f_{LF}=16\text{min}^{-1}$ ) provides acceptable oxygenation even in severe airway stenosis, but its ability to remove  $CO_2$  is limited in the almost totally occluded airway.

## 5AP3-7

### SHFJV vs HFJV efficacy in a model of severe airway obstruction

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**Background:** During deobstructive airway surgery, adequate oxygenation and ventilation can be achieved with superimposed high frequency jet ventilation (SHFJV). SHFJV has however never been systematically compared with conventional single frequency jet ventilation (HFJV) in this setting.

We performed a direct, frequency-wise comparison of SHFJV with HFJV in an animal model of tracheal obstruction. Our hypothesis was that SHFJV would provide higher tidal volume ( $V_T$ ), higher end-expiratory chest wall volume ( $EEV_{CW}$ ) as well as better oxygenation and  $CO_2$  removal than HFJV.

**Methods:** In 10 anaesthetised pigs (25-32kg), airway obstruction was achieved by the insertion of a tracheal stent (inner diameter 4mm, length 2cm). Jet ventilation was performed using 7 frequencies ( $f_{HF}=50-600\text{min}^{-1}$ ), either in combination with a low frequency ( $f_{LF}=16\text{min}^{-1}$ ) for SHFJV, or alone (HFJV). All pigs received all  $f_{HF}$  in both modes in random order for 5min.

Primary outcome variables were  $V_T$  and  $EEV_{CW}$  as measured by Opto-electronic plethysmography, and secondary outcome variables were  $p_aO_2$  and  $p_aCO_2$ .

We report observed values and used mixed model prediction of frequency dependent changes of the outcome variables.

**Results:** Parts of this data have already been presented at Euroanaesthesia2012.

$V_T$  during SHFJV was always greater than 180 (95% CI: 125-259) ml, whereas  $V_T$  during HFJV was greatest at  $f_{HF}=50\text{min}^{-1}$  [112.1 (97-130) ml] and decreased in a hyperbolic manner with increasing frequency ( $p < 0.05$ ) to negligible values at  $f > 150\text{min}^{-1}$ .

$EEV_{CW}$  during SHFJV was at least 165(130-202)ml, independent of frequency. During HFJV,  $EEV_{CW}$  was lowest at low  $f_{HF}$  [52 (39-64) ml at  $f_{HF}=50\text{min}^{-1}$ ] and increased in a frequency dependent ( $p < 0.05$ ) manner to a plateau of around 95ml.

During SHFJV,  $p_aO_2$  was at least 23.6 (16.6-33.5) kPa without any frequency dependence. During HFJV,  $p_aO_2$  was highly frequency dependent ( $p < 0.05$ ), starting from 31.8 (29.1-34.8) kPa at  $f_{HF}=50\text{min}^{-1}$ , and decreased with increasing  $f_{HF}$ , reaching hypoxic values from  $f_{HF} > 150\text{min}^{-1}$ .

For SHFJV,  $p_aCO_2$  was always lower than 8.4 (10.5-13.6) kPa. During HFJV,  $p_aCO_2$  was lowest at  $f_{HF}=50\text{min}^{-1}$  [7.0 (6.1-8.1) kPa], with a frequency dependent ( $p < 0.05$ ) increase to  $p_aCO_2 > 10\text{kPa}$  at  $f \geq 100\text{min}^{-1}$ .

**Conclusion:** In this model of severe airway obstruction, SHFJV provided adequate  $V_T$  and  $EEV_{CW}$ , achieving adequate oxygenation and  $CO_2$  elimination. When using HFJV in the same setting,  $f_{HF} < 100\text{min}^{-1}$  should be used to achieve sufficient  $CO_2$  removal.

## 5AP3-8

### The role of recruitment maneuver during laparoscopic surgery in two different body positions: is it possible to keep in safe the lung?

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**Background and Goal of Study:** Laparoscopy is an established procedure applied both in gynaecological and abdominal surgery, performed in Trendelenburg or Anti-Trendelenburg position. Respiratory mechanics may be impaired by abdominal insufflations and body position. Aim of the study was to evaluate the hypothesis that PEEP titrated in order to obtain the best compliance ( $C_{rs}$ ) has beneficial effects on respiratory mechanics and gas exchange during these surgical procedures.

**Materials and methods:** We enrolled 2 groups of patients: ( $G_{Trend}$ ) 10 patients undergoing hysterectomy and ( $G_{antiTrend}$ ) 10 patients undergoing cholecystectomy. About 15 min after the induction of pneumoperitoneum (PnP) and after hemodynamic stabilization, we applied a RM, consisting in PCventilation with a driving pressure of 20  $\text{cmH}_2\text{O}$  and PEEP applied in steps of 5,10,15 and 20  $\text{cmH}_2\text{O}$  every 5 respiratory breaths; subsequently PEEP was reduced by steps of 2  $\text{cmH}_2\text{O}$ . After the RM PEEP was set at the value corresponding to the highest  $C_{rs}$ . We measured respiratory mechanic, haemodynamic and gas exchange immediately after intubation ( $T_1$ ) at ZEEP, 15 minutes after the induction of PnP ( $T_2$ ), 15 min after the application of the RM with the customized PEEP ( $T_3$ ) and at the end of surgery after abdomen desufflation ( $T_4$ ).

**Results and discussion:** PnP induced an increase in  $P_{plat_{rs}}$  ( $13 \pm 1.72$  in  $G_{Trend}$  and  $13.2 \pm 1$  in  $G_{antiTrend}$  on  $T_1$  vs  $15.4 \pm 2.5$  in  $G_{Trend}$  and  $16.9 \pm 1.19$  in  $G_{antiTrend}$  on  $T_2$ ,  $\text{cmH}_2\text{O}$   $p < 0.001$ ) and a decrease on  $C_{rs}$  ( $64 \pm 6$  in  $G_{Trend}$  and  $63 \pm 5$  in  $G_{antiTrend}$  on  $T_1$  vs  $50 \pm 2.6$  in  $G_{Trend}$  and  $55.4 \pm 10.2$  in  $G_{antiTrend}$  on  $T_2$ ,  $\text{ml/cmH}_2\text{O}$   $p < 0.001$ ). After the RM the PEEP applied was  $7 \pm 1.3$   $\text{cmH}_2\text{O}$  and  $C_{rs}$  was  $75.6 \pm 4.3$  in  $G_{Trend}$  and  $77.3 \pm 11.8$  in  $G_{antiTrend}$ .  $P_L$  (Transpulmonary pressure) was  $8.89 \pm 2$  in  $G_{Trend}$  and  $7.6 \pm 1.2$   $\text{cmH}_2\text{O}$  in  $G_{antiTrend}$  on  $T_2$  vs  $11.4 \pm 1.2$  in  $G_{Trend}$  and  $9.13 \pm 1.5$   $\text{cmH}_2\text{O}$  in  $G_{antiTrend}$  on  $T_3$  ( $p < 0.001$ ). Haemodynamic and gas exchange remained unchanged throughout the study.

**Conclusion(s):** These preliminary data suggest that respiratory mechanics changes during PnP are influenced by body position and could be useful to set the appropriate ventilator strategy for each surgical procedure. The benefit of the study derived from customization of PEEP for each patient which recruit through  $C_{rs}$  and  $P_L$ .

#### References:

Cinnella et al., Effects of recruitment maneuver and positive end-expiratory pressure on respiratory mechanics and transpulmonary pressure during laparoscopic surgery. *Anesthesiology*. 2013 Jan;118(1):114-22

## 5AP3-9

### Effect of laparoscopic bariatric surgery in mechanical ventilation

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**Background and Goal of Study:** Laparoscopic bariatric surgery facilitates the recovery of basal respiratory function in postoperative period, but generate changes on mechanical ventilation during surgery. We design this study to measure this changes.

**Materials and methods:** Prospective study of 15 patients with body mass index (BMI)  $> 40$   $\text{mg/kg/m}^2$  scheduled for laparoscopic bariatric surgery. All patients underwent general anaesthesia and were ventilated with respiratory frequency (FR) of 12 rpm and tidal volume (Vt) of 6-10  $\text{mL/kg}$ , to obtain normal end-tidal partial pressure  $CO_2$  values (EtCO<sub>2</sub>). The I:E ratio was 1:2, with plateau time of 30% and PEEP (positive-end expiratory pressure) of 5  $\text{cmH}_2\text{O}$ . Plateau pressure (PP), peak inspiratory pressure (PIP), Vt, FR and EtCO<sub>2</sub> were monitored with continuous spirometry Physioflex respirator, averaging three consecutive respirator cycles and collecting values in three times; T1: patient in supine position; T2: CMV and curarized patient in anti-Trendelenburg to the maximum 10 min of pneumoperitoneum and T3: 10min of remove pneumoperitoneum, supine. From these data we calculated respiratory compliance by the formula:  $C_{rs} = Vt / (PP - PEEP)$ . Statistical analysis was performed using the SPSS system with Wilcoxon test.

**Results and discussion:** Our results show that the performance of pneumoperitoneum associated with anti-Trendelenburg position during laparoscopic bariatric surgery, increases peak and plateau pressures, decreasing  $C_{rs}$ . In

our group of patients, pneumoperitoneum resulted in an increase of 13% in PIP, 33% in PP and a decrease of 33% in Csr. All results were statistically significant. After suppression of pneumoperitoneum, all values tended to baseline.

Morbidly obese compared with normal weight patients, have changes affecting respiratory volumes, compliance and ratio VA/Q. During the pneumoperitoneum, increased intra-abdominal pressure decreases functional residual capacity, increases peak and plateau pressure, decreases pulmonary compliance and changes ratio VA/Q. However, none of the cases in our study were converted to laparotomy surgery because of patient's cardiorespiratory impairment.

**Conclusion(s):** Elevated intra-abdominal pressure during pneumoperitoneum in bariatric surgery increase peak and plateau pressure and decrease the respiratory compliance almost 50% compared to normal value.

## 5AP3-10

### Negative pressure pulmonary edema with pulmonary hemorrhage

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**Background:** Negative Pressure Pulmonary Edema (NPPE) is an uncommon complication of upper airway obstruction. It is a potentially life threatening condition with an incidence of 0.1% and is more frequent in healthy young males. Laryngospasm is the most common etiology. NPPE pathophysiology is multifactorial but the main mechanism is high negative intrathoracic pressure. Although rarer, in severe cases it may lead to alveolar hemorrhage.

**Case report:** A 17-year-old male patient, ASA physical status 1, underwent surgery for placement of a tissue expander on the scalp. Anesthesia was induced with fentanyl, propofol and atracurium. Orotracheal intubation was performed and intermittent positive pressure ventilation initiated. Anesthesia was maintained with oxygen, N<sub>2</sub>O, sevoflurane and fentanyl. Immediately after extubation laryngospasm occurred and was treated successfully with positive pressure bag mask ventilation and 100% oxygen. The patient was transferred to the PACU (postanesthetic care unit) with an oxygen mask and was stable for two hours, albeit with sporadic productive coughing. After this period, he developed tachypnea, tachycardia and coughing with pink frothy and blood stained sputum. On auscultation bilateral crackles were audible. Arterial blood gas analysis revealed hypoxemia PaO<sub>2</sub> 76mmHg (FiO<sub>2</sub> 40%) and chest X-ray showed diffuse bilateral pulmonary infiltrates. CPAP (continuous positive airway pressure) was initiated and 10mg of furosemide iv administered. The patient improved his condition over the next 4 hours with remission of coughing and hemoptysis. A chest CT was performed and revealed ground-glass opacities, highly suggestive of pulmonary hemorrhage.

**Discussion:** NPPE usually presents as respiratory distress and coughing with pink frothy sputum minutes after extubation but may only present hours later. Differential diagnosis is essential as it is frequently confused with other conditions or has subclinical manifestation. Treatment is supportive with supplemental oxygen although non-invasive ventilation with CPAP may be necessary and in more severe cases invasive mechanical ventilation with PEEP (positive end-expiratory pressure). There is controversy in using diuretics. When promptly recognized and treated the prognosis is usually good.

#### References:

1. Journal of Critical Care (2010) 25, 508.e1-508.e5
2. Rev Bras Anesthesiol (2008); 58: 4: 391-396

**Learning points:** High suspicion, early recognition and intervention in NPPE are essential.

## 5AP4-1

### The effects of tobacco on cytokines values measured by bronchoalveolar lavages during lung surgery

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**Background:** Pulmonary inflammatory response in patients undergoing lung resection surgery can be altered by different circumstances such as chronic diseases, smoking, steroids intake, or immunosuppressive treatments. Tobacco consumption is associated with impaired lung function and increased incidence of infections but, in our knowledge, its impact in lung injury during a lung resection surgery has not been analyzed yet. The aim of our study was to evaluate the pulmonary inflammatory response in patients undergoing lung

resection surgery with active, former and non-smokers.

**Material and methods:** A prospective study was designed and approved by a Local Ethics Committee. Patients scheduled for lung resection surgery were recruited and divided into three groups based on their tobacco habits: non-smokers, former smokers (people who had stopped smoking 4 weeks before surgery) and active smokers (persons who had been smoking up until the week before surgery). All patients were managed with the same anaesthetic protocol and the same ventilatory settings, either in the two-lung ventilation and in the one lung ventilation (OLV). Fiberoptic bronchoalveolar lavages (BAL) were carried out in the dependent and the non-dependent lung before and after OLV. Lung inflammatory markers (IL-1, IL-2, IL-6, IL-10, TNF-alpha) were analyzed with Western Blot method. A comparison of means (ANOVA), for the three groups of patients and a post-hoc analysis with Bonferroni correction was performed. In addition, percentage changes in each cytokine before and after OLV were calculated in both lungs.  $p < 0.05$  was considered significant and all statistical analysis were performed with SPSS 17.0 software.

**Results:** 98 patients were included in the study (19 non-smokers, 61 former smokers and 18 active smokers). IL1 and IL2 values in both lungs, measured by BAL, increased significantly at the end of OLV for the three groups. The increases in non-dependent lung was lower for active smokers (IL-1 (pg/ml) from  $114 \pm 22$  to  $136 \pm 53$ , IL-2 (pg/ml) from  $64 \pm 63$  to  $90 \pm 93$ ), higher for former smokers (IL-1 from  $118 \pm 24$  to  $154 \pm 57$ , IL-2 from  $79 \pm 61$  to  $102 \pm 94$ ), and even higher for non-smoking patients (IL-1 from  $119 \pm 31$  to  $183 \pm 67$ , IL-2 from  $95 \pm 58$  to  $158 \pm 101$ ). IL-1 and IL-2 behaviour in the dependent lung was similar to the non dependent lung.

**Conclusions:** Active smokers release less proinflammatory cytokines IL-1, IL-2 than former and non smokers. We believe this happens because of their poor immune status.

## 5AP4-2

### Moderate versus deep neuromuscular block during one lung ventilation

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**Background and Goal of Study:** Neuromuscular block (NMB) during lung resection surgery with one-lung ventilation (OLV) is mandatory to facilitate handling surgeon, make fibrobronchoscopies, recruitment maneuvers, avoid spontaneous inspiration that could inflate the collapsed lung and maybe decrease airway pressures and lung compliance. Protective ventilation has proposed to decrease acute lung injury (ALI) after this surgery, and whatever tool that we can use to avoid status of high airway pressure or low compliance could be useful. The aim of the study was to compare plateau pressure during OLV under moderate versus deep NMB.

**Materials and methods:** It's an observational study that include 46 consecutive patients undergoing OLV for more than an hour for lung resection surgery. Patients were lateral decubitus placed and control volume ventilated. Lung protective ventilation with 6 ml/kg tidal volume and PEEP >5 cmH<sub>2</sub>O was applied. Four different moments were established: Basal (two lung ventilation), Moderate NMB (OLV and 1-2 TOF responses), 0,3mg/kg rocuronium bolus administration, Intense NMB (5 minutes after rocuronium bolus), and Deep NMB (when TOF = 0 and Post-tetanic count = 1-2). Next parameters were checked: Airway pressure (peak, plateau, mean), static and dynamic lung compliance, heart rate (HR), mean arterial pressure, SpO<sub>2</sub> cardiac index, stroke volume, stroke volume variation and bispectral index.

**Results and discussion:** Plateau pressures decreased when deep block was established, (from  $23 \pm 7$  cmH<sub>2</sub>O during moderate NMB to  $17 \pm 6$  cmH<sub>2</sub>O during deep NMB) ( $p < 0.01$ ). Also peak pressure lowered with deep NMB ( $P < 0.01$ ). An expected compliance decrease was observed when OLV started, but during deep NMB compliance ( $36 \pm 9$  cmH<sub>2</sub>O) was significative higher than moderate NMB ( $30 \pm 9$  cmH<sub>2</sub>O) ( $p < 0.001$ ). HR rises significantly after bolus rocuronium and there was no change in SpO<sub>2</sub> nor hemodynamic parameters. ALI following lung resection surgery and OLV increases not only UCI and hospitalization time that also mortality. Mechanical ventilation parameters are determinant to protect lung from ALI. In our study we showed that peak and plateau pressures were lower after deep block was established. Even though improvement in mechanic ventilatory parameters is small, it's enough to have another lung protective tool.

**Conclusion(s):** Deep neuromuscular block allow us to optimize ventilator parameters, related to the lung protective ventilation beneficial effects.

### 5AP4-3

#### Spanish survey on anesthetic practice in thoracic surgery (2012-2013)

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**Background and Goal of Study:** Since clinical practice anesthesiology in thoracic surgery had already been evaluated in Catalonia, the CardioVascular and Thoracic Section of the Spanish Society of Anesthesiology and Critical Care ( SEDAR ) had the idea to promote this survey across Spain.

**Materials and methods:** A controlled access survey was conducted by email invitation through the SEDAR between June 2012 and October 2013.

**Results and discussion:** This survey was answered by 63 anesthesiologists working in 36 hospitals (74% of all with thoracic surgery activity). The average anesthesiologist was a physician anesthesiologist (80.9 %) of 41.8 years old. The majority of anesthesiologists do not use as a rule specific measures to prevent bronchospasm ( 63.7 %).

For lung isolation, almost all anesthesiologists use the Robertshaw double-lumen tube (DLT) ( 82.5 %) and Bronchial Blocker -BB (60.3 %): Arndt (50.7 %), Cohen (14.2%) and Univent (12.6%). When left lung surgery is performed anesthesiologists use Right-sided DLT (46.0%), Left-sided DLT ( 46.0 %) or BB (7.9 %). With respect to one-lung ventilation (OLV), the most commonly used mode has been volume-controlled ventilation (VCV) or pressure-controlled ventilation (PCV) depending on the type of patient (55.5%), followed by VCV (17.4%) and PCV (15.8%). Most anesthesiologists (58,7%) use alveolar recruitment maneuvers during OLV and double-lung ventilation. The chosen therapeutic measures to treat hypoxemia during OLV are the following:

- 1<sup>st</sup> checking the position of airway devices,
- 2<sup>nd</sup> alveolar recruitment maneuvers,
- 3<sup>rd</sup> PEEP,
- 4<sup>th</sup> CPAP, and
- 5<sup>th</sup> FiO<sub>2</sub> increase.

Most anesthesiologists use techniques to minimize postoperative acute lung injury especially with a tidal volume (Vt) ≤ 6 ml/kg during OLV (80.9%), restrictive fluid management and blood transfusion, and alveolar recruitment maneuver. Regarding to locoregional blocks or postoperative analgesia used by anesthesiologists in lung resection and / or pneumonectomy, thoracic epidural block (84.1%) stands out followed by the paravertebral block (55.5%).

**Conclusion(s):** Anesthesia practice in thoracic surgery has improved in Spain similarly to other European countries as far as airway management, pulmonary protective measures<sup>1</sup> and optimal analgesia management are concerned.

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### 5AP4-4

#### Predictive factors of non-critical hypoxemia during one-lung ventilation

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**Background:** The incidence of severe hypoxemia in one-lung ventilation (OLV) has decreased due to the use of fibero bronchoscopy for the correct positioning of the double-lumen tube. But non-critical hypoxemia (NCH) is still frequent. Recruitment maneuvers and CPAP on the non-dependent lung are used to improve NCH. The most strongly variable related with the low PaO<sub>2</sub>/FiO<sub>2</sub> during OLV is the presence of poor arterial oxygenation during two lungs ventilation (TLV). The goal of the study was to assess the incidence of NCH during OLV and to know if there are predictive factors that can alert us.

**Material and methods:** A prospective study was designed and approved by a Local Ethics Committee. Patients undergoing lung surgery that requires > 1 hour of OLV were recruited. All patients during OLV were managed with protective pulmonary ventilation. Arterial blood gases before starting OLV, within 30 minutes of OLV and at the end of OLV were carried out. Age, sex,

BMI, FEV<sub>1</sub>, FVC, Tiffenau, tobacco habits, airway pressures, ventilatory parameters, arterial blood gases and hemodynamic values were analyzed. NCH was defined as PaO<sub>2</sub>/FiO<sub>2</sub> between 60 to 100 mmHg with FiO<sub>2</sub>=1. Statistical analysis: student's t test and Chi-square were used to compare the characteristics of patients who had NCH during TLV. ROC curves analysis was made to evaluate the predictive capacity of the variables.

**Results:** 2 patients developed critical hypoxemia. 51 of the 98 patients included developed NCH within 30 minutes of starting OLV. In the univariate analysis BMI was the only preoperative variable with p < 0.05 in patients who developed NCH or not, and during the TLV were: PaO<sub>2</sub>, PaO<sub>2</sub>/FiO<sub>2</sub> ratio, EtCO<sub>2</sub> and plateau pressure. ROC area for PaO<sub>2</sub>/FiO<sub>2</sub> basal was 0.782 (CI 95% 0.885-0.678), for BMI 0.770 (CI 95% 0.877-0.663), for plateau pressure in TLV 0.701 (CI 95% 0.811-0.629). The positive (PPV) and negative predictive value (NPV) for PaO<sub>2</sub>/FiO<sub>2</sub> < 100 during OLV: BMI (more or less than 30) PPV 75 %, and NPV 53.6 %. Basal plateau pressure (more or less than 20 cmH<sub>2</sub>O) 63.8 % PPV and NPV 60.7 %. PaO<sub>2</sub>/FiO<sub>2</sub> basal (more or less than 300mmHg) VPP 40.6 % and NPV 29.4 %.

**Conclusions:** PaO<sub>2</sub>/FiO<sub>2</sub> values during TLV is one of the parameters with greater predictive capacity in our study, but both the BMI and the plateau pressure during the TLV showed greater predictive on NCH during OLV. Recruitment maneuvers and/or CPAP should be applied during OLV in patients with high BMI and/or plateau pressures > 20 cmH<sub>2</sub>O during TLV.

### 5AP4-5

#### Desflurane at 1 MAC does not affect respiratory system resistance in patients with chronic obstructive pulmonary disease after thoracic surgery using one lung ventilation

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**Background:** Current *in vitro* and *in vivo* studies displays conflicting evidences regarding the effects of desflurane on respiratory resistance. There is a possibility that desflurane increases respiratory resistance by its irritable characteristics on the airways. The aim of this study was to compare the effects of desflurane on inspiratory respiratory resistance in patients with chronic obstructive pulmonary disease (COPD) and those in patients with normal respiratory function after thoracic surgery.

**Methods:** Seventeen consecutive patients undergoing elective thoracic surgery for lung cancer were enrolled. They were divided into two groups: preoperative forced expiratory volume in 1 s / forced vital capacity ratio (FEV<sub>1</sub>%) < 70% (COPD group) or > 70% (control group). Anaesthesia was maintained with propofol during surgery. After the operation, we replaced double lumen endobronchial tube with single lumen endotracheal tube. Then anaesthesia was switched to desflurane at 1 minimum alveolar anaesthetic concentration for 15 min. Before and at the end of desflurane inhalation, we measured end-inspiratory pressures by adding inspiratory pause of 2 seconds. We calculated respiratory system resistance (Rrs) using an equation: (peak-inspiratory pressure - end-inspiratory pressure) / inspiratory flow. Rrs was analyzed as the percentage change of Rrs between before and after desflurane inhalation. Statistical analysis was performed with paired and unpaired t-test. Data are expressed as mean values ± SD. A p-value of < 0.05 was considered significant.

**Results:** Patients characteristics were similar between groups except for FEV<sub>1</sub>% [46.0 ± 11.5 % in the COPD group (n=9), 76.2 ± 4.6 % in the control group (n=8)]. In both groups, no significant differences in Rrs were observed after inhalation of desflurane (-2.1 ± 13.4 %, p=0.65, in the COPD group and -6.8 ± 9.3 %, p=0.08, in the control group).

**Conclusions:** In patients with COPD similar to those with normal respiratory function, desflurane did not affect respiratory system resistance at 1MAC after thoracic surgery.



## 5AP4-6

### Measurement of matrix metalloproteinase-7 in bronchoalveolar lavage during lung resection surgery: postoperative prognostic value

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**Background:** Some studies have related an important role of matrix metalloproteinases (MMP) in the development of lung injury. However there are not any studies that reviewed the influence of MMP in bronchoalveolar lavage (BAL) during lung resection surgery (LRS) and its relation with postoperative course.

The goal of this study was to assess the expression of MMP in BAL in patients undergoing LRS and its impact in the immediate postoperative prognostic.

**Materials and methods:** We designed a prospective study, which was approved by the local Ethics Committee. Written informed consent was obtained from all patients scheduled for LRS. The exclusion criteria applied were treatment with immunosuppressant drugs prior to surgery and blood products administration in days before the surgery. In one lung ventilation (OLV) patients were managed with protective pulmonary ventilation with low tidal volume (6ml/kg). Fiberoptic BAL was performed in both lungs before and after OLV for MMP7 analysis. MMP7 was measured with Western Blot. We recorded the ICU stay, hospital stay and readmissions into the ICU. For statistical analysis we used Mann Whitney U test and Chi<sup>2</sup> test.

**Results:** 60 patients were included in the study. MMP7 (ng/ml) in BAL was increased in all patients at the end of surgery in both lungs (operated lung (OL)  $0.506 \pm 0.07$  (Mean  $\pm$  standard deviation) basal and  $0.534 \pm 0.06$  at the end; non operated lung (NOL)  $0.515 \pm 0.08$  basal and  $0.543 \pm 0.06$  at the end). The percentage changes in MMP7 values in BAL samples were also increased (OL  $7.8\% \pm 23$  and NOL  $8.2\% \pm 23$ ).

MMP7 values on the OL was lower in the patients whose hospital stay was > 9 days, both before OLV ( $0.47 \pm 0.1$  vs  $0.52 \pm 0.1$ ,  $p=0.02$ ) and at the end of OLV ( $0.51 \pm 0.1$  vs  $0.54 \pm 0.1$ ,  $p=0.045$ ) There was a negative correlation between the MMP7 values on the OL and hospital stay ( $r=-0.431$ ,  $p=0.001$ ).

Patients whose stay in the ICU was more than 24 hours had lower MMP7 values on the OL ( $0.43 \pm 0.1$ ) than those whose stay was less than 24 hours ( $0.51 \pm 0.1$ ) ( $p=0.009$ ). There was a negative correlation between the MMP7 on the OL and ICU stay ( $r=-0.304$ ,  $p=0.019$ ).

Patients readmitted into ICU, had higher MMP7 values in both lungs (at the beginning of the surgery) than those who were not readmitted ( $p=0.07$  on the NOL and  $p=0.09$  on the OL).

**Conclusion(s):** MMP7 as in other lung injury models increases during LRS. Also, MMP7 measures in BAL have an important role in the postoperative outcome of patients undergoing LRS.

## 5AP4-7

### Nonintubated thoracoscopic lobectomy using regional anesthesia and targeted sedation in lung cancer patients

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**Background and Goal of Study:** Our previous study showed that nonintubated thoracoscopic lobectomy under thoracic epidural anesthesia (TEA) is feasible and safe to avoid tracheal intubation-related adverse effects. However, thoracic epidural catheterization can cause unwanted neurological complications and intercostal blocks can be an alternative. The goal of this study is to report our overall experiences of nonintubated thoracoscopic lobectomy in lung cancer patients under either thoracic epidural anesthesia or intercostal blocks (ICB) with targeted sedation.

**Materials and methods:** We evaluated consecutive 205 non-small cell lung cancer patients undergoing nonintubated thoracoscopic lobectomy using either TEA ( $n = 129$ , September 2009 to October 2012) or ICB ( $n = 76$ , November 2012 to November 2013), in combination with intrathoracic vagal blockade and targeted sedation. The perioperative profiles and early outcomes of the two groups were compared.

**Results and discussion:** Mean age of the 205 patients was 59.1 years (range, 28 - 85 years). Both groups had comparable preoperative demographic and cancer staging profiles. Patients in the ICB group had shorter duration of an-

esthetic induction (mean [SD], 12.4 [6.5] min vs 28.9 [19.2] min,  $p < 0.001$ ) and surgical time (163.6 [34.7] min vs 189.8 [66.0] min,  $p = 0.002$ ). Patients in the ICB group also had a trend toward better hemodynamic stability with less use of vasoactive drugs (30.1% vs 62.6%,  $p < 0.001$ ) and less blood loss during operation (59.2 [100.5] mL vs 111.8 [162.2] mL,  $p = 0.011$ ). Postoperatively, the two groups had comparable hospital stay and complication rates, but shorter duration of chest tube drainage in the ICB group (2.4 [1.7] days vs 3.1 [1.9] days,  $p = 0.009$ ). There was no mortality but 12 patients (9.3%) were converted to tracheal intubation in the TEA group and two patients (2.6%) in the ICB group ( $p = 0.123$ ).

**Conclusions:** Nonintubated thoracoscopic lobectomy is easily feasible and safe using either TEA or ICB in selected lung cancer patients. In consideration of learning curves, nonintubated thoracoscopic lobectomy using ICB has its advantages of rapid induction and less hemodynamic interferences intraoperatively, comparing to TEA.

#### References:

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2. Wu CY et al. Ann Thorac Surg 2013;95:405-11.

## 5AP4-8

### Nebulized hyaluronic acid improves tolerability of hypertonic saline solution after lung resection

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**Background and Goal of Study:** Hypertonic saline solution (HSS) has been shown to improve mucociliary clearance, lung function and also have an impact on the pulmonary inflammatory response (1) (2); but adverse effects including marked airway narrowing, cough and saltiness cause intolerance (3). In patients with cystic fibrosis, adding hyaluronic acid (HA) to HSS has been shown to decrease side effects (4).

The aim of our study was to evaluate the safety and tolerability of this combination in patients after lung resection.

**Materials and methods:** Observational, prospective, controlled study in 84 adult patients after lung resection. In the first day after surgery, a single dose of inhaled 7% HSS was administered to a control group (Group 1) and compared with 7% HSS+ 0.1% HA (Group 2). After inhalation, all patients received the same chest physiotherapy (CP) protocol. FVC, FEV1, FEV1% and FEF 25-75% were assessed by portable spirometry (Spirobank II®) performed before and after each inhalation. Tolerability was assessed in terms of cough, irritation, taste and overall feeling.

**Results and discussion:** 4 patients were excluded because of postoperative complications. Of the 80 left, 41 patients received HSS (Group 1) alone and 39 HSS+HA (Group 2). No differences were found between both groups in terms of sex, age, type, length of surgery and surgical approach (thoracotomy or thoracoscopy). Also, pain scale was similar in both groups before inhalation. FVC, FEV1 and PEF (peak end flow) increased in both groups. Cough occurred in 29,3% of patients in Group 1 compared to 10,3% in Group 2 ( $p=0.034$ ). In Group 1 some degree of throat irritation and salty taste occurred in 70,7% and 80,5% of patients, respectively, compared with 59% and 64,1% in Group 2. Bronchospasm was not seen in any patients after inhalation.

**Conclusion(s):** In patients after lung resection, the addition of HA to inhaled HSS improves lung function and reduces the incidence of cough.

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3. Maiz L, Lamas A, Ruiz de Valbuena M, et al. Med Clin, 2012; 4;138(2):57-60.
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### 5AP4-9

#### Lateral decubitus and one lung ventilation in thoracic surgery: the role of esophageal pressure at residual volume. Preliminary physiological study

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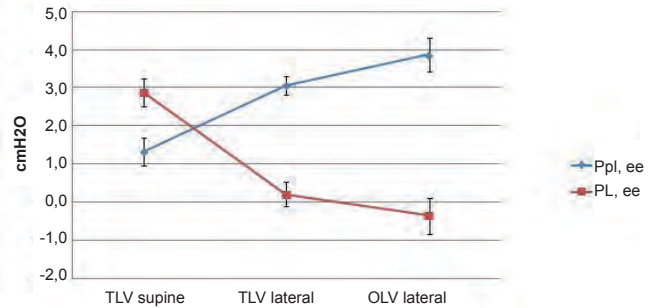
**Background:** In this prospective physiological observational study, we applied a strategy to estimate the end-expiratory pleural pressure ( $P_{pl,ee}$ ) using esophageal manometry to measure the esophageal pressure ( $P_{es}$ ) directly. The estimated  $P_{pl,ee}$  was used to assess the end-expiratory transpulmonary pressure ( $P_{L,ee}$ ), in order to obtain a parameter to target PEEP, thereby minimizing alveolar collapse and resulting hypoxemia at end expiration during normal and one lung ventilation (OLV) in supine and lateral decubitus in Thoracic Surgery.

**Material and methods:** After Ethical Committee approval was obtained, we enrolled patients with age  $\geq 18$  ys, scheduled for thoracic surgery and OLV with double-lumen tube in lateral decubitus. Exclusion criteria: ASA > III, haemodynamic instability, ARDS. Haemodynamics, gas exchange and respiratory mechanics data were recorded at three time points: two lung ventilation in supine position (T1), two lung ventilation in lateral (T2) and one lung ventilation in lateral position (T3).

We applied a factor to correct absolute  $P_{es}$  values to estimate the  $P_{pl,ee}$  by subtracting the  $P_{es}$  value obtained at the relaxation volume of the respiratory system ( $V_r$ ) after manual disconnection from the ventilator, from the  $P_{es}$  value at the end of an expiratory occlusion.  $P_{L,ee}$  was obtained as airway pressure

at the end of the expiratory occlusion minus  $P_{pl,ee}$ .

**Result and discussion:** 8 consecutive patients undergoing to thoracic surgery were included. At T1  $P_{pl,ee}$  was  $1.31 \pm 0.37$  cmH<sub>2</sub>O, and increased overtime ( $3.06 \pm 0.23$  at T2 and  $3.87 \pm 0.43$  at T3;  $p < 0.01$  vs T1), while  $P_{L,ee}$  decreased ( $2.88 \pm 0.36$  cmH<sub>2</sub>O at T1,  $0.2 \pm 0.33$  at T2,  $-0.36 \pm 0.47$  at T3;  $p < 0.01$  vs T1).



[Figure 1. End-expiratory pleural and transpulmonary pressures]

**Conclusion:** Our preliminary results show that the lateral position and the lung exclusion induce an increase in  $P_{pl,ee}$  and a reduction in  $P_{L,ee}$ . We need further studies to determine if the estimation of  $P_{pl,ee}$  on the basis of the  $V_r$  method could allow PEEP titration to target an  $P_{L,ee}$  of 0 cmH<sub>2</sub>O in order to avoid atelectrauma during thoracic surgery.

## Transfusion and Haemostasis

### 6AP1-1

#### Implementation of a multimodal program to reduce blood transfusion rates in primary joint arthroplasties

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**Background and Goal of Study:** Primary joint arthroplasties are associated with significant blood loss, often requiring allogeneic transfusion. These carry risks of infection, immune suppression and are associated with large costs. The majority of these procedures are carried out in the older population where the prevalence of anaemia is already high. We audited transfusion rates before and after the introduction of guidelines and enhanced recovery program for primary joint arthroplasties in our Trust.

**Materials and methods:** In 2011 a single centre observational retrospective analysis was conducted on all patients undergoing primary total knee (TKR) and total hip replacement (THR) over a 3 month period. Preoperative and postoperative haemoglobin (Hb) were noted and all patients receiving perioperative transfusion identified. Following this, recommendations were taken from the NATA guidelines<sup>1</sup>, and an enhanced recovery programme was introduced. The guideline stated that any anaemic patient, as per the WHO definition, required preoperative investigation and optimisation. Tranexamic acid (TXA) was given intraoperatively, wound drains discontinued and early mobilisation initiated. The study was then repeated for a 3 month period in 2013 and results compared.

#### Results and discussion:

	TKR 2011	TKR 2013	THR 2011	THR 2013
No of patients	80	48	73	56
Mean preop Hb (g/L)	137	134	135	140
Mean Hb drop (g/L)	35	28.5	34	32.3
No of anaemic patients	10	9	11	8
% non-anaemics transfused	10	0	9.7	0
% anaemics transfused	40	22	45	50

[Table 1]

Preoperative anaemia is associated with an increased rate of transfusion. Since 2011, the overall transfusion rate has improved with a 0% rate in non-anaemic patients. It is difficult to clarify to what extent each of the changes is responsible for the improvement. It is most likely due to the combined package of care rather than any one component within it.

**Conclusion:** A multimodal strategy involving the introduction of TXA and preoperative optimisation of Hb has been shown to lower the rate of transfusion. This has large implications on reducing transfusion risk as well as huge financial savings. As a unit of blood currently costs £122, a reduction in the non-anaemic transfusion rate from 10% to 0% can give an estimated saving of over £12000 per annum in our Trust.

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### 6AP1-2

#### Early values of serum D-dimer and fibrinogen indicate injury severity and necessity for urgent blood transfusions in trauma patients with bone fractures

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**Background and Goal of Study:** Evaluating the severity of injuries and the need for urgent blood transfusion (BT) promptly in ED is important. We evaluated the suitability of using early values of serum D-dimer (DD) and fibrinogen (F) levels in blood samples as a means of predicting the severity of injuries and the need for BT in trauma patients with bone fractures by adding another data with ones presented in SSAI(2013 R).

**Materials and methods:** This was a retrospective study and the local committee agreed to waive the requirement for informed consent. Patients who presented and were admitted to Shinshu University Hospital with traumatic injuries were enrolled. We excluded the following patients as these factors can influence the results: cardiac arrest patients, patients arriving at the ED more than 300 min after traumatic injury, patients with aortic aneurysm, and patients with no data for the blood levels being studied. The physicians performed their treatments according to Japan Advanced Traumatic Evaluation and Care. The trauma patients were divided into two groups: patients with

bone fractures (GF) and those without bone fractures (GN). We correlated the values of serum DD and F upon arrival at ED with the severity of traumatic injuries and the necessity for BT in the first 24 h. We calculated the injury severity scores (ISS) and the correlation value (CF) between DD and ISS. In addition, sensitivity (SS%), specificity (SF%), positive predictive value (PPV%), negative predictive value (NPV%), positive likelihood (LR+), and negative likelihood (LR-) were calculated for the predictability of urgent BT within 24 h when abnormal values of DD (>10 ng/ml) and F (<180 mg/dl) were observed.

**Results and discussion:** From August 2011 to May 2013, 297 patients were enrolled: 225 GF patients and 72 GN patients. The correlation between DD and SSI was 0.579 in GF patients and 0.197 in GN patients. In GF patients, the data were as follows: SS, 53%; SF, 90%; PPV, 64%; NPV, 86%; LR+, 5.5; and LR-, 0.51. In GN patients, the values were 0%, 97%, 0%, 53.7%, 0, and 0.97, respectively. This shows that in GF patients, the blood levels indicated the severity and necessity for urgent BT.

**Conclusion(s):** The DD and F upon arrival at ED may indicate the severity of their injuries and the urgent need for BT in GF trauma patients, not in GN trauma patients.

#### References:

H Dohgomi et al: Relationship between serum D-Dimer levels and severity of injury in trauma patients with fractures. *SSA*2013

## 6AP1-3

### Starting a patient blood management program in our center.

#### Review of the first year

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**Background and Goal of Study:** Patient blood management (PBM) is an evidence-based, multidisciplinary approach to optimizing the care of patients who might need transfusion. It includes preoperative, intraoperative and postoperative recommendations with the aim of reducing allogenic blood transfusion. The aim of our study was to evaluate the impact on the need of transfusion in our center one year after the generalization of several of these recommendations.

**Materials and methods:** During 2012 we generalized the systematic application of treating preoperative anemia, the use of intraoperative blood-conservation strategies, a restrictive transfusion trigger as well as postoperative actions like managing correctable anemia in order to avoid folate deficiency or iron-restricted erythropoiesis. We compared transfusion rates of all patients undergoing scheduled spinal fusion, knee and hip replacement during 2011 with those undergoing the same procedures during 2012 by means of an observational, retrospective analysis. Both groups were comparable to each other in a similar way (ASA, surgical techniques, medical equipment, comorbidity, etc.).

**Results and discussion:** In 2011 89 patients underwent scheduled total hip replacement, with a transfusion rate of 43,82%, 178 patients had their knee replaced (transfusion rate 20,79%), while 47 patients underwent spinal fusion, of which 42,55% were transfused. One year after, the number of patients undergoing hip replacement was 107, knee replacement 205 and spinal fusion 53. Transfusion rates went up to 37,23% in hip arthroplasty, 17,97% in knee arthroplasty and 27,73% in spinal fusion. These results suggest that just protocolizing simple cost-effective measures like ruling out and treating underlying preoperative anemia if necessary, using anesthetic blood conserving strategies, using pharmacologic hemostatic agents, or reviewing drug interactions might significantly reduce transfusion rates.

**Conclusion(s):** Although we are just analyzing 300-400 patients each year and probably more studies should be necessary, our results suggest and encourage us to take further steps in patient blood management (i.e. generalizing the use of cell salvage in those cases with proved cost-effectiveness) in order to further reduce transfusion rates, thus improving the quality of health care that this implies.

#### References:

Goodnough LT, Shander A. Patient blood management. *Anesthesiology*. 2012 Jun;116(6):1367-76.

## 6AP1-4

### Low hemoglobin levels predict postoperative myocardial ischemia and infarction in elderly patients with hip fractures

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**Background and Goal of Study:** The dominant causes of early in-hospital mortality among hip fracture patients are myocardial infarction, heart failure, and pulmonary embolism. The use of liberal transfusion strategy can reduce hospital mortality and incidence of cardiac events.

The study was aimed to determine the relationship between hemoglobin levels and incidence of myocardial ischemia and infarction in elderly patients with hip fractures and total knee arthroplasty in early postoperative period.

**Materials and methods:** A retrospective chart review of 303 patients over the period from 2005 to 2011 was performed. The patients were over 65 years old (74.8 +/- 5.4) with hip fractures, hospitalized no later than 24 hours after the trauma. Postoperative cardiac complications were diagnosed based on clinical and ECG data. The patients were divided into two groups based on hemoglobin (Hb) levels: group 1 (n = 116) with Hb levels on day 2 higher than 10 g/dL, and group 2 (n = 187) with Hb levels on day 2 lower than 10 g/dL.

**Results and discussion:** There were no significant differences between the groups based on the following variables: AHA/ACA 2007 cardiac status, K.A. Eagle index, ASA classification, type of surgery, type of anesthesia, length of surgery, prescription of vasoconstrictors, volume of infusion-transfusion therapy, perioperative blood loss. The incidence of preoperative anemia was lower in group 1 (11 vs. 39 patients, p=0.015).

Transfusions in group 1 were more common intraoperatively and in the first postoperative hours (67 vs. 35 patients; p<0.001) and less common on days 1 to 4 postoperatively (6 vs. 71 patients; p<0.001).

Hb level on day 2 was significantly higher in group 1 (Hb: median, 10,8 [10.4-11.8] g/dL vs. 8.7 [8.0-9.2] g/dL; p<0.001). In group 1, there was lower incidence of myocardial ischemia (0% vs. 5.3%; p=0.028) and myocardial infarction (0% vs. 6.4%; p=0.013). In group 2, Hb levels in patients with myocardial ischemia and infarction were 8.8 [8.3-9.4] g/dL and 8.4 [7.7-9.0] g/dL, respectively.

**Conclusion(s):** Hemoglobin levels above 10 g/dL in patients older than 65 years with hip fractures are associated with lower incidence of ischemic cardiac complications.

## 6AP1-5

### Perioperative use of balanced tetrastarches in cardiac surgery patients: does the raw material influence blood loss and renal function?

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**Background and Goal of Study:** Tetrastarches (HES 130/0.4) are mainly used for volume replacement therapy in cardiac surgery patients including priming of the cardiopulmonary bypass (CPB). As they originate from different vegetable sources (maize or potato), they may not be bioequivalent (1). The purpose of this prospective, randomized, double-blind, study was to compare two balanced HES 130/0.4 solutions, one maize-derived (Volyte, Fresenius Kabi, Germany) and the other potato-derived (Plasma Redibag Baxter, Belgium) on post-operative blood loss and renal function.

**Materials and methods:** After approval of the IEC, and obtaining written informed consent, 86 patients scheduled for elective cardiac surgery under CPB were included in this study. Patients were randomized to receive either a potato-derived HES or a maize-derived HES solution. Fluids were administered perioperatively (including priming of CPB) until the second postoperative day (POD) to maintain a stroke volume variation related to mechanical ventilation less than 13% (System FloTrac / Vigileo, Edwards, Irvine CA, USA). After extubation, fluid administration was left at the discretion of the clinician. Anaesthetic, surgical and CPB management techniques were standardized. Blood loss until the second postoperative day was calculated using Samama's formula (1). Continuous variables were compared between the two groups using a Mann-Whitney U-test and discrete variables using a chi-square test. Significance was set at p < 0,05.

**Results:** Preoperative demographic and intra-operative characteristics were not different between groups.



VARIABLES	Maize-HES ( n=43)	Potato-HES (n=43)	p
Total crystalloid until POD 2(ml)	4203[3739-4628]	3800[3109-4769]	0,322
Total colloid until POD 2(ml)	1950[ 1250-2650]	2000[1425-2875]	0,654
IN/OUT perioperative (ml)	1108[637-1439]	920[492-1188]	0,109
Peroperative measured blood losses (ml)	340[251-537]	350[284-465]	0,827
Calculated POD 2 blood losses(ml)	465[366-746]	582[427-703]	0,180
Transfused patients(%)	8/43(19%)	13/43(31%)	0,208
Redo surgery for hemorrhage(%)	1/43(2,3%)	3/43(7%)	0,317
Renal replacement therapy (%)	2/43(4,6%)	1/43(2,3%)	0,571
Intensive care length of stay (hours)	72[48-144]	72[48-107]	0,469

## [Results]

Laboratory results and blood gases parameters did not differ between the 2 groups at any time.

**Conclusion:** In the conditions of our study, the raw material of the tetrasarch does not appear to have a significant influence on postoperative blood loss and renal function.

**References:**

1. Lehmann G, and al: Drugs 2007;8:229-240
2. Samama CM and al: Anesth Analg.2002;95:2319-2331

**6AP1-6**

### Red blood cell transfusion during bypass is not a predictive factor of severe postoperative morbidity and mortality in children undergoing cardiac surgery

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**Background and Goal of Study:** In paediatric cardiac surgery, packed red blood cells (RBC) are added in the prime to avoid a too low haematocrit (Hct) during cardiopulmonary bypass (CPB) which has been associated with altered outcome in children (1). The aim of this retrospective study was to assess the effect of such transfusion on postoperative outcome.

**Materials and methods:** All consecutive patients admitted for cardiac surgery with CPB from 1 January 2006 to 31 December 2012 were included in this analysis. Jehovah's witnesses and moribund patients (ASA >4) were excluded. Anaesthetic, CPB and surgical techniques were standardized. Children were transfused on CPB to maintain Hct above 20% after crystalloid cardioplegia. Patients who were transfused exclusively during CPB were compared to those who were not transfused. The primary outcome was severe postoperative morbi-mortality which included at least two of the following criteria: postoperative pulmonary, cardiac or renal failure and/or in-hospital death. Univariate analysis was performed to defined factors associated with the primary outcome followed by a step down multivariate analysis.

**Results and Discussion:** From the 854 patients retained for analysis, 439 (51.4%) were not transfused and 415 (48.6%) received RBCs only in the priming of the CPB circuit (volume: 26.1 [18.2-37.4] ml/kg). Severe postoperative morbidity and mortality occurred in 26.5% of the transfused patients compared to 8% non-transfused children (p < 0.001). Intensive care unit length of stay was longer in the transfused children (5.0 [3.0-8.0] days) than in the non-transfused one (3.0 [2.0-6.0] days; p < 0.001).

Variables	OR [95% CI]	p value
Preoperative weight (kg)	0.81 [0.77-0.87]	< 0.001
ASA score	3.25 [1.88-5.64]	< 0.001
Total intraoperative fluid balance (ml/kg)	1.01 [1.00-1.02]	< 0.001
CBP time (min)	1.01 [1.00-1.01]	< 0.001

## [Predictive factors of postop morbi-mortality]

**Conclusion:** In the conditions of our study, RBC transfusion on CPB is not a predictive factor of severe postoperative morbidity or mortality in children cardiac surgery.

**References:**

1. Jonas RA. J Thorac Cardiovasc Surg. 2003; 126: 1765-74.

**6AP1-7**

### Preoperative hemoglobin level, blood volume or circulating red blood cell volume as predictors for perioperative blood transfusion? A retrospective study on 681 patients undergoing orthopedic major joint replacement

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**Background:** Anemia prior elective surgery is common and transfusion is an independent risk factor for morbidity and mortality. As a contribution to Patient Blood Management (PBM) we assessed preoperative hemoglobin (Hb) levels, hematocrit (HCT), calculated circulating red blood cell volume (RBC volume) and assessed the need for transfusion in a retrospective data analysis of patients undergoing total knee (KEP) or hip (HEP) replacement in a tertiary teaching hospital.

**Methods:** In 424 ♀ (age 73±8; BMI 28.8±5.0 kg/m<sup>2</sup>; HEP 199; KEP 225) and 257 ♂ (age 69±9; BMI 28.8±4.4 kg/m<sup>2</sup>; HEP 143; KEP 114) Hb levels and HCT were determined preoperatively, at ICU admission and on the day after surgery, respectively. Blood volume (BV) was calculated by the equation of Nadler. RBC volume was calculated by total BV and HCT (RBC volume [ml]=BV[ml]\*HCT[l/l]; correction factor peripheral blood sample .91). Quantity and point in time of transfusion of packed red blood cells (PRBCs) were considered. Data are expressed as mean ± SD. ANOVA was used to uncover differences between the groups <sup>§</sup>p < .01. Multiple logistic regression analysis was performed to estimate the impact of preoperative Hb levels, BV and RBC volume on transfusion needs (SPSS 21.0; IBM).

**Results:** Preoperatively, Hb levels<sup>§</sup>, HCT<sup>§</sup>, BV<sup>§</sup> and RBC volume<sup>§</sup> were 13.47±.06 g/dl, 40.12% ±.16, 4276 ml, 1564 ml in ♀ and 14.48±.07 g/dl, 42.33% ±.2, 5438 ml and 2098 ml in ♂, respectively. At hospital admission, 38 ♀ (9.0%) and 23 ♂ (8.9%) presented with anemia according to the WHO definition (♀ < 12.0 g/dl; ♂ < 13.0 g/dl). There were no statistical differences in blood loss between ♀ (533±363 ml) and ♂ (530±389 ml) (p=0.994). PRBCs were necessary in 175 ♀ (41.3%) and 44 ♂ (17.1%)<sup>§</sup>. PRBCs were required in 29 ♀ (76%) and 12 ♂ (52%) with anemia. Patients requiring transfusion presented with an RBC volume < 1663 ml in ♀ and < 2144 ml in ♂.

Regression analysis indicated that RBC volume is superior in predicting transfusion requirements in this patient population compared to preoperative Hb levels (regression coefficient Beta -.165 for Hb and -.335 for RBC volume).

**Conclusions:** Higher transfusion rates in women might be due to a reduced BV. RBC volume seems to be a better predictor for transfusion probability than Hb values. Thus, patients with low RBC volumes are recommended to be integrated in PBM programs to optimize blood volume before surgery.

**References:**

- Nadler SB. Surgery (1962) 51:224-32

**6AP1-9**

### Transfusion in obstetrics - where are we?

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**Background and Goal of Study:** Hemorrhage remains a major cause of maternal morbi/mortality through the world.<sup>1</sup> Blood products transfusion is life-saving<sup>2</sup> and criterion of quality of care of pregnant women. According to RCOG, transfusion decision should be made on clinical and hematological criteria. Rarely indicated when Hb is >10g/dl and almost always indicated when < 6g/dl.<sup>3</sup>

The aim of our study is evaluate the transfusion practice in Obstetrics.

**Materials and methods:** Retrospective study conducted in a tertiary maternity of a Central University Hospital. Clinical reports of women, who received blood products, admitted between 1<sup>st</sup> January 2012 and 31<sup>st</sup> October 2013, were reviewed. Statistical analysis with SPSS20.0<sup>®</sup>.

**Results and discussion:** In a cohort of 4788 deliveries, 120 patients were transfused. The mean age was 31,8±5,3y. Mean Hb value before transfusion was 7,7g/dl(±1,3; 5,2-14,2g/dl) and an average of 2,54U RBC per woman, were transfused. 8 women had Hb < 6g/dl and 7 had Hb >10g/dl. 11 women (9,2%) had an abortion. In the 109deliveries studied: 19,2%(23)eutocic, 38,3%(46) distocic, 30,8%(37) cesarean and 2,5%(3) distocic and cesarean;

28,3%(34) preterm delivery. Etiologies underlying transfuse decision were: 34,2%(41) anemia of unknown causes (not registered); 15,8%(19) genital tract trauma; 17,5%(21) uterine atony; 13,3%(16) retained products of conception; 4,2%(5) hemolytic anemia; 2,5%(3) DIC and 1uterine eversion. There were 1355 cesarean and 120 multiple pregnancies of which 2,95%(40) and 14,2%(17) were transfused, respectively. There is a relation between multiple pregnancy and blood transfusion: OD:7,86(95%CI 4,53 to 13,64; p< 0,0001). In the last 22 months, 2,51% women were transfused which is a high ratio comparing with literature<sup>3</sup>.

The mean Hb value was unexpectedly high. The indications for RBC transfusion were controversial as seen through the clinical records.

**Conclusion:** Multiple pregnancies have a high risk of RBC transfusion. A significant amount of transfusions were inappropriate, partly due to over-transfusion. This could be decreased if guidelines would be more specific, in particular, with respect to the target Hb levels. We have a lot to improve on clinical and organizational measures. Blood bank, Anaesthesiology and Obstetric Departments, should have transfusion protocols and establish clear lines of communication.

**References:**

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2. Blood Transfusion in Obstetrics: RCOG,2008(47)1-10;
3. Obstet&Gynecol2004;112:61-64

**6AP2-1**

**Perioperative blood transfusion is associated with a characteristic immune response, excess infectious complications and death in patients undergoing scheduled major gastrointestinal surgery**

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**Background and Goal of Study:** Whilst the immunomodulating effects of transfusing non leukodepleted whole blood are uncontroversial it remains less clear whether leukodepleted red cells induce a similar response.

**Materials and methods:** Research ethics approval was granted to study patients undergoing scheduled major abdominal surgery. Blood samples were collected preoperatively and at 24 hours postoperatively. Messenger RNA (mRNA) was extracted from whole blood. Mediators descriptive of specific T cell pathways were quantified using polymerase chain reaction (PCR). Post-operative infections were assessed according to predefined criteria. Data relating to blood product transfusion over the first 24 hours were collected. Data were analysed using a Mann-Whitney U test or Fisher's exact test and are presented as median and IQR. PCR data are presented as a relative quantification ratio between the candidate and reference genes.

**Results and discussion:** 129 patients (median age 64 (58 - 72), 60% male) undergoing scheduled major abdominal surgery were recruited. 18 (14%) patients received a blood transfusion in the first 24 hours (12 intraoperative and 6 postoperative).

Blood transfusion in the initial 24 hours was associated with greater IL-10 mRNA levels and lesser levels of pro-inflammatory mediator mRNA.

	Patients requiring transfusion in the initial 24 hours (n= 18)	Patients not requiring transfusion in the initial 24 hours (n= 111)	p value
Cancer diagnosis (%)	94	59	0.003
Age (years)	75 (63 - 80)	64 (56 - 70)	0.002
Duration of operation (minutes)	275 (150 - 378)	220 (148 - 308)	0.13
IL-10 mRNA at 24 hours	4.63 (3.0 - 6.4)	3.30 (2.3 - 4.9)	0.03
TNFα : IL-10 mRNA at 24 hours	8.73 (5.7 - 13.2)	15.75 (10.1 - 27.1)	0.0006
IL-23 mRNA at 24 hours	3.03 (2.1 - 4.4)	4.06 (2.8 - 6.0)	0.02
RORyt mRNA at 24 hours	1.56 (0.8 - 3.1)	2.76 (1.5 - 3.8)	0.006

[Transfusion in the perioperative period]

Multivariate regression analyses confirmed independent associations between gene expression and transfusion.

49 (37%) patients developed infectious complications. Patients receiving a blood transfusion were more likely to develop an infectious complication (OR 3.0 (95% CI 1.06 - 8.3) p=0.04) and pneumonia in particular (OR 4.2 (95% CI 1.09 - 16.2) p=0.04). They were also more likely to die in hospital (OR 13.6 (95% CI 1.2 - 159) p=0.05).

**Conclusion(s):** Blood transfusion during and following scheduled major abdominal surgery is associated with a pattern of gene expression compatible with an immunosuppressed phenotype. Blood transfusion was associated with excess infectious complications and mortality.

**Acknowledgements:** Supported by a grant from the BJA / RCoA, UK

**6AP2-2**

**Effects of peri-ischemic transfusion of aged packed RBC on early hepatic ischemia reperfusion injury**

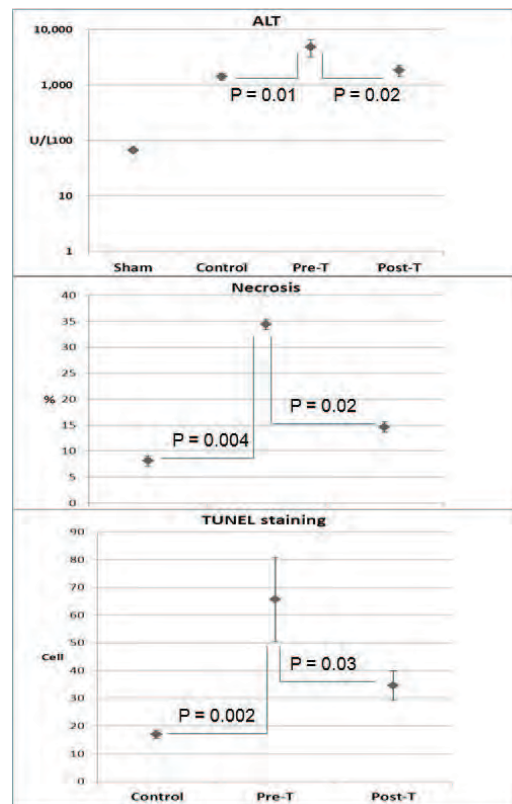
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**Background and Goal of Study:** Transfusion of aged packed RBC (PRBC) seems to prime neutrophils and Kupffer cells (KC) before hepatic ischemia. This may exacerbate hepatic injury during reperfusion. In contrast, phagocytosed aged RBC before or after hepatic ischemia may inhibit KC, producing antiinflammatory effects. It is unknown whether periischemic transfusion exacerbate or attenuate hepatic ischemia reperfusion injury (HIRI).

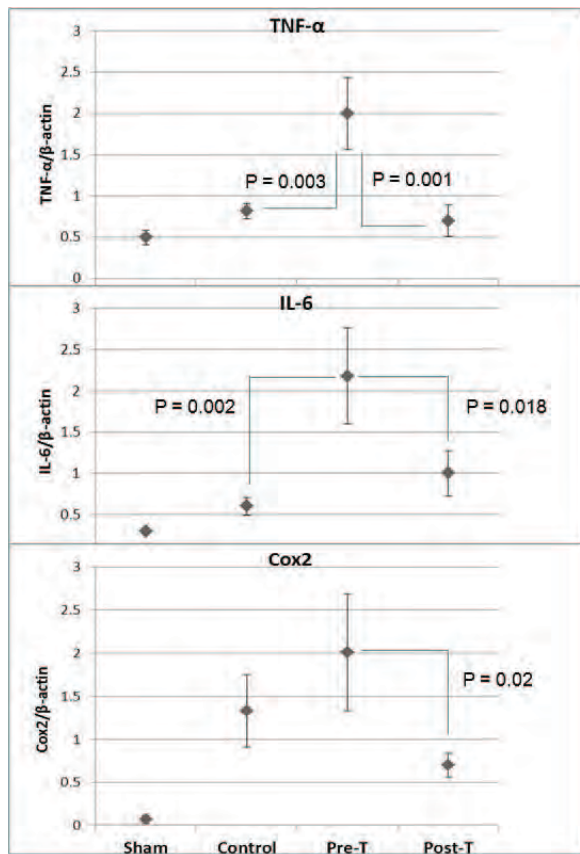
**Materials and methods:** After Institutional Animal Care and Use Committee approval, male Sprague-Dawley rats weighing between 275 and 325 g were included in this study. Rats (n = 24) were divided into: sham operation (Sham); HIRI only (Control); aged PRBC transfusion (15% of estimated blood volume, via tail vein) started at 60 min before HIRI (Pre-T), and, aged PRBC transfusion started at 30 min after IRI (Post-T). Allogeneic PRBC, collected from 4 ~ 6 rats for Pre-T and Post-T and stored for 2 weeks, was used for transfusion. Partial hepatic ischemia (the median and left lateral lobes) was induced for 90 min and reperfusion was allowed for 2 h. Then, blood (for AST and ALT) and liver tissue (for mRNA expression of TNF-α, IL-6, COX2 by RT-PCR with densitometry) were obtained for analysis. Histopathological analysis using IMT i-Solution<sup>®</sup> was also done.

**Results and discussion:** Liver injury markers (serum ALT, necrosis area, apoptotic cell counts) demonstrated that Pre-T increased hepatic injury compared to Post-T or Control (P < 0.05). The mRNA expression of TNF-α, IL-6, and COX2 increased in Pre-T compared to Post-T or Control (P < 0.05).

**Conclusion(s):** Transfusion of aged RBC immediately before hepatic ischemia exacerbated HIRI more than transfusion immediately after ischemia did. The results suggest that Pre-T produce more robust inflammation than Post-T or Control, as indicated by increased expressions of inflammatory cytokines and COX2.



[Liver injury markers]



[Inflammation markers]

### 6AP2-3

#### Comparison of two RBC transfusion strategies in pediatric cardiac surgery patients

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**Background and Goal of Study:** Despite numerous publications regarding safe thresholds of blood transfusion, there are still insufficient data of optimal blood transfusion strategy in pediatric population. The aim of this study was to compare outcomes of two transfusion strategies, in pediatric cardiac surgery patients, "restrictive" (R.B.C. transfusion threshold hemoglobin level < 8 g/dl) and "liberal" (Hb < 10 g/dl).

**Materials and methods:** From March 2013 to May 2013, in a randomized controlled trial, we studied 43 patients with non-cyanotic congenital heart defects, age from 1 to 7 years, underwent elective cardiac surgery, in stable postoperative condition. After written informed consent and approval by the institutional Ethics Committee, we randomly divided patients in two groups: "restrictive" group (n = 23) and "liberal" group (n = 20).

The outcome measures analyzed were: volume of RBC transfused perioperatively, in-hospital length of stay (LOS), LOS in the PICU, duration of mechanical ventilation, in-hospital morbidity. Continuous variables are described as mean with (SD) and were tested with the Mann-Whitney U test or Student's t test. Categorical variables are described as numbers or percentages and were examined using a chi-square test or Fisher's exact test. A Kaplan-Meier curve was used to assess LOS (in-hospital and PICU) and duration of mechanical ventilation. Differences between groups were considered significant when p value was ≤ 0.05.

**Results and discussion:** Transfused RBC volume was: 264 (59) RBC ml/kg in "liberal" vs. 164 (71) in "restrictive" group (p < 0.05). The duration of M.V. - 13.8 (3.1) hours in "liberal" vs. 12.2 (3.1) in "restrictive". The length of PICU stay was similar in both groups - 3.7 (2.2) vs. 3.8 (1.9) days. In-hospital LOS was 10 (3.5) vs. 10.3 (1.2). Morbidity rate was 5.8% in "liberal" group "vs. 6.1% in "restrictive". In this pilot study, with the small number of patients, we couldn't find any difference in outcome measures between "liberal" and "restrictive" groups. Only difference was observed, is the amount of transfused RBC, that was significantly higher in the "liberal" group.

**Conclusion(s):** We can conclude: "restrictive" RBC transfusion strategy in pediatric cardiac surgery is at least as safe as "liberal" strategy. If the amount of transfused RBC will be taken in to consideration, "liberal" strategy is more expensive in comparison to "restrictive" strategy.

### 6AP2-4

#### Predictors of patient survival following liver transplantation

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**Background and Goal of Study:** Liver transplantation (LT) is known as a highly complex procedure. Several variables can affect the outcome. Many attempts have been undertaken to better predict outcome after the transplantation procedure. These could assist on the very difficult task of balancing the waiting list mortality and the post-transplant outcome. Centro Hospitalar do Porto has a LT program since 1996, with about 1100 performed transplants. The aim of this study was to identify the pre- and intra-operative variables that may influence the outcome of cadaveric LT, at a single institution.

**Materials and methods:** Anesthetic records from 237 consecutive patients who underwent LT from deceased donors between June 2006 and December 2011 in our institution were reviewed in this retrospective study. Patients undergoing retransplantation were excluded from the analysis as were patients with familial amyloid polyneuropathy because we considered these to be a very different entity from all the other primary diagnosis. Pre-operative variables studied were age, gender, MELD score, primary diagnosis, cold ischemic time, preoperative international normalized ratio (INR), serum albumin and hemoglobin levels. Intra-operative variables included were norepinephrine consumption (mg), blood loss (mL), red blood cell (RBC) transfusion (number of units) and surgical time (min). All variables statistically significant at the 10% level at bivariate analysis were included in a multivariate Cox proportional hazard model.

**Results and discussion:** Bivariate analysis revealed that norepinephrine consumption, blood loss, RBC transfusion and surgical time were associated with patient survival (P values 0.008, 0.001, < 0.001, 0.066, respectively). When these variables were included in a multivariate Cox regression model, only RBC transfusion was identified as a significant independent predictor of survival after LT (hazard ratio per unit transfused 1.19, 95% confidence interval 1.07 - 1.34). These findings support previously published studies demonstrating the association between intra-operative transfusion of RBC and adverse outcome after LT.

**Conclusion:** RBC intra-operative requirement is an independent risk factor for survival after LT, in our center. These findings have important implications for transfusion practice and should be considered when determining the risk-benefit ratio of blood product transfusions in LT recipients.

### 6AP2-5

#### Preischemic transfusion of aged packed RBC exacerbates hepatic ischemia reperfusion-induced renal injury

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**Background and Goal of Study:** Hepatic ischemia reperfusion (HIR) may induce remote kidney injury. Transfusion of aged packed RBCs (PRBC) has been shown to prime neutrophils and monocyte-macrophage system. It is unknown whether remote renal injury with transfusion before HIR may be severer than that without transfusion or after HIR.

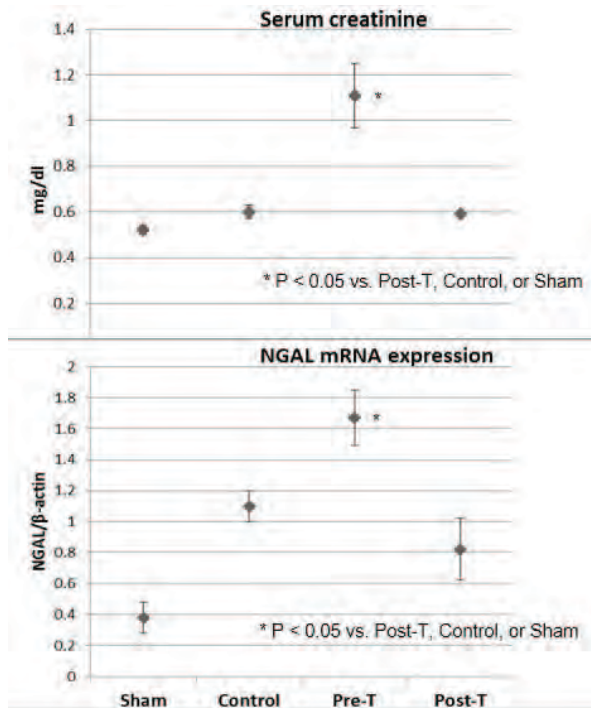
**Materials and methods:** After Institutional Animal Care and Use Committee approval, male Sprague-Dawley rats weighing between 275 and 325 g were included in this study. Rats (n = 24) were divided into: sham operation (Sham); HIR only (Control); aged PRBC transfusion (15% of estimated blood volume, via tail vein) started at 60 min before HIR (Pre-T) or 30 min after HIR (Post-T). Pooled allogeneic PRBC, collected from 4 ~ 6 rats for Pre-T or Post-T and stored for 2 weeks, was used for transfusion. Partial hepatic ischemia (the median and left lateral lobes) was induced for 90 min and reperfusion was allowed for 12 h. Then, blood (for ALT and creatinine) and renal tissue (for mRNA expression of HO-1, SOD, eNOS, and NGAL by RT-PCR with densitometry) were obtained for analysis.

**Results and discussion:** Serum ALT increased in Control, Pre-T or Post-T vs. Sham, as a result of HIR (P < 0.05). Pre-T produced severer renal injury than Control or Post-T did, as indicated by serum creatinine and renal mRNA

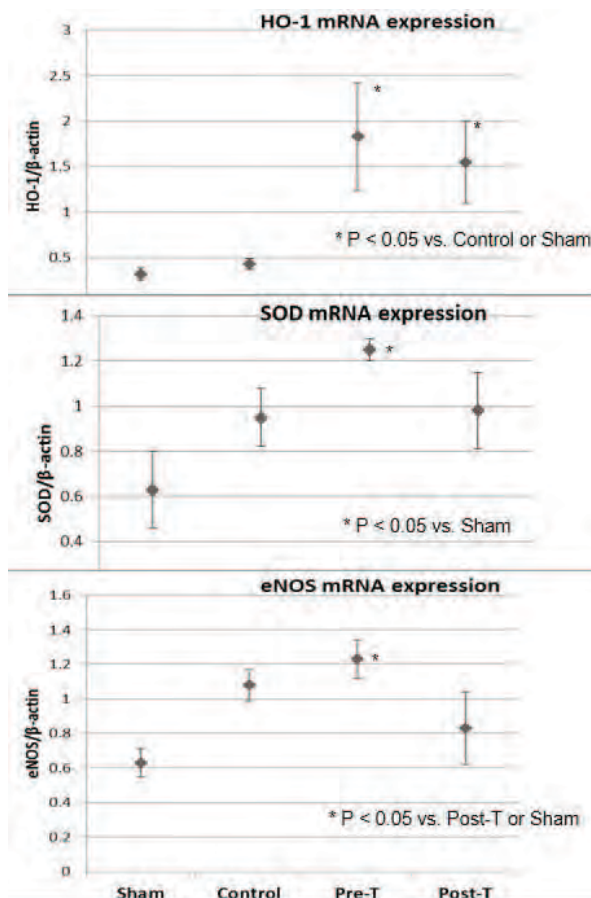


expression of NGAL ( $P < 0.05$ ). The renal mRNA expression of antioxidant enzymes increased in Pre-T, compared to Control or Sham, whereas eNOS expression was higher in Pre-T than Post-T ( $P < 0.05$ ).

**Conclusion(s):** Transfusion of aged PRBC before hepatic ischemia exacerbated remote renal injury. The results suggest that Pre-T induce more robust oxidative stress in rats at 12 h after reperfusion, than Control or Post-T.



[Kidney injury marker]



[Renal expression of antioxidant enzymes and eNOS]

## 6AP2-6

### Evaluation of postoperative bleeding and acute myocardial injury after major orthopedic surgery

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**Background:** Preoperative blood management involves cardiovascular assessment and estimation of the tolerable blood loss, depending on the preoperative hematocrit and Total Blood Volume (TBV) of each patient. We studied the incidence of myocardial damage according to postoperative bleeding in patients undergoing major elective orthopedic surgery.

**Methods:** Single-center prospective observational study including patients undergoing total hip (THA) or knee arthroplasty (TKA) between 2009 and 2012. Tolerable blood losses were evaluated with a transfusion threshold based on the 2002 French Health Agency's recommendations. Blood loss and troponin I (cTnI) values were noted on postoperative day 1, 3 and 5. Myocardial injury was defined by an increase of cTnI > 99<sup>th</sup> percentile (> 0.05ng/mL).

Patients were separated into two groups: those whose blood losses were higher than tolerable loss, and those whose losses remained below their transfusion threshold. We analyzed postoperative cTnI elevation for these two groups. The results are presented as mean ± standard deviation or median [interquartile range] depending on their distribution. T-test or chi2-test were used.

**Results:** After approval by the local ethics committee, 1549 patients were enrolled, whose clinical characteristics are presented in table 1.

	Blood losses > transfusion threshold (n=281)	Blood losses < transfusion threshold (n=1268)	p
Age (years)	73 ± 11	67 ± 12	<0.001
ASA III-IV (%)	157 (56)	310 (24)	<0.001
Tolerable blood losses (mL RBC)	555 ± 259	883 ± 282	<0.001
Day 5 blood losses / TBV (%)	40 [32-51]	25 [19-32]	<0.001
Postoperative cTnI peak	0.02 [0.01-0.04]	0.01 [0.01-0.02]	<0.001
Myocardial injury (%)	48 (17)	84 (7)	<0.001

[Table 1]

The occurrence of a least one episode of blood losses exceeding the tolerable blood loss is associated with myocardial injury (OR=2.91,95%CI:1.99-4.27,p< 0.001). Blood losses greater than the transfusion threshold were associated with a concomitant measurement of a high cTnI value on day 1 (p = 0.004), day 3 (p< 0.001) and day 5 (p< 0.001).

**Conclusion:** Our study suggests that blood losses exceeding the transfusion threshold increase the risk of myocardial injury. We demonstrated a temporal association between a postoperative hematocrit lower than the transfusion threshold and high cTnI. Patients at risk of dropping underneath their transfusion threshold are older, with more comorbidity, and have less tolerance to bleeding. Attentive and early care must be taken in the assessment of these patients to make them benefit from the most comprehensive blood conservation strategy.

## 6AP2-7

### The predicting risk factors for pulmonary embolism and deep vein thrombosis after lower extremity arthroplasty: a retrospective analysis based on the diagnosis using multidetector CT

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Recent advances in thromboprophylactic strategy have reduced the incidences of deep venous thrombosis (DVT) and pulmonary embolism (PE) after total hip replacement (THA) or total knee replacement (TKA) significantly. However, the true incidences of PE and DVT events and their predicting risk factors are not known. We studied the incidence of DVT or PE using 4-, 64-row multidetector CT (MDCT) after TKA or THA, and examined the predicting factors to the incidence.

**Methods:** After approval by the institutional ethics committee (No. 1584), we collected records of patients who had undergone TKA or THA from April 2011 through July 2013 at our institution. Among the 1263 screened patients, 100 (7.9%) were not eligible for the study. Patients were placed on one of the following anticoagulation regimens, enoxaparin 20 mg twice a day, fondaparinux 15 mg once a day or heparin for 7 days beginning 24 hours after surgery, if they have no contraindications. All patients had pneumatic compression devices and compression stockings until ambulation.

One week after surgery, D-dimer was measured, and MDCT pulmonary arteriography and venography were performed for the diagnoses of PE and DVT, respectively. MDCTs were interpreted by staff radiologists.

**Statistics:** By using T-test, we compared patient characteristics, types of anesthesia or surgery-related variables and D-dimers of two cohorts, *i.e.*, patients with PE or DVT and those without PE or DVT according to the MDCT diagnosis. Multivariate logistic regression analysis was performed to identify the predicting risk factors to DVT and PE events.

**Results and Discussion:** Among 1163 patients, 674 underwent THA and 489 TKA including unilateral knee arthroplasty. PE was detected in 20 (1.7%), and DVT in 44 (3.8%). The incidences of PE or DVT are significantly lower than those of previously reported <sup>1</sup>. The fact that the two cases of in-hospital death were unrelated with DVT or PE events supports the efficacy of our strict anticoagulation regimen. Although there were differences in age, weight, duration of anesthesia between two cohorts, logistic regression analysis identified the type of surgery (TKA>THA), and D-dimer level as the predicting risk factors.

**Conclusions:** With strict anticoagulation strategy, the incidences of PE or DVT events after TKA or THA are low. A high D-dimer level one week after surgery is suggestive of the events.

#### Reference:

1. Arch Intern Med. 2002 ;162:1833-40

## 6AP2-8

### Transfusion and impact on lung transplantation

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**Background and Goal of Study:** Lung transplantation is an accepted therapy for end-stage lung disease. It often requires blood transfusion. Bleeding complications and transfusion have been linked to increased morbidity and mortality.

The goal of this research was to analyze transfusion requirements and associated factors in this setting. We also evaluated the impact of transfusion on mechanical ventilation time, primary graft dysfunction, rejection, infection and mortality.

**Materials and methods:** We retrospectively obtained data from 160 patients who underwent lung transplantation in Puerta de Hierro Majadahonda Hospital in Madrid from October 2008 to October 2013.

We analyzed intraoperative and immediate postoperative (24h) transfusion.

**Results and discussion:** The average age of patients was 51 ± 14 years, 65% men and 34% women with no difference in transfusion. 63% were transfused. 69% were double-lung and 27% single-lung.

Transfusion was associated to:

- Double-lung transplantation (75.7% of patients transfused vs 31.9% of single-lung transplantation;  $p < 0.01$ ).
- CPB (87.8% vs 51.4%;  $p < 0.01$ ).
- Preoperative pulmonary hypertension (74.7% vs 49.3%;  $p < 0.01$ ).

- Patients with preoperative anemia were more frequently transfused (78.9% vs 58.8%) although this difference didn't reach statistical significance ( $p = 0.09$ ).

The median of days without mechanical ventilation after 30 days was significantly greater in patients without transfusion (28 days) compared with transfused (24 days);  $p = 0.02$ .

We did not find any differences in the occurrence of primary graft dysfunction, rejection, pneumonia, infection by multi-resistant germs or sepsis.

Although the length of Critical Care Unit stay was higher within the transfusion group, it didn't reach statistical significance (13 days vs 10 days in non transfusion).

Mortality within 30 days was higher in transfused (15.2% vs non transfusion;  $p = 0.02$ ) with an odds Ratio (OR) 5.1 (1.1-23.1). One year mortality was higher in transfused (37.3% vs 14.3%; OR 3.6 (1.3- 9.5).

**Conclusion(s):** Blood requirements are higher in double lung transplantation, patients with pulmonary hypertension and cases that needed CPB. Other factors as age, sex, preoperative anemia and pulmonary pathology weren't related to blood transfusion in this series.

In addition, blood transfusion may have an impact on mechanical ventilation time, time to extubation and mortality.

## 6AP2-9

### Characteristics of preoperative anemia in major elective orthopedic surgery

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**Background and Objective:** Preoperative anemia is a major independent risk factor for allogeneic blood transfusion in patients undergoing major orthopedic surgery (MOS), whereas hematinic deficiency may blunt the recovery from postoperative anemia. We evaluated the prevalence and the characteristics of preoperative anemia in patients scheduled for elective MOS.

**Patients and methods:** An observational prospective analysis of all consecutive patients scheduled for total hip and knee replacement from January 2013 to June 2013. A set of demographic and laboratory data (full blood count; creatinin, ferritin, vitamin B<sub>12</sub>, folic acid, and C reactive Protein) was gathered from all patients.

**Results:** Three hundred forty-three (230 women/ 95 men) entered the study. According to WHO criteria the prevalence of anemia was 11.1%, but 30.6% had Hemoglobin (Hb) < 13g/dl. Anemic patients were older and with higher comorbidity (60.5% ASA 3) but with no gender related difference. Prevalence of hematinic deficiencies, with or without anemia, was 17.2% for iron, 18.4% for vitamin B<sub>12</sub>, and 0.3% for folic acid. There were 66.3% patients with nutritional deficiency anemia (38.9% with iron deficiency anemia) and 11.6% with anemia of chronic disease (ADC), 11.7% with ACD plus nutritional deficiency and 10.4% with anemia of indeterminate cause.

**Conclusions:** The prevalence of anemia, as well as hematinic deficiency with or without anemia, is high in patients scheduled for MOS. As these conditions are linked to increased perioperative requirements for blood transfusion and slow recovery from postoperative anemia, they should be adequately investigated and treated before surgery.

#### References:

Goodnough LT et al. Detection, evaluation and Management of preoperative anaemia in the elective orthopaedic surgical patient: NATA guidelines. Br J Anaesth. 2011; 106(1):13-22.

## 6AP2-10

### TRALI and underdiagnosis in the critically ill population

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**Background and Goal of Study:** Transfusion-Related Acute Lung Injury (TRALI) is the most common cause of mortality due to hemotherapy. Its true incidence has been underrated. In some studies, critically ill patients appear to be at highest risk and the rate of TRALI is estimated from 5 to 8% with a mortality rate between 5 and 35%. High-plasma-volume components have consistently shown the greatest risk.

Since no TRALI cases were reported to hemovigilance during 2012, the goal of this study was to review the epidemiology of TRALI in the critically ill population at Hospital Universitario Puerta de Hierro Majadahonda in Madrid, Spain, from January to December 2012.

**Materials and methods:** We retrospectively studied 261 patients (165men/96women) who had been transfused with plasma (2498 units in 414 transfusional events) out of 1990 patients admitted to a mixed ICU in 2012. The average age was 60,1 ys (SD=14,3). Patients transfused with plasma during the 24 hours before admission to ICU were excluded.

We applied the TRALI/possible TRALI diagnostic criteria defined by the National Heart Lung and Blood Institute (USA) and the Canadian Consensus Conference:

#### TRALI:

- Acute lung injury (ALI): PO<sub>2</sub>/FIO<sub>2</sub> < 300mmHg or SpO<sub>2</sub> < 90% on room air, bilateral infiltrates on frontal chest X-ray, no evidence of left atrial hypertension.
- No evidence of ALI prior to transfusion and no temporal relationship to an alternative risk factor for ALI.
- Onset during the transfusion or in the following 24 hours.

#### Possible TRALI:

- Same criteria above with temporal relationship to an alternative risk factor for ALI.

**Results and discussion:** The global incidence for TRALI was 1,5% and for possible TRALI was 26,5%. In 87,7% there had been previous surgery. Mortality rate was 50% in TRALI and 30.4% in possible TRALI.

Using a 24-hour period instead of the traditionally used 6-hour period as the

limit for diagnosis may allow for the detection of later onset TRALI. We may have only identified severe cases, weak TRALI events could be still unperceived.

**Conclusion(s):** Underdiagnosis occurred in our hospital, mainly due to heterogeneity of diagnostic criteria which are based on clinical aspects, frequent coexisting risk factors for ALI and complicated differential diagnosis with Transfusion-associated Circulatory Overload.

Active surveillance is essential to develop donor-exclusion policies. Mortality of TRALI in this population is higher than the rates reported in previous studies.

### 6AP2-11

#### Lung complications observed after postoperative multitransfusion in cardiac surgery

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**Objective:** Study of multitransfusion effects on the development of complications after cardiac surgery.

**Material and methods:** A retrospective observational analytical study of patients admitted after cardiac surgery during the last three years in our critical care unit. Exclusion factors: Patients Who didn't receive some type of transfusion.

Variables: Age, sex, mean stay, hospital and ICU mortality, Euroscore, APACHE II, surgery indication, critical situation before surgery, mean pre-transfusal concentrations of haemoglobin, prothrombin time, platelets, and fibrinogen, multitransfusion intra and postoperative (differentiating between blood, plasma and platelets), operative time.

Statistical study: Mean, mode, comparison of means, Chi square and Student *t* test. Multivariate regression analysis to assess multiple variables.

**Results:** The study comprised 200 patients, mean age 66 years. The mean APACHE II was 11, Euroscore 6. Mean pretransfusal hemoglobin 8.4, platelets 166.000, prothrombin time 57%. The average red blood cell transfusions in operating room was 125 cc, plasma transfusions 92 cc, and less of one pool of platelets. On the other hand, during post-operative time, the mean red blood cell transfusions was 750 cc, plasma transfusion 738 cc, most in the first 48 hours of postoperative time.

Multitransfusion was defined as ( more than 4 packed red cells or > 900 cc of plasma) (38% vs 21%). Concerning the markers associated with pulmonary complications (pneumonia, distress or pleural effusion) (26%), kidney failure, (17%), and prolonged ICU stay (>5 days) (32%). We found significant differences,  $P < 0.001$ , in the following groups: post-operative plasma (> 900 cc) and blood transfusion (> 1250 cc), and intra-operative massive blood transfusion (> 1250 cc).

The multivariate analysis showed that only post-operative massive plasma transfusion was an independent risk factor for lung complications (OR 2.3;  $P < 0.001$ ; 95% CI 1.8-5.5).

In conclusion intraoperative plasma transfusion is associated with increased morbidity and although no increase mortality we should rethink new transfusions strategies in cardiovascular postoperative.

### 6AP3-1

#### Hemostasis and cytokines in children with sepsis and severe sepsis

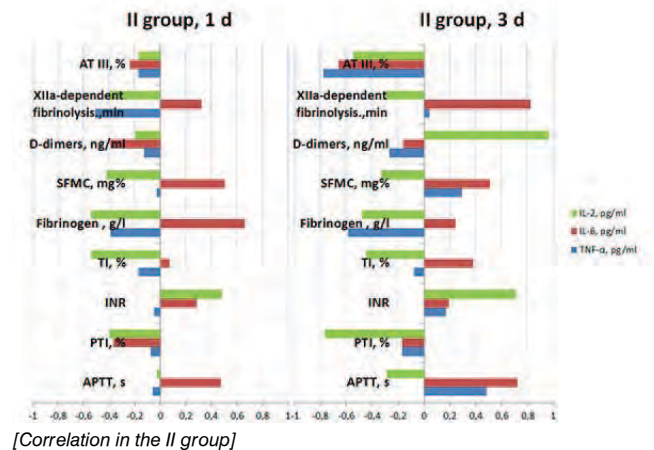
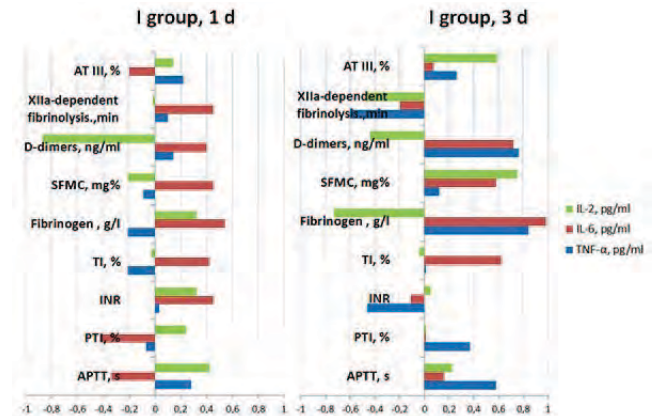
Filyk O., Pidhirnyy Y. Lviv National Medical University named after Danylo Halysky, Dept of Anaesthesiology & Intensive Care, Lviv, Ukraine

**Background and Goal of Study:** The main causes of mortality in children with sepsis are septic shock and the development of multiple organ disorders. Tissue hypoperfusion results to damage of the endothelium with increasing permeability and formation of thrombus in his lumen. DIC syndrome is an independent predictor of multiple organ failure and death. We studied the relationship between indicators of hemostasis and cytokine levels, using correlation analysis.

**Materials and methods:** We examined 33 children aged 3 to 11 years with sepsis. The patients were divided into two groups: the first included children with sepsis, which during the first three days had a positive clinical and paraclinical dynamics of the state, the second included patients who developed severe sepsis in the next three days. To investigate the hemostatic profile we determined: PTI, TI, APTT, INR, SFMC, AT III, D-dimers, time of XIIa-dependent fibrinolysis, platelet count. The levels of TNF- $\alpha$ , IL-6, IL-2 was determined by ELISA. The dynamics of hemostatic parameters, cytokine levels and the level

of organ dysfunction on a scale P-MODS analyzed at 1 and 3 days of treatment.

**Results and discussion:** Patients of the first group observed a significant decrease in time XIIa-dependent fibrinolysis ( $p < 0,05$ ) and a decrease in D-dimer's level ( $p < 0,05$ ) on the third day of treatment with simultaneous decrease in the level of multiple organ dysfunction on a scale P-MODS.



**Conclusion(s):** Increasing of level TNF- $\alpha$  in patients with sepsis is a negative prognostic sign and is accompanied by the increase of the level of multiple organ dysfunction syndrome and depletion haemostatic potential.

### 6AP3-2

#### A specific antidote (Idarucizumab) to dabigatran reduces blood loss and improves coagulopathy in a dabigatran- and trauma-induced bleeding model in pigs

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**Background and Goal of Study:** The new oral anticoagulants have demonstrated efficacy and safety in preventing stroke in patients with atrial fibrillation; however, one feature they all share is the lack of a specific antidote in cases of excess bleeding or overdose. A specific antibody fragment (Idarucizumab) is in development to reverse the effects of dabigatran. This study investigated the potential of idarucizumab to reverse bleeding in a dabigatran-anticoagulated pig trauma model.

**Materials and methods:** Experiments were approved by the local governmental animal care. 30 male pigs were given dabigatran etexilate for 3 days (30 mg/kg bid PO). To achieve supratherapeutic levels, dabigatran was infused for 90 min prior to injury on day 4 in anesthetized pigs. Next a standardized blunt liver injury was inflicted. Following hemorrhagic shock, blood loss (BL) was recorded 10 min post trauma and animals were randomized (n=6/group) to a single injection of the antidote at 30, 60 or 120 mg/kg iv or



vehicle. Sham animals (n=6) underwent blunt liver trauma injury, but received no dabigatran and no antidote. Blood loss and hemodynamic variables were monitored over 4 h or until time of death.

**Results and discussion:** After infusion and prior to injury dabigatran levels were  $1147 \pm 370$  ng/mL. BL was  $409 \pm 53$  mL 10 min post injury in sham animals and increased to  $700 \pm 107$  mL at 4 hrs. In contrast, anticoagulation with dabigatran resulted in a BL of  $801 \pm 66$  mL 10 min after injury. Mortality was 100% with a mean BL of  $2977 \pm 316$  mL and mean survival time of 121 min (range: 90 - 153 min;  $p < 0.05$  vs idarucizumab- and sham-group). In contrast, treatment with idarucizumab was associated with a dose-dependent reduction in bleeding. A dose of 30 mg/kg resulted in a 50% reduction of BL ( $1586 \pm 619$  mL; mortality 17%) as compared to dabigatran alone. BL was further reduced in animals receiving 60 ( $1077 \pm 103$  mL; 100% survival) or 120 mg/kg antidote ( $1137 \pm 121$  mL; 100% survival). Clinically and macroscopically no adverse events were observed.

**Conclusion:** This porcine model demonstrates that the dabigatran antidote, idarucizumab, is effective in immediately reversing the anticoagulant effects of dabigatran. Despite supratherapeutic dabigatran concentrations, idarucizumab significantly reduced blood loss in this lethal pig animal model. Clinical studies are awaited to confirm these findings.

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### 6AP3-3

#### Thromboelastometric assessment of hypercoagulability during liver transplantation and liver resection

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**Background and Goal of Study:** As blood loss during extensive liver surgery has decreased substantially over the last decade, the problem of surgery-related thromboembolic events is gaining more attention. These complications are common in patients with both cirrhotic and noncirrhotic liver disease. The role of integrated viscoelastic tests to detect hypercoagulability during extensive liver surgery has been shown [Krzanicki D, 2013]. Unfortunately, the criteria of hypercoagulability as well as corresponding algorithm of intraoperative antithrombotic therapy are not widely accepted. The goal of our study was to assess the rate of hypercoagulability during liver transplantations (LT) and major liver resections (LR) by means of thromboelastometry (TEM) and to find out correlation with blood loss and thromboembolic events rate.

**Materials and methods:** We performed a retrospective analysis of our database for a 4-year period. 73 LT (mostly due to cirrhosis) and 71 extensive LR (mostly due to tumor) were included in the study. Screening coagulation tests and TEM tests were performed according to protocol at specified time points. The amount of donor blood packed red cell (PRC), fresh-frozen plasma (FFP) and cell-saver PRC were recorded. All cases of perioperative thromboembolic events were also noted.

**Results and discussion:** At the beginning of operation TEM signs of hypercoagulability as shortening the clotting time (CTex) and rise of clot firmness (MCFex) were recorded in 8 of 73 pts (11 %) of LT group and in 21 of 71 pts (29 %) of LR group. In addition, 4 pts (5 %) of LT group revealed opposite changes: increase of CTex and increase of MCFex. Hypocoagulability was observed in 59 of 73 pts (80 %) of LT group and in 28 of 71 pts (39 %) of LR group. The amount of donor PRC transfusion during LT was  $913 \pm 819$  ml, during major LR -  $501 \pm 550$  ml. The PRC transfusion rates within LT and LR groups did not significantly differ in pts with hypercoagulability or hypocoagulability. The rate of FFP transfusion was 3 times higher in hypocoagulable vs hypercoagulable pts in LT group ( $4498$  vs  $1523$  ml,  $P < 0.001$ ) and 2 times higher in hypocoagulable vs hypercoagulable pts in LR group ( $1926$  vs  $774$  ml,  $P < 0.05$ ).

**Conclusions:** Hypercoagulability was detected in 16 % of liver transplant recipients and in 27 % of patients, undergone liver resection due to tumor. Hypercoagulability significantly decreased intraoperative FFP requirements, no other differences were revealed.

### 6AP3-4

#### PFA 100 adenosine diphosphate-test in prediction of bleeding, blood transfusions and effectiveness of platelet transfusion in patients undergoing cardiac surgery - a pilot study

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**Background and Goal of Study:** Bleeding is often in cardiac surgery. Platelet dysfunction is contributor. PFA-100 adenosine diphosphate test (PFA) is rather inconsistent in cardiac surgery. Patients without cardiopulmonary bypass are expected to be without disorder in primary hemostasis. We investigated PFA for prediction of bleeding and effectiveness of platelet transfusion (PT).

**Materials and methods:** After Medical Ethics Committee approval, 41 patients undergoing cardiac surgery for the first time, with normal coagulation and platelets and no antiplatelets for at least 5 days, were enrolled. Twenty-one patients were scheduled for cardiopulmonary bypass (CPB), and 20 without (NCPB). Measurements for PFA were performed at three time points: preoperatively, during cardiac surgery-before PT and following PT-after protamin. Blood loss (BL) was registered for 24 hours postoperatively in ml. Blood products intra and postoperatively were recorded. Descriptive statistics and Pearson's correlation were performed with significance  $P < 0.05$ .

**Results and discussion:** In NCPB patients BL was  $841,8 \pm 460,5$ , BT intraoperatively were  $412,5 \pm 200$  ml, postoperatively  $525,0 \pm 607,5$  ml, and PT postoperatively were  $3,20 \pm 5,28$  PLT dose. PFA before PT were  $129,4 \pm 81,1$  s, and after PT were  $139,9 \pm 74,1$  s. In CPB patients BL was  $358,1 \pm 249,5$ , BT intraoperatively were  $845,0 \pm 412,2$  ml, postoperatively  $430,0 \pm 375,0$  ml and PT postoperatively were  $0,95 \pm 2,5$  PLT. PFA were before PT  $199,5 \pm 88,7$  s and after PT were  $122,8 \pm 51,9$  s.

In NCPB group correlation between PFA and BL,  $p < 0,001$ , PT,  $p < 0,001$ , and BT,  $p = 0,007$  postoperatively was registered. There was no correlation between pretransfusion PLT count and BL, PT and BT.

In CPB group correlation was found between PFA and BL,  $p = 0,004$ . Insignificant correlation between PFA and PT and BT was found. Correlation was found between pretransfusion PLT count and PT,  $p = 0,020$ . In CPB group we found a significant reversible surgery induced decrease in primary haemostasis with no need for transfusions. In NCPB group decrease in primary haemostasis was irreversible and needed postoperative transfusions. Posttransfusion absolute PLT increment was insufficient measurement to determine the efficacy of PT. The normalization of the PFA correlated with PT efficacy.

**Conclusion:** PFA may predict BL in CPB, and NCPB cardiac surgery patients, but may predict PT and BT only in NCPB patients. The normalization of post-transfusion PFA correlates with bleeding quantity and platelets' requirements.

### 6AP3-5

#### A logistic regression model to predict complications in complex deformity spine surgery

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**Background and Goal of Study:** Adult spinal deformity surgery is associated to a high perioperative complication rate. The development of a predictive model would be useful for preoperative patient selection and counseling. The purpose of this study was to evaluate the correlation between patients' preoperative medical condition and magnitude of surgery with the occurrence of complications after major reconstructive spinal surgery in adults.

**Materials and methods:** A retrospective analysis of prospectively collected data from a multicenter adult spinal deformity database (2010-2013) was performed. The inclusion criteria were patients >18 years with any of coronal or sagittal deformity. Preoperative patients' condition, intraoperative data and existence of postoperative major complications were used to build a predictive model. A logistic regression analysis with the binary variable major complication and four predictive variables was established: ASA grade, age, total surgical time and estimated blood loss (EBL, %) as continuous or quartiles, (estimated blood volume: men 75 ml/kg, women 65 ml/kg). The sample was stratified in four quartiles of EBL defined as: < 15%, 15-30%, 30-50% and

>50%. The effect of ASA grade and total surgical time were analyzed. The Area Under the ROC Curve (AUC) was determined to define the discriminatory power of the model.

**Results and discussion:** 260 patients, 205 females, mean age 48.21 (SD 19.72) met inclusion criteria. 59 (23%) were excluded due to system missing. Average blood loss volume was 1546.15ml (SD 1102.52) that represented a mean of 35.59% EBL (SD 25.46). Total surgical time mean was 297.67min (SD 141.69). 60 complications were found (29.8%), 18 of them considered as major (8.9%).

Within the same ASA score, the risk of major complications rises with the increase of surgical time and EBL. In the worse situation (EBL>50%), risk of major complications in patients with ASA grade II is four-fold higher than ASA grade I (Odds Ratio 3.99) and ASA grade III/IV is six-fold higher than ASA grade I (Odds Ratio 5.77). AUC was 0.78.

**Conclusion:** Complex spine deformity surgery is related with a high probability of major complications. Their appearance can be predicted with ASA grade according to our results. Higher EBL shows a tendency towards the risk of major complications. More comorbidities should be included in the analysis, as well as more patients, in order to improve this preoperative predictive model.

## 6AP3-6

### Binding of dabigatran to its specific antidote, idarucizumab, is not influenced by infusion solutions used during resuscitation in a porcine hemorrhagic shock model

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**Background and Goal of Study:** A specific antibody fragment (Idarucizumab) is in development to reverse the effects of dabigatran in cases of life-threatening bleeding. In trauma, different volume expanders are used for resuscitation, but it is unknown if the volume expanders influence binding of dabigatran to its antidote. In this study we investigated whether frequently used infusion solutions affect binding of dabigatran to idarucizumab.

**Materials and methods:** After ethical approval, pigs were treated for 3 days with dabigatran etexilate (30 mg/kg bid). On the 4<sup>th</sup> day anesthetized pigs were infused with dabigatran just prior to hemorrhagic shock, achieved by removing ~50% of total blood volume. Animals were randomized to (n=5/group): Ringer's, 6% HES 130/0.4, 6% HES 200/0.5, 4% gelatin, transfusion of washed red blood cells (RBC) or control (no hemodilution). Resuscitation consisted of 1:1 to blood loss for crystalloids, 25 mL/kg for colloids, and 12 mL/kg for RBC. Idarucizumab was then given (30 mg/kg iv) and serial samples were taken for up to 24 hrs to measure active dabigatran as diluted thrombin time (dTT) and total dabigatran by LC-MS/MS. Antidote concentrations were measured by ELISA and the half-life calculated in each group. Coagulation was assessed with aPTT, ACT and ROTEM (ExTem and InTem). Data are mean ± SE.

**Results and discussion:** Mean plasma dabigatran levels were 640 ± 60 ng/mL after infusion and 625 ± 123 ng/mL after ~50% hemodilution with no differences between groups. 30 mg/kg iv idarucizumab resulted in an immediate reduction of active dabigatran in all groups. In addition the amount of total dabigatran (bound to antidote and free drug) was not different across groups. Coagulation was prolonged with dabigatran as shown by aPTT (45±6 to 68±10 sec), ACT (97±6 to 297±25 sec), CT ExTem (36±4 to 1205±598 sec) and CT InTem (122±12 to 989±219 sec). Fab treatment restored coagulation by ~73% (range 58 and 95% with different assays) at 5 minutes following administration with no differences between the volume expanders. Half-life of idarucizumab was 3.2 ± 0.1 hrs in control animals and not different in hemodilution animals (p>0.05).

**Conclusions:** In this study clinically used infusion solutions for resuscitation do not interfere with binding of dabigatran to idarucizumab. Inhibition of dabigatran at this dose restored coagulation by ~70% independent of the volume applied and reversal could be measured using standard plasma based assays.

## 6AP3-7

### Perioperative predictors of survival after liver transplantation for familial amyloidotic polyneuropathy in a Portuguese center

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**Background:** Liver transplantation (LT) is an effective treatment to halt the progression of Familial Amyloidotic Polyneuropathy (FAP). Portugal has the highest prevalence and number of transplants for FAP. The independent factors for survival after LT reported in few studies are age, modified body mass index (mBMI, calculated by multiplying BMI by serum albumin) and time interval between diagnosis and LT. The aim of our study was to assess survival rate and identify independent factors for overall survival at our center.

**Methods:** Prospective observational study of FAP patients who underwent a first LT between 2006 and 2011. Clinical data collected included sex, age at LT, preoperative albumin, BMI, mBMI, preoperative haemoglobin (Hb), INR, cold ischemia time, operation time, blood loss, number of red blood cell (RBC) units transfused during LT and noradrenaline requirements. Log-rank tests, and univariate and multivariate Cox regression models were used to select and assess independent prognostic factors. Quantitative variables are presented as median [interquartile range]. Statistical significance was set at P<0.05.

**Results:** The study analyzed 103 patients: 41% males; age 38[33-45]years; preoperative Hb 13.3[12.5-14.2]g/dl; mBMI 889[748-1104]kg.g/l.m<sup>2</sup>; operation time 254[222-293]min; blood loss 1250[850-2100]ml; RBC transfusion 0[0-1]units.

In 70% of patients there was no need for RBC transfusion. The median follow-up period was 2.9[1.3-4.9]years. The analysis of overall survival revealed 3-months, 1-year and 3-years survival rates of 88% (CI95%: 80%-93%), 83% (CI95%: 75%-89%) and 79% (CI95%: 70%-86%), respectively.

Regarding the clinical parameters, the statistical analysis with the multivariate Cox regression identified the factors RBC-units transfused and operation time to independently predict survival. For each RBC-unit transfused there was an increase of 63% (CI95%: 9%-143%) in mortality. The operation time increased mortality rate in 20% (CI 95%: 2%-41%) for each 15 minutes of surgery.

**Conclusions:** Unlike other reports, in our study there was no relation between mBMI and survival (P=0.534), probably due to a mBMI higher than 700 kg.g/l.m<sup>2</sup> in more than 75% of patients. In our center there was a difference in outcome related to RBC transfusion and operation time for LT in FAP patients, that has not been reported before. Our overall survival is similar to other studies. Our data questions the influence of mBMI in survival in our center.

## 6AP3-8

### Reduction of prasugrel-related bleeding by transfusion of human platelets in a rabbit model

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**Background and Goal of Study:** Prasugrel is a thienopyridine that provides a more rapid and more effective inhibition of platelet aggregation compared to clopidogrel, thus leading to an increased bleeding risk.

The aim of the study was to evaluate the efficacy and safety of platelet transfusions to limit blood loss after a prasugrel loading dose in a rabbit model of bleeding and thrombosis.

**Materials and methods:** With approval of the ethics committee for animal experimentation, 28 rabbits were randomly assigned into five groups: control (saline-saline), placebo (prasugrel-placebo), platelet low dose (prasugrel-platelet transfusion +40-80G.I<sup>1</sup>), platelet intermediate dose (prasugrel-platelet transfusion +80-120G.I<sup>1</sup>), platelet high dose (prasugrel-platelet transfusion ≥+120G.I<sup>1</sup>).

The day before the haemorrhagic challenge, rabbits were given orally saline or a prasugrel loading dose (4 mg.kg<sup>-1</sup>) and their reticulo-endothelial system was inhibited by ethyl-palmitate infusion.

The day after, rabbits were anesthetized and mechanically ventilated. A stenosis and a vessel injury were performed on the carotid artery that induced cyclic thrombotic events detected as flow reductions. Rabbits received placebo or were transfused with human platelets over 15 minutes. Thirty minutes after the end of the transfusion, haemorrhage was induced by standardized liver sections and blood loss was monitored for 15 minutes.

**Results and discussion:** Blood loss (median and interquartile range) in the control group was 8.4g [7.4-11.7g] and was increased in the placebo group 16.8g [12.1-25.2],  $p=0.02$ . In the platelet low- and intermediate dose groups, blood loss did not significantly vary as compared with the placebo group. However, high dose of platelet transfusion significantly reduced prasugrel-induced bleeding (9.1g [8.1-11.0]),  $p=0.02$ , and blood loss in this group was thus similar to the control group.

Regarding safety, platelet transfusion was not associated with an increase of thrombotic events, whatever the dose of platelet transfusion in this model.

**Conclusion(s):** In this animal model, a high dose of platelet transfusion was necessary to significantly decrease prasugrel-related bleeding.

## 6AP3-9

### Monitoring heparin by the activated clotting time in endovascular treatment in ruptured intracranial aneurysms

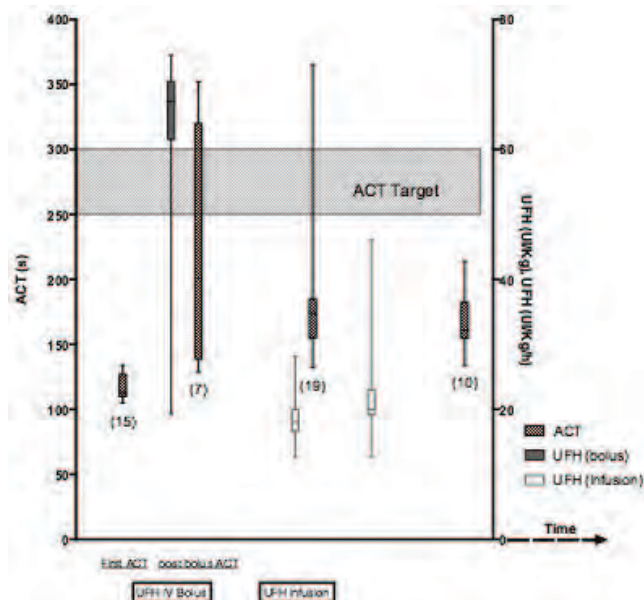
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**Background and Goal of Study:** The most frequent risk during endovascular treatment of ruptured intracranial aneurysm is thromboembolic complication. Thromboembolic complications are prevented by heparin. Heparin effect may be monitored using activated clotting time (ACT) but the appropriate heparin administration protocol is still under debate, with doses varying between 50 and 100 UI/Kg. The aim of this study was to evaluate a new heparin administration protocol using ACT.

**Materials and methods:** 20 patients undergoing endovascular treatment for intra cranial ruptured aneurysm were prospectively included. They received an intravenous heparin bolus (70 UI/Kg) followed by infusion of 18UI/Kg/h. The ACT target was 250 - 300 s. These 20 patients were compared to an historical cohort of 100 patients undergoing the same procedure and anticoagulated with heparin bolus (50 UI/Kg) followed by infusion of 25 UI/Kg/h, without heparin monitoring.

**Results and discussion:** Thromboembolic complications were similar (10% in each group). There were no differences in bleeding complications ( $p=1$ ). ACT before heparin injection was  $117 \pm 8$  s. After intravenous heparin bolus of 67.3 UI/Kg (IQR 70.4 - 61.5) ACT value was  $225 \pm 85$  s. The heparin infusion was 17.9 UI/Kg/h (IQR 19.8 - 16.5). ACT at the end of endovascular procedure was  $182 \pm 42$  s (Figure 1). The total amount of heparin administrated was higher in the ACT group than in the control group: 68.5 UI/Kg/h (IQR 87.5-54.4) versus 54.8 UI/Kg/h (IQR 68.8 - 45.5) ( $p = 0.029$ ).



[Figure 1: ACT values according unfractionated heparin (UFH) injection. Results are presented in box plot]

**Conclusion:** This study showed that, with heparin dose of 70 UI/Kg followed by 18UI/Kg/h, the ACT target 250 -300 s is not reached, despite an increase in the bolus dose as compared with the control group. Hypercoagulability induced by subarachnoid hemorrhage may explain this result. Bolus of heparin has probably to be higher in the setting of ruptured intracranial aneurysms.

## 6AP3-10

### Removal of epidural catheter under dual antiplatelet therapy: a challenge in patient's safety

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**Background:** Unexpected postoperative coronary events challenge anaesthesiologist professional using regional anaesthesia.

**Case report:** A 61 year old male with a past medical history of hypertension, hypercholesterolemia, remote tobacco use, lumbar scoliosis and a good functional class (> 4 METS) underwent an aorto-bifemoral bypass for infrarenal aorto-occlusive disease. The procedure was done using combined anaesthesia, an epidural catheter was used during the procedure, the patient remained hemodynamically stable and there were no intraoperative complications.

In the early postoperative period, the patient complained of chest pain associated with hypotension and bradycardia. He was diagnosed with acute coronary syndrome (STEMI) and was treated with percutaneous coronary angioplasty with an *everolimus-eluting* stent placement and dual antiplatelet therapy, with a good hemodynamic recovery.

At 72 hours after surgery, the removal of epidural catheter was outlined. In a multidisciplinary decision, the catheter was removed after discontinuing clopidogrel and enoxaparin treatment for 24 hours, transfusion of 5 units of platelets and immediate removal of the catheter. Antiplatelet and anticoagulation therapy was restored at 6 hours. The patient did not have any coronary or neurologic complication.

**Discussion:** Epidural analgesia after an abdominal vascular procedure is the best option for pain control, to avoid hemodynamic instability. Removal of the epidural catheter on dual antiplatelet therapy in postoperative period is not described in practical guidelines and there are only four case reports published<sup>1</sup> in the last ten years, with diverse solutions and opposed recommendations. It should be taken into account the risks of antiplatelet therapy modifications, comparing the coronary re-thrombosis with the risk of epidural hematoma<sup>2</sup>.

**Learning points:** Epidural catheter removal in a patient with double antiplatelet and anticoagulation therapy should involve haematologist, cardiologist and anaesthesiologist in a multidisciplinary decision based on specific and potential patient's risk. Development of consensus protocols is necessary.

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## 6AP3-11

### Reversal of dabigatran in a patient with life-threatening intracranial haemorrhage

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**Background:** Novel oral anticoagulant drugs are being used increasingly in clinical practice. As a result, patients who are taking these new anticoagulant drugs are presenting for both elective and emergency surgery.

**Case report:** A 64-year-old woman who taking Dabigatran 110 mg twice daily for non-valvular atrial fibrillation was transferred to our hospital with intracranial bleeding, increasing intracranial pressure and a reducing Glasgow coma scale score. CT brain showed a subarachnoid haemorrhage with evolving hydrocephalous. The neurosurgical team decided to insert an emergency External Ventricular drain (EVD) and refer the patient to the Interventional Neuro-radiology team for coiling of a posterior communicating artery aneurysm. The time since the last dose of Dabigatran was less than 24 hours. FEIBA (Factor Eight Inhibitor Bypass Activity) 80 u/kg and Octaplex 30 u/kg were administered intravenously before the insertion of the External Ventricular Drain under general anaesthesia. There was minimal intraoperative blood loss. The patient was kept sedated and ventilated in the Neurosurgical ICU overnight and coil-



ing of the intracranial aneurysm was performed successfully on the following day. The patient was extubated after the coiling and neurological evaluation did not show any significant deficits. There were no thromboembolic manifestations in the postoperative period.

**Discussion:** The use of Novel oral anticoagulants has increased several folds in recent years. Dabigatran, a direct thrombin inhibitor. Dabigatran does not have a specific reversal agent. For emergency surgery and in particular patients with intracranial bleeding no single clear reversal strategy has been described. FEIBA (Factor Eight Inhibitor Bypass Activity) and Octaplex could be beneficial in improving surgical haemostasis.

**Conclusion:** We assume that this is the first case report of successful management of intracranial haemorrhage in a patient who is using Dabigatran. Activated prothrombin complex concentrate (Octaplex) and FEIBA (Factor Eight Inhibitor Bypass Activity) are useful agents. Additional studies are warranted to confirm the findings of our observation.

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## 6AP4-1

### Changes in pharmacological strategies, surgery techniques and transfusion requirements in liver transplantation: a prospective cohort study

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**Background and Goal of Study:** During the last years, changes in liver transplantation surgery have been made at Hospital Universitario Ramón y Cajal (HURYC), in order to reduce bleeding and transfusion requirements. These changes include pharmacological and surgery techniques. The aim of our study is to analyze the influence of these modifications.

**Materials and methods:** We performed a retrospective analysis of prospectively collected data recorded in HURYC liver transplantation database between 2002 and 2012, including a total of 398 patients. Four cohorts were considered according to the treatment applied: Group 1 (G1), Aprotinin and 'classical' technique of liver transplantation (n= 177, January 2002- November 2006); Group 2 (G2), Tranexamic Acid and 'classical' technique (n= 72, December 2006-October 2008); Group 3 (G3), Tranexamic Acid and 'piggyback' technique (n= 117, November 2008- December 2011); Group 4 (G4), Tranexamic Acid, 'piggyback' technique and the use of thromboelastography (n= 32, January 2012- December 2012).

**Results and discussion:** We compared the number of blood products transfused: Packed Red Cells (PRC), Fresh Frozen Plasma (FFP) and platelets.

The sum of blood products for each group was (mean ± SD):  
G1.- 10,8 Units ± 14,3; G2.- 16,8 ± 23; G3.- 17 ± 17,01; G4.-14,7 ± 17,1.  
PRC :G1.- 5,1 ± 6,2; G2.- 8 ± 12,2; G3.- 7,9 ± 7,7; G4.- 6,8 ± 9,5.  
FFP: G1.- 3,4 ± 5; G2.- 5,9 ± 8,5; G3.- 6,1 ± 6,4; G4.- 5,7 ± 6,8.  
Platelets: G1.- 2,4 ± 4,7; G2.- 2,8 ± 4,4; G3.- 3,2 ± 4,6; G4.- 3,4 ± 4,2.

We have observed an increase in PRC and FFP requirements between groups (p= 0,014 and p= 0,001 respectively). Some variables may have influenced the results: increased donors age, percentage of suboptimal grafts and length of surgery.

**Conclusion:** Despite of the introduction of different strategies trying to minimize blood loss in liver transplantation surgery at HURYC, PRC and FFP transfusion requirements have increased. These results could be associated with donor age, graft quality and/or length of surgery among others. Aprotinin withdrawal may also be related. Further studies should be performed to improve transfusion therapy in liver transplantation surgery.

**Acknowledgements:** We appreciate the efforts of the liver transplantation team to maintain the anesthesia liver transplantation database.

## 6AP4-2

### Blood loss is reduced in patients undergoing open radical cystectomy and urinary diversion with a low pelvic venous pressure: a secondary analysis of a randomized clinical trial

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**Background and Goal of Study:** The impact of the local venous pressure during open radical cystectomy on blood loss is unknown. For major liver resection surgery it has been shown that a central venous pressure < 5mmHg can significantly reduce blood loss. The objective of this study was to determine the influence of the pelvic venous pressure (PVP) on blood loss during open radical cystectomy and urinary diversion.

**Materials and methods:** In 82 patients of a low-volume/norepinephrine group and in 81 patients of a control group with a liberal fluid regimen, PVP was measured at the beginning of the pelvic lymph node dissection (PLND), at the end of the PLND, after removal of the bladder, and finally before closure of the abdominal wall. PVP was measured with the gauzes placed in the abdominal cavity (in order to remove the bowel from the surgical field, i.e. abdominal packing) and after removal of the gauzes with the abdominal wall lifted, in order to analyse the impact of the gauzes/packing on venous return. Each group was categorized into subgroups with PVP < 5mmHg and PVP ≥5mmHg after removal of the bladder.

**Results and discussion:** Both after PLND and after removal of the bladder, blood loss significantly correlates with higher PVP at  $r^2=0.159$  ( $P=0.012$ ) and  $r^2= 0.233$  ( $P< 0.0001$ ), respectively. A PVP < 5mmHg after removal of the bladder was present in 42/82 patients (51%) in the low-volume/norepinephrine group and 13/81 patients (16%) in the control group ( $P< 0.0001$ , relative risk 0.58, 95% confidence interval 0.46-0.74). Median blood loss was in the subgroup with a PVP < 5mmHg of the low-volume/norepinephrine group was 800ml [range: 300-1200ml] compared to 900ml [500-1800ml] in the subgroup with a PVP ≥5mmHg;  $P=0.003$ . In the control group, median blood loss was the subgroup with a PVP < 5mmHg 1000ml [600-1600ml] vs 1300ml [400-3000ml] in the subgroup with a PVP ≥5mmHg,  $P=0.025$ . PVP dropped significantly after removal of the gauzes from the abdominal cavity and lifting of the abdominal wall with a retractor in both groups at all time points in both groups.

**Conclusion(s):** Increased blood loss was showed in patients with PVP ≥5mmHg. Elevated PVP was more likely in patients receiving a more liberal fluid administration (control group). Techniques to reduce PVP, such as the use of a low-volume regimen combined with norepinephrine, should be established for open radical cystectomy and urinary diversion.

## 6AP4-3

### Impact of preoperative anemia and perioperative blood transfusion in elective orthopedic surgery

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**Background and Goal of Study:** Preoperative anemia (PA) is an independent risk factor for perioperative allogeneic blood transfusion (PBT) in patients undergoing major orthopaedic surgery. PBT has been attributed to increase morbidity. Our main objective was to audit, in our hospital, preoperative anemia among elective orthopaedic surgical patients and its influence in patient outcomes.

**Materials and methods:** From May to October 2013, all 18-years old inpatients scheduled for elective orthopaedic surgery entered the study. Demographic, perioperative risks factors, blood transfusion and 30-day postoperative morbidity were recorded. Patients were divided in two groups: a major orthopaedic surgery group (MO group) scheduled to knee and hip replacement and instrumented spinal fusion; and a non-major orthopaedic surgery group (NMO group). Anemia was defined as mild, moderate or moderate-to-severe according to haematocrit values and World Health Organization recommendations (WHO). Data were expressed as a percentage or mean ± standard deviation. Statistical analysis used: Chi-square test, t-test, Pearson correlation coefficient. IBM SPSS 21 software was used; p-value < 0,05 was considered statistically significant.

**Results and discussion:** Two hundred and sixty six patients were enrolled in the study, 36.6% in the MO group. This group was older and had a greater prevalence of men ( $p< 0,001$ ). No differences in ASA physical classification were found. According to WHO criteria, the prevalence of PA was 18%, with no

differences between the two groups, but with a greater prevalence in women (77% vs. 23% for female and male patients, respectively;  $P = 0.01$ ) and in older patients ( $p < 0.01$ ). Perioperative blood transfusion (PBT) was more frequent in the MO group (70.8% vs 33.1% for MO group and NMO group, respectively,  $p < 0.001$ ). The incidence of postoperative complications was greater in MO group ( $p < 0.05$ ). In both groups PBT, not PA severity, was associated with a greater incidence of morbidity (21% with transfusion vs. 0.5% without it,  $p < 0.001$ ). These findings are supported by recent evidence and emphasize the importance of the diagnosis and appropriate treatment of PA at the time of preoperative assessment to reduce requirements for PBT and its associated risks.

**Conclusion(s):** PBT seems to be associated with a greater incidence of postoperative complication. This highlights the importance of preoperative evaluation and treatment of anemia to avoid PBT and its complications.

## 6AP4-4

### Albumin versus 6% HES 130/0.4 in pediatric cardiac surgery: effects on blood loss and transfusion requirements

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**Background and Goal of Study:** Colloids are widely used in paediatric cardiac surgery for perioperative volume replacement including the priming of cardiopulmonary bypass (CPB). Albumin is considered as the reference solution but synthetic colloids like tetrastarches may represent an interesting alternative because of their lower cost(1). The goal of this study was to compare HES 130/0.4 to albumin on peri-operative blood loss(BL) and transfusion requirements.

**Materials and Methods:** This retrospective study included all children undergoing cardiac surgery under CPB between 2002 and 2010. Jehovah's witnesses, newborns and ASA V were excluded. Anaesthetic, CPB and surgical techniques were standardized. Following data were analyzed: measured and calculated (determined from estimated circulating blood volume and pre- and postoperative day 3 haematocrit) BL, and exposure to allogeneic blood product. Patients who received albumin were compared to those who received HES 130/0.4 using genetic matching(2). Further statistical analyses included ANCOVA and logistic regression.

**Results and Discussion:** The study included 1495 children, with a mean age of 32,5 months (SD: 41,9) and a mean weight of 11,0 kg (SD: 9,9). 488 were treated with albumin ( $41.5 \pm 28.7$  ml/kg) and 1007 with HES ( $39.6 \pm 12.6$  ml/kg).

	N	ALBUMIN	N HES 130/0,4	HES 130/0,4	P
Intra-op BL(ml/kg)	488	87,1 ± 77,2	1007	70,3 ± 55,2	0,194
Postop BL(ml/kg)	488	19,2 ± 15,8	1006	18,0 ± 15,2	0,830
Total BL (ml/kg)	488	48,6 ± 29,4	1007	35,8 ± 28,6	0,466
Calculated BL (ml/kg)	488	37,9 ± 26,9	1007	24,7 ± 19,3	<0,001
RBC received(%)	488	81,1	1007	66,3	0,007
RBC volume (ml/kg)	488	37,8 ± 36,7	1007	22,1 ± 26,8	<0,001
FFP received (%)	488	82,8	1007	85,5	0,537
FFP volume (ml/kg)	96	35,5 ± 42,5	146	26,0 ± 26,0	0,001
Platelets received(%)	488	5,3	1007	5,7	0,882

#### [Perioperative BL and transfusions]

Data are presented as mean ± SD or percentage, RBC: red blood cell; FFP: fresh frozen plasma.

**Conclusion:** In the conditions of our study, HES 130/0.4 was associated with a significant decrease in calculated BL resulting in a lower exposure to RBC transfusion. Our observations do not indicate any deleterious effect of HES 130/0.4 on haemostasis when compared to albumin in paediatric cardiac surgery.

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## 6AP4-5

### Postoperative bleeding after total hip and knee arthroplasty: utility of a standardized blood loss evaluation

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**Background:** The evaluation of blood loss in elective orthopedic surgery can anticipate transfusion requirements and allows the implementation of blood conservation techniques. There are several formulas described for the calculation of blood loss and total blood volume (TBV); however the results have not been compared. From a prospective observational registry of patients undergoing primary total knee (TKA) or total hip arthroplasty (THA), we compared two forms of TBV assessment for calculation of postoperative blood loss.

**Materials and methods:** This prospective observational study examined all patients undergoing primary THA or TKA over a period of four years in a French learning hospital. The TBV was calculated according to Gilcher (1), adapted to the Body Mass Index (BMI), and according to a standard method adapted to body surface area (BSA) (2). Postoperative losses were calculated according to Mercuriali (based on hematocrit) and by Gross (based on hemoglobin). Variations of hemoglobin and hematocrit levels were calculated between day 0 (D0) and postoperative day 5 (D5). We compared the results of D5 blood losses and the percentage of blood loss on the TBV in univariate analysis by a Mann-Whitney test. Quantitative variables are expressed as median [interquartile range].

**Results:** After approval by the local ethics board, 1547 patients were included, made of 891 THA and 656 TKA between 2009 and 2012. Blood losses calculated according to Mercuriali are expressed in ml of pure RBCs. The ratio of blood loss on the TBV is in ml of whole blood to a hematocrit of 35 percent. There is a significant difference in the assessment of blood loss using the different formulas for calculating the TBV. These differences disappear when losses are expressed as a fraction of TBV.

		TBV Gilcher	TBV BSA	p
Total Hip Arthroplasty	Total Blood Volume (mL)	5250 [4550-6000]	4642 [4220-5128]	<0.001
	D5 losses Mercuriali (ml of RBC)	446 [319-607]	406 [296-539]	<0.001
	D5 losses Gross (ml)	1152 [819-1633]	1051 [748-1439]	<0.001
	Mercuriali / TBV (%)	25 [18-33]	25 [18-33]	0.88
	Gross / TBV (%)	23 [16-31]	23 [16-31]	0.89
Total Knee Arthroplasty	Total Blood Volume (mL)	5250 [4690-6000]	4727 [4320-5147]	<0.001
	D5 losses Mercuriali (ml of RBC)	562 [418-757]	513 [377-667]	<0.001
	D5 losses Gross (ml)	1518 [1459-1581]	1363 [1315-1429]	<0.001
	Mercuriali / TBV (%)	31 [23-39]	31 [23-39]	0.86
	Gross / TBV (%)	29 [21-38]	29 [21-38]	0.86

[Table 1: Comparison of total blood volume assessment formulas]

**Conclusion:** Our study shows wide disparities in assessment of blood loss, and calls for a harmonized evaluation, based on a ratio of the total blood volume, in order to provide a more appropriate blood conservation strategy for each patient.

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## 6AP4-6

### Incidence of red blood cell transfusion in an urological center between 2005-2012

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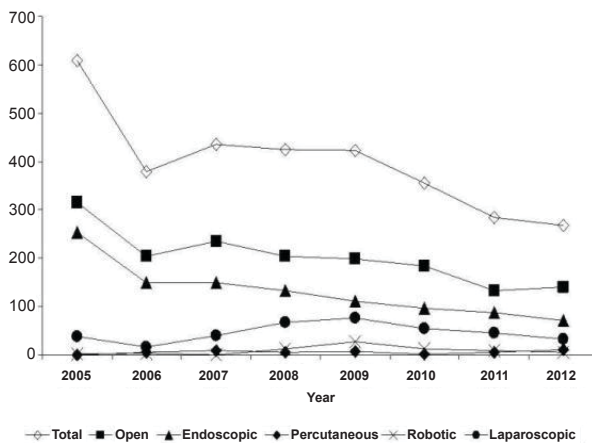
**Background and Goal of Study:** Restrictive blood transfusion approach is being increasingly implemented as best practice<sup>1</sup>. In 2003 our center implemented a clinical guide to improve red blood cell (RBC) transfusion management. Our aim is to assess the rate of red blood cell transfusion from 2005 to 2012 and to know in what kind of surgeries that rate improves.

**Materials and methods:** A retrospective review of institutional database of 12,948 urologic surgeries was carried out. We included patients that underwent open, endoscopic (transurethral resection of prostate and/or bladder

tumor), percutaneous (over kidney), laparoscopic and robotic surgeries. We checked over the annual incidence of the number of patients transfused in the different types of surgery, and the RBC units per patient and per surgery. **Results and discussion:** The rate of patients that needed a RBC transfusion per group of surgery is presented in table 1. There is only a decrease in this rate in the endoscopic surgery group. The RBC units transfused are presented in Figure 1. The total amount of units clearly decreases, with similar number of surgeries that needed a transfusion. The greatest decrease is again in the endoscopic surgery group.

Surgeries	2005	2006	2007	2008	2009	2010	2011	2012
Open	31.3%	26.8%	32.6%	36%	41.9%	40.2%	34.8%	33.6%
Endoscopic	10.2%	9.3%	8.9%	8.2%	7.5%	6.4%	8%	5.4%
Laparoscopic	9.8%	6.3%	6.6%	10.1%	13.3%	9.6%	9.3%	9.4%
Robotic laparoscopic	2.6%	4.5%	0%	10%	23.9%	8.5%	9.1%	6.7%
Percutaneous	0	2.9%	11.1%	6.4%	10.2%	2.1%	6.1%	9.8%

[Table 1. Transfused patients percentage per year]



[Annual RBC units per surgeries]

**Conclusions:** The rate of patients needing a RBC transfusion didn't decrease, but the number of RBC units transfused did decrease. So there was a reduction of the number of RBC units used per patient. Endoscopic surgery is the only group of surgeries where there is a reduction of the transfusion rate.

#### References:

1. Goodnought L, Levy J, Murphy M. Concepts of blood transfusion in adults. *Lancet* 2013;381:1845-54
2. Aryeh Shander, Irwin Gross, Steven Hill et al. *Blood Transfus* 2013; 11: 193-202

## 6AP4-7

### Lower preoperative haemoglobin and platelets values predicting multitransfusion after liver transplantation

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**Background and Goal of Study:** To determine risk factors reliably associated with the need for multitransfusion and haemorrhage during the immediate postoperative period.

**Materials and methods:** A retrospective observational analytical study of patients admitted after liver transplantation during the last three years in our critical care unit. Exclusion factors: none.

**Variables:** Age, sex, stay, mortality, intra-operative and immediate post-operative haemorrhage, important intra-operative ascites, MELD, Child Pugh, APACHE II, transplant indication, percentage of patients with pretransplant haemoglobin values < 10, international normalized ratio (INR) > 1.6, prothrombin time > 40%, platelets < 70.000 IU/L, Factor V < 60%, fibrinogen < 100 mg.

**Statistical Study:** Mean, mode, comparison of means: qualitative variables compared by Chi square and quantitative variables by Student *t* test. Multivariate regression analysis to assess multiple variables.

**Results:** The study comprised 140 patients, mean age 59 years. The mean MELD was 15, Child Pugh 7, APACHE II 18. Most had alcoholic cirrhosis 51%,

37% hepatocarcinoma, and 46% were HCV positive recipients.

No significant differences were found between groups concerning the INR, Factor V, or fibrinogen. There were significant differences ( $P < 0.05$ ) relating to those with platelets < 70,000, with a greater risk of immediate haemorrhage (50% vs. 13%;  $P=0.001$ ), multitransfusion (>3 packed red cells) during the first 24 postoperative hours (56% vs. 20%;  $p < 0.05$ ), and early kidney failure (43% vs. 13%;  $P < 0.05$ ). Haemoglobin values < 10 g/L were associated with greater transfusion (46%), haemorrhage (38%), pulmonary complications (pneumonia, distress or pleural effusion) (46%), and prolonged ICU stay (>5 days) (42%).

The multivariate analysis showed that only pretransplant haemoglobin < 10 g/L was independently associated with the risk for multitransfusion (OR 2.6;  $p=0.001$ ; 95% CI 2.8-68). There were no significant differences between groups concerning death.

**Conclusion:** A higher number of patients is probably needed to find a marker of coagulopathy better associated with mortality. Nevertheless, give these results we should re-evaluate the procedure in those patients with pretransplant haemoglobin values < 10 g/L.

## 6AP4-8

### Predicting massive transfusion in trauma and non-trauma patients

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**Background and Goal of Study:** Early prediction of massive transfusion (MT) allows optimal resuscitation, and aggressive, early correction of coagulopathy in severe haemorrhage (SH). However, MT predictive values of scoring systems differ greatly and validated scoring system or parameter to predict MT in perioperative or medical SH is lacking. We assessed the predictive values of clinical parameters used in our centre to activate an MT protocol that includes different causes of SH.

**Material and methods:** We performed a single-centre, prospective cohort study in SH patients from January-December 2012. Haemostatic resuscitation included massive fixed ratio transfusion protocol of blood products and rotation thromboelastometry (ROTEM) guided therapy. Criteria to activate MT protocol was transfusion of 4 or more RBCs in one hour during bleeding in surgical and medical patients, and blood consumption (ABC) score  $\geq 2$  in trauma patients.

We assessed sensitivity and positive predictive values of these two criteria and investigated the value of ROTEM in early prediction of MT.

**Results and discussion:** Of 97 patients with SH (replacement of 50% total blood volume within 3h), 51 (53%) received MT. Main causes for bleeding were cardiac surgery (24%), trauma (16.5%), vascular surgery (13%), general surgery (10%) and digestive bleeding (7%). Mean age was 63 (SD 17.9) years and 71% were males. Mean ISS score in trauma patients was 56.5 (DS 18.7). 71.13% of MT non-trauma patients received 4 or more RBCs in the hour before MT protocol activation; 44.4% of MT trauma patients had an ABC score  $\geq 2$ . Predictive positive values (PPV) of these criteria were 47% and 50%, respectively. Mean value of FIBTEM (MCF) in patients receiving MT was significantly lower than in those who did not have MT (6.6mm (95% CI 4.3-8.9) vs. 11mm (95% CI 8.5-13.9)).

**Conclusion:** Transfusion of 4 or more RBCs in one hour showed a good predictive value of MT in non-traumatic patients. ABC score may not be the best criteria to predict MT but it is simple and easy to perform. Adding FIBTEM MCF to this clinical parameters can improve predictive value, decreasing the percentage of false positives and therefore unnecessary activation of the MT protocol.

## 6AP4-9

### 6% albumin versus HES 130/0,4 in pediatric cardiac surgery: effects on renal function

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**Background and Goal of Study:** Colloids are widely used in pediatric cardiac surgery for perioperative fluid therapy including the priming of cardiopulmonary bypass (CPB). Albumin is the « gold standard » but tetraarches (HES 130/0.4) may be an interesting alternative because of its lower cost (1). The goal of this study was to compare HES 130/0.4 to albumin on postoperative renal function.



**Materials and methods:** This retrospective study included all children undergoing cardiac surgery with CPB between January 2002 and December 2010. Jehovah's witnesses' patients, newborns (< 1 month of age) and ASA V children were excluded from this study. Anaesthetic, CPB and surgical techniques were standardized. The following parameters were analyzed: need for renal replacement therapy (RRT), postoperative day 1 (POD1) and 3 (POD3) creatinine values, maximal postoperative creatinine value and glomerular filtration rate (GFR) ratio calculated as the ratio between POD1 and preoperative glomerular filtration rate calculated according to the Schwartz formula (2). Acute renal failure (ARF) was defined as a GFR ratio below 25%. Patients who received exclusively albumin as perioperative colloid were compared to those who received HES 130/0.4 using genetic matching (3). Further statistical analyses included ANCOVA for continuous variables and logistic regression for discontinuous variables. A  $p < 0.05$  was considered significant.

**Results and discussion:** The study included 1495 children with a mean age of 32.5 months [SD 41.9 months] and a mean weight of 11.0 kg [SD: 9.9 kg]. Of the total population, 488 were treated with albumin (41.5 ± 28.7 ml/kg) and 1007 with HES (39.6 ± 12.6 ml/kg). Data are presented in table 1 as mean ± SD or percentage (%)

	6% Albumin		HES 130/0,4		P
	N	Mean ± SD or percentage	N	Mean ± SD or percentage	
RRT (%)	487	1,20	1005	1,10	<0,001
Creatinine POD1 (mg/dl)	458	0,46 ± 0,33	986	0,37 ± 0,18	0,04
Creatinine POD3 (mg/dl)	400	0,37 ± 0,31	763	0,28 ± 0,17	0,44
Creatinine max (mg/dl)	477	0,56 ± 0,39	1000	0,41 ± 0,23	<0,001
GFR ratio	452	1,05 ± 0,42	970	1,06 ± 0,57	0,91
ARF (%)	450	0,20	975	0,51	0,74

[Postoperative renal function]

**Conclusion(s):** In the conditions of our study HES 130/0.4 has no demonstrable deleterious effect on immediate postoperative renal function when compared to albumin.

#### References:

1. P Van der Linden et al., Anesthesiology, 2013 Aug8 [Epub ahead of print]
2. Schwartz GJ et al., Pediatrics 1976,58:259-263
3. Sekhon JS, Journal of statistical software 2011, 42(7), 1-52

## 6AP4-10

### Impact of fibrinolytic activity on postoperative bleeding after on-pump cardiac surgery

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**Background and Goal of Study:** The fibrinolytic activity depends on balance between fibrinolytic activators and inhibitors which may influence a bleeding tendency, particularly, after cardiac on-pump surgery. The most important fibrinolytic system inhibitor in the circulation is plasminogen activator inhibitor type-1 (PAI-1) a fast acting inhibitor of tissue plasminogen activator (t-PA). PAI-1 binds to t-PA forming a stable complex (t-PA/PAI-1) which is considered to be an indicator of the concentration and function of active PAI-1. The goal: to evaluate impact of fibrinolytic activity on bleeding after on-pump cardiac surgery determined by PAI-1 and t-PA/PAI-1 plasma concentrations.

**Materials and methods:** After ethical approval, elective 83 patients were studied prospectively. During on-pump cardiac surgery all patients received Tranexamic acid 2-4 g i.v. To assess fibrinolysis PAI-1 and t-PA/PAI-1 complex were determined preoperatively and 24 h postoperatively. Bleeding volume from chest tube drainage system was registered 1h, 4h and 24h (T1, T4, T24) after surgery. Associations between blood loss, parameters of fibrinolysis were analysed.

**Results:** Mean preoperative PAI-1 concentration was 24 ± 12 ng/mL. PAI-1 values that are higher or equal to as normal of 25 ng/mL were noticed in 30 patients (38 ± 7.5 ng/mL). The latter showed significantly lower postoperative bleeding volume: at T1 47 ± 30 ml vs. 67 ± 31 ml ( $p = 0.008$ ), at T4 159 ± 109 ml vs. 237 ± 118 ml ( $p = 0.003$ ), at T24 454 ± 227 ml vs. 635 ± 272 ml ( $p = 0.002$ ). Moreover, there was an association between preoperative PAI-1 plasma levels and 24h blood loss ( $r = -0.3$ ,  $p = 0.01$ ). Mean postoperative t-PA/PAI-1 plasma concentration measured 24 h after surgery was 3.6 ± 2.1 ng/mL. Complex levels higher or equal to as normal of 5 ng/mL were found in 18 patients (7.2 ± 1.3 ng/mL). Patients with greater levels of t-PA/PAI-1 than 5

ng/mL showed significantly lower postoperative bleeding: at T1 49 ± 16 ml vs. 63 ± 34 ml ( $p = 0.02$ ), at T4 169 ± 59 ml vs. 220 ± 131 ml ( $p = 0.02$ ), at T24 465 ± 163 ml vs. 598 ± 287 ml ( $p = 0.01$ ).

**Conclusion(s):** There was found an association between fibrinolytic activity determined by PAI-1 and t-PA/PAI-1 plasma levels and postoperative bleeding volume. Therefore, they may be useful for bleeding risk stratification and targeting antifibrinolytic therapy perioperatively.

## 6AP4-11

### An anaesthetic management of severe postpartum haemorrhage in 39 years old parturient subjected to repeated laparotomies, a case report

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**Background:** The new guidelines on haemostatic management were proposed by ESA in 2013 year pointing the early use of specific blood components and thromboelastometric monitoring.

**Case report:** A 39 years old parturient at 40<sup>th</sup> week pregnancy with history of previous caesarean section (CS) due to the breech presentation was scheduled for elective CS. Her laboratory and physical examination were normal. After counselling with gynaecologist she decided to undergo sterilization during the CS in general anaesthesia (GA).

She was given cefazolin sodium before induction to GA. Thiopental sodium, rocuronium, fentanyl and sevoflurane were used for GA. During the uneventful surgical procedure a healthy male neonate was delivered. She was given 500 ml of Ringer's solution and 10 IU oxytocin. Approximately 20 minutes after the surgical procedure was finished a severe vaginal bleeding occurred and oxytocin was repeated. A hysterectomy was performed, and blood product replacement started. She was initially given topical haemostatic agents, 6 doses of red blood cells (RBCs), 6 fresh frozen plasma (FFP) and one pool of platelets. Despite all surgical and haemostatic manoeuvres the bleeding continued, and laparotomies were repeated three times: The bleeding stopped after repeated abdomino-pelvic packaging with local haemostatic agents. During the 24 hours she was given 40 RBCs; 30 FFPs, 3 platelets apheresis, 2 prothrombin complex concentrates, 5 cryoprecipitates, calcium, recombinant human factor VIIa, and 2500 ml of crystalloids. Tranexamic acid was not given. Standard coagulation monitoring showed no coagulation disorders at any time point. After the massive bleeding and transfusions she had no organ dysfunction.

**Discussion:** An initial massive transfusion protocol (MTP) with 1:1:1 fixed ratio of RBCs, FFP and platelets satisfactory maintained microcirculatory perfusion of brain, heart, lungs and other vital organs, whereas crystalloid infusion was limited. A routine coagulation monitoring was not useful in the bleeding diagnostics.

#### References:

- Kozek-Langenecker SA, et al. Eur J Anaesthesiol. 2013;30:270-382.

#### Learning points:

- Tranexamic acid should be considered before cesarean section.
  - An initial MTP with 1:1:1 ratio of blood products was successful in the massive PPH and prevented dilutional coagulopathy.
- A thromboelastometry may more accurately identify obstetric coagulopathy, especially fibrinolysis.

## 6AP5-1

### Rotation thromboelastometry versus standard coagulation tests in cirrhotic pretransplant patients

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**Background and Goal of Study:** The cirrhotic patients were assumed to have a bleeding tendency based on standard coagulation tests. Recent studies showed a state of rebalanced hemostasis in which abnormalities in procoagulant factors are compensated by changes in anticoagulant drivers. Since standard tests of coagulation only assess components of clot formation those tests cannot reflect this rebalanced state of the cirrhotic coagulopathy. Rotation thromboelastometry ROTEM is a point-of-care device that enables evaluation of the process of clot initiation, formation and stability using whole blood.

The goal of the study was to assess the correlation between standard coagulation laboratory tests (SCT) and ROTEM parameters in cirrhotic patients, and also to investigate if the ROTEM parameters reflect the severity of the liver disease.

**Materials and methods:** 26 pretransplant patients with liver cirrhosis were included in a retrospective observational study. Standard coagulation tests-INR/PT, aPTT, platelet number, fibrinogen levels and rotation thrombelastometry (ROTEM) were performed. Patients that received recently fresh frozen plasma, cryoprecipitate, platelet concentrate or coagulation factors were excluded from the study group. MELD, MELD Na scores and the intraoperative bleeding were recorded. Statistical analysis was performed using SPSS Statistics v.19.1.

**Results and discussion:** The study group included 20 men (77%) and 6 women. Mean ( $\pm$ SD) age was 52.15 ( $\pm$ 10.08) years. CT and CFT of INTEM correlated well with aPTT ( $p=0.046$  and  $0.024$  respectively). CT of EXTEM showed a good correlation with INR ( $p=0.012$ ), but CFT of EXTEM did not correlate with INR ( $p=0.262$ ). Clot amplitude at 10 minutes (A10) of EXTEM and INTEM and maximum clot firmness (MCF) of both EXTEM and INTEM correlated well with fibrinogen levels and platelet number. MCF of FIBTEM showed a very good correlation with fibrinogen levels ( $p < 0.01$ ). None of the ROTEM parameters studied correlated with the severity of the liver disease as assessed by MELD and MELD-Na scores. The quantity of blood loss during liver transplantation did not correlate with any of the preoperative ROTEM parameters.

**Conclusion(s):** In our study we found good correlations between SCT and ROTEM parameters, except for CFT (EXTEM) and INR. The patients in the study group showed normal or hypocoagulability on SCT and none of the patients was detected with hypercoagulability on the ROTEM parameters.

## 6AP5-2

### Goal directed fibrinogen concentrate (FC) therapy guided by thrombelastometry (ROTEM®) in massive postpartum hemorrhage (PPH) with uterus atony and severe hypofibrinogenemia (HF)

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**Background:** PPH is a major risk factor for maternal morbimortality. Early recognition and correction of an underlying or associated HF is crucial for its successful management.

**Case report:** In a healthy, preeclamptic 39 year old primigravida, 38 + 6 weeks of gestation, labour was initiated with oxytocin perfusion under peridural anaesthesia. Deteriorating fetal assessment by cardiotocography led to emergency cesarean section. After 40 min acute onset of vaginal bleeding with clinical signs of uterus atony caused severe hemorrhage shock. Immediate ROTEM® determination showed severe HF with a FIBTEM clot firmness at 10 min of 4 mm (in retrospect 0.42 g/l in the conventional laboratory analysis). General anaesthesia was induced and HF was immediately treated with 6 g of FC resulting in a completely normalized ROTEM® after 30 minutes and clear improvement of clinical bleeding dynamics. The patient suffered an estimated blood loss of 6 liters. Six packed red blood cells, 2 platelet concentrates, 2 liters of fresh frozen plasma were transfused. Further treatment lines consisted of: fluid resuscitation, oxygen therapy, 4 g of tranexamic acid, triple uteroton treatment, external uterus massage and an intrauterine balloon device. Bleeding control was achieved after 60 minutes. After a few hours she was safely extubated. The next day she underwent embolization of epigastric and uterine arteries after a newly hemoglobine drop of two points. She was discharged at day 18.

**Discussion:** Fibrinogen (fib) determination should not only be a routine pre-delivery exam but also one of the main focuses in case of active PPH as fibrinogen levels  $< 2$  g/l are a well known risk factor for PPH bleeding severity (1). It is of major interest to dispose of fib levels in the fastest possible way to start immediate goal directed therapy. Point of care devices as ROTEM® play an important role, as results are faster available than those determined by traditional laboratory Clauss methods (CM). The additional "off label use" of FC in comparison to FFP allows a much faster and - by means of volume charge - less aggressive treatment, as it's fib concentration is up to 10 times higher and thawing time is avoided.

#### References:

1. Charbit B et al., The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. *J Thromb Haemost* 2007;5: 266-73

**Learning Points:** The combination of ROTEM® with FC is the fastest and most effective means to treat severe HF in PPH.

## 6AP5-3

### The addition of prothrombin complex concentrate has no additional impact on blood loss following fibrinogen and tranexamic acid substitution in a two-hit model of blunt liver injury

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**Background and Goal of Study:** Despite a shift in treatment algorithms to use coagulation factors in the treatment of massive bleeding, prospective studies investigating the impact of such therapy regimes are largely missing. We investigated in a two-hit pig model and haemorrhagic shock the impact of a combined therapy with tranexamic acid (TX), fibrinogen, and prothrombin complex concentrate (PCC).

**Materials and methods:** After ethical approval trauma was induced in 36 anaesthetised pigs. A second hit standardised blunt liver injury grade III was induced. After the first injury phase with severe haemorrhagic shock over 30 minutes, animals were resuscitated with crystalloids. Ten minutes after the second liver injury animals were re-transfused with washed RBCs and randomised to receive ringers solution (control), TX (15mg/kg, TX group), TX and fibrinogen (90mg/kg, TXF group) or TX, fibrinogen and PCC (20 U/kg, TXFP group). Thromboelastometry (ROTEM, TEM), thrombin generation (TG) and TAT complexes were monitored over 4 hours and blood loss was measured. Statistical analysis was performed using ANOVA with Tukey *post hoc*.

**Results and discussion:** The total blood loss as the primary endpoint of this study was lowest in the TXF ( $1012 \pm 86$  ml) and TXFP ( $1037 \pm 118$  ml) groups, followed by the TX ( $1579 \pm 306$  ml) and control group ( $2376 \pm 478$  ml). All animals of TXF and TXFP groups survived, whereas five of nine animals (55%) and two out of nine animals (22%) died in the control and TX groups, respectively. Coagulation was severely impaired after the infliction of injuries and haemorrhagic shock. Both PT ( $15 \pm 2$  sec) and clot formation ( $81 \pm 14$  sec) prolonged over time, whereas clot strength (MCF:  $53 \pm 4$  mm) significantly decreased. Infusion of fibrinogen restored MCF and decreased clot formation without showing an effect on TG. In contrast, PCC substitution significantly enhanced TG and TAT levels with only minor effects TEM variables and PT.

**Conclusion(s):** In this experimental model with blunt liver injuries and prolonged haemorrhagic shock both TX and fibrinogen significantly reduced blood. Although therapy with PCC significantly enhanced thrombin generation and activation of coagulation, no additional effects on blood loss were observed. The results of this study confirm that fibrinogen and not thrombin generation primarily affect haemostasis.

**Acknowledgements:** Support by CSL Behring

## 6AP5-4

### Combined perioperative use of tranexamic acid with a postoperative reinfusion/autotransfusion drainage system dramatically decrease the allogenic transfusion needs in total knee arthroplasty (TKA)

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**Background and Goal of Study:** The prevalence of TKA is increasing, still associated with considerable blood loss due to surgical damage of muscles, sinovia, bone resection and by transient activation of the fibrinolytic system which leads to significant anemia, increased cardiovascular and transfusion related risks. Allogenic transfusion could induce blood incompatibility, early/late immune responses, immunosuppression, clotting factor deficiency, increased infectious risk.

Efforts for blood conservation and reduction of perioperative blood loss become desirable. Our aim was to investigate if combined perioperative use of tranexamic acid (antifibrinolytic) and a reinfusion p.o. system drainage which allows reinfusion of the collected blood lost during 24h p.o. will reduce the need for allogenic transfusion in TKA.

**Materials and methods:** Prospective randomised 1 year study of 78 patients ages 51-89, surgery for TKA allocated in 3 groups  
Group A no tranexamic acid, standard vacuum drainage  
Group B,C received 10mg/kg of tranexamic acid i.v. before tourniquet release

Group C supplementary received a reinfusion system drainage at the end of surgery

Blood transfusion was made at Hb < 9/dl/anemic symptom

Patients in group C received all collected blood from reinfusion system during 24h and allogenic transfusion if needs We measured changes in postoperative Hb level, the amount of allogenic transfusion, intra/postop bleeding in 24h, the allogenic transfusion frequency, TVP incidence.

**Results and discussion:** Anova tests used for statistical analyses, p value < 0,05 statistically significant.

No differences in preop. Hb level. At 24h Hb was significantly higher in group C. Blood loss was significantly lower in group B, C. Mean allogenic blood transfusion volume was significantly lower in group C, B vs A (33 ml vs 100ml vs 466,6 ml) Allogenic transfusion was required in 92,3% in group A, 23,1% group B, 7,6% group C. No differences in TVP

**Conclusion(s):** Combined tranexamic acid use and p.o. reinfusion system lead to a statistically significant reduction in blood loss and fewer patients requiring allogenic transfusion with no apparent increased risk of thromboembolic events.

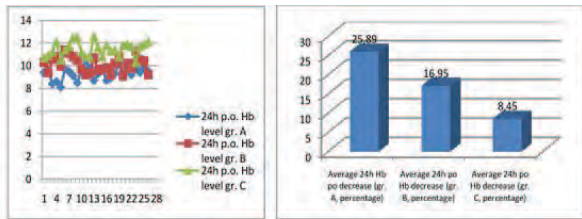


Fig 1. Hb level at 24h, p<0,05 (C vs A,B)

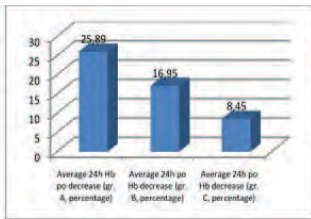


Fig 2. 24h p.o. Hb decrease, percentage, p<0,05

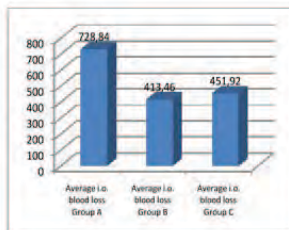


Fig 3. Average i.o. blood loss, p<0,05 (C, B vs A)

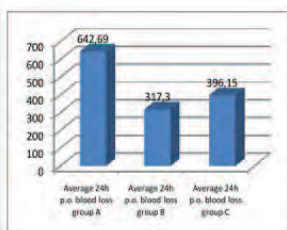


Fig 4. Average 24h p.o. blood loss, p<0,05 (C,B vs A)

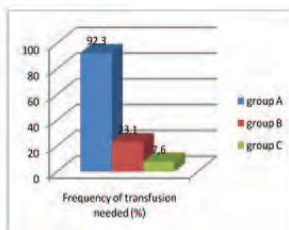


Fig 5. Frequency of allotransfusion needed, p< 0,05

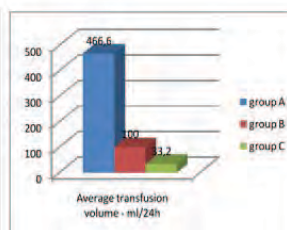


Fig 6. Average transfusion volume, p<0,05

[Graphics]

### 6AP5-5

#### Effect of tranexamic acid on platelet dysfunction during cardiopulmonary bypass

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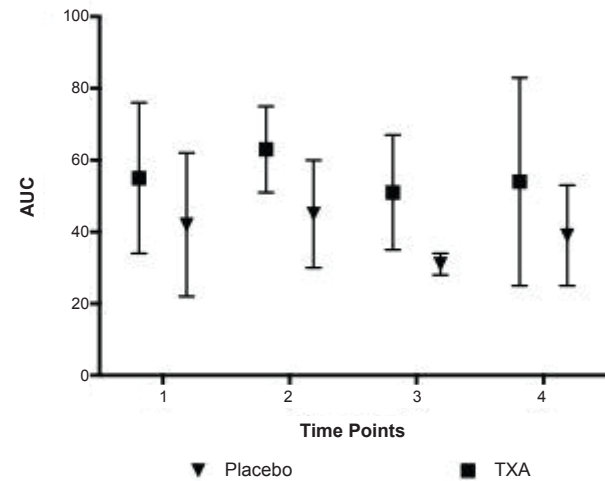
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**Background and Goal of Study:** The impact of tranexamic acid on platelet function is not well known. The goal of our study was to examine the effect of tranexamic acid on platelet function in patients undergoing cardiac surgery treated with aspirin or not.

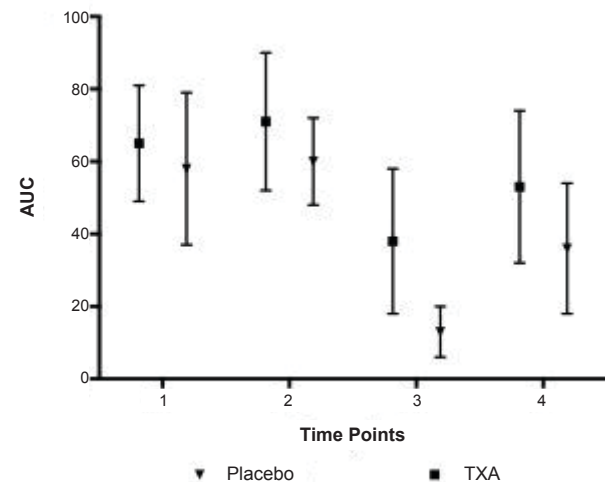
**Materials and methods:** Patients undergoing elective cardiac surgery with CPB were enrolled. Patients without aspirin interruption were enrolled in "group ASPIRIN" and those that had never treated with aspirin were included in the "group CONTROL". From each group, patients were randomized to

receive either tranexamic acid or placebo. Multiple electrode aggregometry (MEA) tests were used to assess platelet function using different reagents (ADP, ASP, COL, TRAP) at different time points during the surgery (induction of anaesthesia (1), post loading dose (2), aortic unclamping (3), 5 min after protamine administration (4)). Two-way ANOVA analysis of variance for repeated measures was used to compare the 4 sub-groups. If relevant, multiple comparisons were performed using the Tukey's test.

**Results and discussion:** We included 18 patients in the group ASPIRIN and 10 patients in the group CONTROL. Patients included in the group ASPIRIN have a decreased platelet function in any tests at any time points compared to group CONTROL. No statistical difference was observed between patients treated with TXA and placebo in group ASPIRIN at any time points. However, TXA improved platelet function measured on ADP



[Figure 1]



[Figure 2]

tests at the end of CPB in patient included in group CONTROL. No difference in postoperative blood loss was observed between groups.

**Conclusion(s):** In the context of our preliminary study, TXA administration seems to improve platelet function in patients that did not received preoperative aspirin. Although, this beneficial effect was not observed in the presence of aspirin.



## 6AP5-6

### Tissue-type plasminogen activated hyperfibrinolysis in children with congenital heart diseases: concentration-effect relationship determined by rotational thromboelastometry

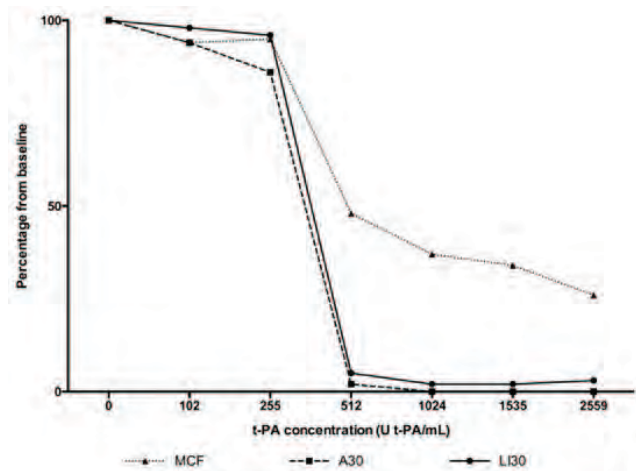
Sanchez Torres C.<sup>1</sup>, Rozen L.<sup>2</sup>, Demulder A.<sup>2</sup>, Van der Linden P.<sup>1</sup>, Faraoni D.<sup>1</sup>  
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**Background and Goal of Study:** Ex vivo evaluation of hyperfibrinolysis remains difficult. The aim of this study was to assess the ability of the rotational thromboelastometry to explore ex vivo hyperfibrinolysis by determining the tissue-type plasminogen activator (t-PA) concentration-effect relationship observed on fibrinolytic parameters measured on the EXTEM test. The secondary objective of this study was to assess the same concentration-effect relationship after cardiopulmonary bypass while children have received TXA during the surgery.

**Materials and methods:** Blood samples obtained from 20 cardiac surgery children were analysed at two predefined time-points: after induction of anaesthesia, before administration of tranexamic acid (TXA) (baseline) and at the end of surgery when TXA is administered according to our local dosing scheme: 10 mg/kg loading dose followed by an infusion of 10 mg/kg/h until the end of surgery (end surgery).

At baseline, an EXTEM test was performed without and with increasing concentration of t-PA (102, 255, 512, 1024, 1535, 2539 units t-PA/ml) used to induce hyperfibrinolysis. At the end of surgery, an EXTEM test was performed without and with 2 different concentrations of t-PA (1535 and 2539 units t-PA/ml). Concentration-effect sequences were analysed by probit analysis, based on the logistic regression method using R software.

**Results and discussion:** The concentration-effect evaluated on the whole population allowed the determination of the ED50 and the ED95 for the different parameters:



[Figure 1]

A30: 294.6 (262.8-326.3) and 515.1 (311.5-718.7); MCF: 413.0 (369.4-456.6) and 825.3 (596.0- 1054.6); LI30: 295.4 (263.0-329.9) and 530.4 (325.7-735.1). At the end of surgery, no concentration-effect analysis could be performed as fibrinolysis was completely inhibited.

**Conclusion(s):** The t-PA concentration-effect relationship allowed the determination of ED95, corresponding to extreme hyperfibrinolysis. This design could be used in further studies to determine the concentration-effect of TXA on fibrinolysis inhibition measured on rotational thromboelastometry in the same population.

## 6AP5-7

### What is the coagulation state during pregnancy?

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**Background and Goal of Study:** Normal pregnancy is accompanied by changes in the coagulation and fibrinolytic systems. These changes may be important for reducing intrapartum blood loss, but they determine an increased risk of thromboembolism during pregnancy and puerperium.

**Materials and methods:** We studied the coagulation system of 63 women with normal pregnancies. To compare the results were also studied the coagulation system of 67 healthy volunteers. This study was approved by the Research Ethical Board (3723-G) of Odessa National Medical University on 20 of May 2013. Monitoring of hemostasis was by low-frequency piezoelectric hemoviscoelastography (LPH). We measured the difference in the basic parameters of hemostasis, to ascertain the significant changes in the state of blood coagulation.

**Results and discussion:** Aggregation index the intensity of the contact phase of coagulation was increased on 54.7% ( $p < 0.05$ ), the time the contact phase of coagulation on 39.8% ( $p < 0.05$ ) and initial rate of blood aggregation on 41.6% ( $p < 0.05$ ) which create a state hyperaggregation. Coagulation indexes: a constant thrombin activity was increased on 34.5% ( $p < 0.05$ ), the intensity of clot polymerization on 37.8% ( $p < 0.05$ ), the formation of platelet-fibrin clot structure on 41.6% ( $p < 0.05$ ), the intensity of coagulation drive was increased on 29.2% ( $p < 0.05$ ) and maximum density of the clot was increased on 48.5% ( $p < 0.05$ ). All this results create a state of hypercoagulability. Also an fibrinolysis indicator the intensity of the retraction and clot lysis decreased by 44.7% ( $p < 0.05$ ), create a hypofibrinolytic state.

**Conclusion(s):** Using our method, we confirmed the diagnosis of changes in the hemostatic system from initial viscosity and platelet aggregation to coagulation and lysis of clot. During normal pregnancy the hemostatic balance changes in the direction of hyperaggregation, hypercoagulability and hypofibrinolytic state.

## 6AP5-8

### Therapy with prothrombin complex concentrate reverses dabigatran and trauma-induced bleeding in pigs

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**Background and Goal of Study:** In situations of life-threatening bleeding involving new oral anticoagulants, interventions with coagulation factor concentrates (PCC) have been used with conflicting outcomes. We investigated for the first time the ability of increasing doses of PCC to overcome the anticoagulant effects of dabigatran in a porcine polytrauma model.

**Materials and methods:** After ethical approval, 24 male pigs were administered dabigatran etexilate (30 mg/kg) for 3 days. On day 4, dabigatran was infused prior to injury to achieve supratherapeutic levels in anesthetised pigs. 12 min after inflicting standardised bilateral femur fractures and blunt liver injury, animals randomly received PCC (25, 50, 100 IU/kg) or placebo ( $n=6$ ). Blood loss and coagulation variables, including thromboelastometry (TEM), D-Dimers and thrombin antithrombin levels (TAT) were measured over 300 min post trauma. Data were analysed by two-way ANOVA and presented as mean  $\pm$  SEM.

**Results and discussion:** Infusion of dabigatran and inflicting trauma caused coagulopathy as indicated by a prolongation of TEM variables. Application of PCC partially reversed these effects, as seen by a significant reduction of TEM variables 300 min post injury, which remained stable in PCC 50 / 100 IU/kg animals. High levels of TAT complexes in animals receiving PCC (no PCC  $\sim 10 \mu\text{g/L}$  vs. PCC 50 & 100:  $> 60 \mu\text{g/L}$ ) indicated activation of coagulation. In addition, there was significant elevation of D-Dimers up to 167,500 ng/mL in 100 IU/kg PCC. Blood loss was significantly increased in dabigatran-treated (38.5 mL/min) and PCC 25 IU/kg (22.6 mL/min) animals. PCC 50 or 100 IU/kg resulted in a significant reduction in blood loss (5.9 or 6.0 mL/min). Consistent with this, dabigatran animals (mean survival: 106 min) and PCC 25 IU/kg animals (mean survival: 204 min) died before the end of observation period.

All PCC 50 and 100 IU/kg animals survived. These results show that PCC at higher doses is effective in reducing blood loss in dabigatran-anticoagulated pigs. This may be due to the excess of prothrombin in relation to dabigatran, thereby allowing normal haemostasis and is supported by the observation that PCC at 25 IU/kg had a lower impact on blood loss with enhanced mortality.

**Conclusions:** PCCs can reduce blood loss and improve survival in a lethal porcine polytrauma model with dabigatran anticoagulation. Using PCC may be an alternative for dabigatran-treated patients with life-threatening bleeding.

## 6AP5-9

### Does RBC storage duration influence coagulation assessed by the ROTEM®?

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**Background and Goal of Study:** Monitoring of haemostasis during haemorrhage is essential to detect coagulopathy and to guide therapeutic strategies in the bleeding patient. Although red blood cells (RBC) contribute to haemostatic function (1) the effects of storage duration on coagulation remains largely unknown.

The aim of this prospective observational study was to assess the effects of RBC storage duration on parameters of coagulation measured by the ROTEM®.

**Materials and methods:** After IEC approval and written informed consent, 12 healthy volunteers were included in this study and gave 3 units of 100 ml of whole blood that were stored for 0, 14 and 35 days respectively. Blood samples were obtained from these units and mixed with autologous rich platelet plasma to obtain a haematocrit of 40% while platelet count and fibrinogen concentration were maintained constant. Samples were analyzed using the EXTEM and the INTEM tests. Measured variables were analyzed using a two-way analysis of variance for repeated measurements followed, if significant, by paired comparisons using LSD test. A p-value < 0.05 was considered significant.

**Results and discussion:** The 12 volunteers included 6 men and 6 women aged 33±10 years and weighing 71±8kg. Table 01

Parameters	Day 0	Day 14	Day 35
Haematocrit (%)	40.8 ± 1.0	40.6 ± 1.1	40.5 ± 0.5
CT extem (s)	60 ± 6*	67 ± 8*§	75 ± 13*§
CFT extem (s)	137 ± 20	131 ± 16	117 ± 34
MCF extem (mm)	54 ± 3	57 ± 2*§	58 ± 3*§
α_extem (°)	64 ± 4	64 ± 3	65 ± 3
CT_intem (s)	198 ± 15	205 ± 18	221 ± 25*§
CFT_intem (s)	97 ± 19	101 ± 9	101 ± 12
MCF_intem (mm)	53 ± 4	54 ± 2	57 ± 4*§
α_intem (°)	72 ± 4	70 ± 2	70 ± 2

[Table 1: Effect of RBC storage duration]

\*p < 0,05 vs Day 0 - § p < 0,05 vs previous]

Although duration of RBC storage increased significantly the clotting time and the clot firmness, these changes appears minimal as the measured values remains within the normal range (2).

**Conclusion(s):** In the conditions of our study, duration of RBC storage has a minimal impact on coagulation parameters assessed by the ROTEM® while platelets count and fibrinogen concentration were maintained constant.

### References:

1. Ouaknine-Orlando B et al. Anesthesiology 1999;90:1454-61.
2. Lang T et al. Blood Coagul Fibrinolysis 2005;16(4):301-10.

## 6AP5-10

### Influence of haematocrit level on thromboelastometry parameters

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**Background and Goal of Study:** Rotational thromboelastometry (ROTEM®) has been shown useful to guide platelets and fibrinogen administration in the massively bleeding patient (1). Although red blood cells (RBCs) interfere with normal haemostasis, their impact on the parameters measured by the ROTEM® remains poorly evaluated. This prospective observational study assessed the effects of haematocrit on the coagulation parameters measured by the ROTEM.

**Materials and methods:** After IEC approval and written informed consent, 12 healthy volunteers were enrolled in this study. Whole blood samples were collected and used to prepare in-vitro samples at 4 different levels of haematocrit (0%, 12.5%, 25% and 40%) with platelets count and fibrinogen concentration maintained constant. Coagulation was assessed on each sample using the EXTEM, the INTEM and the FIBTEM tests. Variables obtained were analyzed using a two-way analysis of variance for repeated measurements, followed if significant by paired comparisons using LSD test. A p-value < 0.05 was considered significant.

**Results and discussion:** The studied population included 6 men and 6 women, aged 33±10 years and weighing 71±8 kg. Table 01

	Hct 0%	Hct 12.5%	Hct 25%	Hct 40%
EXTEM CT (s)	53 ± 6	55 ± 6	56 ± 7	60 ± 6*
EXTEM CFT (s)	99 ± 10	112 ± 14*§	113 ± 18*	137 ± 20*§
EXTEM alpha (°)	72 ± 4	68 ± 3*§	68 ± 4*	64 ± 4*§
EXTEM MCF (mm)	50 ± 3	57 ± 3*§	57 ± 3*	54 ± 3*§
INTEM CT (s)	210 ± 11	206 ± 18	193 ± 17*§	198 ± 15*
INTEM CFT (s)	85 ± 11	85 ± 15	85 ± 14	97 ± 19*§
INTEM alpha (°)	74 ± 2	74 ± 3	74 ± 3	72 ± 4*§
INTEM MCF (mm)	57 ± 3	55 ± 3*§	55 ± 3*	53 ± 4*§
FIBTEM A20 (mm)	12 ± 3	11 ± 2	11 ± 3	10 ± 4

[Table 1]

\*p < 0.05 versus hct 0%; § p < 0.05 versus previous measurement

Although increasing the haematocrit in the samples was associated with an increased clot formation time and a decreased angle alpha, these changes as those observed on the clotting time and on the clot firmness appeared minimal. Most of the measured variables remain within the normal range (2).

**Conclusion(s):** Our results suggest that haematocrit level has minimal impact on coagulation parameters measured by the ROTEM® when platelet count and fibrinogen concentration are maintained constant. ROTEM® parameters didn't provide information on the haematocrit level to be maintained in the bleeding patient.

### References:

1. Rahe-Meyer N et al. Br J Anaesth. 2009 Jun;102(6):785-92
2. Lang T et al. Blood Coagul Fibrinolysis 2005;16(4):301-10.

## Neurosciences

### 7AP1-1

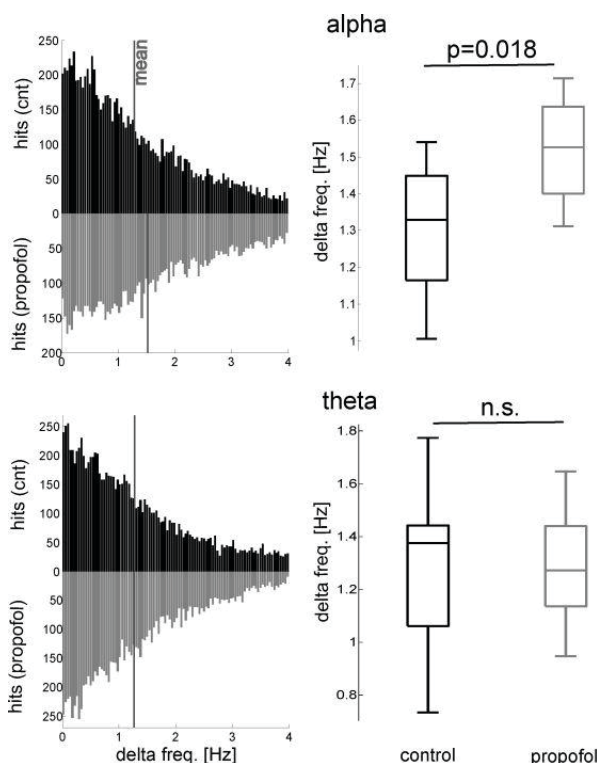
#### Propofol drives 8-12 Hz oscillations in hippocampus and prefrontal cortex apart

Kreuzer M.<sup>1</sup>, Butovas S.<sup>2</sup>, Drexler B.<sup>3</sup>, Antkowiak B.<sup>3</sup>, Kochs E.F.<sup>1</sup>, Schwarz C.<sup>2</sup>  
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**Background:** Communication between cerebral cortex and hippocampus is essential for consolidation of memories. Anesthetics impair information processing between these brain structures, e.g. by actions on  $\theta$ -oscillations. Instantaneous frequency (IF), a local measure compared to the global Fourier transform, might allow for evaluation of propofol effects on oscillatory activity between prefrontal cortical (pctx) and hippocampal areas (hipp). IF can be determined by using the Hilbert transform (HT). HT allows representation of the signal as change in phase. Consequently, the IF of the signal can be derived for each time point. Anesthetic-induced changes on the difference between IF in pctx and hipp may reflect processes associated with the anesthetic's amnesic component.

**Methods:** Nine local field potential (LFP) sets from wild type mice were recorded with 20kHz at control conditions and hypnotic concentrations of propofol (30mg/kg) in pctx and hipp. Episodes of 5s were extracted from each recording and used for analysis after bandpass filtering to 4-8 ( $\theta$ ) or 8-12Hz ( $\alpha$ ) and downsampling to 250Hz ( $\Delta t=4$ ms). The filtered signals complex representation was derived using HT. The real part conforms to the original signal, whereas the imaginary part contains the 90° phase shifted original signal. The analytic phase  $P$  of a signal  $x(t)$  is derived by  $P(t)=\text{atan}[\text{Im}(x(t))/\text{Re}(x(t))]$  and  $\text{IF}(t)=[P(t)-P(t-1)]/\Delta t$ .  $\Delta\text{IF}(t)=\text{IF}_{\text{pctx}}(t)-\text{IF}_{\text{hipp}}(t)$  was used to elucidate effects of propofol. In a last step, differences  $>4$ Hz were excluded to dismiss phase slips.

**Results and discussion:** Propofol significantly increases  $\Delta\text{IF}$  in the  $\alpha$ -range. The increase was from  $1.30\pm 0.18$ Hz (control, mean  $\pm$  standard deviation) to  $1.52\pm 0.14$ Hz (propofol,  $p=0.018$ , unpaired Wilcoxon test), whereas no effect could be observed in the  $\theta$ -range (control:  $1.29\pm 0.31$ Hz; propofol:  $1.28\pm 0.23$ Hz). Oscillatory frequencies drifting apart might illustrate the impairment mechanisms of cortico-hippocampal interactions during anesthesia. The concept of using IF seems capable to analyse propofol-induced effects on changes in the oscillation structure between pctx and hipp.



[Figure 1]

**Conclusion:** Propofol drives hippocampal and cortical LFP  $\alpha$ -oscillations apart, hence possibly disturbing information processing between the areas and supporting mediation of the amnesic component of anesthesia. Unlike global Fourier transforms the concept of using IF is capable to detect frequency changes between pctx and hipp at a local time scale.

### 7AP1-3

#### Role of spinal $\beta$ -endorphin on substance P release and c-FOS expression in the spinal cord dorsal horn

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**Background and Goal of Study:**  $\beta$ -endorphin is an endogenous opioid peptide, which exhibits high affinity to the mu- and delta-opioid receptors. In the spinal cord dorsal horn, mu- and delta-opioid receptors are thought to inhibit neurotransmitter release from primary afferents and hereby mediate analgesia. This study aimed to assess the ability of spinally-administered  $\beta$ -endorphin on noxious stimuli-induced pain behavior and neurotransmitter release from primary afferents.

**Materials and methods:** Male Holtzman Sprague-Dawley rats (approximately 250g) with chronic intrathecal (IT) catheter received IT treatment saline,  $\beta$ -endorphin (1, 3 and 10 $\mu$ g),  $\beta$ -endorphin (10 $\mu$ g) + intraperitoneal (IP) naloxone (3mg/kg) or  $\beta$ -endorphin (10 $\mu$ g) + IP naltrindole (3mg/kg). Rats received intraplantar injection of 2.5% formalin (50 $\mu$ l) to the left hindpaw. Formalin-induced flinches were recorded for an hour by an automated device. Rats were transcardially perfused at 120 min after formalin and c-Fos expression in the lumbar spinal dorsal horn were quantified by immunohistochemistry. In separated groups, rats were perfused at ten min after formalin and the incidence of neurokinin 1 receptor (NK1r) internalization in the superficial dorsal horn were quantified by fluorescent immunohistochemistry.

**Results and discussion:** Unilateral formalin injection induced an intense, biphasic flinching behavior in the injected paw, which was inhibited dose-dependently by IT  $\beta$ -endorphin pretreatment. Robust NK1r internalization in the ipsilateral L3 to L5 dorsal horn was observed after formalin. IT  $\beta$ -endorphin significantly reduced NK1r internalization ( $P < 0.05$ ). Formalin also induced c-Fos expression in the superficial and deep dorsal horn neurons, which was again blocked by IT  $\beta$ -endorphin ( $P < 0.05$ ). The effects of  $\beta$ -endorphin on formalin-evoked flinching behavior, NK1r internalization and c-Fos were abolished by pretreatment of naloxone or naltrindole.

**Conclusion(s):** Spinally-administered  $\beta$ -endorphin exhibited strong anti-hyperalgesic activity in the formalin model. At the analgesic dose,  $\beta$ -endorphin inhibited the release of substance P from primary afferents as well as c-Fos expression in dorsal horn neurons. The effects were at least in part mediated by the delta-opioid receptors.

**Acknowledgements:** This work was supported by NIDA-02110.

### 7AP1-4

#### Direct actions of Ultiva® on dorsal horn neurons in the rat spinal cord revealed by patch clamp analysis

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**Background and Goal of Study:** Remifentanyl is an ultra short-acting  $\mu$ -opioid receptor (MOR) agonist and produces rapid onset of analgesic effect and recovery. However, human and animal studies have demonstrated that remifentanyl administration can provoke opioid-induced hyperalgesia (OIH) by activation of the N-methyl-D-aspartate (NMDA) receptor. In addition, commercially available formulation of remifentanyl, Ultiva® contains glycine which is known as not only an inhibitory neurotransmitter but also an NMDA receptor co-activator.

Therefore, it is still not fully understood whether Ultiva® facilitates or inhibits nociceptive transmission in the spinal cord. In this experiment, we aimed to examine the effect of Ultiva® on the rat spinal dorsal horn (DH) neurons.



**Materials and methods:** In vivo and slice preparations were made from Sprague-Dawley rats (5-8 weeks old) anesthetized with urethane (1.5 g/kg). Whole cell patch-clamp recordings were performed from superficial DH neurons. Ultiva® (50  $\mu$ M) was superfused after starting recordings. We evaluated the effect of Ultiva® by analyzing the activity and responses of DH neurons to noxious pinch stimuli.

**Results and discussion:** In the current-clamp mode, Ultiva® hyperpolarized membrane potentials. In the voltage-clamp mode, Ultiva® induced outward currents. Barrage of excitatory postsynaptic component evoked by the stimuli was completely suppressed by Ultiva® in both modes. Ultiva®-induced outward currents were completely abolished in the presence of MOR antagonist naloxone (100  $\mu$ M) and by using Cs<sup>+</sup>-based pipette solution. The glycine-induced currents were not observed. The current-voltage relationships of Ultiva®-induced currents showed an average reversal potential of  $-86.3 \pm 1.4$  mV ( $n = 25$ ), close to the equilibrium potential for K<sup>+</sup>. These findings indicate that Ultiva® exhibits analgesic effects by hyperpolarizing the membrane of DH neurons via the activation of K<sup>+</sup> channels induced by MOR.

**Conclusion:** This study suggests that Ultiva® doesn't have hyperalgesic but analgesic effects on DH neurons by the activation of MOR and that glycine contained in Ultiva® has no physiological activity.

## 7AP1-5

### Neuroprotective effects of nitrite-derived NO in brain injury is via NOS-independent but GC-dependent pathway

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**Background and Goal of Study:** Recently, it has been shown that nitrite-derived NO protects brain against ischemia-reperfusion injury. However, the precise mechanism of the neuroprotective effects of nitrite in the brain injury is not well understood. Present study was aimed and designed to examine the further mechanism of nitrite-derived NO in reducing cerebral infarct volume following focal cerebral ischemia-reperfusion in the chronic rat model.

**Materials and methods:** With IRB approval ninety male Sprague-Dawley rats were used. Under anesthesia, rats were intubated and mechanically ventilated. Mean arterial pressure, heart rate, brain temperature, regional cerebral blood flow were monitored continuously. All of the rats received one-hour occlusion of middle cerebral artery with a nylon suture followed by the reperfusion.

After 5 days, the brain was taken and sliced for TTC and HE staining to confirm cerebral infarction. The cerebral infarct area of each brain slice was analyzed and integrated using software and evaluated the infarct volume as a percent of the whole brain volume. Rats were assigned to ten-treatment groups ( $n=7-10$ ). Rats were received saline only, sodium nitrite (0.1mg or 1.0mg or 10mg), NOS inhibitor (L-NNA) (10mg/kg) with or without sodium nitrite (1.0mg), soluble guanylate cyclase inhibitor (ODQ) (20mg/kg) with or without sodium nitrite (1.0mg), NO scavenger (C-PTIO) (10mg) with or without sodium nitrite (1.0mg) 30 min prior to the ischemia respectively. For statistics, ANOVA and SNK test were used.  $P < 0.05$  considered significant.

**Results and discussion:** Nitrite reduced the cerebral infarct area in a dose-dependent manner. In the presence of either C-PTIO or ODQ, the nitrite-induced reduction of cerebral infarct area was not observed. However, in the presence of L-NNA, nitrite-induced significant reduction of the cerebral infarct area was still observed.

**Conclusion(s):** Therefore, it is suggested that nitrite-derived NO protects brain against ischemia-reperfusion injury possibly via NOS-independent but GC-dependent pathway.

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Early Intravenous Infusion of Sodium Nitrite Protects Brain Against In Vivo Ischemia-Reperfusion Injury. Keun-Hwa Jung, et al: *Stroke*. 2006; 37: 2744-2750  
Soluble Guanylate Cyclase  $\alpha 1\beta 1$  Limits Stroke Size and Attenuates Neurological Injury. Dimitry N. Atochin et al: *Stroke*. 2010; 41: 1815-1819

## 7AP1-6

### The effects of dental pulp cell and dental pulp cell-derived neurosphere on the expression of Brain-derived neurotrophic factor mRNA in rat brain after global ischemia

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**Background and Goal of Study:** The side population cells in the dental pulp tissue have an ability to differentiate to neuronal precursor cells. Utilizing these cells has been attempted for various nervous system disorders as a replacement therapy. In our preliminary study using rat model of severe forebrain ischemia, post-ischemic administration of dental pulp derived neurospheres ameliorated outcome. We hypothesized that neurotrophic factors, brain derived neurotrophic factor (BDNF), from neurospheres had some effects to reduce neuronal injury. The goal of our study is to reveal the changes of BDNF gene expression over times after global ischemic insult.

**Materials and methods:** Male Sprague-Dawley rats were used. Dental pulp was extracted from 5-weeks rats, and cells (pulp group) or neurospheres (neurosphere group) were prepared. Neurospheres were obtained after one week of suspension culture. Surgery for severe forebrain ischemia was performed using rats with 8-11 weeks under halothane anesthesia under strict control of pericranial temperature at 37°C. Ischemic insult was provided for 11 min by two-vessel occlusion with systemic hypotension method, and  $1 \times 10^6$  cells of either dental pulp tissue or dental pulp-derived neurospheres were intravenously administered at 3 h after ischemia. Normal saline was injected to control animals (control group). Sham animals were operated as other groups but ischemia was not given (sham group). Animals in each group were sacrificed at 0, 3, 6, 12, 24 h after administration of vehicles ( $n=3$  at each time point). At the given end points, rats were euthanized and brain tissues were immediately collected. The hippocampal tissues were processed for RT-PCR. The alterations in the messenger ribonucleic acid content in the hippocampus were examined by sensitive and quantitative technique.

**Results and discussion:** There were no significant differences between the groups regarding BDNF gene expression. However, pulp group had higher expression of BDNF mRNA than any other groups at 3 hour after the injection ( $P=0.0799$ ). Expression of BDNF mRNA in neurosphere group remained unchanged over time course after administration. BDNF might not be related to ameliorated outcome in the neurosphere group.

**Conclusion(s):** Post-ischemic administration of dental pulp cells induced increased expression of BDNF mRNA, while neurosphere lacked any changes.

## 7AP1-7

### The xenon-mediated reduction of thalamocortical but not of intracortical signal propagation depends on adenylyl cyclase activity

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**Background and Goal of Study:** The thalamocortical network is one of the key target regions for anaesthetics to induce loss of consciousness (1). Xenon (xe) has been reported to reduce thalamic excitability by an impairment of HCN-2-channels (2) which are known to be highly expressed in the thalamus. Xe was suggested to modulate adenylyl cyclase (AC) activity because xe failed to impair HCN-2 channels when AC was blocked (2). It is unclear how the modulation of AC activity affects thalamocortical and intracortical flow of information. In this study we investigated the AC-dependency of the xe-induced inhibition of the thalamocortical network in vitro.

**Materials and methods:** Acute brain slices with preserved thalamocortical connectivity were prepared in sucrose-based artificial cerebrospinal fluid (aCSF) from male C57BL/6 mice (p28-42). The slices transferred to aCSF containing the voltage-sensitive dye Di-4-ANEPPS (7.5 mg/ml) for 15 min. Neuronal activity was recorded in carbogenated (95% O<sub>2</sub>; 5%CO<sub>2</sub>) aCSF with a MiCAM02-HR camera. Fast depolarisation-mediated signals (FDS) in the cortex were evoked by electrical stimulation applied to either the ventrobasal thalamus or the cortical lamina IV. After baseline recordings in the absence (control) or the presence of the AC inhibitor SQ55236 (SQ; 100  $\mu$ M), the aCSF was saturated with 65% xe.

**Results:** Under control conditions, xenon reduced the peak amplitude of cortical FDSs evoked by thalamic stimulation to (mean  $\pm$  SEM)  $85.3 \pm 1.9\%$  ( $n=5$ ;  $p < 0.05$ ). Intracortical depolarization was reduced to  $85.3 \pm 4.1\%$  by xe ( $n=5$ ;  $p < 0.05$ ). When AC was blocked, xenon failed to decrease thalamocortical

signal propagation ( $96.1 \pm 5.0\%$ ;  $n=5$ ;  $p>0.05$ ) whereas the xe-induced reduction of intracortical activity propagation remained unaffected ( $85.5 \pm 4.3\%$ ;  $n=5$ ;  $p < 0.05$ ) by SQ.

**Conclusion:** We could demonstrate that the xe-mediated reduction of thalamocortical connectivity is dependent on AC activity whereas xe's effects on intracortical signal propagation were independent on AC. This might be explained by different levels of expression of HCN-2 channels in the thalamus and the cortex (3). Our findings provide evidence that the modulation of the AC might be a new mechanism how anaesthetics region-specifically modulate neuronal network activity.

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## 7AP1-8

### Tranexamic acid equipotently impairs GABAergic synaptic transmission in the murine amygdala and hippocampus

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**Background and Goal of Study:** Tranexamic acid (TXA) is commonly used to reduce blood loss in cardiac surgery and in trauma patients [1]. High-dose application of TXA is a risk factor of postoperative seizures [2]. It has been suggested, that this proconvulsive action is due to an antagonism against GABA<sub>A</sub> receptors [3]. Since both the amygdala [4] and the hippocampus [5] are brain regions relevant for the initiation of seizures, we compared the antagonistic action of TXA against GABAergic synaptic transmission in these two brain regions.

**Materials and methods:** 350  $\mu$ m coronar (sagittal) brain slices of the amygdala (hippocampus) were obtained from male mice (Bl6; d 28-35). Neurons in the basolateral amygdala (CA 1 stratum pyramidale) were identified by infra-red videomicroscopy. GABA<sub>A</sub> receptor mediated inhibitory postsynaptic currents, elicited upon electrical stimulation of the external capsule (Schaffer collateral-commissural pathway), were isolated pharmacologically. Under control conditions, the slices were kept in carbogenated artificial cerebrospinal fluid. TXA was added with final concentrations of 0.1, 0.3, 1 or 10 mM.

**Results:** In both brain regions, TXA concentration-dependently and reversibly reduced GABA<sub>A</sub> receptor mediated inhibitory postsynaptic currents, with a half-maximum inhibitory concentration of 0.76 mM in the basolateral amygdala and 0.47 mM in the hippocampus ( $n=5-10$  for each data point). Two-way analysis of variance revealed no significant difference between the dose-response relationships in the two brain regions ( $P=0.21$ ).

**Conclusion:** We demonstrate that TXA impairs GABA<sub>A</sub> receptor-mediated inhibitory synaptic transmission in the basolateral amygdala and the hippocampus with a similar potency. Reported concentrations of TXA in the cerebrospinal fluid after intravenous administration range from 0.2 mM [6] to 1.24 mM [2]. Thus, in both brain regions, the inhibition of GABA<sub>A</sub> receptors by TXA occurred within a clinical relevant range and might explain how TXA promotes epileptiform activity in the central nervous system.

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## 7AP1-9

### Efficacy of terutroban in preventing delayed cerebral ischemia after subarachnoid haemorrhage: a functional isotope imaging study on a rat model

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**Background and Goal of Study:** After a subarachnoid haemorrhage (SAH), delayed cerebral ischemia (DCI) remains the principal cause of morbidity. F2-isoprostanes are recognized as biomarkers of DCI. These lipid metabolites, by fixing the Thromboxane and Prostaglandin (TP) receptor, induce vasoconstriction and platelet aggregation.

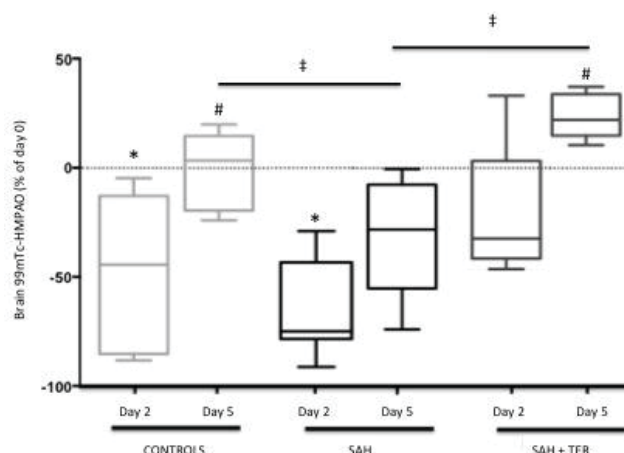
Our objective was to evaluate the efficacy of Terutroban (TER), a TP receptor

specific antagonist, in preventing DCI after SAH.

**Materials and methods:** Twenty rats were assigned to one of 3 groups: a double 250  $\mu$ L intracisternal injection (ICI) was realized with saline in CONTROLS group ( $n=6$ ) or with autologous arterial blood in SAH ( $n=8$ ) and SAH+TER ( $n=6$ ) groups. Treated animals received an oral administration of 30 mg/kg/day of TER during 5 days following blood injection. Rats were evaluated using functional isotope imaging technique (high-resolution microSPECT). Brain captation of three 99m technetium radiolabeled tracers was evaluated: HMPAO at day 0, 2 and 5 for cerebral perfusion quantification, DTPA at day 3 for blood brain barrier (BBB) integrity study and Annexin V-128 at day 4 for apoptotic activity study. Radioactivity was measured in predefined region of interest: cerebrum, cerebellum and brainstem. A one-way ANOVA followed by Student's *t* test was used to analyse the data.

**Results and discussion:** Brain HMPAO perfusion microSPECT (figure) reveals a transient hypoperfusion after ICI (day 2) and a lasting hypoperfusion in the SAH group. TER curtailed the SAH-induced decrease of the HMPAO uptake. TER also significantly counteracted the SAH-induced increase of DTPA in the brainstem (SAH  $2.6 \pm 0.7$  vs SAH+TER  $1.3 \pm 0.1$  ppm/mm<sup>3</sup>;  $P=0.016$ ) and increase of Annexin V-128 in the cerebrum (SAH  $1.2 \pm 0.1$  vs SAH+TER  $1 \pm 0.06$  ppm/mm<sup>3</sup>;  $P=0.012$ ).

**Conclusion(s):** We made the first microSPECT scan description of a DCI rat model. After induction of SAH, TER improves cerebral perfusion, prevents BBB disruption in the brainstem and decreases apoptotic phenomenon in the cerebrum.



[\*  $P < 0.01$  vs day0; #  $P < 0.01$  vs day2; †  $P < 0.01$ ]

## 7AP1-10

### Neuroprotective effects of pre- and post-treatment with fasudil (a Rho-kinase inhibitor) in a rat transient spinal cord ischemia-reperfusion model

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**Background and Goal of Study:** We examined the neuroprotective effects of post-treatment with fasudil (a Rho-kinase inhibitor) in a transient spinal cord ischemia-reperfusion model, since we have previously reported that pre-treatment with fasudil provided neuroprotective effects in the same model (1).

**Materials and methods:** After approval by our animal research committee, 25 adult male SD rats (300-400 g) were divided into sham (S), control (C) and fasudil (F) group ( $n = 5, 10, \text{ and } 10$ , respectively). Spinal cord ischemia was induced by intra-aortic balloon occlusion combined with proximal arterial hypotension for 10 min. Then, spinal cord was re-perfused. Group F received intravenous fasudil 10 mg/kg from 5 min after the start of re-perfusion for 60 min, while group C received normal saline. Group S received only catheter insertions. Neurologic deficit score (NDS, 0: intact - 8: worst) was assessed 1 and 7 days after ischemia, and numbers of intact neurons in the ventral part of the gray matter 7 days after ischemia. Additional 25 rats were examined in the same protocol to determine the neuroprotective effects of fasudil 14 days after ischemia. Data were analyzed by Kruskal-Wallis analysis or ANOVA with  $P < 0.05$  being significant.

**Results and discussion:** 7 day study: NDS were similar between groups 24 hours (C: 5.5, F: 7) and 7 days (C: 6, F: 6) after ischemia. Number of intact neurons was significantly greater in the group F than the group C (F:

23 ± 13%, S: 35 ± 3, C: 10 ± 7%,  $P < 0.05$ ). 14 day study: NDS were similar between the groups C and F 24 hours (C: 6, F: 7), 7 days (C: 4, F: 4.5), and 14 days (C: 3.5, F: 3.5) after ischemia. Numbers of intact neurons were significantly greater in the groups F and S than the group C (F: 16 ± 5, S: 26 ± 2, C: 9 ± 3;  $P < 0.05$ ). Our results suggest that post-treatment with fasudil 10 mg/kg provides a neuroprotective effect against transient spinal cord ischemia-reperfusion in rats. In comparison with our previous data of pre-treatment with fasudil, there were no significant differences in outcomes between pre- and post-treatment with fasudil.

**Conclusion:** Pre- and post-treatment with fasudil provides the comparable neuroprotection in a rat transient spinal cord ischemia-reperfusion model.

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1. 3rd Asian Society for Neuroanesthesia and Critical Care

## 7AP1-11

### Alterations of intraneuronal Ca<sup>2+</sup> stores after nerve injury and the development of hyperalgesic behavior

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**Background and Goal of Study:** Neuropathic pain is usually the result of damage to peripheral nerves, but occurs with variable frequency in the clinical setting. Prior studies using an animal model revealed a reduction of endoplasmic reticulum (ER) Ca<sup>2+</sup> stores in the first sensory neuron in the dorsal root ganglion (DRG) in animals developing hyperalgesia after nerve injury. The experiments presented here explored the differences in Ca<sup>2+</sup> stores in DRG neurons after axotomy in animals with and without hyperalgesic (HA) behavior.

**Materials and methods:** Male Sprague-Dawley rats were subjected to spinal nerve ligation (SNL), where the fifth (L5) and sixth spinal nerve are ligated and cut, whereas the fourth (L4) spinal nerve is left intact. Control rats received only anesthesia and skin incision. After surgery, rats were tested three times for HA behavior by stimulation of the ipsilateral hindpaw with a 22G spinal needle. Animals were considered HA when they displayed 20% or more hyperalgesia-type behavioral responses while non-hyperalgesic animals had a rate of ≤5%.

Animals were sacrificed on post-operative day 21-28, DRGs were harvested and dissociated and the neurons were plated on cover slips and imaged using Ca<sup>2+</sup> microfluorimetry. Cytoplasmic Ca<sup>2+</sup> alterations after caffeine or thapsigargin were recorded with Fura-2, whereas mag-Fura-2 was used to assess intraluminal [Ca<sup>2+</sup>] within the ER.

**Results and discussion:** A total of 33 rats were used (15 control, 12 non HA, 11 HA after SNL). Resting Ca<sup>2+</sup> levels in the axotomized L5 neurons did not differ in HA (34.9 ± 10.2nM) versus non-HA (45.3 ± 10.1nM,  $p = 0.99$ ) animals, but were higher in control animals (136 ± 10.2nM,  $p = 0.001$ ). Ca<sup>2+</sup> transients after 20 mM caffeine application resulting in a complete release of ER Ca<sup>2+</sup> stores were larger in control animals, but were similar in HA and non-HA animals. Application of thapsigargin, which drains out ER Ca<sup>2+</sup> stores, produced similar results. Ca<sup>2+</sup> concentrations measured directly within the ER were lowered in both HA (52.9 ± 43nM) and non-HA (58.3 ± 26.4) stores ( $p = 1.0$ ) as compared to control neurons (107.6 ± 26.3,  $p < 0.05$  vs SNL animals).

**Conclusion(s):** After SNL, HA and non-HA animals showed similar alterations in ER Ca<sup>2+</sup> stores. Therefore, changes in neuronal Ca<sup>2+</sup> stores cannot be held responsible for the development of the HA phenotype after nerve injury.

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## 7AP2-1

### Intracranial and cerebral perfusion pressure during xenon and propofol anaesthesia in neurosurgical patients

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**Background and Goal of Study:** Xenon has been shown to exert neuroprotection but its use in neurosurgery is limited because of controversial data upon cerebral perfusion. The aim is to evaluate the effect of xenon upon intracranial (ICP) and cerebral perfusion pressure (CPP) in comparison with propofol in neurosurgical patients.

**Materials and methods:** After local ethical committee approval in 20 patients undergoing supratentorial tumor removal we measured directly ICP and ar-

terial pressure and calculated mean arterial pressure (MAP) and CPP at 3 stages:

- 1) propofol anesthesia with 30% oxygen in air inhalation;
- 2) 30% xenon inhalation;
- 3) 65% xenon inhalation.

Craniotomy was started under propofol anaesthesia, and before the flap removal the Codman microsensor ICP transducer connected to the Codman ICP express monitor (Codman, UK) was inserted subdurally through a burr hole. Then surgical activity was stopped not to influence the measurements. Throughout the study propofol dose was adjusted to get surgical anaesthesia depth (BIS, Aspect Medical Systems, USA).

**Results and discussion:** Main results are shown in table 1. Xenon increased ICP in dose-dependent manner. At stage 1, 7 pts (35%) had intracranial hypertension (ICH) (6 - mild and 1 - moderate). At stage 2, 10 pts still needed low-dose propofol infusion to maintain surgical depth. Reaching stage 3, with 55% to 65% of xenon in the circuit, in 6 pts (30%; 5 with initial ICH and 1 without) we observed a jump increase in ICP to 25 mm Hg, and according to the protocol stopped the study and changed the anaesthetic. Despite ICP increase and owing to MAP changes the highest CPP was observed at stage 2 when low dose xenon inhalation was complemented by low dose propofol infusion or its trace concentration.

stage	MAP (mm Hg, mean ± SD)	ICP (mm Hg, mean ± SD)	CPP (mm Hg, mean ± SD)	EtCO <sub>2</sub> (mm Hg, mean ± SD)	BIS (mean ± SD)	HR (bpm, mean ± SD)
1	75.8±14.4	13.9±5.4	61.9±13.8	33.8±2.2	33.3±11.3	65.8± 15
2	78±14.6	16.1±6.8*	62.5±15.4	34.8± 2.5*	39.1±6*	60.4±14.8*
3	76.5±15.2	19.3±7.2*#	57.8±15*	34.8± 1.4#	40.8±7#	56.3±11.4*#

[ICP and CPP during propofol and xenon anaesthesia]

\*  $p < 0.05$  compared to previous stage; #  $p < 0.05$  compared to stage 1; one sample Kolmogorov-Smirnov test.

**Conclusion(s):** Xenon increased ICP in neurosurgical patients. When ICH is present, low-dose xenon inhalation combined with low-dose propofol infusion may be a safer issue when xenon sedation or anaesthesia seems advantageous.

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## 7AP2-2

### Severe intraoperative hyperglycemia during brain surgery and the risk of postoperative infections: preliminary results

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**Background and Goal of Study:** In neurosurgical patients, intraoperative blood glucose concentration (BGC) abnormalities are associated with increased perioperative morbidity and mortality. Aim of this prospective observational study in patients undergoing brain surgery was to test if severe intraoperative hyperglycemia (BGC ≥ 180mg/dl) is associated with an increased incidence of infections within 7th postoperative day.

**Materials and methods:** Adults ≥ 18 years of age, who underwent elective or emergency brain surgery were prospectively recruited and categorized according to the type of procedure into 4 groups: brain tumors (gliomas, meningiomas, neurofibroma of the eighth cranial nerve and pituitary adenoma); metastatic tumors; neurovascular lesions (intracranial hemorrhage, subarachnoid hemorrhage, arteriovenous malformation, aneurysms); traumatic brain injury (TBI). In all patients intraoperative BGC was measured twice: at the beginning of the procedure and at the end of surgery on arterial whole blood by blood gas analysis. Patients with one or both BGC > 180 mg/dl were categorized as having "severe intraoperative hyperglycemia". Postoperative infections (pneumonia, blood stream, urinary, surgical site/wound and cerebral infections) were diagnosed according to Center for Disease Control and Prevention criteria within 7 days after surgery. Sample size calculation: order to test a difference > 30% in the infection rate between intraoperatively hyperglycemic and normoglycemic patients.

**Results and discussion:** We have now enrolled a total of 96 patients: 81 had intraoperative BGC < 180mg/dl and 15 had at least one of the 2 intraoperative BGC > 180mg/dl. Fifty-five patients had brain tumors (6 were hyperglycemic); 4 had metastatic tumor, 25 had neurovascular lesions (4 were hyperglycemic); 8 had TBI (5 were hyperglycemic). In patients with intraoperative severe



hyperglycemia the rate of postoperative infections within the 7<sup>th</sup> postoperative day was significantly higher as compared with those normoglycemic: 6/15 (40%) vs. 5/81 (6%),  $p < 0.001$ .

**Conclusions:** In these preliminary results we report that in patients undergoing brain surgery, the presence of intraoperative severe hyperglycemia is associated with a significantly higher risk of postoperative infections. These patients possibly deserve a dedicated postoperative care management.

## 7AP2-3

### Postoperative complications in children and adults with sub- and supratentorial brain tumors

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**Background and Goal of Study:** Requirements to the anesthesiologist and intensive care doctor must be to ensure maximally early recovery of the patient after surgery. So, the accounting and focus on prevention of postoperative complications is relevant. Retrospective evaluation of postoperative complications in children and adults, operated because of tumors of the CNS in conditions of inhalation or total intravenous anesthesia.

**Materials and methods:** 464 child (age from 8 to 17 years) - group I and 658 adult patients (ages 18 to 65 years) - group II, with ICH syndrome were examined. Each group depending on the etiology of CNS damage was divided into 2 subgroups.

1. Supratentorial tumors of the CNS;
2. Subtentorial tumors of the CNS.

**Results and discussion:** In patients, operated for subtentorial tumors of the CNS in the postoperative period were identified: assessment in adults on a scale SOFA was 3.06 points, in children 4.77. In the study, the most impressive were the data on delayed mortality (up to 3 months of observation), which amounted in adults 32.9%, in children 53.8%. Thus, the postoperative period is actually difficult in patients with subtentorial tumors. Possible predictor of complicated postoperative period can be considered purulent-septic complications that require early prescription of antibiotic therapy.

In patients, operated for supratentorial tumors of the CNS in the postoperative period revealed the following features: score on a scale SOFA was significantly lower in children: 3.04 points in adults, 3.0 in children. Postoperative mortality in this group was lower in both adults and children, compared with a group of subtentorial tumors.

However, data on delayed mortality (up to 3 months of observation) showed the true severity of the patients were not significantly different from the group of subtentorial tumors.

Thus, the postoperative period in the patients with supratentorial tumors was more severe in adult patients. Predictor in this group were purulent-septic complications, the same in group with subtentorial tumors.

**Conclusion:** Thus, complicated postoperative period in patients, operated for tumors of the CNS leads to a high delayed mortality rate in these patients, connected, apparently, with a delay of the beginning of the specific immunotherapy or radiation therapy. The main predictor of postoperative complications are purulent-septic complications that require early administration of wide spectrum antibiotics.

## 7AP2-4

### Safety of rapid ventricular pacing in cerebrovascular surgery using near-infrared spectroscopy and follow-up of peri-operative cardiac troponin levels

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**Background and Goal of study:** Intraoperative aneurysm rupture increases morbidity and mortality after cerebral aneurysm surgery (CAS). Rapid ventricular pacing (RVP) during critical steps of surgery lowers the blood pressure significantly in a controlled and directly reversible manner (1). The aim of the study was to investigate the safety of RVP by monitoring brain oxygenation (SctO2) using near-infrared spectroscopy (Foresight, Casmed) (2) and changes in perioperative cardiac troponin levels.

**Materials and methods:** After local Ethics Committee approval, 40 patients undergoing CAS were studied. Anesthesia was standardized. Before surgery, a bipolar pacing electrode was placed in right ventricular position, as confirmed by fluoroscopy. During exposure and clipping of the aneurysm, rapid pacing was performed during short periods. Invasive arterial blood pressure and SctO2 were continuously monitored. Peripheral blood samples were collected before pacing, 6h and 24h postoperatively to assess troponin levels. Results are presented as mean  $\pm$  SD. A mixed effect model was used for statistical analysis. A Wilcoxon test was used for troponin analysis.

**Results:** Patients were paced at 180 bpm for 28.0 $\pm$ 14.4s. During RVP systolic arterial blood pressure decreased significantly ( $p < 0.0001$ ). SctO2 decreased by 7% ( $p < 0.0001$ ), however may be considered as not clinically significant (Table1). Pacing duration had no influence on the drop of systolic blood pressure ( $p = 0.754$ ) and SctO2 changes ( $p = 0.69$ ) within our maximal pacing cut-off duration of 70 seconds. Six hours postoperatively troponin levels were elevated (0.082 $\mu$ g/l $\pm$ 0.10) compared to pre-pacing (0.021 $\mu$ g/l $\pm$ 0.017) ( $p < 0.001$ ) and normalized 24hrs postoperatively (0.030 $\mu$ g/l $\pm$ 0.031) ( $p = 0.185$ ), but were not clinically relevant (3).

	Pre-pacing	Pacing	Post-pacing
ABPs (mmHg)	96.0 $\pm$ 12.5	41.1 $\pm$ 10.7	92.4 $\pm$ 12.7
SctO2(%)	71.5 $\pm$ 6.1	66.2 $\pm$ 6.3	71.8 $\pm$ 6.1

[Table 1]

**Conclusion:** Rapid ventricular pacing significantly decreased the arterial blood pressure during CAS. Cerebral oxygenation decreased but remained above clinical threshold considering the limited pacing duration. Transient elevation of troponin was not consistent with cardiac ischemia. RVP appears to be a safe technique with regard to short time blood pressure reduction during CAS.

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## 7AP2-5

### The efficacy and complications of microvascular decompression of the trigeminal nerve in patients with trigeminal neuralgia according to a position of a patient during surgery: semilateral versus semisitting

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**Background and Goal of Study:** A controversy exists regarding to a patient's positioning during posterior fossa and upper cervical surgery. In our retrospective study the efficacy and complications of microvascular decompression (MVD) of the trigeminal nerve were analyzed in 200 patients with trigeminal neuralgia according to a position of a patient during surgery: semi lateral (SL) vs. semisitting (SS).

**Materials and methods:** 104 patients were operated in the SL position (SL group: SLG), 96 patients: in the SS position (SS group: SSG) by two surgeons with a similar operative technique. The criterion for efficacy was pain regress after MVD. Complications included anesthesia and postoperative adverse effects. Surgery duration, ICU stay, and hospital days were reported. Statistics were analyzed by SPSS 20.

**Results and discussion:** There were no differences between groups in age, sex, BMI, ASA classes, length of disease and carbamazepine doses as well as in side of MVD and compression vessels. Pain regression was 94.2% in the SLG and 92.7% in the SSG ( $\chi^2$ ,  $p = 0.663$ ). Postural hypotension was observed in 33.4% of patients in the SSG. 8.3% of patients in the SSG developed hypotension during surgery, none of the patients - in the SLG ( $\chi^2$ ,  $p = 0.003$ ). 7.3% vs. 0% of patients in the SSG and SLG, respectively, needed cardiovascular supporting therapy during hypotension. Hypertension during trigeminal nerve manipulation was reported in 14.6% and 14.4% of patients in the SSG and SLG, respectively ( $\chi^2$ ,  $p = 0.203$ ). The incidence of venous air embolism (VAE) was 43.8% detected by pericardial Doppler monitoring and 19.8% detected by ETCO2 in the SSG. The incidence of VAE was 0.96% in the SLG detected by ETCO2 ( $\chi^2$ ,  $p < 0.001$ ). There were 3.8% and 1% postoperative CSF leakage in the SLG and SSG, respectively ( $\chi^2$ ,  $p = 0.204$ ). There were 2 cases of tension pneumocephalus, a case of facial nerve palsy and a case of ulnar nerve injury in the SSG ( $\chi^2$ ,  $p > 0.05$ ). Duration of surgery was shorter in the SLG, than in the SSG (166 $\pm$ 6 vs. 189 $\pm$ 9 min, t-test,  $p < 0.001$ ). 27.1%

and 1.9% of patients spent a night in ICU after surgery in the SSG and SLG, respectively ( $\chi^2$ ,  $p < 0.001$ ). Hospital days were shorter in the SLG, than in the SSG ( $7.6 \pm 0.4$  vs.  $9.2 \pm 0.7$  days,  $t$ -test,  $p < 0.001$ ).

**Conclusions:** The efficacy of MVD was not affected by the positioning of a patient with trigeminal neuralgia. SL positioning was associated with less intraoperative and postoperative adverse effects, and shorter recovery time.

## 7AP2-6

### Blood loss and body temperature decline during resective pediatric epilepsy surgery: a retrospective analysis

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**Background and Goal of Study:** Resective epilepsy surgery is an established and effective method to reduce seizure burden in drug-resistant epilepsy. It was the objective of this study to assess intraoperative blood loss, transfusion requirements and the degree of hypothermia of pediatric epilepsy surgery in our center.

**Materials and methods:** Patients were identified by our epilepsy surgery database, and data were collected via retrospective chart review over the past 25 years. Patients up to the age of 6 years were included, and patients with insufficient data were excluded.

**Results and discussion:** Forty-five patients with an age of  $3.2 \pm 1.6$  (mean  $\pm$  SD) years and a body weight of  $17.7 \pm 4.7$  kg were analysed. Duration of surgery was  $3h49min \pm 53min$ , which was accompanied by an intraoperative blood loss of  $199 \pm 186$  ml. This corresponded to  $14.7 \pm 13.9$  % of estimated total blood volume, ranging from 0 to 75%. A minimal haemoglobin count of  $8.8 \pm 1.4$  g/dl was measured, which was substituted with erythrocyte concentrate ( $126 \pm 158$  ml) in 23 patients. Body core temperature dropped from  $36.0 \pm 0.7$  °C at baseline to a minimum of  $35.7 \pm 0.7$  °C, and increased significantly ( $p < 0.001$ ) thereafter to  $37.1 \pm 0.7$  °C until the end of surgery. A significant ( $p = 0.0003$ ) correlation between duration of surgery and blood loss (Pearson  $r = 0.52$ ) was observed. However, age, minimal body temperature or number of antiepileptic drugs seemed to have no impact on blood loss.

**Conclusion(s):** Resective epilepsy surgery is a safe procedure even in the pediatric population, however it is associated with significant blood loss especially during long surgical procedures.

## 7AP2-7

### The human carotid body releases cytokines, acetylcholine and ATP during hypoxia

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**Background and Goal of Study:** While the human carotid body (CB) is the primary peripheral chemosensor for a range of blood-borne stimuli (e.g. oxygen, CO<sub>2</sub>, glucose and pH), there is growing evidence for a role of the CB in inflammatory signaling.

Here we uncover novel functional properties of the *human CB* in inflammatory signaling during hypoxia, of relevance in situations with chronic or intermittent systemic hypoxia.

**Materials and methods:** CB slices from adult surgical patients were analyzed for ATP and ACh release using ATP assay and HPLC as well as multiplex assay for release of inflammatory mediators after exposure to either 15-min or 1-h of hypoxia or hyperoxia. Corresponding signaling proteins and morphology were studied with immunohistochemistry and Hematoxylin-eosin staining.

**Results and discussion:** We show that the human CB increases the release of IL-1 $\beta$ , IL-4, IL-6, IL-8 and IL-10 in response to hypoxia. The human CB moreover expresses an array of corresponding cytokine receptors and also the hypoxia-inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ) and HIF-2 $\alpha$ . Finally, the study translates previous findings in animal models by showing that the human CB releases acetylcholine and ATP upon hypoxia.

**Conclusion(s):** This study demonstrates an increased release of key pro- and anti-inflammatory cytokines from the human CB in response to hypoxia, suggesting that the human CB, in addition to a key role in oxygen sensing also has a sensory function in inflammatory signaling. We speculate that the expression of corresponding cytokine receptors as well as the HIF-1 $\alpha$  and HIF-2 $\alpha$  is important for sensing external immune signals and/or for autocrine effects of cytokines released from the CB during hypoxia.

## 7AP2-8

### Optimization of anaesthesia care in patients with massive ischemic stroke when conducting decompression craniotomy

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**Introduction:** One of the promising methods of treatment of malignant massive (hemispheric) ischemic stroke (MII) is a decompressive craniotomy (DCT) as it aims to eliminate the impact of compressing the swollen ischemic hemisphere of the brain stem structures and reverse the development of dislocation syndrome.

**Objective:** To present the experience of anesthetic management during DCT patients with MII. Table 1

Parameters	1 stage	2 stage	2 stage	3 stage
		17 (81%)	4 (19%)	
APs, mm Hg	116.6	114.5	63.8	199.9
APd, mm Hg	58.5	56.5	37.2	60.2
MAP, vv Hg	80.2	77.8	46.2	83.1
HR, b/min	90.9	94.3	100.6	87.4
PetCO <sub>2</sub> , mm Hg (min-max)	36.3 (35-38)	35.6 (34-37)	31.5 (30-32)	34.1 (32-35)
ICP, mm Hg (min-max)	32.9 (28-38)	32.3 (28-38)	36.2 (31-41)	16.5 (15-18)
CPP, mm Hg (min-max)	59.5 (52-67)	57.1 (50-64)	47 (45-49)	64.3 (54-72)

[Parameters of the study]

**Materials and methods:** A analysis of 21 cases of anesthesia for DCT patients (9 men and 12 women) with the MII for the period 2011 - 2013. Intraoperative monitoring was carried out in a volume of ECG leads with three analysis segment ST; SpO<sub>2</sub>, BP, PetCO<sub>2</sub>, BIS, ICP. Induction of anesthesia was carried by propofol bolus dose of 2.5 mg / kg and fentanyl in a dose of 3-5 mg / kg; myoplegia - rocuronium 0.6 mg / kg. Supported anesthetic sevoflurane was based on technology low-flow (1 L / min). Sevoflurane concentration ranged from 1.2-1.3 MAC, with boluses of fentanyl in a dose of 1.5-2 mg / kg on the most traumatic stages of the operation: the imposition Meynfeldt staples, skin incision, trepanning, cutting and traction of the dura mater (TDM). The study was conducted in three stages: stage 1 - before anesthesia, 2 stage - after induction, 3 stage - after craniotomy and dura opening.

**Results:** Data on the initial (stage 1) are presented in the table. After induction (Stage 2) in 19 % of patients reported a decrease MAP to 46.2 mm Hg, CPP to 47.0 mm Hg, and an increase in ICP to 36.2 mm Hg. These patients underwent short infusion at a dose of norepinephrine 0.04-0.06 mcg / kg / min and hyperventilation (decrease PetCO<sub>2</sub> to 25-27 mm Hg). In the third stage (after the creation of the defect and the trepanation opening TDM during anesthesia were: quite stable hemodynamics, and the levels of ICP and CPP were 16.5 mmHg and 63 mm Hg respectively. After DCT survived 12 (56.3 %) patients, including the level of consciousness at the time of transfer from the ICU 15 points - 9 cases, 14 points - 1 observation and 13 points - 2 patients.

**Conclusions:**

1. In 81% of patients with MII general anesthesia propofol and sevoflurane did not lead to significant changes in ICP and CPP.
2. By reducing MAP after induction of anesthesia below 50 mmHg justified to carry out short-term infusion of norepinephrine at a dose of 0.04-0.06 mg / kg / min, and hyperventilation (decrease PetCO<sub>2</sub> to 25-27 mm Hg).
3. Conducting DCT MII led to survival in 56.3% of patients.

## 7AP2-9

### Prevention of hypotension during translation in the sitting position of the patient during surgery operations on postcranial fossa tumors

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**Objective:** To determine the optimal mode of infusion therapy to minimize hypotension when transferring the patient in a sitting position.

**Material and methods:** 34 patients with tumors localized in the posterior cranial fossa, which were randomized into 2 groups: group 1 (19 patients) - patients who received infusions of sedation in 940 ± 140 (from 800 to 1000) ml balanced brines in the neurosurgery department 2 hours before being transferred to the operating room, and group 2 (15) - patients who infusion started after laying the patient on the operating table before the induction of anesthesia. Transfer of the patient in the sitting position was carried out discretely with increasing degrees elevation to 10-15°. Hemodynamic monitoring was carried out throughout the time of transfer of the patient in the sitting position. The study was conducted at the following stages: Stage 1 - before the transfer of the patient in the sitting position, 2 stage - after the transfer of patients in the sitting position with the elevation of the head end to 15-20°, stage 3 - sitting position.

**Results:** Volume infusion prior to transfer of the patient in the sitting position in Group 1 was 1180 ± 220 ml in group 2 - 1140 ± 160 ml. CVP measured at the 1st stage in group 1 was 9,3 ± 2,1 cm H<sub>2</sub>O in group 2 - 9,1 ± 2,3 cm H<sub>2</sub>O; MAP - 72 ± 11 mm Hg and 76 ± 14 mm Hg respectively.

After the transfer of patients in the sitting position with the elevation of the head end to 15-20° (Stage 2) noted reduction in MAP to 63 ± 8 mm Hg and 58 ± 13 mm Hg, respectively. Increased infusion rate in group 1 resulted in increased MAP to 71 ± 13 mm Hg, while in group 2, 4 patients took titration of norepinephrine, and only then able to stabilize the blood pressure at the level of 70 ± 11 mm Hg.

Further rise to transfer the patient to the desired position (stage 3) to maintain stable hemodynamics titration adrenaline carried 2 (10.5%) patients from the first group and 5 (33.3%) patients in the second group, and the total volume of infusion was 1520 ± 120 ml and 1540 ± 170 ml, respectively.

Further during the intraoperative period was uneventful, the end of surgery titration of norepinephrine was discontinued in patients with both first and second groups.

**Conclusion:** Inclusion in premedication balanced salt solution infusion in patients with tumors of the posterior cranial fossa allows to achieve hemodynamic stability when transferring the patient in a sitting position in 89.5 % of cases.

## 7AP2-10

### Spanish anesthesiologists approach on "intraoperative awareness with explicit recall". Comparison between two national surveys performed in 2005 and 2011

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**Background and Goal of Study:** Increased risk of intraoperative awareness in patients with a history of awareness with explicit recall (AWR) has recently been demonstrated (1). 2004 Joint commission alert (2) and an ASA advisory published in 2006 highlighted the social and anesthesiologist concern on AWR.

**Materials and methods:** We performed a Survey on AWR among the attendants of the 2005 Spanish Anesthesia National Congress (SEDAR Mallorca) (3). Six years afterwards we repeat the Survey (SEDAR Madrid 2011) in order to study the evolution of AWR approach. The last Survey had 36 questions and was available on line for three months. We compare the results between both surveys using Fisher's exact test for the analysis of responder subgroups.

### Results and discussion:

	2005	2011	
Answers	473	389	
Years of practice	11.6 (range 1 to 40) Median: 9	17.9 (range 1 to 43) Median: 12	
Concern on AWR (1 low concern to 5 high concern)	High (Median 4.5 over 5)	High (88%: 4 or 5)	
Confirmation of AWR occurrence in „own“ patients	221 (46.7%)	135 (34.7%)	P=0.0004
Information of AWR during the preoperative evaluation	377 (79.7%)	48 (12.3%)	P=0.0001
Evaluation for AWR 24 h after surgery	119 (25.16%)	51 (13.1%)	P=0.0001
Hypnosis monitor available in the OR	175 (37.1%)	331 (85.1%)	P=0.0001

[2005-2011 Survey Results]

**Conclusion(s):** Intraoperative awareness with recall is still considered as an important risk of general anaesthesia among the Spanish anesthesiologist that answered our Survey. In the last six years intraoperative hypnosis monitoring has reach almost every OR in our country. Nevertheless, information to the patients has dramatically decreased; we do not talk about AWR at all, neither in the preoperative setting nor in the postoperative control. We trust on monitoring, but we need to interrogate the patients in order to detect previous AWR episodes and avoid subsequent.

### References:

1. Aranake A et al Anesthesiology 2013;119(6):1275-83);
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## 7AP2-11

### Surgical treatment of adolescent idiopathic scoliosis: neural complications

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**Background and Goal of Study:** Adolescent idiopathic scoliosis surgery (AISS) presents a challenge to anesthetist due to the extensive nature of the surgery and the constraints on anesthetic techniques of intraoperative neurophysiological monitoring (IONM) of the spinal cord.

Iatrogenic spinal cord injury is the most feared complication of scoliosis surgery (0.26%-17%). The type of procedure, curve magnitude, type of instrumentations, combined approach and decreased spinal cord perfusion due to hypotension and/or significant hemorrhage are associated with neural complications.

IONM combining both somatosensory evoked potentials (SSEPs) and motor evoked potentials (MEPs) have become a standard of care by preventing neurologic sequelae and lesions of the spinal cord.

Our aim was to assess the incidence of neural complications in surgical treatment of AISS and investigate possible factors associated with it.

**Materials and methods:** From January 2009 to October 2013, 216 medical records of patients who underwent AISS with posterior spinal fusion were reviewed. Experienced surgical neurophysiologists monitored spinal cord function with use of a standardized multimodality technique were included.

Relevant neurophysiological change was defined as a reduction in amplitude (unilateral/bilateral) of ≥50% SSEPs and ≥60% for transcranial electric MEPs when compared with baseline. When the decrease in amplitude was >80% a wake-up test was performed.

Categorical variables were presented as numbers and percentages, comparisons were made using Fischer's exact test. Continuous variables were presented as median and interquartile range; comparisons were made with Mann-Whitney test. Statistical significance was *p*-value < 0.05. To measure the association between the study variables and outcome (changes in SSEPs or MEPs), odds ratio and 95% confidence intervals were calculated.

**Results and discussion:** A total of 216 patients were included, with 88% women. Mean age was 15.1 years old. There were 5 (2.3%) complications. Two patients presented intraoperative significant changes in neurophysiologic parameters that improved following corrective actions by surgeons and anesthesiologist; 3 patients required removal of implants. Two patient presented transient postoperative neurologic deficits.



**Conclusion(s):** Early detection affords the surgical team an opportunity to perform rapid intervention to prevent injury progression or possibly to reverse impeding neurologic sequelae.

### 7AP3-1

#### Correlation between different physiologic derangements and angiographic vasospasm, cerebral ischemia and poor outcome after subarachnoid hemorrhage

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**Background and Goal of Study:** Early identification of patients at an increased risk for vasospasm, cerebral ischemia and poor outcome could allow more aggressive therapy and influence better outcome. The aim of our study was to examine the correlation between signs of different physiologic derangements with the emergence of angiographic vasospasm, cerebral ischemia and poor outcome.

**Materials and methods:** We prospective enrolled 54 patients with SAH treated from May 2011 to May 2013. Serum level of sodium, magnesium, hematocrit and leukocyte count was determined every day and glucose level at least twice a day during the first 10 days after SAH. Patients were classified as febrile if body temperature  $\geq 37,8$  degrees C was documented on two consecutive days. CT and CT angiography were obtained on the 9th day of rupture regardless of neurological status. CT and CTA were obtained earlier if clinical symptoms implied neurological deterioration. The outcome was assessed after 6 months using the eGOS scale.

**Results and Discussion:** 54% of the patients recruited had angiographic vasospasm and 46% had cerebral ischemia on CT scans. Mean blood glucose value for the first 10 days after SAH was significantly higher in patients with angiographic vasospasm ( $6.30 \pm 1.15$  vs  $6.49 \pm 0.89$   $p=0.032$ ). The mean value of hematocrit for the first 3 days was significantly higher ( $p=0.08$ ) in the group with vasospasm. The association between leukocytosis ( $p=0.08$ ) and hyponatremia ( $p=0.06$ ) with cerebral ischemia clearly existed but wasn't significant enough. More patients with hypomagnesiemia and fever had vasospasm and cerebral ischemia but the difference wasn't relevant. Our results show significant correlation of hyponatremia ( $p=0.03$ ) and mean value of hematocrit for the first 3 days ( $0.38 \pm 0.03$  vs  $0.35 \pm 0.04$   $p=0.041$ ) with poor outcome (1-4 on eGOS scale). Leukocytosis also has some influence on poor outcome but not strong enough ( $p=0.10$ ). Mean blood glucose value for the first 10 days exceeded  $7.1$  mmol/l in only 8 patients. This is a consequence of small study sample and exclusion of WFNS level V patients from the study. Mean value of hematocrit for the first 3 days exceeded  $0.35$  only in patients with vasospasm, cerebral ischemia and poor outcome.

**Conclusion:** We consider that daily monitoring of blood glucose, hematocrit, sodium and leukocytes level in early course of SAH treatment can contribute identifying patients with high risk of neurological complications and poor outcome.

### 7AP3-2

#### Dynamics of the concentration of uric acid in the cerebrospinal fluid and death in cerebral stroke

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**Background and Goal of Study:** Uric acid (UA) - the most important hydrophilic antioxidant of the human body. We study and compare the factors of death in neurointensive patients according to the presence / absence of reducing UA in the cerebrospinal fluid (CSF) during the acute period of cerebral stroke.

**Materials and methods:** In 626 adult ICU patients in the acute period of cerebral stroke, along with conventional clinical, instrumental and laboratory tests, the samples of CSF and venous blood on the 1st, 3rd, 7th day the onset of illness was performed spectrophotometric determination of the concentration of adenine, guanine, hypoxanthine, xanthine and UA, malondialdehyde (MDA). Calculated activity of xanthine oxidase in the CSF and serum.

**Results and discussion:** In patients with a reduction UA level in the CSF in the acute period of stroke (54% patients), significantly important factors contributing to death, were on the 1st day XOSumm high levels (RR=2.6, OR=5),

reduced XO2 (RR=3.6, OR=7.7) and high XO1 (RR=7.2, OR=12.2) in the cerebrospinal fluid, as well as the UA (RR=1.8, OR=5.1), xanthine (RR=2.7, OR=6.5), MDA (RR=3.3, OR=8.0) of serum. The factors significantly contributing to the survival, were: identified in the 1st day of stroke increased activity in CSF NO2 (RR=7.0, OR=11.8), hyperglycemia (RR=3.0, OR=5.0) and hyperadeninemia (RR=2.7, OR=5.1).

In the absence of reducing UA in the CSF in the acute period of stroke (46% patients), any parameters, is significantly associated with a fatal outcome, were not found.

In patients with a reduction in UA in the CSF in the acute period of stroke, significantly important clinical factors contributing to death, were: initial (on admission to ICU) tachypnea (RR = 4.5, OR = 8.0) and baseline depression of consciousness (RR=3.9, OR=9.0), without reducing UA in the CSF in the acute period of stroke - background COPD (RR=2.9, OR=8.6), and the background of CHD (RR = 2.6, OR = 5.0).

Drugs, significantly "contributes to" death by reducing UA in the CSF in the acute period of stroke, were osmotic diuretics (RR=2.3, OR=4.5), haemostatics (OR=3.0, OR=5.0). In the absence of reducing UA in the CSF in the acute period of stroke significant influence of pharmacotherapy on death was absent.

**Conclusion(s):** Probably, in patients with a reduction in UA in the CSF in the first 7-10 days period of stroke osmotic diuretics and hemostatics not want to use, and it is desirable to maintain moderate hyperglycemia (6-10 mmol / L).

### 7AP3-3

#### Dynamics of uric acid in the cerebrospinal fluid and the level of consciousness in acute cerebral stroke

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**Background and Goal of Study:** We study and compare the factors associated with preservation of consciousness of the oppressed (deeper stupor - coma) by the end of the acute period of cerebral stroke, depending on the presence/absence of reducing uric acid (UA) level in cerebrospinal fluid (CSF) during the acute period.

**Materials and methods:** In 626 adult patients (in first 7 day of stroke - "acute" period) of the stroke care unit in the initial development of the disease (regardless of type, variant), along with the standard instrumentation and laboratory tests, the samples of CSF and venous blood was performed spectrophotometric determination of concentration of adenine, guanine, hypoxanthine, xanthine, UA. The XO activity was calculated as the ratio of the concentrations UA and hypoxanthine.

**Results and discussion:** The most important "anti-comatose" factor for patients with reducing UA in CSF is the initial hyperglycemia (OR = 3,0;  $p < 0,05$ ); in patients without reducing UA in CSF during treatment, laboratory parameters, associated with prolongation comatose status by the end of the acute period of stroke, is not detected.

Respiratory disorders: presence of dyspnea (OR = 5,0;  $p < 0,05$ ), the background of respiratory failure at admission in ICU (OR = 5,1;  $p < 0,05$ ), development of pneumonia during the acute period of cerebral stroke (OR = 7,1;  $p < 0,05$ ) - the most important clinical factors for prolong coma for patients with reducing uric acid level in CSF. In the absence of reducing UA in CSF reliable predictor of saving a coma until the end of the acute period of stroke (ie, 7-10 days of the disease) was only self baseline (on admission) depression of consciousness (OR = 16,5;  $p < 0,01$ ) ...

Therapeutic agents, "contributing to" the preservation of a coma for 7-10 days with a decrease in the initial UA in CSF during treatment planning were appointed osmotic diuretics (OR = 5,8;  $p < 0,05$ ). If there is no reduction of the UA in CSF during treatment, drugs, contributing to the continued coma, are glucocorticoids (OR = 19,0;  $p < 0,01$ ).

**Conclusions:** In patients with decreased UA in CSF during treatment support of moderate hyperglycemia, adequate correction of respiratory symptoms and the exclusion osmotic diuretics from the therapeutic arsenal can potentially accelerate out of coma.

## 7AP3-4

### Insulin and brain: a sweet relationship, a systematic review

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**Background and Goal of Study:** Insulin, a peptide hormone produced by beta cells of the pancreas, plays important roles in the brain: specific insulin receptors (IRs) have been widely identified in CNS mediating: cellular growth, energy hemostasis and cognition. Aim of this review article is to present interactions between insulin and the brain.

**Materials and methods:** A literature search of 2 medical data base was accomplished: PubMed Medline. Only complete studies (no abstracts), published in English in peer-reviewed journals were included. Two authors (FB. and M.P.L.) independently screened and assessed titles, abstracts, and the full-text papers, using inclusion and exclusion criteria. A total of 5996 papers were screened and 5803 were excluded. We present 93 articles into 5 subchapters: insulin brain receptors (18), insulin and neuronal metabolism, function, neurotransmission (31); insulin and neurogenesis, neuroprotection, apoptosis (15); insulin and neurodegenerative disease (15); insulin as therapy (14).

**Results and discussion:** Insulin receptors: brain IRs have unique molecular features and distribution (highest concentration in thalamus; intermediate in cerebellum; lowest in the substantia nigra), suggesting that, in human brain, IRs are not limited to glucose utilization. Neuronal metabolism: insulin infusion results in an increase in frontal N-acetylaspartate (NAA), creatine (CR) and frontal and temporal glutamate/glutamine/ $\gamma$ -aminobutyric acid complex (GLX). Neuronal functions: insulin plays a role in synaptic plasticity, modulating excitatory and inhibitory receptors (Glutamate and GABA receptors). In glial cells insulin produces an increase in norepinephrine and cAMP. Neuroprotection: insulin activates PI3K-Akt, signaling which inhibits the proapoptotic glycogen synthase kinase 3 $\beta$  (GSK3 $\beta$ ), and modulates amyloid  $\beta$  peptide (A $\beta$ ): mitochondrial poison with detrimental effects on synapses, involved in pathogenesis of Alzheimer's disease (AD).

**Conclusion(s):** In brain, there is a tight relationship between IRs, neuronal growth, neuronal functions, energy homeostasis, memory and cognition. These data demonstrate the link between neurons and insulin impairment, and disclose potential therapeutic use of insulin in patients with post-acute brain damage and neurodegenerative disorders.

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Chiu S.L., Chen C.M., Cline H.T. Insulin receptor signaling regulates synapse number, dendritic plasticity, and circuit function in vivo. *Neuron*. 2008;58(5):708-19.

## 7AP3-5

### Is infrared spectroscopy effective for determination of time for balloon inflation during cerebral vascular embolization?

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**Background and Goal of Study:** During embolization of cerebral vascular aneurysms the vessels are transiently occluded by a balloon. Thus it is possible to dispose the plug in the aneurysm and to prevent it to displace to the proximal. However the duration of balloon inflation time causes transient hypoxia of the proximal cerebral tissue. It may cause a permanent injury to prolong this time in order to mount the plug. In this study, it is aimed to evaluate the effectiveness of NIRS in determination of duration of balloon inflation during this intervention.

**Materials and methods:** Prospectively evaluated are the 35 patients scheduled by interventional radiology for embolization under general anesthesia of aneurysms located in a region possible to change blood flow of frontal lobe. Cerebral oxygenation is monitored by Somanetics InvoS Oxymeter 5100C. Basal value is determined before the intervention and it is compared to the values obtained during and after intervention. A 20% decrease in cerebral oxygenation or a cerebral oxymetry below 40 was considered significant.

**Results and discussion:** Basal cerebral oxygen saturation before anesthesia was found to be 75,32 $\pm$ 11,50 %. Compared to basal levels, there was a 20,15% increase after tracheal intubation, a 7,1% decrease at the beginning of intervention after angiography, 15% decrease during intervention while placing the coil, after coiling a 20,96% decrease and 6,25% decrease after extubation was determined.

Due to the use of contrast agents during angiography and coiling the monitor-

ing could not be continued (Fig 1). Values could not be monitored for 40-80sec after injection of contrast media. Out of 125 measurements 42 (33,6%) values before inflation, 25 (20%) values during inflation and 28 (22,4%) values after inflation could be recorded. Because of the insufficiency of data, comparisons between before- during- and after inflation values could not be performed.

**Conclusion(s):** Generally NIRS monitoring is valuable during cerebral endovascular interventions. However the use of contrast media may intervene the continuity of monitoring as they can absorb near-infrared light. In this study as well, during embolization, sufficient values for evaluation could not be recorded and NIRS monitoring was found to be ineffective for determination of duration of balloon inflation time.

## 7AP3-6

### Cerebral intraparenchymal hemorrhage: analysis of risk and prognostic factors. Preliminary report

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**Background and Goal of Study:** Intraparenchymal hemorrhage (IPH) is linked to high morbidity/mortality.

Aim of the study was to identify variables that influence outcome of IPH pts.

**Materials and methods:** Patients admitted to ICU and Neurosurgery, with positive CT scan for IPH, deep structures and lobar, were retrospectively enrolled. Data collected: age, sex, risk factors and comorbidities, GCS on admission, vital signs, imaging (localization, size), surgery (timing, extent of blood removal), therapy, complications. Primary outcome: survival at ICU discharge. Probability of survival after IPH was correlated with variables used for stratification.

**Results and discussion:** In 2010, 27 pts. were identified (17 M, 10 F), mean age was 64.7 y. 4 pts. aged 30-49 y: 3 survived (probability 75%); 8 aged 50-65 y: 2 survived (25%); 15 were over 65: 4 survived (26.6%). No differences in survival between male (6) and female (3) (35% vs 30%). In 16 (59%) out of 22 pts. with hypertension, IPH pathogenesis was correlated to hypertension. 9 pts. (33%) received anticoagulant therapy. 6 pts. received anticoagulants and suffered hypertension. 2 pts. had no risk factors. Probability of survival: pts. with only anticoagulant therapy 66%; hypertension 33%; both risk factors 16%. 11 pts. suffered previous cardiovascular event. 8 were diabetics. In 5 pts. no comorbidities. Probability of survival in cardiovascular pts. 27%; in diabetics 25%; in pts. without comorbidities 60%. 3 groups of GCS on admission: GCS  $\leq$  8, 19 pts. 2 survivors (probability of survival 10%); GCS 9-13, 8 patients 7 survivors (probability 87%). 18 pts. presented IPH >6 cm, 3 survived (16%). 9 pts. presented IPH < 6 cm, 6 survived (66%). 20 pts. presented midline shift, 6 survived (30%). 18 pts. underwent surgical decompression, 6 survived (33%). Subtotal surgical blood removal was a distinctive factor. 3 non operated survived (33%). 7 patients didn't present midline shift (no surgery), 3 survived (42%).

**Conclusions:** Negative prognostic factors were: elderly, size of IPH > 6cm, midline shift, low GCS. If associated these factors showed worst outcome. Hypertension and previous cardiovascular event were the more frequent risk factors. Raw data showed similar survival rate among pts. undergoing surgery or conservative treatment. The study will be retrospectively extended to a 10 y. period (2000-2010) to reach a statistically significant population.

## 7AP3-7

### Relationship between minimum alveolar concentration and occurrence of dream recall or implicit memory during sevoflurane anesthesia

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**Background and Goal of Study:** There is controversial evidence about the level of hypnosis at which patients may experience unconsciously perceived complex phenomena, such as dreams recall (DR) or implicit memory (IM) (1,2). The aims of this study were:

- 1) to check whether the use of Bispectral Index (BIS) as a guide for administration of sevoflurane would affect frequency of DR and/or IM;
- 2) to investigate whether intraoperative MAC (Minimum Alveolar Concentration) of sevoflurane and/or preoperative anxiety levels could predict occurrence of IM and/or DR.

**Materials and methods:** After local Ethical Committee approval, 130 patients, aged 18-70 years, with ASA physical status I-II, undergoing thyroidectomy, were enrolled. Preoperatively, patients were asked to fill out 2 questionnaires investigating status and trait anxiety (STAI-Y1 and STAI-Y2, respectively). Patients were randomly assigned to two groups: in BIS group, end-tidal sevoflurane concentration was changed on the basis of BIS value which was maintained between 40 and 50; in HP group, BIS was recorded but hemodynamic parameters (mean arterial pressure and heart rate greater or less than 20% compared to preoperative values) were used as a guide for end-tidal anesthetic concentration changes. Induction of anesthesia was standardized. An audiotape containing one of two stories was presented to patients during anesthesia maintenance. Patients were interviewed about DR and IM immediately upon awakening and after 24h. Fisher exact test, Anova analysis and logistic regression were used for statistical purpose.

**Results and discussion:** Frequencies of DR (27% (17/63) in BIS group, 18% (12/64) in HP group,  $p = 0.37$ ) and IM (6% (4/63) in BIS group, 7% (4/64) in group HP;  $p=0.63$ ) were comparable in the two groups. Patients with DR ( $n=29$ ) showed higher preoperative STAI Y-1 scores ( $p < 0.01$ ) and lower MAC values compared with patients without DR ( $p < 0.01$ ). DR and IM were less probable to occur in patients with MAC values greater than 0.93 (area under ROC curve=0.83; specificity=94% and sensibility=38%). Nothing in the reports about DR alluded to possible awareness episodes.

**Conclusion(s):** BIS titration to values ranging from 40 to 50 did not affect frequency of DR and IM. Preoperative anxiety level was able to predict DR. At least 0.93 MAC of sevoflurane should be used in order to abolish both DR and IM.

#### References:

1. Leslie K et al. *Anesthesiology* 2007;106:33-42.
2. Kerrensens C et al. *Anesthesiology* 2009;111:518-24

## 7AP3-8

### The effect of dexmedetomidine as hypnotic in general anaesthesia on electrocorticography in epileptic patients during neurosurgical procedures

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**Background and Goal of Study:** The Electrococtogram (ECoG) is an accurate method for mapping and monitoring any epileptogenic areas during removal of such foci in neurosurgery. It is also a very sensitive method for examining the effect of many drugs used during general anesthesia. The use of dexmedetomidine (Dex) as hypnotic in general anesthesia of these procedures has allowed us to significantly improve the records obtained using ECoG.

**Materials and methods:** We studied 8 patients with medically intractable epilepsy who underwent surgical resection of these foci. Under general anesthesia using sevoflurane 2.5%, fentanyl 4mcg/kg, end-tidal carbon dioxide tension at 30 mm Hg and continuous bispectral index BIS® monitoring, we obtained a first register of ECoG by means of electrodes placed on the cerebral cortex exposed in the surgical field. Then sevoflurane was decreased to 0.7%, and dex infusion (1 mcg/kg/h) was administered during 10minutes, after which a new ECoG recording was made. We compared the median frequency of ECoG, spectral power density of each spectral band, and number of spikes at each time.

**Results and discussion:** The median frequency of ECoG in leads from all patients was significantly decreased by Sevoflurane 2.5% compared with those at Sevoflurane 0.7% with Dex. The number of leads with spikes was properly the same, but the number of spikes in all leads was higher in the second register.

**Conclusion(s):** In our experience, our preliminary results suggest that sevoflurane decreased the median frequency of ECoG and the number of spikes in comparison to the use of Dex.

## 7AP3-9

### Nefopam does not decrease parasympathetic tone under general anesthesia

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**Background and Goal of Study:** Nefopam is a non-opioid analgesic whose action is spinal and supraspinal, including an inhibition of dopamine, nor-epinephrine and serotonin recapture (1). Adverse drug events (ADEs) after nefopam injection in awake patients include tachycardia, urine retention, sweating, dryness of the mouth, confusion and convulsions, suggesting an anticholinergic effect. Although the mechanism of this anticholinergic effect is unknown, it has never been investigated in patients under general anesthesia. The aim of the present study was to investigate the effect of nefopam on heart rate (HR) and parasympathetic tone assessed by heart rate variability (HRV) spectral analysis in patients under stable general anesthesia.

**Materials and methods:** Twenty ASA I status patients, scheduled for orthopedic surgery were included. General anesthesia was induced by propofol (3-4 mg/kg) and sufentanil (0.2-0.3 µg/kg), and maintained with sevoflurane in 60% O<sub>2</sub>-air mixture to achieve BIS between 40 and 60. Then, 20 mg intravenous injection of nefopam was given. Heart rate and analgesia nociception index (ANI) (a surrogate marker of parasympathetic activity derived from HRV spectral analysis) were recorded before induction (INS), at the time of nefopam injection (Nef Inj) and 1,2,3,4,5,10 and 15 minutes after. HR and ANI were compared using repeated measures analysis of variance.  $P < 0.05$  was considered significant. Data are expressed as mean ± SD.

**Results and discussion:** HR was  $69 \pm 3$  and ANI was  $77 \pm 3$  before induction and  $66 \pm 3$  and  $70 \pm 4$  at Nef Inj respectively. No statistically differences were found in HR and ANI values at 1,2,3,4,5 and 10 minutes when compared to Nef Inj. At 15 min HR decreased to  $60 \pm 2$  and ANI increased to  $88 \pm 4$  ( $p < 0.05$ ) suggesting an increase in parasympathetic tone.

**Conclusion(s):** The present study demonstrated that nefopam injection in anesthetized patients did not result in significant anticholinergic effects. Moreover, significant increase in parasympathetic activity occurred at 15 minutes which could be explained by the deepening of anesthesia.

#### References:

1. Chanques et al. *British Journal of Anaesthesia* 2011;106:336-43

## 7AP3-10

### Noninvasive monitoring of cerebral blood flow in healthy volunteers: "beach chair" and hypercapnia challenges

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**Background and Goal of Study:** In neurosurgery, orthopaedics, and in some laparoscopies the head is elevated as in "beach chair" (BCh), compromising cerebral blood flow (CBF).

**Materials and methods:** In 15 healthy volunteers we performed noninvasive monitoring of microvascular CBF measured by a custom "diffuse correlation spectroscopy" instrument (Institut de Ciències Fotòniques, Spain)(1) with two symmetric probes located in the forehead; Systolic and mean blood flow velocities (MCA s/m) with Transcranial Doppler (TCD) of mean cerebral arteries (Rimed®, Germany); Regional brain saturation (rSO<sub>2</sub>) (Somanetics®, USA); cardiac index (CI) (NICOM®USA); end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>). We recorded all these variables in supine as basal value. Afterwards the subjects were positioned in "beach chair" (50°), the percentage of change in the variables from the basal were calculated. In both positions a breathing mix including 7.5% CO<sub>2</sub> was introduced (Hypercapnia). When an increase of 20 mmHg was observed it was kept constant for two minutes.

**Results and discussion:** Changing position from supine to BCh decreased CBF, MCA s/m velocities, rSO<sub>2</sub> and cardiac index (CI) Hypercapnia challenge in supine increased CBF, MCA s/m velocities and rSO<sub>2</sub> without any change in CI. The same challenge in BCh increased CBF, MCA s/m velocities, rSO<sub>2</sub> and CI. (Table 1)



	CBF	MCA s/m	rSO <sub>2</sub> (right)	CI
Beach chair*	-17%	-2.7% / -7.1%	-2.1%	-23.5%
Hypercapnia supine	+ 55%	+ 43.3% / + 49.2%	+ 18.7%	No change
Hypercapnia 50 <sup>o**</sup>	+ 68%	+ 33.9% / + 33.7%	+17%	+ 4%

[Mean relative changes to the baseline]

\*% variation from basal in supine;\*\*% of variation from basal in BCH

**Conclusion(s):** Our results support that BCH triggers a decrease in cardiac index and in CBF that in healthy volunteers is compensated by cerebral autoregulation, inducing slight changes in MCA s/m and in rSO<sub>2</sub>. Notwithstanding, acute hypercapnia has a direct effect on cerebral vessels without significant change in cardiac index. We want to highlight that hypercapnia challenge response was similar in both head positions. Further studies are needed in order to know if "moderate hypercapnia" can be a brain ischemia protector during beach chair in patients without brain pathology under anaesthesia.

#### References:

1. Yodh A G. Diffuse correlation spectroscopy for non-invasive micro-vascular cerebral blood flow measurement. *Neuroimage*, 85(1):51-63, 2013.

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## 7AP4-1

### Different neurotransmitter therapy in severe traumatic brain injury patients: pilot study

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**Background and Goal of Study:** To study the effectiveness of various neurotransmitter drugs in patients with severe traumatic brain injury (TBI).

**Materials and methods:** We examined 74 patients with TBI (56 men and 18 women), mean age - 33 ± 5.3 years. The level of consciousness on the Glasgow Coma Scale (GCS) at admission was 7.2 ± 2.1 points, coma in acute trauma lasted an average of 16 ± 5 days. Patients were prescribed conventional therapy TBI. All patients were divided into 2 groups, depending on the type of lesion mediator structures: dopaminergic deficiency syndrome (DDS) (36 patients); cholinergic deficiency syndrome (CDS) (38 patients). Each group was allocated two subgroups: control and basic, in which traditional scheme was supplemented by the introduction of IT: the DDS (18 patients) of amantadine sulphate (3-day infusion of 400 mg day, then 400 mg day oral); CDS with (20 patients), citicoline (1000 mg i.v two times a day).

**Results:** Positive dynamics was shown to improve the neurological status. Showed an increase in the amount of points on the GCS, level of consciousness increased by 10 - 14% during therapy, and by day 3 was obtained significant difference ( $p < 0.05$ ) compared with the control group. In the control group on the 2nd day consciousness recovery was only 2% of patients, and in patients receiving therapy neurotransmitter, this figure corresponded to 10% and 12% ( $p = 0.06$ ). On the 5th day in the control group consciousness recovery was 20% of patients, whereas in the group receiving therapy amantadine and citicoline - 40 and 45% of patients ( $p = 0.05$ ), respectively. Exit out of the coma is marked by 5.3 ± 1.2 (group 1) and 12.4 ± 3.1 (group 2) days. Dates of mechanical ventilator in the study group patients were also shortened by 15.9% compared with the group receiving traditional therapy. As a result, the number of pulmonary complications in this group also decreased by 22.8% ( $p = 0.09$ ). Outcome on the Glasgow outcome scale was increased during therapy and was received significant difference ( $p < 0.001$ ) compared with the control group.

**Conclusion(s):** The results indicate the need for selection neuromodulator therapy in accordance with the clinical syndrome of neurotransmitter dysfunction in severe brain injury. With the prevalence of signs of depression stem structures in patients advantage in therapy have cholinomimetic drugs, while dominance symptoms subcortical lesions - dopaminergic agents.

## 7AP4-2

### Predictors of outcome in traumatic brain injury (TBI) defined by multimodality neuromonitoring including near-infrared spectroscopy (NIRS)

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**Background and Goal of Study:** Due to the heterogenic nature of TBI, it is important to define as many outcome predictors of this pathological condition. Current prognostic models are based on admission characteristics. The aim was to determine the differences of cerebral oxygenation within groups of positive and lethal outcomes, estimate their correlation with other cofactors and determine their prognostic value.

**Materials and methods:** Data analysis from 72 h perioperative multimodality monitoring of 48 adult TBI patients who underwent surgery was made. NIRS data and basic parameters were monitored. Clinical data and functional outcomes were obtained. Statistical methods of one-way ANOVA, bivariate correlation and Cox regression were used to determine the associations and prognostic value. Results were deemed significant when  $p < 0.05$ .

**Results and discussion:** 15 women and 33 men with age mean of 54.2±8.5 years were enrolled into the prospective study. There were 15 lethal outcomes. Left hemisphere rSO<sub>2</sub> (rSO<sub>2</sub>L) values were significantly higher in the survival group, with biggest difference in the period after extubation (79.2±4.9 vs 60.2±9.7;  $p < 0.000$ ). Right hemisphere rSO<sub>2</sub> (rSO<sub>2</sub>R) values, particularly before and right after operation, correlated well with Barthel index ( $r=0.677$ ;  $p=0.004$  and  $r=0.683$ ;  $p=0.003$ ). Pre- and intraoperative rSO<sub>2</sub> values were higher in male population (83.2±4.5 vs 71.4±8.1;  $p=0.005$ ). Group of lethal outcomes had significant differences in primary GCS score (5.7±1.5 vs 11.0±2.3;  $p < 0.000$ ), hemoglobin (116.4±13.4 vs 132.9±7.8;  $p=0.011$ ), blood glucose (9.0±1.5 vs 6.8±0.8;  $p=0.003$ ), urea (6.09±0.98 vs 4.52±0.96;  $p=0.021$ ), PTT (35.9±3.6 vs 31.9±1.8;  $p=0.011$ ) and other variables. With minimised entropy, Kaplan-Meier analysis indicated groups with primary GCS score below 10 and blood glucose level above 9mmol/l to have poorer survivability (Mantel-Cox  $\chi^2=10.4$ ;  $p=0.001$  and Mantel-Cox  $\chi^2=13.0$ ;  $p < 0.000$ ). Cox regression indicated primary GCS score and blood glucose level as strongest predictors of survivability when combined in a model ( $R^2=0.77$  and  $R^2=1.32$ ;  $p=0.000$ ).

**Conclusions:** The study showed association between rSO<sub>2</sub>L and survivability, but rSO<sub>2</sub>R correlated better with functional outcome, regardless of the lesion location. The sample was too small to include rSO<sub>2</sub> in a prognostic model with other cofactors. Many other variables are related to outcome after TBI, but future studies are needed for novel prognostic models introduction.

## 7AP4-3

### Effects of prehospital intubation and sedation on mortality after traumatic brain injury

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**Objective:** To determine the importance of intubation and sedation and others factors on mortality after traumatic brain injury.

**Methods:** A retrospective observational analytical study in a intensive care unit of a reference Spain hospital. We study all patients admitted after severe traumatic brain injury associated with multiple trauma or just isolated TBI admitted between 2011 and 2012.

The following variables were studied on admission: APACHE II, AIS severity scale, GCS score, Data Bank score, sex, age, sedation and intubation before admission. Others variables: prolonged stay, infectious complications, raised intracranial pressure at any time during the evolution, hospital mortality.

**Results:** We study 147 patients, mean age of 39 ± 18 years, APACHE II 18.1, ISS 16.3, Data Bank score 2.6, GCS 7.9 on admission. Hospital mortality was 30%.

The univariate analysis showed that patients who died were older, had worse scores and were less likely to be intubated and sedated before admission. There were significant differences,  $P < 0.005$ , when the initial CT severity according to the Data Bank score was  $\geq 3$  (40% mortality versus 10%,  $P :0.00.1$ ), age more than 65 years, and when patients were not sedated or intubated before admission.

No significant differences were found concerning mortality when the APACHE II was more than 15 or When the GCS score on admission was less than 8.

The multivariate analysis showed that Data Bank score more than 3 was an independent risk factor for death (OR 1.9, P 0.001, CI 95% 1.3-1.9).

**Conclusions:** Trauma severity score assessed by Data Bank score had more influence on mortality than sedation and intubation prior to hospital admission.

## 7AP4-4

### Effect of transfusion on cerebral metabolism after severe traumatic brain injury: liberal versus restrictive strategy

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**Background:** Anemia may reduce oxygen brain transport and worsen neurological prognosis after severe traumatic brain injury (TBI). However, blood transfusion may have harmful effects in critically ill patients and the optimal transfusion threshold after TBI remains under debate. The aim of this study was to assess the effect of red blood cell transfusion on cerebral metabolism after severe traumatic brain injury, comparing a restrictive and a liberal strategy.

**Method:** Randomized controlled multicenter trial (Nancy, Toulon, Rouen). We included 33 patients with severe TBI who were found with hemoglobin concentration of less than 9.0 g/100 ml. They were randomized to a liberal transfusion strategy (hemoglobin target: 10-12 g/100 ml) or a restrictive strategy (hemoglobin target: 7-9 g/100 ml). In all TBI patients were monitored intracranial pressure (ICP), brain cerebral tissue oxygen (PtiO<sub>2</sub>) and cerebral metabolic parameters using microdialysis. The primary outcome was mean brain lactate during the first 72 hours. All parameters are reported for the first 72 hours.

**Results:** Mean hemoglobin concentration: 7.8±0.7 in the restrictive group, 11.1±0.9 in the liberal group. Cerebral metabolic parameters are reported on table 1. Duration of brain hypoxia (PtiO<sub>2</sub>< 10 mmHg): 2.4±3.0 hours/day in the restrictive group, 2.7±5.1 hours/day in the liberal group (p=0.28). There were no difference in the number of elevated ICP(>20 mmHg) (6.5±4.2 vs 5.0±4.8 episode/day, p=0.31) nor in the duration of low cerebral perfusion pressure (< 70mmHg) (7.3±5.0 vs 6.9±5.5 hours/day, p=0.72).

	Restrictive group (n=15)	Liberal group (n=18)	p
Lactate (mmol/l)	3.59±1.93	3.54±0.88	0.42
Pyruvate (mmol/l)	131±71	128±42	0.63
Ratio L:P	30.8±10.8	31.5±12.2	0.99
Glucose (mmol/l)	1.45±0.86	1.28±0.79	0.46
Glutamate (μmol/l)	12.5±14.1	8.7±7.9	0.51

[Table 1: Brain metabolic parameters]

**Conclusion:** Despite its small number of patients, this study showed that, in patients suffering from severe TBI, blood transfusion did not improve neither brain metabolism nor brain oxygenation. Moreover, there was no visible impact on brain hemodynamics.

## 7AP4-5

### The possible role of peritoneal dialysis in neuroprotection

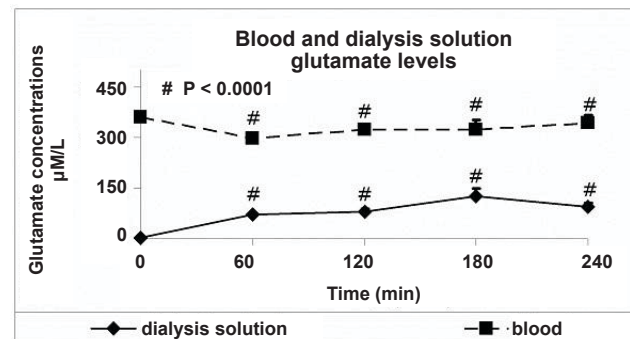
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**Background and Goal of Study:** Glutamate is released in high concentrations after various brain insults and plays a crucial role in causing secondary neuronal damage. Previous studies demonstrated the efficacy of hemodialysis in reducing blood glutamate levels. The purpose of the present study is to investigate whether peritoneal dialysis (PD) may be effective in lowering glutamate levels, which may serve as a potential tool for improving neurological function after brain injury.

**Materials and Methods:** Two liters of dialysis solution were infused over 10 minutes into 18 patients with stage V chronic kidney disease. Blood samples were collected immediately prior to initiation of PD, and hourly for a total of 5 blood samples. Blood samples were sent for determination of glutamate, creatinine, urea, glucose, glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT). PD samples were collected and analyzed for glutamate, creatinine, urea and glucose at the same time points as the blood samples.

**Results and Discussion:** Blood glutamate concentrations were significantly reduced by 60 minutes after the infusion of dialysis solution and remained decreased throughout the experiment (p<0.0001), whereas levels of glutamate in the dialysis solution were increased significantly by 60 minutes (p<0.0001) (Figure 1).



[Figure 1]

**Conclusions:** We demonstrated that PD is an effective modality in reducing blood glutamate concentrations. This method may be potentially utilized for the treatment of acute and chronic brain disorders that are accompanied by elevated glutamate in the brain's extracellular fluid (ECF). Unlike pharmacological methods of blood glutamate scavenging, PD offers a definitive way to excrete glutamate from the body. Considering the rapid saturation of the PD solution with glutamate, we recommend frequent dwelling of the PD solution in order to maintain low concentrations of blood glutamate.

## 7AP4-6

### Prognostic factors and functional status six months after decompressive craniectomy

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**Background and Goal of Study:** To analyze in patients who undergo decompressive craniectomy (DC) the relation between the functional and the clinical status 6 months after admission.

**Materials and methods:** Prospective study of patients with structural brain damage (spontaneous subarachnoid haemorrhage secondary to aneurysmatic rupture (SAH), spontaneous haemorrhagic stroke (SHS), ischaemic stroke and traumatic brain injury (TBI)) requiring decompressive craniectomy during their ICU stay, between 2006-2012. We use Student t test, Chi squared and logistic regression.

**Results:** 62 patients, 19 with SAH of nontraumatic origin, 5 with SHS, 6 with ischaemic stroke and 32 with TBI. Mean age 73±48.22 years, Glasgow on admission 9.35±3.68. Prior to surgery 28 patients (45.2%) had isochoic pupils, 32 (51.6%) had anisocoria and 2 (3.2%) had bilateral mydriasis. Hospital mortality was 40.3%. The functional status at 6 months was known in 56 patients (6 missing): 27 died (48.2%), 5 vegetative (8.9%), 10 limited not self-sufficient (17.9%), 10 limited self-sufficient (17.92%) and 4 normal (7.1%); 14 patients (25%) had a good functional status (normal or self-sufficient).

According to the diagnosis, a good evolution was seen in 10 of the 30 patients (33.3%) with TBI, 3 of the 6 (50%) with ischaemic stroke, 6.7% of the 15 with SAH, and none of the 5 with SHS (p=0.058). Grouping the patients according to whether or not the damage was haemorrhagic showed that only 1 of 20 (5%) with haemorrhagic disorders (SAH and SHS) had a good evolution and 13 of the 36 (36.1%) with non-haemorrhagic disorders (ischaemic stroke and TBI) had a good evolution (p=0.01). Four of 31 (12.9%) patients with pupillary abnormalities prior to surgery and 10 of 25 (40%) with normal pupillae had a good evolution at 6 months (p=0.02).

Multivariate analysis showed that a poor evolution at 6 months was related to

the pupillary abnormalities prior to surgery: OR 4.19 (1.04-16.86), and type of diagnosis (haemorrhagic vs. non-haemorrhagic): OR 10.05 (1.16-87.21).

**Conclusion:** We found that 25% of patients admitted to the ICU with structural brain damage who undergo decompressive craniectomy have a good functional status at six months. The prognosis was better if they have non-haemorrhagic disorders or if the procedure is performed before the onset of pupillary abnormalities.

## 7AP4-7

### Deep hypothermia circulatory arrest: is it enough to protect the brain?

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**Background:** Thoracic aorta surgery frequently requires temporary interruption of the cerebral circulation for varying periods. Hypothermia is the principle component of these methods of brain protection. The main protective effect of hypothermia is based on reduction of cerebral energy expenditures and largely depends on adequate suppression of cerebral function. It is most effective at deep hypothermic levels. There is solid experimental and clinical data indicating the safe limits and outcome following hypothermic circulatory arrest (HCA)<sup>1,2</sup>.

The aim of study was to determine efficiency of HCA in patients underwent aortic arc surgery.

**Methods:** After local Ethic Committee approval and informed consent we have studied 14 patients 13-66 years (mean age 43±16,1yrs) underwent thoracic aorta repair with hypothermic circulatory arrest (13-18 degree C). We have studied neurological outcomes, neurocognitive functioning before and after surgery, core temperature during surgery, changes of electroencephalography during surgery, blood gases (PO<sub>2</sub>, PCO<sub>2</sub>), saturation of hemoglobin with oxygen (SO<sub>2</sub>), glucose (Glu) and lactate (Lac) level in arterial and venous blood taken from jugular bulb. Also we have calculated arteriovenous oxygen and carbon dioxide difference (a-jbO<sub>2</sub> diff, jb-aCO<sub>2</sub> diff), oxygen extraction and arteriovenous glucose difference (a-jbGlu diff).

**Results:** Duration of hypothermic circulatory arrest was 48.6±12.8 minutes. Early postoperative mortality was 28.6%. Non of lethality related to brain injury. We have found inverse correlation of electroencephalography amplitude, PjbO<sub>2</sub> and SbjO<sub>2</sub> with core temperature. a-jbGlu decreased by 4 times during hypothermia. jb-aCO<sub>2</sub> difference and level of jb Lactate increased significantly immediately after reperfusion. All patients had neurocognitive dysfunction after surgery. Severity of this dysfunction correlate with duration of circulatory arrest.

**Discussion:** Despite a significant decrease in brain electrical activity and increasing of a-jb Glu difference we consider that the metabolism of the brain is not completely inhibited during deep hypothermia. This assumption is confirmed by an increasing of lactate and jb-aCO<sub>2</sub> difference after reperfusion and neurocognitive dysfunction after surgery.

#### References:

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2. Conolly S, Arrowsmith JA, Klein AA, *Journal of Critical Care & Pain* 2010 Vol. 10 N 5: 138-142.

## 7AP5-1

### The effect of dexamethasone on cognitive decline after cardiac surgery: a randomized clinical trial

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**Background and Goal of Study:** Cardiac surgery can be complicated by postoperative cognitive decline (POCD), which is characterized by impaired memory function and intellectual ability. The systemic inflammatory response that is induced by major surgery and the use of cardiopulmonary bypass (CPB) may play an important role in the etiology of POCD. Prophylactic intraoperative corticosteroids to attenuate the inflammatory response may therefore reduce the risk of POCD. We aimed to study the effect of intraoperative high-dose dexamethasone on the incidence of POCD at one and twelve months after cardiac surgery.

**Materials and methods:** This multicenter, randomized, double-blind, placebo-controlled trial is a pre-planned substudy of the Dexamethasone for Cardiac Surgery (DECS) trial. 291 adult patients undergoing cardiac surgery with CPB were recruited in three hospitals in The Netherlands between August 2010 and October 2011.

Patients were randomized to receive dexamethasone 1 mg/kg (n=145) versus placebo (n=146). The main outcome measures were incidence of POCD at one and twelve months follow-up, defined as a decline in neuropsychological test performance beyond natural variability in test performance, as measured in a control group.

**Results and discussion:** At one month follow-up, 19 out of 140 patients in the dexamethasone group (13.6%) and 10 out of 138 patients in the placebo group (7.2%) fulfilled the diagnostic criteria for POCD (RR 1.87, 95% CI 0.90 to 3.88, P=.09). At twelve months follow-up, 8 out of 115 patients in the dexamethasone group (7.0%) and 4 out of 114 patients (3.5%) in the placebo group had POCD (RR 1.98, 95% CI 0.61 to 6.40, P=.24).

**Conclusion(s):** Intraoperative high-dose dexamethasone did not reduce the risk of POCD after cardiac surgery.

#### References:

Trial registration: Clinicaltrials.gov registration no. NCT00293592

## 7AP5-2

### Pre-operative inflammatory burden in the elderly increases the risk of developing postoperative cognitive dysfunction

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**Background:** Postoperative cognitive dysfunction (POCD) may be a complication after surgery in the elderly. The etiology of POCD remains unclear. Tissue damage activates the peripheral immune system resulting in the release of inflammatory mediators. Neuro-inflammation can be accompanied by cognitive dysfunction. Inflammatory markers may be useful in predicting those individuals at a greater risk of developing dementia. We sought to determine whether the degree of preoperative inflammatory burden would have an effect on the progression of POCD at 6 months.

**Methods:** 36 patients aged 65 and older undergoing major surgery were recruited. The cytokines IL-6, IL-8 & IL-10 were measured at baseline and 6 months postoperatively. All subjects had neurocognitive tests at baseline and 6 months postoperatively. Tests were transformed using regression based norms (age, gender, baseline score, time to follow-up) from the NYU Center for Brain Health. Spearman's Rho correlation analysis was used to test the degree of change in cytokine levels relative to the change in cognitive performance. Analysis populations included all patients and a second group omitting the two outliers; p< 0.05 was considered significant.

**Results:** Postoperative decline was defined as a lower performance on two or more cognitive tests of at least two Standard Deviations below expected performance based on age, education, sex, and baseline scores. An elevated preoperative inflammatory burden was associated with a greater decline in performance on the Digit Span Forward test (a measure of attention) at 6 months. Analyzing all subjects, correlation coefficients (p value) for the composite score, and IL-6, IL-8 and IL-10 separately were -0.597 (p=0.000), -0.551 (p=0.002), -0.468 (p=0.009), and -0.457 (p=0.011). All p values significant using multiple comparison corrections by Holms and Hochberg; significance was still attained for the composite cytokine score omitting the two outliers, or using Pearson's correlation.

**Conclusion:** These prospective findings suggest that the subgroup of elderly patients with a relatively increased baseline inflammatory burden are most at risk at six months after surgery for a negative impact upon attention and concentration, as measured by the Digit Span Forward test. The identification of a specific subgroup of patients who are predisposed to POCD raises the possibility of optimizing patient inflammatory status preoperatively or of modulating the immune system perioperatively.



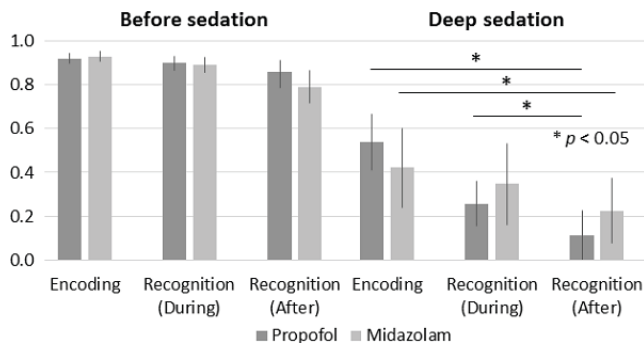
## 7AP5-3

### Effect of midazolam and propofol sedation on memory function

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**Background and Goal of Study:** Midazolam and propofol impair memory even when administered at light-sedation. However, the extent to which type of memory is affected by these drugs is yet to be ascertained. We studied the effect of midazolam and propofol sedation on memory using working memory tests.

**Materials and methods:** After obtaining approval from the local ethics committee and written informed consent from the participants, 10 healthy men (age: 23.1 ± 3.5 years, ASA: 1 or 2) were enrolled in the study. Drugs were randomly assigned. In the encoding, participants were asked to memorize words belonging to a specific category. They listened words and judged whether which should be memorized. Ten minutes after that, during the recognition, they listened words and judged whether which should have been remembered. These tests were performed before and during sedation. Immediately after sedation, they recognized the memorized words again. One week after sedation, they recognized the memorized word category. Using target-controlled infusion pump or pharmacokinetic simulation system, we first determined the effect site concentration of the sedation drug at loss of response to name calling and eyelash-reflex (Ce-LOR). We then adjusted the Ce of the sedation drug at 3/4 of Ce-LOR, and performed the memory test. Chi square test and paired t-test were done with JMP 10.01 software.



[Working memory test performance]

**Results and discussion:** The results of the recognition did not reveal any significant difference between the drugs before sedation. However, significant differences were observed in the recognition performance of words divided by encoding performance during and immediately after sedation ( $p = 0.0015$ ).

However, there were no significant differences between the drugs. The results of the recognition performed 1 week after sedation revealed that the propofol group tended to limited recognition of words in comparison with the midazolam group ( $p = 0.07$ ).

**Conclusion:** Both drugs had an anterograde amnesiac effect when administered at a level of 3/4 of Ce-LOR. However, this effect may be stronger in propofol. Moreover, the results suggest that the retrograde amnesiac effect may be stronger in propofol.

## 7AP5-4

### Comparison of sevoflurane and propofol anesthesia during off-pump coronary artery bypass grafting: effects on cerebral oxygenation and cognitive function

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**Background and Goal of Study:** Off-pump coronary artery bypass grafting (OPCAB) can be complicated by cerebral ischemia and cognitive dysfunction. The aim of our study was to compare the influence of anesthesia with sevoflurane vs. propofol on cerebral oxygenation and cognitive function in patients undergoing OPCAB.

**Materials and methods:** We enrolled 28 patients, who underwent elective OPCAB using general (propofol/fentanyl or sevoflurane/fentanyl) anesthesia. The patients were randomized into two groups: the propofol group (PG) ( $n=14$ ) and the sevoflurane group (SG) ( $n=14$ ). Induction of anesthesia was performed with propofol (1.5-2.5 mg/kg) and fentanyl (2 mcg/kg) in the PG and with sodium thiopental (3-5 mg/kg) and fentanyl (2 mcg/kg) in the SG, respectively. In the PG, anesthesia was maintained with propofol 3-5 mg/kg/h, whereas the SG group received sevoflurane 0.5-3 vol%. Both groups received intravenous fentanyl 3-5 mcg/kg/h. Cognitive assessment was performed using Montreal Cognitive Assessment (MoCA) score at 12 h before OPCAB and at 24 and 120 hours after surgery. In all patients, we assessed hemodynamic parameters using PiCCO<sub>2</sub> (Pulsion Medical Systems, Germany) and cerebral oxygen saturation using Fore-Sight cerebral oximeter (CAS Medical Systems, USA). The data were assessed by Mann-Whitney U-test and expressed as median (25<sup>th</sup>-75<sup>th</sup> percentiles).

**Results and discussion:** Cerebral oxygen saturation decreased significantly in the PG group compared with the SG group at several stages of the perioperative period. The hemodynamic parameters did not differ significantly between the groups. In the PG, the MoCA score reduced at 120 h after OPCAB compared to baseline values: -1.5 (-3.0-0.0), whereas in the SG it returned to preoperative levels: 0.0 (-1.0-3.0) ( $p = 0.021$  between the groups).

**Conclusion(s):** Compared with propofol anesthesia, the use of sevoflurane during OPCAB improves cerebral oxygenation and attenuates postoperative cognitive dysfunction.

## 7AP5-5

### Early postoperative cognitive dysfunction in patients undergoing open radical cystectomy with urinary diversion and intraoperative fluid regimen: an observational study

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**Background and Goal of Study:** Postoperative cognitive dysfunction (POCD) is recognized to contribute to perioperative morbidity and mortality of the elderly. The incidence of POCD varies greatly with reported rates of 10% to 55% after major surgery. Patient characteristics such as age, education, type and length of surgical procedure and preoperative cognitive status have been found to affect the incidence and severity of POCD. The influence of intraoperative volume management on cognitive function has not been assessed. The objective of this study was to assess cognitive function in patients undergoing open radical cystectomy and the impact of fluid management on POCD.

**Materials and methods:** Patients undergoing open radical cystectomy with urinary diversion were included in a double blind, parallel group randomized clinical trial. Combined anesthesia was similar in both groups (induction with propofol and fentanyl, maintenance with isoflurane, and perioperative use of a thoracic epidural analgesia). Patients were assigned to receive a restricted deferred intraoperative balanced crystalloid regime combined with the adjuvant noradrenaline administration ("intervention group") or a more conservative, constant and liberal fluid management ("control group"). Only native German speaking patients were included in the assessment of the cognitive function. Cognitive function was assessed by a study nurse blinded to the groups using the Consortium to Establish a Registry for Alzheimer's disease (CERAD-Plus) test battery on postoperative day 1 and 10. CERAD adjusted total scores including age, gender and education were calculated. A decrease in adjusted CERAD total score difference was defined as POCD.

**Results and discussion:** Data were completed for 94 patients (46 patients in the intervention group vs 48 patients the control group. Baseline characteristics were similar in both groups. The overall incidence of POCD (36 patients/94) was 38% on postoperative day 1. POCD was found in 18/46 (39%) in the intervention group and 18/48 (38%) in the control group on postoperative day 1 ( $P=0.95$ ). On postoperative day 10, 16/46 patients (35%) in the intervention group and in 21/48 patients (44%) in the control group had POCD ( $P=0.41$ ).

**Conclusion(s):** Mainly, POCD is common in this cystectomy population. Using an intraoperative restrictive fluid regimen seems to have no negative impact on the rate of early POCD.

## 7AP5-7

### Very short exposure of volatile anesthetics induces long-term learning deficit in young adult male rats

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**Background and Goal of Study:** General anesthesia induces long-term deficits of cognition and learning, however, whole aspect of this phenomenon is poorly understood. We previously reported that Isoflurane exposure to young adult rats induces long-term learning deficit in contrast to propofol administration. We made very short exposure model of Isoflurane and Sevoflurane using young adult rats for comprehensive elucidation of postoperative cognitive dysfunction (POCD).

**Material and methods:** We applied only 5 minutes exposure of anesthetic gases to SD rats (young adult, male) for very short anesthesia model. Control group were exposed to 33% oxygen for 5 min, Isoflurane group were exposed to 2.0% Isoflurane (1.38 MAC) for 5min and Sevoflurane group were exposed to 3.0% Sevoflurane (1.30 MAC) for 5min. Rats were allowed to breathe spontaneously. Then, we performed Inhibitory avoidance test (IA) 1 and 7 days after anesthesia (independent groups were applied for each intervals), to evaluate hippocampus-dependent contextual learning.

**Results and discussion:** In the IA test, Isoflurane group (day1 [n=18] 341 ± 15 s; day7 [n=18], 267 ± 31 s; Student's t-test,  $p = 0.04$ ) showed significant decline of retention latency, although control group (day1 [n=18] 313 ± 25 s; day7 [n=18], 315 ± 24 s; Student's t-test,  $p = 0.93$ ) and Sevoflurane group (day1 [n=18] 289 ± 30 s; day7 [n=18], 241 ± 31 s; Student's t-test,  $p = 0.27$ ) showed no significant change.

We revealed young adult rats causes long-term learning deficit 7 days after very short exposure of Isoflurane exposure. This supposes that temporal use of volatile agent for slow induction of general anesthesia may affect cognition and memory.

We previously reported Isoflurane exposure to adult rats suppress hippocampal LTP and we suggested that overexpression of GluA1 may affect synaptic plasticity. Very short exposure of Isoflurane may also cause any modulation of GluA1 in the hippocampus. We need to perform further investigation.

**Conclusion:** The Isoflurane exposure for only 5 minutes to young adult rat induces a long-term deficit of cognition and learning.

## 7AP5-8

### Does euroscore predict delirium after cardiac surgery?

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**Background and Goal of Study:** Despite recent advances in cardiac surgery, anesthetic and perfusion technics postoperative delirium still has a big role. The goal of this study was to determine preoperative risk factors of delirium after open heart surgery.

**Materials and methods:** We investigated 1967 adult cardiac surgery patients operated in recent years. Patients were divided into groups: group 1 with postoperative delirium and group 2 without postoperative delirium. Anesthesia protocol in both groups was similar.

Continuous variables were analyzed by using descriptive statistics (mean, standard deviation, 95% confidence intervals (CI)); categorical data were analyzed as proportions. Continuous variables were compared between patients with and without delirium by using a t-test. Statistical analyses was performed by using SAS software.

**Results and discussion:** Group 1 consists of 55 men and 13 women and group 2 - 1456 men and 441 women. Mean age in these groups was 61,5±9,4 (CI 95% 59,2-63,7) and 56±10,3 (CI 95% 56,1-57,0), respectively ( $p < 0,01$ ). In the delirium group 53% patients had coronary artery disease alone (CAD), 27% had only heart valve disease (HVD) and 20,3% had combination of CAD with HVD. In the second group diagnosis were CAD 74,3%, HVD 17,8% and 7,9% had combination CAD/HVD ( $p < 0,05$ ). Preoperative of stroke or encephalopathy were 17,6% and 6,5% in the group 1 and 2 ( $p < 0,01$ ). Median of Euroscore value was 4,5 (3 - 7) and 3 (1 - 4) in group 1 and 2 respectively. Preoperative ejection fraction (EF) in group 1 and 2 was 48,1±8%; (CI 95% 46-50,1%) and 49,6±7%; (CI 95% 50-50,3%),  $p = 0,1$ .

54% in group 1 and 36% patients in group 2 had operations with opened chambers. Our investigation revealed that patients with delirium had poorer functional state, than patients with "normal" postoperative course.

**Conclusion(s):** We found out that high value of Euroscore as well as age, history of neurological dysfunction and procedures with opened chambers can predict postoperative delirium.

## 7AP5-9

### A prospective evaluation of dementia following coronary artery bypass graft surgery

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**Background and Goal of Study:** It is well known that a significant proportion of older individuals suffer postoperative cognitive dysfunction (POCD) following anaesthesia and surgery. It remains to be elucidated if long-term cognitive impairment follows surgery and anaesthesia. Additionally, it is unknown if the cognitive decline of ageing such as Alzheimer's disease (AD) dementia, is related to POCD. Given the large numbers of elderly presenting for surgery (approximately 30% of all operations), and the known long pre-clinical phase of AD, it is likely many people undergoing surgery and experiencing POCD are in the pre-clinical phase of AD. It is unknown if surgery and anaesthesia initiates or exacerbates progression to dementia. This study aimed to prospectively evaluate dementia in the long-term following cardiac surgery, and compare this with population prevalence rates.

**Materials and methods:** Dementia was assessed using the Clinical Dementia Rating (CDR) with verification by a psychogeriatrician 5 - 10 years following coronary artery bypass graft (CABG) surgery in 123 individuals. Instrumental Activities of Daily Living (IADL) were measured at the same assessment.

**Results and discussion:** The mean age of participants at study entry was 67.8y (SD 7.3y) and 96 (78%) were male. Mean time to assessment was 7.7y (SD 1.7y). Dementia was identified in 40 (33%) participants which is significantly higher than the population prevalence of dementia of 10% ( $p < 0.001$ ). The CDR sum of boxes score ranged from 0.5 - 15.0. The breakdown of dementia prevalence by age category compared with population prevalence age-norms demonstrated a significantly greater prevalence of dementia 7.7y following CABG surgery for all age categories to 80 years. Not surprisingly, dementia diagnosis was associated with poor IADL score (41.3±4.2 vs 33.7±12.1,  $p < 0.001$ ).

**Conclusion(s):** As far as we are aware, this is the first study to prospectively evaluate dementia following anaesthesia and surgery. This work demonstrates a prevalence of dementia in the long-term following cardiac surgery which is far greater than that estimated from the community of the same age group, and which is associated with reduced ability to perform normal daily functions. This suggests cardiac surgery, or factors contributing to the necessity for cardiac surgery, may have an impact on progression to dementia and reduced functional capacity.

## 7AP5-10

### Prediction of postoperative cognitive dysfunction using the intraoperative cerebral oxygen saturation in the elderly subjected to cardiac surgery

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**Background and Goal of Study:** Neuropsychological dysfunction is a major cause of morbidity-mortality after cardiac surgery in the elderly. Intraoperative cerebral desaturation ( $rSO_2$ ) measured by near-infrared spectroscopy cerebral/somatic oximeter (INVOS<sup>®</sup>) had prognostic relevance thus it reflected cerebral and systemic oxygen balance. Intraoperative  $rSO_2$  and depth of anaesthesia are related to postoperative cognitive dysfunction in cardiac surgery. We evaluated if intraoperative cerebral desaturation and depth of anaesthesia are related to postoperative cognitive dysfunction in cardiac surgery in the elderly.

**Materials and methods:** A prospective, before and after, longitudinal study in ASA class II-IV patients scheduled for cardiac surgery undergoing intravenous general anaesthesia with remifentanyl plus propofol was done. Clinical and surgical parameters, cardiopulmonary function,  $rSO_2$  measured by INVOS<sup>®</sup> and depth of anaesthesia measured by bispectral index (BIS) were continuously recorded and corrected throughout surgery. Standardized test measuring capacity of attention, language, verbal and visual memory, visual-spatial

orientation, executive, psychomotor and motor capacity as well as independence in daily life and the perception of the patient of their psychological situation (WAIS III, Mini Mental Test, trail making test a/b y digit & symbol, WSM III list of words, digit span, executive function letters and numbers (L&N), Stroop test, STAIC, EPQ-R, Yesavage, QOLIE-31 and Barthel test) were used to assess the cognitive function before and 7 days after surgery.

**Results and discussion:** Patients (n=44, 77.3% male, aged 59.9±1.9 years old, 65.9% < 65 years vs. 34.1% ≥65 years), scheduled to coronary (36.4%), aortic valve replacement (18.2%), mitral valve replacement (13.6%), coronary plus valve replacement (13.6%) and others (18.2%) surgery, on pump 98.4% were enrolled. Reduction of rSO<sub>2</sub> higher than 15% at the end of the surgery compared with basal values were related with significantly lower values of concentration-auditive memory (WSM III) and concentration-visual memory (trail making test) and executive function (executive function L&N test) (p< 0.05), and with non-significant lower values of capacity of attention, language, visual-spatial orientation, and visual memory in patient over 65 years old, 7 days after surgery.

**Conclusion:** rSO<sub>2</sub> may help to predicts early postoperative cognitive dysfunction in the elderly subjected to cardiac surgery.

## 7AP5-11

### Development of a safe, practical and effective regimen for the anesthetic management of awake craniotomy in a single Bulgarian institution

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**Background and Goal of Study:** There is a trend towards implementation of awake craniotomy in increasing number of neurosurgical centers worldwide. We began to perform this procedure for the first time in Bulgaria in 2005. In 2009 our current anesthetic protocols were introduced and the aim of the present study is to determine its efficacy and safety.

**Materials and methods:** We performed a prospective observational case series study. It included all patients scheduled for awake craniotomy between February 2009 and February 2012. The main outcome measures were the quality of conditions provided for functional testing and the rate of intraoperative complications. Descriptive analysis was made. Results are given as median (range) or mean (SD), or n (%) as appropriate.

**Results and discussion:** Sixty- three consecutive awake craniotomies on 59 patients (ASA I- III, mean age 46 (14,5), male to female ratio 26: 33) were performed. Different anesthetic methods have been described in literature with no consensus as to the best of them. Our approach was consistent with the locally available resources. We used an “asleep- awake- asleep” technique with propofol- fentanyl infusion and laryngeal mask airway (LMA) inserted during the first part of the operation. Mapping was performed as planned in 60 cases. In 3 patients the procedure was modified due to some unpredicted event. The median time to awakening was 20 (10- 55) min. We find it relatively long which may possibly be attributed to the manually controlled fentanyl infusion. The median duration of the awake phase was 90 (25- 325) min and was generally well tolerated. Regarding the alertness and cooperativeness of the patients during the awake phase, it was assessed as good in 54 of them (85,7%). The communication was possible, but difficult in 6 patients (9,5%), impossible- in 1 and 2 were left anesthetized during the whole procedure. All cases with difficult communication had some preoperative speech or cognitive deficits. The most common intraoperative complication was the occurrence of seizures (27%), 2 of them were generalized. LMA displacement occurred in 3 interventions, but in none of the cases urgent intubation was required. Other complications included hemodynamic disturbances, tight brain, mild headache or discomfort, shivering and catheter related urge to urinate. All of them were successfully treated.

**Conclusion:** The presented protocols seems to be generally safe, effective and well- tolerated by the patients.

## 7AP6-2

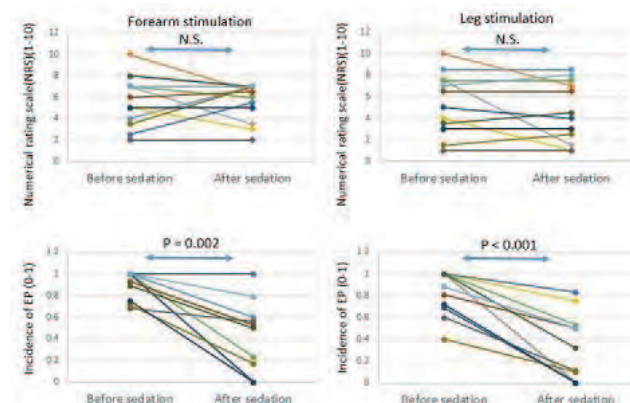
### Correlation between changes in brain activity and subjective pain intensity under sedation by using the contact heat-evoked potential method

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**Background and Goal of Study:** Pain is closely related with consciousness and its perception by the human brain depends on multiple complex factors. Contact heat-evoked potentials (CHEPs) reflect brain activity through the functioning of the A-delta fiber. However, there are very few studies on the changes in evoked potentials (EPs) under sedation. We aimed to clarify the relationship between subjective pain intensity and brain activity by using CHEPs under sedation induced by target control infusion (TCI).

**Materials and methods:** This study was approved by the Osaka University Hospital Research Ethics Committee, and all participants provided written informed consent. The participants were otherwise healthy adult males (ASA1 or 2) aged 23.1 ± 3.5 years and were randomly assigned to either the propofol or midazolam groups. Each drug was applied once at the effect-site concentration and caused loss of the participants' eyelid-closure reflex. The drug concentration was then maintained at three-quarters of this effect-site concentration using TCI. Participants then underwent CHEPs testing before and during sedation 20 times at 2 sites (forearm and leg) at 51 degree C for 1.2 s and an interstimulus interval of 8-12 s. Scalp potentials were recorded at the Cz location, and participants were asked to rate subjective pain intensity from 1 to 10 after every 10 stimulations. The changes in subjective pain intensity and EP incidence were analyzed using paired t-test.

**Results and discussion:** Under sedation, pain intensity increased in some subjects and decreased in others; as a result, there was no significant difference in pain intensity overall. However, the incidence of EP statistically decreased at both the forearm and leg.



[Figure: Changes in subjective pain intensity and incidence of EPs before and after sedation]

Since pain perception by the human brain depends on multiple factors, EP is not the only measure that should be used to study it.

**Conclusion:** This study revealed that the changes in brain activity measured using CHEPs are unrelated to subjective pain intensity.

## 7AP6-3

### Oxidative stress contributes to isoflurane-induced apoptosis in the PC12 neuronal cell line

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**Background and Goal of Study:** In animal experiments where the developing brain of young animals such as rodents and monkeys is exposed to general anesthetics, the neurological prognosis is adversely affected. Mitochondria have been reported to be likely associated with the neurotoxicity of anesthetics in the developing rat brain. Based on the finding that injured mitochondria



could increase the reactive oxygen species (ROS) levels, oxidative stress is thought to be involved in the mechanism underlying the induction of neurotoxicity. However this mechanism remains to be elucidated. Using metabolomic analysis, this study aimed to clarify which metabolites are affected following an exposure of the rat adrenal pheochromocytoma cell line (PC12) to isoflurane.

**Materials and methods:** PC12 cells were incubated at 37°C in media with and without serum and exposed to isoflurane for 1 hour. After centrifugation, the cells were lysed in 50 µL of water to prepare samples for analysis. Samples of a control group of cells not exposed to isoflurane were also prepared. Metabolomic analysis was performed on the samples using capillary electrophoresis mass spectrometry (Agilent CE-MS/6224 TOFMS). Quantitative analysis of the metabolites was performed based on m/z (calculated exact mass) and migration time of the metabolite reference materials.

**Results and discussion:** Of 102 types of the metabolites identified, 91 types were determined. Reduced glutathione (GSH) with antioxidant action decreased while oxidized glutathione (GSSG) increased in the group exposed to isoflurane, indicating that isoflurane accelerated oxidative stress.

**Conclusion:** These results suggest that oxidative stress was associated with the mechanism involved in isoflurane-induced apoptosis of rat adrenal pheochromocytoma (PC12) cells.

## 7AP6-4

### Innate behavior is impaired by neonatal exposure to general anesthetics in mice

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**Background and Goal of Study:** In animal models, exposure to general anesthetics induces widespread increases in neuronal apoptosis in the developing brain (1). Subsequently, abnormalities in brain functioning are found as adulthood, long after the anesthetic exposure. These abnormalities include not only reduced learning abilities but also impairment of social behaviors, suggesting pervasive deficits in brain functioning. But the underlying features of these deficits are still largely unknown.

The goal of this study is to understand the effects of neonatal exposure to general anesthetics on innate behaviors.

**Materials and methods:** Six-day-old C57BL/6 female mice were exposed to 3% sevoflurane for 6 hours. At 7 to 9 weeks of age, they were mated with healthy males. The first day after parturition, the innate behaviors (e.g. maternal behavior) of dams were evaluated.

**Results and discussion:** Female mice that received neonatal exposure to sevoflurane could mate normally and deliver healthy pups similar to controls. But these dams often left the pups scattered in the cage and nurtured them very little, so that about half of the pups died within a couple of days. Yet these dams did not show any deficits in olfactory or exploratory behaviors. Notably, pups born to sevoflurane-treated dams were successfully fostered when nursed by control dams.

**Conclusion(s):** In an animal model, sevoflurane exposure in the developing brain caused serious impairment of maternal behaviors when fostering their pups, suggesting pervasive impairment of brain functions including innate behavior essential to species survival.

#### Reference:

1. Jevtic-Todorovic et al. (2003) Early exposure to common anesthetic agents causes widespread neurodegeneration in the developing rat brain and persistent learning deficits. *J Neurosci* 23:876-882.

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## 7AP6-5

### Two different variants of p.2508 in Japanese malignant hyperthermia patients causing hypersensitivity of ryanodine receptor 1

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**Background and Goal of Study:** Ryanodine receptor 1 (RYR1) is a Ca<sup>2+</sup>-release channel located in the sarcoplasmic membrane of skeletal muscle. More than 200 variants of RYR1 have been identified, and shown to be associated with malignant hyperthermia (MH) and central core disease (CCD). Most of the MH/CCD-related variants have been found in mainly 3 regions, called "hot spots". However, a large number of those variants have also been found outside of those hot spots in Japanese MH patients. Three different variants (R2508C, R2508G and R2508H) were reported in the p.2508 portion in 6 MH patients. We hypothesized that these different variants in p.2508 play important roles in pathological conditions related to MH and investigated their functions.

**Materials and methods:** Mutated RYR1 expression vectors corresponding to R2508C and R2508H, which have reported in MH patients, and an artificial novel variant of R2508K and R2508S were transfected into human embryonic kidney (HEK)-293 cells. At 72 hours after transfection, the cells were loaded with Fura-2 AM for 1 hour. Next, they were excited alternately at 340 and 380 nm, then fluorescent emissions of Fura-2 were observed at 510 nm to evaluate intracellular Ca<sup>2+</sup> changes. We determined intracellular Ca<sup>2+</sup> changes induced by caffeine and calculated the half maximal effective concentration (EC50) using the Prism 4.0 software package. A p value of < 0.05 was considered to be statistically significant.

**Results and discussion:** EC50 values of wild type (WT), R2508C-, R2508H-, R2508S- and R2508K-transfected cells were 1.97 mM (95% CI: 1.806 to 2.146), 1.31 mM (0.9896 to 1.742), 1.48 mM (1.316 to 1.673), 1.60 mM (1.397 to 1.825), and 1.29 mM (1.086 to 1.537), respectively. The values for the 4 mutations were lower than that for WT (p < 0.05).

**Conclusion(s):** Our findings indicate that all of the mutations in the p.2508 portion of RYR1 play important roles in the pathogenesis of MH.

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2. Ibarra CA., et al. *Anesthesiology* 2006; 104:1146-54.

**Acknowledgements:** We express our appreciation to Professor David H. MacLennan for the generous gift of Rabbit-RYR1/pc DNA.

## 7AP6-7

### Effect of erythropoietin on heme oxygenase-1 enzyme activity in acute spinal cord injury in rats

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**Background:** After Spinal cord injury (SCI) primary insult occurs at the time of trauma and results with tissue damage and apoptosis. Secondary insult is a result of multiple endogenous injury processes and is mediated by cell death pathways including inflammation and free radical-induced cell death. Currently, studies in animal models indicate that erythropoietin (EPO) is very effective for limiting the consequences of SCI.

**Goal of Study:** We aimed to investigate whether intraperitoneal EPO exerts its neuroprotective activity by its effects on Heme Oxygenase-1(HO-1) and Nitric Oxide Synthase(NOS) enzymes in a rat model of SCI.

**Materials and methods:** Thirty-three adult female Wistar albino rats were randomly allocated to Sham Group S, n=3, Ischemia Group I, n=10, EPO Group E, n=10, Methylprednisolone(MP) Group M, n=10. Laminectomy at thoracic 6-10 were performed in all rats. We used clip compression method that mimic spinal cord injury in all rats in the other three groups and 3 minutes compression was applied by 11mm clips with 70 gr pressure. 5000 U/kg i.p recombinant human EPO (r-hEPO) was administered in Group E, and 30 mg/kg i.p MP was administered in the Group M in the beginning of reperfusion. Spinal cord samples were taken after 2 hours and HO1 and nitrite (NO<sub>2</sub><sup>-</sup>) ve nitrate (NO<sub>3</sub><sup>-</sup>) levels were assessed biochemically.

**Results and discussion:** Experimental studies and clinical observations have shown that significant expansion of damage and extending of paralysis to

higher segments after spinal cord injury is the consequence of further destruction by secondary insult. Among the experimental animal models, clip compression method is the best model that mimic the spinal cord injury in humans.

HO-1 activity was significantly higher in the Group I compared to Group S but there were no significant difference between Group S and Groups M and E. Mean  $\pm$  Std Dev of **HO-1 activity** was  $0,47 \pm 0,0265$  in **Group S**;  $0,903 \pm 0,348$  in **Group I**;  $0,675 \pm 0,254$  in **Group M** and  $0,656 \pm 0,195$  in **Group E**. There were no significant differences between groups when nitrite/nitrate levels were compared.

**Conclusion:** In this study we showed that EPO exerts its neuroprotective activity in pathways other than nitric oxide synthase and heme oxygenase 1 pathways.

## 7AP6-8

### Ultrastructural changes in the brain cells after discontinuation of sevoflurane anesthesia in rats

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**Background and Goal of Study:** Though there have been questions about where in the nervous system inhaled anesthetics exist and act, and the nature of the biologic interaction between an anesthetic and a substrate that requires an ability to measure anesthetic effects (1), there is no single, accepted answer. To approach to an answer of these questions, we examined the ultrastructural changes in the brain cells after sevoflurane anesthesia.

**Materials and methods:** We divided SD rats into sevoflurane group and control group. Spontaneously breathing rats were anesthetized with 3% sevoflurane, 33% oxygen in nitrogen for 6 h in the sevoflurane group. Just after the end of anesthesia, the chest was opened under intraperitoneal (IP) pentobarbital injection. A catheter was inserted through the apex of the left cardiac ventricle and advanced into the ascending aorta for infusion of 0.1 M cacodylate buffer (pH 7.4). The right atrium was inserted to drain the perfusion fluid. These were postfixed in 2% glutaraldehyde solution in 0.1 M cacodylate buffer. The brain was removed and embedded in Epon, and ultrathin sections were made. These were stained with lead citrate and uranyl acetate and were observed in a transmission electron microscope (H-7650, HITACHI, Tokyo, Japan). Control group rats were anesthetized with IP pentobarbital. The other treatments were same as the sevoflurane group.

**Results and discussion:** In the sevoflurane group, there were many degeneration cells with atrophic nuclei in both cerebral cortex and hippocampus. Perivascular glial cells showed swelling and pressing of vessels, which caused narrowing of vessels. There were many particles of various electron densities in cytoplasm of perivascular cells. Fluorescent granular perithelial (FGP) cells (2), tissue macrophages of brain in close contact with cerebral blood vessels, phagocytized round-shaped nonstructural particles. These changes as described above were not found in the control rats.

**Conclusion(s):** We found many degeneration cells with atrophic nuclei and particles in both cytoplasm of perivascular cells and in FGP cells after sevoflurane anesthesia. These findings suggest that the particles are likely sevoflurane existing in cytoplasm and acting in various organelle.

#### References:

1. Eger EI, et al. *Anesth Analg* 84: 915-8, 1997.
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## 7AP6-9

### Differential impact of phenytoin and phenobarbital administration on the developing brain in rodents

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**Background and Goal of Study:** Many experimental studies performed in infant animals have shown that drugs commonly used in pediatric population may produce negative long-term behavioral consequences. It is beyond doubt that administration of certain antiepileptics and anesthetics during the period of rapid synaptogenesis produces profound alternations in the developing brain by influencing neurogenesis, apoptosis, cell proliferation and synaptic plasticity in animal models<sup>1</sup>. Adverse effects of the drugs studied so far include impaired performance in various spatial learning and behavioral tasks, as well as a decrease in seizure threshold, which could result in facilitated

epileptogenesis<sup>2</sup>. However, clinical studies in infants and young children, who were exposed to potentially neurotoxic drugs, have either reported long-term deficits in learning and behavior or no effects at all. It is therefore mandatory to

answer the question of whether antiepileptic or anesthetic use in pediatric patients poses a risk to their development.

**Materials and methods:** The experimental protocol was approved by the Ethical Committee of the Medical University in Lublin, and all the procedures were in compliance with the European Communities Council Directive of 24 November 1986 (86/609/EEC). All experiments were carried on Wistar rats. To test long-term effects of treatment with drugs, which induce apoptosis and suppress neurogenesis in the developing brain, we treated male rats with either phenobarbital or phenytoin during the first two postnatal weeks and evaluated them on the Morris water maze at the age of 3 months.

**Results and discussion:** Our results show, that administration of phenobarbital, but not phenytoin results in impaired learning and memory in adulthood. Rats exposed to phenobarbital also displayed a slower weight gain during the first 30 days of life, as compared to controls and phenytoin-treated litter mates.

**Conclusion(s):** These findings show that drugs producing increased apoptosis and suppressed neurogenesis in the infant animals may be responsible for diverse long-term behavioral consequences in the adult life.

#### References:

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**Acknowledgements:** This study was financed by the Polish Ministry of Science and Higher Education.

## 7AP6-10

### Cerebral oxygenation monitoring using NIRS with the INVOS monitor in the prone position results in lower measured values at normoxia and hypoxia

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**Background and Goal of Study:** Non-invasive regional cerebral oxygenation (RcO<sub>2</sub>) is widely monitored using near infra-red spectroscopy (NIRS). Patients subjected to surgery in the prone position may require this monitoring, however, none of the monitors has been validated for use in this position. Our objective was to assess the performance of the INVOS cerebral oxygenation monitor in the prone position.

**Materials and methods:** Ten healthy volunteers were monitored with the INVOS while breathing 21% oxygen, an hypoxic mixture delivered to achieve a SpO<sub>2</sub> of 90% and 50% O<sub>2</sub>. While breathing at normoxia or hypoxia they were asked to either normoventilate, hyperventilate, or hold their breath. Ethics committee and informed consent were obtained. Statistics used two-way paired t-test and regression analysis. Data are mean $\pm$ SD.

**Results and discussion:** Average FiO<sub>2</sub> to achieve a SpO<sub>2</sub> of 90% was 13%. At 21% O<sub>2</sub>, SpO<sub>2</sub> was  $99,57 \pm 0,4\%$  (supine) and  $99,3 \pm 0,7\%$  (prone) ( $p=0,04$ ). Also at 21% O<sub>2</sub>, RcO<sub>2</sub> was  $66 \pm 9,0\%$  in the supine position and  $58,4 \pm 11,7\%$  in the prone position ( $p=0,0005$ ). With the hypoxic mixture SpO<sub>2</sub> decreased to 89% in both positions while RcO<sub>2</sub> also decreased significantly in the ventral ( $54,8 \pm 3$ ) vs the supine ( $55,1 \pm 3$ ) ( $p < 0,05$ ). At 50% O<sub>2</sub> there were no differences between the positions at any FiO<sub>2</sub> level. For both positions at 21%, hypoxia and 50% O<sub>2</sub> there was a strong correlation between SpO<sub>2</sub> and RcO<sub>2</sub> ( $p < 0,01$  and  $R^2=0,11$ ). None of the volunteers showed any clinical signs of cerebral hypoxia or any side effects.

**Conclusion(s):** Our results suggest that positioning in the prone position may alter the measurements made by the INVOS monitor resulting in lower readings. The low readings obtained in the prone position most certainly do not reflect lower cerebral oxygenation and seem to represent an artifact of the monitor. The fact that in the supine position a correlation between SpO<sub>2</sub> and RcO<sub>2</sub> is maintained, suggests that the monitor keeps the ability to discriminate, but does so with an offset of the baseline. This could be due to changes in the venous component of blood related to venous stasis or to a change resulting from the fact that the sensors are pressed against the forehead and not in direct contact with room light. It seems appropriate to obtain a baseline for RcO<sub>2</sub> by placing the patient in the supine position while still awake.

## 7AP6-11

### indoleamine 2,3-dioxygenase, as a pre-operative inflammatory markers, is associated with the risk of postoperative learning and memory impairment in rats

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**Background and Goal of Study:** Pathophysiological mechanisms leading to learning and memory impairment are not clear. Age is a known risk factor and hypothesized to be accompanied by a low-grade inflammatory state and an activation of increased indoleamine 2,3-dioxygenase (IDO). IDO is a rate-limiting enzyme of kynurenine pathway, which converts tryptophan into kynurenine in extrahepatic tissues, may contribute to cognitive impairment. In light of the ageing/inflammation theory, we investigated the association of IDO with learning and memory impairment in adult and elderly rats.

**Materials and methods:** Male Sprague-Dawley rats (5-month-old adult rats

and 24-month-old elderly rats) were randomly assigned into two groups: 40% oxygen inhalation, left nephrectomy under 1.8% isoflurane anaesthesia. Cognitive function was assessed daily in Y maze. Levels of IDO, tryptophan and kynurenine in plasma were determined pre-operatively and at 6 hour, 1, 3 and 7 days after treatment by using ELISA and HPLC.

**Results and discussion:** Levels of IDO and IDO activity, determined by the ratio of tryptophan and kynurenine in plasma, is higher in elderly rats than adult's rats before surgery and at 1, 3 days after surgery, which returned to normal levels at 7days after surgery. Nephrectomy plus isoflurane increased levels of IDO and IDO activity, and finally induced cognitive impairment. These data show that indoleamine 2,3-dioxygenase may be as a post-operative learning and memory impairment marker, to predict the risk of postoperative learning and memory impairment in rats.

**Conclusion:** These results suggest the potential role of IDO pathway in POCD pathogenesis, pending on further studies.

#### References:

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2. Gong CY, Li Z, Wang HM, et al. Targeting the kynurenine pathway as a potential strategy to prevent and treat Alzheimer's disease. *Med Hypotheses* 2011; **77**: 383-5
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## Regional Anaesthesia

### 8AP1-1

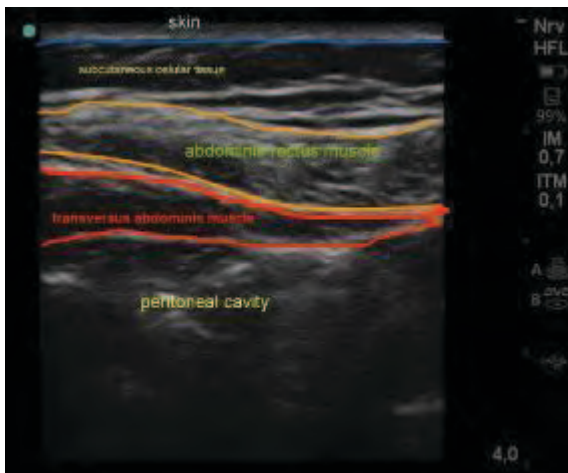
#### Providing abdominal wall relaxation and spontaneous ventilation in a critical ill patient with bilateral continuous subcostal TAP block

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**Background:** Transversus abdominis plane (TAP) block is known to be effective for abdominal surgery analgesia and was recently described as a sole anesthetic technique with conflicting results. This report aims to present a case in which ultrasound-guided bilateral continuous subcostal TAP block was performed in a high-risk patient and discuss its implications.

**Case report:** A 77-year-old woman, 50Kg, ASA 4, who had undergone a subtotal gastrectomy complicated with severe intra-abdominal sepsis requiring midline laparotomy was scheduled for laparostomy wound closure. Past medical history included arterial hypertension, chronic renal failure and myocardial infarction. She was in the ICU for 2 weeks with reported difficulty in weaning from mechanical ventilation. Prescription included enoxaparin 40mg daily, last dose being administered 8h before. In the operating room, patient was conscious, breathing through a T-piece with stable vital signs. After premedication with 50ug fentanyl and 1mg midazolam, ultrasound-guided bilateral continuous subcostal TAP block<sup>1</sup> was performed with 40ml 0.5% ropivacaine. Loss of sensation was demonstrated over T6-T10 dermatomes.



[Fig.1]

Sedation was provided with 0.3 MAC sevoflurane and patient breathed spontaneously throughout an uneventful surgery lasting 105 minutes. She returned to ICU with a visual analogue score for pain (VAS) 0/10. A 72h 0.2% ropivacaine continuous infusion (5mL/h) plus paracetamol and rescue morphine PCA were prescribed. In the 3-day follow-up she was extubated with average VAS 0/10 (rest) and 2-3/10 (motion). No opioid boluses were registered. Transfer to the ward occurred on the 4<sup>th</sup> postoperative day.

**Discussion:** We believe this is the first continuous subcostal bilateral TAP block using a two point injection technique for anaesthesia and postoperative analgesia in a difficult-to-wean ICU patient with severe comorbidities in whom mechanical ventilation should be avoided and neuroaxial anesthesia was contraindicated. Sedation was added to relieve anxiety and avoid possible consequences of peritoneum manipulation. Effective analgesia was essential for favorable ventilatory mechanics and early extubation.

#### References:

- 1-Hebbard P. *Anesth Analg* 2008;106:674-5.

**Learning Points:** Continuous TAP block with a low sevoflurane concentration provided abdominal wall relaxation without neuromuscular blockers, spontaneous ventilation, hemodynamic stability and opioid sparing postoperative analgesia, manifestly valuable in ICU settings.

### 8AP1-2

#### Two level - thoracic and lumbar epidural anaesthesia - an exclusive choice for latissimus dorsi free flap

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**Background:** The term of "free flap" is used to describe flaps that are completely detached from the body and reattached at a distant site using microsurgical techniques for vascular anastomoses. Anaesthetic management directly influences the viability of transferred tissues through the changes in central haemodynamics and regional blood flow.

**Case report:** A 48 year-old (70kg, 170cm), ASA I patient with a vicious stump of the right lower leg was proposed for a musculocutaneous latissimus dorsi free flap. Regional anaesthesia was selected as exclusive choice and informed consent was obtained from the patient. The techniques used depended on the stages and site of surgery. Unilateral spinal anaesthesia with 8 mg hyperbaric Bupivacaine 0.5% was followed by lumbar epidural block with 7 ml Ropivacaine 1% for the preparation of the recipient site; thoracic epidural anaesthesia with 13 ml Ropivacaine 1% plus 50 µg Fentanyl, with additional 6 ml Ropivacaine 1% 90 minutes later for the flap rising; and finally, lumbar epidural anaesthesia with 8 ml Ropivacaine 1%, and 120 minutes later an additional 4 ml for covering the defect and microvascular sutures. Two catheters were inserted at L2-L3 and T5-T6 interspaces and were advanced cranially



by a maximum of 3-4 cm into the epidural space. During 9 hours of surgery we injected neuraxially a total of 8 mg hyperbaric Bupivacaine 0.5%, 380 mg Ropivacaine 1% and 50 µg Fentanyl.

**Discussion:** The aim of this paper was to evaluate the exclusive use of regional anaesthesia for latissimus dorsi free flap. We chose Ropivacaine for its advantages vs Bupivacaine: its lower cardiovascular and central nervous system toxicity allows the use of higher concentrations and doses, and its fast onset. Pulseoximetry, ECG, noninvasive blood pressure, heart rate, body temperature and urine output were monitored continuously. Haemoglobin, haematocrit and arterial blood gases were checked every 3 hours. Postoperative analgesia was provided with continuous Ropivacaine 0.2%. No intra- and postoperative side-effects were noted.

**Learning Points:** In our case of latissimus dorsi free flap exclusive regional anaesthesia was an efficient and safe alternative to general anaesthesia; it provided intra- and postoperative analgesia and vasodilatation, it prevented vasospasm, reduced the incidence of deep venous thrombosis, and thus contributed to a successful surgery.

### 8AP1-3

#### Selective nerve block as a part of management in patients with tendon injury - case series

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**Background:** Injury of hand tendons often results into its malfunction which impairs the patient's quality of life. Surgical treatment with teno- and adhesiolysis often remains the only way of treatment. During the surgery identification of the main functional problem could be especially difficult, because of the presence of adhesions and other tissue changes. Regional anaesthesia - particularly selective peripheral nerve blocks (sPNB) - preserving patient's active motion may be the solution.

**Case report:** We would like to describe a method of sPNB in 15 patients, who underwent hand surgery due to its malfunction after tendon trauma. The blocks were performed with combination of ultrasonographic navigation and nerve stimulation. sPNB were applied to the distal (sensoric) parts of nerves. Patients were asked to flex and extend fingers during the operation to assess the effect of tenolysis. The sPNB was successfully used in all of the patients and each of them was able to flex/extend fingers during surgery as needed. At the end of the procedure considerable improvement of the range of the motion was present in all patients.

**Discussion:** Distal nerves blocks are usually used as a rescue technique to support insufficient upper brachial plexus blocks. Only anecdotal references describe application of these blocks for hand surgery.<sup>1,2</sup> There is no reference concerning sPNB as an anaesthetic technique preserving patient's active motion during the surgery. One article describes application of continuous sPNB for early rehabilitation.<sup>3</sup> Our case-series shows, that sPNB could contribute to successful treatment of patients with hand trauma.

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3. BROEKHUYSEN, C. L.; et al. Feasibility of Forearm The Use of a Selective Peripheral Median Nerve Block for Pain-Free Early Active Motion After Hand Surgery. *The J. of Hand Surg.*, 2006, vol. 31, no. 5, p. 857-859.

**Learning Points:** sPNB as anaesthetic technique for hand surgery could contribute to better surgical functional results in patients with tendon trauma and thereby could improve quality of their life.

### 8AP1-4

#### Ultrasound-guided phrenic nerve block for CT-guided percutaneous lung biopsy

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**Background:** CT-guided percutaneous lung biopsy allows radiologists to achieve a correct diagnosis of lung nodules (1). Lung biopsy of small lung nodules in the lower lobes or the diaphragmatic pleura is difficult due to diaphragm motion and often leads to sampling errors and complications (2). Phrenic nerve block (PhNB) may be useful in these cases. We report two cases of an in plane ultrasound (US)-guided PhNB to perform CT-guided percutaneous lung biopsy while paralyzing the homolateral diaphragm.

**Case 1:** A 70-year-old man had a right diaphragmatic pleural nodule. A right-sided in plane US-guided PhNB was performed with lidocaine 2%, 2 mL. US and CT evaluation showed a completed paralysis of the right diaphragm. The patient did not refer dyspnoea. There were not relevant changes in RR, ETCO<sub>2</sub>, SpO<sub>2</sub> (FiO<sub>2</sub> 0.28), ABP or ECG. With the patient in prone position, CT-guided percutaneous biopsy was performed 30 min after the PhNB. Estimated right diaphragm paralysis was 90%. CT showed a minimum pneumothorax that did not progress. PhNB reverted totally after 1h. A solitary fibrous tumour of the pleura was diagnosed.

**Case 2:** A 33-year-old woman presented a pulmonary infiltrate in the right inferior lobe. Mepivacaine 1%, 2 mL, was used for the US-guided PhNB achieving a complete paralysis of the right diaphragm. The patient developed a Horner's paralysis and hypoesthesia of the right arm. No other clinical or monitoring alterations were registered. A biopsy was performed in the prone position without pulmonary complications achieving a correct diagnosis (vasculitis). PhNB reverted after 1h and the Horner's syndrome and hypoesthesia disappeared in a few hours.

**Discussion:** An US-guided in plane PhNB is feasible for paralyzing the homolateral diaphragm. A total paralysis of the hemidiaphragm is not needed for an effective and safe CT-guided lower lung lobes or diaphragmatic pleural biopsy. Blockade of the stellate ganglion and brachial plexus can occur. An individualized indication of PhNB must be done in patients with reduced FRC. Monitoring and oxygen supply are mandatory.

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1. AJR Am J Roentgenol. 2009;193:1228-35.
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**Learning points:** The US-guided PhNB may lead to improve the success of the CT-guide lung biopsy and reduce the risk of pulmonary complications especially in nodules located in the lower lobes or close to the diaphragm.

### 8AP1-5

#### Epidural anesthesia for nephroureterectomy in a patient with spinobulbar muscular atrophy (Kennedy's disease)

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**Background:** Spinal and bulbar muscular atrophy (Kennedy's disease) is a rare lower motor neuron disorder that causes generalized muscle weakness. We describe the anesthetic management, with epidural anesthesia, of a patient with Kennedy's disease that presented for open nephroureterectomy, a procedure that is usually performed under general anesthesia.

**Case report:** A 69-year-old man with spinal and bulbar muscular atrophy was scheduled for left open nephroureterectomy. He presented muscular atrophy, weakness, dysarthria, dysphagia, tremor and fasciculations of the tongue and facial muscles. Two weeks before, spinal anesthesia had been administered for ureteroscopy, and no complications were reported. After discussion with the patient, an epidural anesthesia was performed, with the catheter placed at the L1-L2 vertebral interspace after premedication with midazolam (2 mg). Anesthesia was obtained with a solution of ropivacaine 0.75% and fentanyl (100 µg), with a sensory block extending to T5, complemented with mild sedation using propofol (20 mg single bolus). Post-operative pain was controlled with paracetamol, tramadol and an epidural infusion of ropivacaine. The perioperative course was complicated by a prolonged ileus and respiratory infection.

**Discussion:** Kennedy's disease is a rare, X-linked disorder of the lower motor neuron, caused by a CAG trinucleotide expansion of the androgen receptor (AR) gene. The pathogenic AR accumulates in the motor neurons and exerts a toxic effect<sup>1</sup>. There is an increased risk of pulmonary aspiration and post-operative respiratory complications, and epidural anesthesia can be a safer alternative in the anesthetic management of these patients<sup>2,3</sup>.

**References:**

1. Finsterer J. Perspectives of Kennedy's disease. *J Neurol Sci* 2010; 298(1):1-10
2. Niesen AD, Sprung J, Prakash YS, Watson JC, Weingarten TN. Case series: anesthetic management of patients with spinal and bulbar muscular atrophy (Kennedy's disease). *Can J Anesth* 2009; 56(2):136-141
3. Okamoto E, Nitahara K, Yasumoto M, Higa K. Use of epidural anaesthesia for surgery in a patient with Kennedy's disease. *Br J Anaesth* 2004; 92(3):432-3

**Learning points:** Anesthesiologists should be aware of the complications that may result from neuromuscular dysfunction in patients with spinal and bulbar muscular atrophy. Coordination with the surgeon and cooperation of the patient are fundamental for the safe administration of epidural anesthesia for nephroureterectomy.

**8AP1-6****Management of unpredictable higher level of block following psoas compartment block (PCB)**

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**Background:** Psoas Compartment Block (PCB) is proved to be effective as a locoregional technique for analgesia after hip surgery\*. Serious complications of PCB were already described. The risk of these complications could further increase in patients who had back surgery. We report a case of unexpected higher level of bilateral block to a level of (T6) in a patient who had spinal surgery following PCB.

**Case report:** A 57-year-old obese gentleman with high BMI was posted for Resurfacing of Hip and Revision Hip Arthroplasty. He had a laminectomy at lumbar level. He was allergic to Morphine and morphine products. General Anaesthesia (GA) with PCB was chosen. GA induced with standard doses of induction agents and airway secured with LMA. PCB with 30 ml 0.42% Levobupivacaine was administered. During the middle of operation more than expected hypotension was noticed which was treated with fluids, vasopressors and blood. During the surgery he lost around 1500 ml of blood loss. The block was assessed in recovery He had complete motor block in both legs and sensory loss till T 6 level. The possibilities of epidural spread, cord compression, total spinal was considered for differential diagnosis. He was observed closely with special precautions. The block remained effective for another 12 hours. Pain relief was provided with PCA using Pethidine. Patient recovered fully from PCB.

**Discussion:** GA with PCB with back up PCA using Pethidine was chosen in view of his earlier back surgery. The higher level of bilateral block up to level T6 could probably be explained due to epidural spread. The possibility of total spinal and Cord compression secondary to haematoma were also considered for differential diagnosis and appropriate instructions were given to monitor it. Serious complications of a PCB include Epidural spread (3 and 27%)\*, Total spinal anaesthesia and Systemic toxicity (central nervous system/cardiac)\*\*. Spinal surgery further removes the barriers of spread of local anaesthetic and increases the risk of these complications.

**References:**

\*Review Article The Psoas Compartment Block for Hip Surgery: The Past, Present, and Future M. A. de Leeuw, 1 et.al, Anesthesiology Research and Practice Volume 2011, Article ID 159541,

\*\*Psoas compartment block, Stephen Mannion, CEACCP | Volume 7 Number 5 2007

**Learning points:** High vigilance and appropriate monitoring of serious complications is needed if PCB is given to patients who had earlier spinal surgery.

**8AP1-7****Anaesthetic management of a patient with Hunter syndrome**

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**Background:** Hunter syndrome is a rare, X-linked, progressive lysosomal storage disease in which patients are deficient in the lysosomal enzyme iduronate-2-sulfatase (I2S). In the absence of sufficient enzyme activity, glycosaminoglycans (GAG) accumulate in the lysosomes of many tissues and organs which explain the multiorgan involvement of the disease<sup>(1)</sup>. The disease has a very heterogeneous phenotype but all patients experience somatic involvement which can include facial dysmorphism, enlarged liver and spleen, stiff joints and contractures in the major articulations, cardiac involvement and upper-airway obstruction.

**Case report:** A 22 year old man, ASA III, with severe Hunter syndrome including cardiac, pulmonar and skeletal involvement was scheduled for total hip replacement. The patient had Mallampati III score, limited mouth opening,

enlarged tongue and diminished cervical mobility. He presented no neurological symptoms.

Monitorization was according to ASA standards. No pre-medication was used. Combined spinal epidural block was performed in the L3-L4 space and 6 mg of 0.5% isobaric levobupivacaine with 2 µg of Sufentanyl were injected in the subarachnoid space. The epidural catheter (18G) was introduced four centimeters in the cephalad direction. A bolus of 18.75 mg of 0.5% ropivacaine was administered through the catheter one hour after the subarachnoid block. Vasopressors and atropine were not used. No incidents occurred during surgery. The surgery lasted two hours and ten minutes. The patient was discharged to post anesthesia care unit.

**Discussion:** Respiratory problems and complications related to general anesthesia are life-threatening involvements related to Hunter Syndrome. Local or regional anaesthetic techniques may be unsuitable as the sole form of anaesthesia in these patients because they may fail as a result of deposition of mucopolysaccharides (MPS) in the nervous system. These patients require a multidisciplinary approach in order to optimize cardiac and pulmonary function and for a careful evaluation of the airway. In the present case, no neurologic deficits were reported in the patient history, regional anaesthesia was chosen to avoid any cervical manipulation and airway approach. The subarachnoid block was performed with success providing good surgical conditions.

**References:**

1. Pediatrics. 2009 Dec;124(6):e1228-39

**8AP1-9****Peribulbar block: a safe alternative in myasthenia gravis?**

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**Background:** Myasthenia Gravis (MG) is characterized by changes in the neuromuscular junction, due to antibodies directed to the nicotinic acetylcholine receptor of the postsynaptic membrane (1). The purpose of this clinical case is to demonstrate the safety and efficacy of peribulbar block (PB) with Ropivacaine avoiding serious postoperatively respiratory complications.

**Case report:** A 64 years old female with moderate MG, was proposed for posterior vitrectomy + membrane peeling. She reported transitory ptosis without diplopia. Plan anesthesia was done with PB with Ropivacaine 10mg/ml with. The patient did not do any anesthesia premedication. We carried out the instillation of eye drops (oxibuprocaina 0.4%) and performance the BP through three approaches with a needle of 22 mm and 27 G: infero-external (2ml), superior-internal (1.5 ml) and caruncle (0.5 ml).

After blocking, it was held manual massage of the eyeball (GO) and obtained sensory and motor block. After surgery it was applied a bag cold serum on the GO.

The effectiveness of this technique resulted in good operating conditions with hemodynamic stability and without other analgesics in the first 24 hours post-operative. After 24 hours still had slight ptosis, disappearing after 36 hours.

**Discussion:** Regional anesthesia is the first option in MG (1). Anxiolytics, sedatives and other opioid analgesics should be avoided and if is necessary another analgesic, anti-inflammatory drugs are the first choice (2). Regarding the local anesthetic (LA) lidocaine is contra-indicated and ester anesthetics should not be used (2). It is recommend the use of anesthetics of amide type and always at the lowest possible dose (2). We recommend the dispersion of the AL with manual pressure and not with the Honan balloon and avoidance of heat prevents the onset myotonic crisis (2). Although the literature is not consensual, we did not suspended the anti-cholinesterase medication (2)

**References:**

Stoelting Anesth. and Co-Existing Disease 2. Rev Assoc. Med Hosp ABC 2003

**Learning points:** There are no specific recommendations for peribulbar block in these patients, although it seems that is a safe and effective anesthetic and analgesic technique. Due to the greater sensitivity to local anesthetics, it should be given minimal and serial doses of ropivacaine to allow successive evaluation of the motor block.

## 8AP1-10

### Epidural anaesthesia in patient with Strumpell Lorrain disease

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**Background:** Strumpell-Lorrain disease - also known as hereditary spastic paraplegia (HSP) - comprises a group of rare neurological disorders affecting mainly the higher motor neurons, mainly characterized by variable degrees of stiffness and weakening of the muscles of the legs, muscle spasms, and bladder control problems.(1)

Patients with neurological diseases pose a challenge when planning anaesthesia, and there are practically no studies in the literature on the safety of general anaesthesia versus regional anaesthesia in this disease.

**Case report:** A 50 year-old man, ASA II E, proposed for urgent repair of femoral neck fracture.

Obese (BMI=30,5) and HSP for 26 years, autonomous but with neurological deficits (loss of strength in the lower extremities and neurogenic bladder), treated with baclofen 25mg t.i.d. Mallampati IV, neck circumference >50cm, decreased neck extension. Preoperative laboratory test showed no alterations.

We opted for an epidural anaesthesia under standard monitoring. We placed a 18-G Tuohy needle in the midline at the L4-5 interspace, and T10 sensory block level was obtained after 2 bolus of levobupivacaine 0,5% 25mg + 15mg. Surgery lasted 50 minutes without complications. Epidural catheter was removed before discharge from the unit of post anaesthetic care. Postoperative pain was well managed with anti-inflammatory analgesic drugs.

The patient was discharged home after 7 days, walking with crutches and without worsening of pre-existing neurological deficits.

**Discussion:** A PubMed literature search with the keywords "Strumpell-Lorrain", "hereditary spastic paraplegia" and "anaesthesia" yielded a very limited number of articles, mainly in the field of obstetric anaesthesia.

In this case, due the existing neurological deficits, the possibility to have a difficult airway and surgery may be performed with a loco-regional anaesthesia. We chosen the epidural anaesthetic technique by the advantages of the superior control on the level of sensory blockade with minimal hemodynamic implications. The option of not use hypnotics or opioids, aimed to lower the pharmacological interference with the central nervous system.

We report this case, where despite a conservative attitude was always maintained the safety and comfort of the patient without causing any deterioration in its underlying pathology.

#### References:

1. Rev Bras Anesthesiol. 2013;63(1):113-118

**Learning points:** This case suggests that epidural anaesthesia is a valid and safety option in patients with HSP

## 8AP2-1

### Effectiveness of peripheral nerves blocks on postoperative pain control in thumb arthroplasty outpatient surgery

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**Objective:** To analyze the efficacy of selective ultrasound peripheral median and radial nerve blocks with levobupivacaine 0.125% to improve postoperative pain control for thumb arthroplasty surgery.

**Methods:** Randomized controlled trial in 80 patients undergoing elective ambulatory surgery to treat trapeziometacarpal osteoarthritis. Patients were randomly allocated into two groups: R (n=40) underwent ultrasound guide median and radial nerve blockade performed postoperatively at the elbow with 5 ml of levobupivacaine 0.125% around each nerve; and C (n=40) received no additional blocks. Anaesthetic techniques (axillary brachial plexus block with mepivacaine 1% 20ml) and analgesia regimen prescribed at discharge (dexametoprolen plus tramadol for rescue analgesia) were the same in both groups).

Patients telephoned by a nurse 24h and 48h postoperatively. Recorded mean variables were: pain at discharge, postoperative pain until 48h by means of visual analogue scale (VAS), VAS maximum at 24-48h, recovery time from sensory block, need for rescue analgesia and incidence of nausea and vomiting.

**Results:** Groups were homogeneous for demographic and surgical characteristics. Patients in group C had significantly more pain (p< 0.001) at discharge (VAS 1.1 +/-1.5 versus 0.1 +/- 0.6), on call 24h (VAS 4.3 +/-2 versus

1.3 +/-1.3) and maximum pain during first 24h (VAS 7.1 +/-2 versus 2.9 +/-1.5). At 48h, we observed the same differences: on call 48h (VAS 2.8 +/-1.5 versus 0.8 +/-1.1) and maximum pain on the second day (VAS 5.5 +/-2.1 versus 2 +/-1.4). Maximum pain level appeared at 24 h postoperatively. Patients in group C required more rescue analgesia until 48h; p< 0.001 (67.5% versus 17.5% at 24h and 62.5% versus 15% at 48h) and had a higher incidence of nausea and vomiting until 48h; p< 0.05 (50% versus 7.5% at 24h and 30% versus 7.5% at 48h). Sensory time recovery after peripheral nerve blocks was 10 hours.

**Conclusions:** Postoperative nerve blocks with long acting anaesthetics at the elbow provide effective postoperative analgesia in outpatient hand surgery, comparing with NSAID with tramadol rescue regimen.

#### References:

1. Lin E et al. Peripheral nerve blocks for outpatient surgery: evidence based indications. Curr Opin Anaesthesiol 2013;26:467-74.

2. McCarthey CJ et al. Evidence basis for the use of ultrasound for upper-extremity blocks. Reg Anesth Pain Med 2010;35:S10-S14.

## 8AP2-2

### A randomized comparison of infraclavicular and axillary continuous peripheral nerve blocks for postoperative analgesia

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**Background:** In this prospective, randomized study, we tested the hypothesis that ultrasound guided continuous infraclavicular perineural catheter provides superior analgesia for elbow arthrolysis compared with an axillary perineural catheter, with lower post-operative VAS and lower incidents of catheterization-related complications.

**Materials and methods:** Total 80 elbow stiffness patients scheduled for elbow release surgery were randomly assigned to receive a brachial plexus perineural catheter in either the infraclavicular or axillary location using an ultrasound-guided nonstimulating catheter technique. Catheters were advanced blindly 3cm beyond needle tip. 1%lidocaine 40mL was administered and sensory block of all the four nerves within 15 minutes was defined as success. All surgery was conducted under general anaesthesia.

Postoperatively, subjects were discharged ward with a portable pump (250mL reservoir) infusing 0.2% ropivacaine (basal rate of 5mL/hr; 5mL bolus dose; 20min lockout interval). Cathetering procedure time, pain level and side effects during needle insertion were recorded. Post-operative VAS, motor block incidence were assessed respectively at 24h,36h and 48h. Range of motion(ROM) percentage of the elbow joint on POD3, patient satisfaction and were recorded.

**Results:** All perineural catheters were successfully placed. The time of catheter insertion was significantly shorter in the IF group than in the AX group. (155.05±4.77s versus 218.75±9.18s, P=0.018 ) and incidence of side effect including fluid leakage at site and nerve paresthesia was 2 and 5 in infraclavicular group vs 18 and 12 in axillary group ( P=0.001, P=0.050). Both groups reported average inserting pain as mild (P=0.591). There was no significant difference in the rest VAS at the three postoperative observe points, however, the infraclavicular group reported lower motor VAS as median 1.1 at 36h (P=0.001) and mild 0.7 at 48h (P=0.001). Although with a longer duration and wider distribution of motor block, the infraclavicular group got superior ROM improvement, similar patient satisfaction and no catheter dislocation or occlusion.

**Conclusion(s):** Compared with axillary perineural catheter, ultrasound guided continuous infraclavicular perineural catheter provides superior analgesia for elbow arthrolysis, with shorter catheter insertion time ,better operation and management facility, lower post-operative motor VAS and better elbow ROM improvement.

## 8AP2-3

### Ultrasound-guided continuous infraclavicular nerve block for analgesia after elbow release surgery - a comparison of medial and lateral approach

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**Background:** Although the comparison of the medial and lateral technique for single-injection ultrasound guided infraclavicular block is well established, no controlled study of it is available, and the relative risks and benefits remain unknown. In this randomized study, we compared the lateral (LIT) and medial (MIT) puncture sites for continuous infraclavicular block (CINB), with respect to catheterization facility and analgesia quality for elbow release surgery.



**Materials and methods:** Forty patients undergoing elbow release surgery were randomly assigned to receive ultrasound-guided CINB either with the lateral puncture inferior to the coracoids process (lateral group, n=20) or the medial one at the apex of the delto-pectoral groove (medial group, n=20). Catheters were advanced blindly 3cm beyond needle tip. 1% lidocaine 40mL was administered and sensory block of all the four nerves within 15 minutes was defined as success. All surgery was conducted under general anesthesia. Postoperatively, subjects were discharged ward with a portable pump (250mL reservoir) infusing 0.2% ropivacaine (basal rate of 5mL/hr; 5mL bolus dose; 20min lockout interval). Cathetering procedure time, ultrasound anatomy structure character and side effects during needle insertion were recorded. Post-operative VAS was assessed respectively at 24h, 36h and 48h. Range of motion (ROM) percentage of the elbow joint on POD3 (gold standard for surgery effect), patient satisfaction and were recorded.

**Results:** All catheters were successfully placed. Cathetering procedure time was 200.45±6.71s in LIT and 233.0±4.47s in MIT (P=0.811). LIT had higher nerve paresthesia incidence but lower risk of fluid leakage at site (62.5% versus 37.5%, P=0.347; 10% versus 40%, P=0.032), besides, more stable position of the nerve cords and less amount of veins within the puncture path ensured its catheterization facility. MIT had more perfect block for cutaneous brachii medialis N, while LIT for axillary N. There were no significant differences in pain scores, improvement of ROM percentage, incidence of catheter occlusion or dislocation and patient satisfaction between the two groups.

**Conclusion(s):** In CINB under ultrasound guidance, LIT had more clear and stable anatomy structures, facilitating the catheterization operation and lower the side effects of catheter insertion while providing a similar quality of analgesia after elbow release surgery as compared with MIT.

## 8AP2-4

### Evaluation of side effects of dexmedetomidine on axillary brachial plexus block in rats

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**Background and Goal of Study:** Peripheral nerve blocks have frequently used in a variety of surgical procedures for surgical anesthesia and postoperative pain. Long-acting local anesthetics alone provide analgesic action for 9-14 h. Dexmedetomidine, an  $\alpha_2$ -adrenoceptor agonist, exhibits anti-nociceptive actions at the spinal cord, and enhances the effects of local anesthetics in the peripheral nervous system. The side effects of dexmedetomidine on brachial plexus block were investigated using rats.

**Materials and methods:** Dexmedetomidine was injected directly to the axillary brachial plexus after anesthesia with Zoletil 50<sup>®</sup>. The animals were sacrificed at 6 h, 12 h, and 24 h after dexmedetomidine administration. For this study, hematoxylin & eosin (H & E) staining, terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling (TUNEL) assay, immunohistochemistry for caspase-3 and neurofilament, and western blotting for Bax, Bcl-2, nerve growth factor (NGF) were performed.

**Results and discussion:** Morphological alterations and neurofilament-positive density in the brachial plexus were not observed by dexmedetomidine administration. Dexmedetomidine treatment enhanced anti-apoptotic tendency at 6 h and 12 h after dexmedetomidine administration, whereas, anti-apoptotic effect was decreased at 24 h after dexmedetomidine administration. Furthermore, NGF expression was increased at 6 h after dexmedetomidine administration. However, NGF expression was decreased at 12 h and 24 h after dexmedetomidine administration.

**Conclusion(s):** Dexmedetomidine showed anti-apoptotic effect and did not induce degeneration of brachial plexus, thus the use of dexmedetomidine on nerve block can be considered as safe method in patients.

#### References:

1. Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on neuronal and peripheral nerve block: a systematic review and meta-analysis. *Br J Anaesth*. 2013; 110: 915-25.
2. Brummett CM, Hong EK, Janda AM, Amodeo FS, Lydic R. Perineural dexmedetomidine added to ropivacaine for sciatic nerve block in rats prolongs the duration of analgesia by blocking the hyper polarization-activated cation current. *Anesthesiology*. 2011; 115: 836-43.

## 8AP2-5

### Intravenous regional anesthesia or ultrasound-guided infraclavicular block for upper limb surgery

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**Background and Goal of Study:** Intravenous regional anesthesia (IVRA) has been preferred because it is simple and fast. On the other hand ultrasound-guided infraclavicular block (UGICB) is a new safe technique(1).

The aim of this study was to compare IVRA and ultrasound guided infraclavicular block in their success rates and times to perform for upper limb surgery.

**Materials and methods:** After approval by the hospital ethics committee, 100 patients (18-85 years) with ASA; I-III, who were scheduled for elective hand, wrist or forearm surgeries were included.

Patients were randomly selected to receive either a IRVA or UGICB. In group I (n=50); intravenous regional anesthesia were applied with 3 mg kg<sup>-1</sup> prilocaine in 40 mL. In group II (n=50); ultrasound-guided infraclavicular brachial plexus block were applied with prilocaine 1 % in 20 mL. The degree of sensory and motor block for each terminal nerve was recorded by the same investigator who performed the block.

Block performance time (min), pain and hemodynamic parameters were recorded. Patient and surgeon comfort related to the block procedure was noted.

**Results and discussion:** In group II; sensorial block level were significantly higher than group I at 10<sup>th</sup> and 15<sup>th</sup> minute. (p=0.00, p=0.02) Time to reach Modified Bromage Score  $\leq 2$  was faster in group II in all recorded time. (p=0.000) No patient had pain in both groups during procedure. Procedure times were significantly shorter in group II when compared with group I (4.1  $\pm$  1.3min / 2.2  $\pm$  1.3 min, p=0.000). Degree of patient comfort were significantly higher in group II compared with group I (p=0.006) No vascular puncture was recorded in group II. In group I; mean arterial pressure values were higher than in group II at 5<sup>th</sup> minute.(p=0.005) Need of the analgesic agent time in the postoperative period was shorter in group I comparing with group II. (9.8  $\pm$  2.6min / 337  $\pm$  168.7min, p=0.000)

**Conclusion(s):** Although, both methods were useful for upper limb surgery; ultrasound guided infraclavicular block was more rapid and comfortable for the patient. Besides, UGICB had advantage for the postoperative analgesia. We believe that ultrasound-guided infraclavicular block is a good alternative to intravenous regional anesthesia for upper limb surgery.

#### References:

1. Sandhu NS, Manne JS, Medabalmi PK, Capan LM. Sonographically guided infraclavicular brachial plexus block in adults: a retrospective analysis of 1146 cases. *J Ultrasound Med* 2006; 25: 1555-61.

## 8AP2-6

### Effects of parecoxib versus dexamethasone with bupivacaine by infraclavicular block for upper limb surgery

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**Background and Goal of Study:** The effect of Parecoxib with local anesthetics was evaluated in spinal and axillary block analgesia (1,2). We propose to evaluate its effects with Bupivacaine in infra clavicular block (ICB) versus Dexamethasone.

**Materials and methods:** This is a prospective study including 118 patients proposed for upper limb surgery under ICB anesthesia. Patients were randomized into 3 groups all receiving Bupivacaine associated with Parecoxib 20mg (P group), Dexamethasone 4mg (D group) or saline (C group). End-points were the onset and duration of the block. Time to first analgesic intake and VAS at the first (D1) and second (D2) postoperative days was also assessed. All criteria were evaluated by an independent investigator.

**Results and discussion:** Demographic data were comparable between the 3 groups. No incident was reported.

Comparative endpoints between 3 groups (Means  $\pm$ SD) were shown in the table on the following page.

	P Group (n=44)	D Group (n=40)	C Group (n=34)
Onset sensory block(sec)	77,82±80,616 (*#)	383,45±274	302,94±307,668
Onset motor block(sec)	120,45±79,25 (*#)	440,5±240,449	316,24±346,393
Duration sensory block(min)	1165,68±447,826 (*)	1562,5±488,1(*#)	1140,88±424,552
Onset of complete lifting motor block(min)	1259,77±498 (*)	1696±1010(*#)	1108,53±401
Onset first analgesic intake(min)	1248,86±496,238	2283±1141,27 (*#)	1408,18±905,825
VAS D1(cm)	2,68±1,58	0,7±0,92 (*#)	2,11±0,99
VAS D2(cm)	4±0,925	2,35±1,42 (*#)	4,23±1,2

[Comparative endpoints]

\* p < 0,05 vs C group.

# p < 0,05 vs D or P groups.

**Conclusion(s):** Parecoxib with Bupivacaine in the ICB reduces significantly the onset time of sensory and motor block. Dexamethasone combined with bupivacaine in ICB improves the quality of analgesia compared to Parecoxib and saline.

#### References:

1. Anesth Analg. 2007; 105:822-824.;
2. Clin Orthop Relat Res 2013; 471:562-568.

## 8AP2-7

### Ultrasound-guided approach in trauma and orthopaedic practice increases the willingness for regional anaesthesia

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**Background and Goal of Study:** The needs for safe and efficient anaesthesia are growing increasingly. The aim of our study was whether the ultrasound (US) guidance can give inspiration and success for anaesthesiologist. Can this approach change the routine practice improving the willingness for performing regional anaesthesia? Development over the last five years was studied after the introduction of ultrasound technique.

**Materials and methods:** Data were retrospectively collected on 11568 consecutive unselected patients (m:5270 f:6298) divided in three anaesthesia type group undergoing elective orthopaedic (O:2831) and trauma (T:8737) upper and lower limb surgery during the last 6 years. Annual tendencies of general/GA and regional (spinal/SA and peripheral nerve block/PNB) anaesthesia were compared with the figures of 2008, the year before the start of US approach. The rate of freehand and US guidance were examined in this five years period. Furthermore in a comparative study the block-to-incision time and analgesia duration of single shot 36 ml 0,5% lidocain and 0,25% bupivacain mixture was carried out in the PNB (n=60, n'=60) population (2009 vs. 2012). Student's-t test and ANOVA were used for the statistical analysis.

**Results and discussion:** After the introduction of US (2009-2013) not only the number of PNB (160- 333) but SA(598-832) increased significantly whereas GA (1123-828) decreased at nearly the same annual cases. The percent of regional anaesthesia per year increased from O:68,2, T:31,7 to O:94,5, T:53,7% vs.O:56 and T:26% in 2008. The initial rate of free hand technique continuously decreased from 27,5 to 9,6%. Block-to-incision mean (SEM) time significantly decreased from 44,0 (6,9) min to 17,4 (5,9) min. Duration of analgesia was 645,7 (19,8) min in 2009 vs.740,3 (17,6) min in 2012 with the same anaesthetic mixture and dose.

**Conclusion(s):** Our study clearly demonstrates that the rate of PNB and SA were gradually increased during the last five years beyond the number of US guidance. Reintroducing of regional anaesthesia with US approach inspired the anaesthesiologists to perform more regional anaesthesia, initially revitalize the old techniques and improve their skills with a novel one. However more data should be collected how can double or multiple site injections improve the analgesic duration and decrease the volume of solution, replacing the single shot technique.

## 8AP2-8

### Ultrasound differences of six needles of regional anaesthesia in animal tissue and phantom models

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**Background and Goal of Study:** To evaluate ultrasound visualization of different types of needles plexus in animal tissue model and phantom.

**Materials and methods:** Observational study on ultrasound experimental fresh porcine tissue model consisting of skin, subcutaneous and muscle tissues, and blue phantom models. Six types of plexus needles were studied (22G 80 mm): Polymedic-Polyplex US (I); Vigon - Echoplex (II); Nanoline Pajunk (III); Sonoplex Pajunk (IV); Uniplex Pajunk (V); Braun Stimuloplex D (VI). After optimizing Sonosite S-Nerve echograph parameters, only one expert anesthesiologist performed in-plane echographs with each needle at 30°, 40° and 50° in 2D mode in both porcine and phantom models. Only four centimeters of each needle were introduced into biology and phantom models. The best final quality images were recorded and blindly evaluated by experienced anesthesiologists in ultrasound from different hospitals. Score measured from 0 to 10 was attributed for quality assessment and visualization of the needles. Images were grouped according to the angle, biological and phantom models. Data were analyzed with chi2, t students and ANOVA when appropriate. p < 0,05 was considered significant.

**Results and discussion:** 38 experienced anesthesiologists from 2 hospitals were included in this study, and evaluated 36 static images. Significant differences in scores were found according to hospital where they were evaluated -center 1 to 2 -0.42 (-0.56, -0.29) p < 0.001 The view of the needles was better when observed at 30° vs. 40° -0.94 (-1.10, -0.77) and 50° -1.22 (-1.38, -1.05) p < 0.001.

Needle II and IV obtained higher scores, especially at 30° and 40°, and 50° respectively in both animal tissue and phantom model (p < 0.001).

**Conclusion(s):** Score of the evaluated images depends on the experience of each center. Although there are special needles for ultrasound guidance only Vigon - Echoplex at 30° and 40° and Sonoplex Pajunk at 50° obtained significant differences compared to the rest.

## 8AP2-9

### A randomized controlled trial on motor function and patient satisfaction in ultrasound-guided peripheral nerve block anesthesia for outpatient hand surgery

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**Background and Objectives:** The optimal regional anesthesia technique for hand surgery is not known. Brachial plexus blocks are effective but produce undesirable motor loss and numbness. We hypothesize that a distal forearm block would preserve more motor function, leading to greater patient satisfaction.

**Methods:** This was a triple-masked randomized controlled trial. The Human Research Review Committee at the University of New Mexico Health Sciences Center (Albuquerque, NM) approved this study, and the protocol was registered prospectively with ClinicalTrials.gov (NCT01579747). Adult subjects, ASA I to III, who were scheduled for elective ambulatory hand surgery under regional anesthesia and sedation were recruited. All subjects received ultrasound-guided supraclavicular brachial plexus block or distal forearm block of the ulnar and median nerves and infiltration at the distal crease. Subjects were randomized to receive 15ml of 1.5% mepivacaine in supraclavicular block (Proximal group) or distal forearm block (Distal group), with 15 ml of normal saline in the alternate block. The primary outcome (grip strength) was tested in both hands before the block and before discharge from recovery. Subject satisfaction data were collected the day after surgery.

**Results:** Fourteen subjects were enrolled. Median (interquartile range [IQR]) strength loss in the Distal group was 21.4% (14.3, 47.8%), while all subjects in the Proximal group lost 100% of their presurgical strength; p=0.001. Sub-

jects in the Distal group were more satisfied with their block procedures on the day after surgery;  $p=0.012$ . Subject satisfaction correlated inversely with surgical-side strength loss [Spearman's rho  $-0.62$  ( $p=0.016$ ), and Kendall's tau  $-0.55$  ( $p=0.025$ )].

**Conclusions:** This study suggests that distal forearm blocks can be used as the primary anesthetics in hand surgeries that do not require more than 30 minutes of tourniquet time. Distal forearm block confers the advantage of maintaining motor function. This in turn results in increased subject satisfaction. In our institution, the distal forearm block has been found particularly useful in subjects who require a trigger finger release and carpal tunnel release in the same hand. This allows the subject to obtain surgical anesthesia for both surgeries and still be able to move the finger during surgery for the trigger finger release.

## 8AP2-10

### Anatomical variations of the cords of the brachial plexus at proximal infraclavicular level

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**Background and Goal of Study:** The topographical anatomy of the brachial plexus at infraclavicular level changes along its course in this region. The classic layout of the cords, around the axillary artery, is observed when those run under the pectoralis minor muscle, in relation with the second portion of the axillary artery. The aim of this study is to describe the topographical relationship of the neurovascular structures, as well as the sectional area including the artery and brachial plexus cords on the first portion of the axillary artery.

**Materials and methods:** Fifty healthy volunteers who underwent a bilateral infraclavicular ultrasound examination were included. It was determined the distribution in degrees of the cords in relation to the artery, the distance from the artery to every cord, to the skin, to the pleura and the sectional area.

**Results and discussion:** The lateral cord was found at  $-64^\circ \pm 17^\circ$  and at a distance to the artery of  $1 \pm 0.3$  cm, in the upper lateral quadrant in 99% of cases. The medial cord was located at  $-107^\circ \pm 11^\circ$  and at a distance of  $0.9 \pm 0.3$  cm in the inferior-lateral quadrant in 81% of cases. The posterior cord is located at  $-95^\circ \pm 11^\circ$  and at a distance of  $1.6 \pm 0.3$  cm from the artery, in the upper lateral quadrant in 70% of cases. Sectional area, including the three cords and the axillary artery was of  $2.3 \pm 0.5$  cm<sup>2</sup>. Both the area and the view of the cords were influenced by overweight.

**Conclusion(s):** Our study determines the layout and distance of the neurovascular structures of the brachial plexus at infraclavicular level in its first portion, showing a high degree of homogeneity that is not influenced by anthropometric variables. However, in patients with overweight the visualization has lower quality and the depth of the plexus is greater, which could cause difficulties in the identification of the structures.

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## 8AP2-11

### Comparing onset times and vascular punctures in axillary blocks with nerve stimulation or ultrasound: a randomised controlled trial

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**Background and Goal of Study:** The axillary brachial plexus block is a relatively easy procedure, which has gained its popularity through its' low complication incidence. In the last few years ultrasound probes have been used for peripheral nerve blocks in order to minimise side effects and onset times of the blocks(1). We hypothesized that the time needed for an axillary brachial plexus block to take effect as well as the possibility of vascular puncture would be lower when using an ultrasound probe for nerve identification.

**Materials and methods:** Ninety-nine patients ASA I-III, scheduled for elective or urgent elbow, hand or forearm surgery were randomised to have axillary

brachial plexus blocks, performed using either a nerve stimulator or an ultrasound probe in an out-of-plane technique for nerve identification. With both methods we identified all four nerves of the brachial plexus, using a multiple injection technique, under continuous aspiration. We analysed and compared the blocks' onset times as well as the amount of blocks during which vascular punctures and blood aspiration were acknowledged. The randomisation as well as the informed consent was done at the preoperative visit. The groups after analysis included: 58 patients in the nerve stimulator (NS) and 41 in the ultrasound (US) group. All patients were recruited in a one year period in the university hospital of Alexandroupolis, Greece. Statistical analysis was done using the SPSS 16. The trial was registered at the scientific board of the Democritus University of Thrace, no funding was needed.

**Results and discussion:** There was a significant difference between the two groups onset times 21.36 min (SD 8,13) NS group, and 14.61 min (SD 4,25) US group ( $p=0,001$ ) using an independent samples t-test. However no significant difference in between the groups concerning the probability of vascular puncture was observed (Pearson Chi Square 0,54). All patients were followed-up for 7 days postoperatively up to which time no complications were reported.

**Conclusion:** In summary, in our setting axillary block's onset times was reduced, using an ultrasound probe for nerve identification in relation to blocks with a nerve stimulator whereas the possibility of vessel puncture was not diminished using the out-of-plane method.

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## 8AP3-1

### Segmental epidural anaesthesia for percutaneous kyphoplasty

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**Background and Goal of Study:** Percutaneous kyphoplasty is performed under local anaesthesia with sedo-analgesia, spinal or general anaesthesia (1, 2). The objective of this study was to evaluate the efficacy of segmental epidural anaesthesia in patients requiring kyphoplasty.

**Materials and methods:** After approval from institutional review board and local Ethics Committee, fifty ASA class I to III patients electively undergoing kyphoplasty were recruited to the study. Patients were divided into two equal groups. The volume and dose of local anaesthetic solution were determined in a pilot study. In control group (Group GA, n=25), patients were received general anaesthesia including propofol 2 mg.kg<sup>-1</sup> and rocuronium bromide 0.6 mg.kg<sup>-1</sup> for the induction and sevofurane end tidal 2-2.5% in N<sub>2</sub>O-O<sub>2</sub> mixture (FiO<sub>2</sub>= 35%) for the maintenance, using mechanical ventilation (EtCO<sub>2</sub>= 4-4.5 kPa). In the segmental epidural anaesthesia group (Group SEA, n= 25), Tuohy needle was introduced into the intervertebral space one segment lower than that of affected one. Aperture of the needle was directed to cranial and levobupivacaine 0.5% 5 mL for thoracal and 6 mL for lumbar approach was administered with single shot technique. Recovery profiles, stay in post anaesthetic care unit (PACU), VAS pain scales, and analgesic consumptions in the early postoperative period were determined. Statistical analyse was performed using t and U tests and significance level was considered as 0.05.

**Results and discussion:** There was no significant difference between study groups in respect to haemodynamic variables during intraoperative and early postoperative periods. Recovery profiles were better and PACU periods were shorter in patients performed epidural anaesthesia than general anaesthesia. Thirteen patients were directly transferred to the ward, PACU stay were  $1.8 \pm 2.0$  min for Group SEA, vs  $31.7 \pm 7.1$  min for Group GA,  $p < 0.0001$ . Pain scales in the first 4 h were also significantly lower in the Group SEA.

**Conclusion(s):** Our results indicate that segmental epidural anaesthesia may be a suitable option in patients undergoing percutaneous kyphoplasty. This technique offers better recovery profiles, shorter PACU stay and lower pain scores in early postoperative period.

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### 8AP3-3

#### Impact of postoperative thoracic epidural analgesia on the frequency of postoperative atrial fibrillation in lung cancer surgery

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**Introduction:** Patients undergoing lung cancer surgery have a high risk of developing postoperative atrial fibrillation. The frequency of postoperative atrial fibrillation (POAF) in thoracic surgery is 12-40%.

**Objectives:** We aimed to evaluate the impact of thoracic epidural analgesia on the frequency of POAF in patients undergone lung cancer surgery.

**Methods:** 472 adult patients undergoing lung cancer surgery (lobectomy - 330, pneumonectomy - 142) were divided into two groups:

1) general anesthesia (GA) n=300 (propofol, ketamine, fentanyl, sevoflurane), 2) combined general-epidural anesthesia and postoperative epidural analgesia for a 5-6 days (CA) n=172 (propofol, ketamine, fentanyl, sevoflurane, ropivacaine).

In postoperative period all patients in both groups received standard systemic analgesia with opioid analgesics, NSAIDs, paracetamol.

**Results:** In GA the frequency of POAF was 15.3% (46/300). The overall incidence of POAF did not differ between patients undergone pneumonectomy and lobectomy in GA (21.6% (16/74) vs. 13.7% (30/226), respectively (p=0,08)).

In CA the frequency of POAF was significantly reduced versus GA (8,7% (15/172) vs. 15,3% (46/300), respectively (p=0,04)). Patients undergone pneumonectomy suffered from postoperative atrial fibrillation in 13,2% (9/68) of cases and lobectomy in 6,2% (6/104) of cases in CA (p=0,09). The frequency of POAF in patients undergone pneumonectomy did not differ significantly between the groups (p=0,19), but the frequency of postoperative atrial fibrillation in patients undergone lobectomy was significantly reduced in CA versus GA (p=0,04).

**Conclusions:** Postoperative thoracic epidural analgesia significantly decreases the frequency of postoperative atrial fibrillation in patients undergoing extended lungs surgery. It most effective in patients undergoing lobectomy.

### 8AP3-4

#### Thoracic epidural anesthesia diminishes the risk of surgical site infection through the up-regulation of lipocalin-2 in LPS-treated rats

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**Introduction:** Thoracic epidural anesthesia (TEA) is appreciated as a promising approach to minimize the risk of surgical site infection (SSI) (1) whereas the underlying mechanisms remain unclear. Lipocalin-2, known as neutrophil gelatinase-associated lipocalin, has been shown to limit bacterial growth in infected models (2,3). We therefore tested the hypothesis that TEA minimized the risk of SSI through the expression of lipocalin-2.

**Methods:** With institutional approval of IRB, 43 male Wistar rats (250-350g) were inserted with arterial, venous and epidural catheters (Th10-11 level) under general anesthesia, and thereafter intravenously infused saline at 6 ml/kg/hr. Pseudo-surgical incision was made on their back (1cm length of skin incision reaching muscle layer) and lipopolysaccharide (LPS, 0.25mg/kg) was intravenously administered to elicit systemic inflammatory response.

The animals were randomly assigned into 3 groups: control (Group C; n=6), saline (Group S; n=19) or 0.5% lidocaine (Group L; n=18) group. Group C and Group S were epidurally infused saline at 50µl/hr, whereas Group L received lidocaine infusion at 0.25 µg/hr for the next 72 hr. To evoke SSI, *Escherichia coli* (*E.coli*, approximately  $5.0 \times 10^5$  CFU) were pasted on the pseudo-surgical incision in Group S and L.

At 72 hr period, the tissue (approximately 200 mg of muscle) of pseudo-surgical site was obtained to measure tissue lipocalin-2 mRNA and *E.coli* DNA by using real-time polymerase chain reaction.

All data were expressed as mean  $\pm$  standard deviation. Student's t test was used for comparison of lipocalin-2 gene expression and *E. coli* copy number.

**Results:** Four in Group S and 3 animals in Group L died during the study periods. A marked elevation of tissue lipocalin-2 mRNA was found in Group L compared to Group C and S ( $9.77 \pm 4.43$  versus  $1.00 \pm 0.45$  and  $4.84 \pm 2.66$ , respectively,  $p < 0.01$ ). Furthermore, *E.coli* DNA copy number in tissue was significantly increased in Group S compared to Group C and L ( $3.9 \pm 2.6 \times 10^5$

versus  $7.24 \pm 9.27 \times 10^0$  and  $0.94 \pm 1.30 \times 10^5$  copy number/mg-tissue, respectively,  $p < 0.01$ ).

**Conclusions:** TEA for 72 hours provided significant bacteriostatic effects on infected surgical site by augmenting the lipocalin-2 expression in LPS-treated rats, indicating that long-term application of TEA could be a promising procedure to attenuate SSI in the presence of systemic inflammation.

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2. J Immunol 2009;182:4947.
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### 8AP3-5

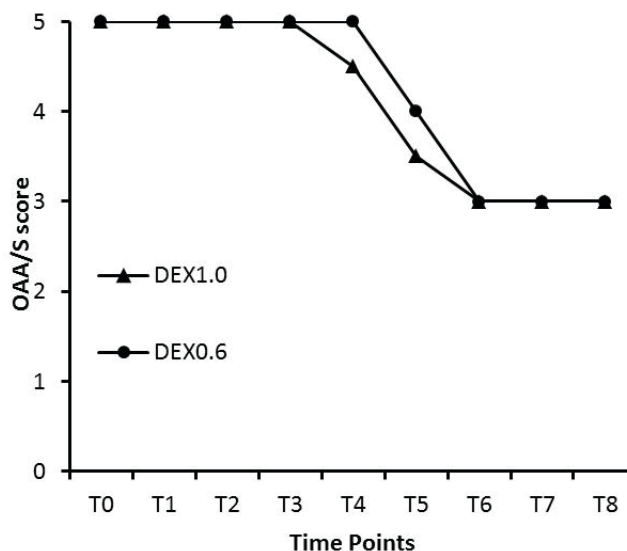
#### Comparison of two loading doses of dexmedetomidine for sedation during spinal anesthesia

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**Background and Goal of Study:** During spinal anesthesia, conscious sedation is frequently provided to alleviate patient anxiety. However, the dose of sedative drug can be reduced during spinal anesthesia [1]. Dexmedetomidine (DEX) offers reliable sedation without significant respiratory depression but bradycardia, hypotension or hypertension can occur especially during loading dose infusion [2].

In this study, we compared 0.6 µg/kg of loading dose to 1.0 µg/kg of recommended loading dose for the efficacy and safety in patients during spinal anesthesia.

**Materials and methods:** Twenty four patients were randomized into two groups. As a loading dose, 1 µg/kg (DEX1.0 group) or 0.6 µg/kg (DEX0.6 group) of intravenous DEX was administered for 10 minutes. After the initial loading dose, 0.4 µg/kg/hr of DEX was infused continuously. BP, HR, SpO<sub>2</sub>, BIS(bispectral index), and OAA/S (Observer's assessment of alertness/sedation) score were recorded from baseline to 20 min after the maintenance infusion. Hypotension (Mean arterial pressure < 60 mmHg or 30% decrease from baseline) or bradycardia (HR < 50 or 30% decrease from baseline) was treated with ephedrine.



[OAA/S score]

**Results and Discussion:** Patient's demographic data and maximum block level were similar in two groups. BIS and OAA/S score were correlated (coefficient of correlation=0.98 and 0.92 in DEX1.0 and DEX0.6 respectively), and showed appropriate score for sedation in both group (Median OAA/S score was 3 in each group from 5 min after the maintenance infusion). OAA/S score started to decrease from 5 min after the loading dose in both groups. DEX1.0 group showed steeper decline but the difference was not statistically significant. BIS index in both groups followed similar trend with OAA/S. There was no between group difference in the incidence of bradycardia or hypotension.

Events	Time Points	OAA/S DEX1.0	OAA/S0.6
Initial	T0	5	5
Right after S.A	T1	5	5
5 min after S.A	T2	5	5
Loading dose finished(10 min)	T3	5	5
5 min after starting loading dose	T4	4.5(4-5)	5(3-5)
loading dose finished(10 min)	T5	3.5(1-5)	4(2-5)
5 min after maintenance dose	T6	3(1-5)	3(2-5)
10 min after maintenance	T7	3(1-4)	3(1-4)
20 min	T8	3(1-4)	3(1-4)

[Time point and events. OAA/S scores in each group]

**Conclusion(s):** Dexmedetomidine loading dose of 0.6 µg/kg achieved adequate sedation within 5 min of maintenance infusion. The onset time and the incidence of bradycardia and hypotension were similar with recommended loading dose of 1 µg/kg. Therefore, lower loading dose of dexmedetomidine can be considered during spinal anesthesia.

#### References:

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- Bhana N, Goa KL, McClellan KJ. Dexmedetomidine. *Drugs* 2000; 59: 263-268

## 8AP3-6

### Spinal anesthesia for lumbar spine surgery in prone position: plain vs heavy bupivacaine

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**Background and Goal of Study:** Spinal anesthesia (SA) is an effective and safe alternative for general anesthesia for elective lumbar spine surgery. However, consent recommendations as for the SA technique for operations in prone position and baricity of local anesthetics are absent. The study is aimed to establish which bupivacaine, plain or heavy, is preferable for lumbar spine surgery in prone position.

**Materials and methods:** Ninety five ASA I-II adult patients undergoing lumbar spine surgery were recruited. SA was performed in the sitting position with 0.5% plain (1<sup>st</sup> group, n=49) or heavy (2<sup>nd</sup> group, n=46) bupivacaine (with 20 mcg of clopheline) in the L2-L3 interspace. No preload was used. After anesthesia patients of the 1<sup>st</sup> group positioned themselves into the prone position immediately, while patients of the group 2 laid in the supine position for 5 minutes and then were turned by medical staff into the prone position. The sensory level of block was assessed 10 min after SA by pinprick test. Non-invasive blood pressure, heart rate and oxygen saturation were also measured continuously with 3 min interval.

**Results and discussion:** All the patients had excellent analgesia that was enough for 3-hour surgery. The level of sensory block was higher in patients of the 2<sup>nd</sup> group ( $p < 0,05$ ), mean arterial pressure decreased earlier and more significantly in patients of group 2 ( $p < 0,05$ ). Tendency to bradycardia was found in patients of both groups without significant difference ( $p > 0,05$ ). No desaturation occurred in all patients. No statistical difference in the duration of anesthesia was found. The start of the operation was faster in 1<sup>st</sup> group ( $p < 0,01$ ).

**Conclusion(s):** Plain 0.5% bupivacaine is more preferable than heavy for elective lumbar spine surgery in prone position as it provides sufficient anesthesia of the operated area and at the same time it has less influence on arterial blood pressure. Moreover, patients can position themselves into the prone position immediately after injection, thus preventing his/her pressure injuries and avoiding extra charge on medical stuff, and the operation can begin earlier after SA.

## 8AP3-7

### Skin conductance responses and visual analog scale used to compare the effect of per-oral and epidural analgesia during thoracic drain removal

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**Background and Goal of Study:** Thoracic drain removal (TDR) is reported painful for some patients different from others. The purpose of this study was to examine if the pain responses during TDR was influenced by the analgesia treatment, epidural or per-oral, by using Skin conductance Responses (SCR) per second, and Visual Analog Scale (VAS).

**Materials and methods:** Patients scheduled for TDR were included, after informed consent was obtained, either in conventional ward or in intensive care unit. Before, during and after TDR, simultaneous assessment of anxiety (A-VAS) and pain (VAS) were performed. In addition, SCR per second - a non invasive measurement of skin sympathetic nerve activity through electrodes on the palm - was recorded to study the pain response. Heart rate (HR) and respiratory rate (RR) were monitored as well. Comparison between subjective, VAS, and objective, SCR, values was performed according to the modality of analgesia. Furthermore, the predictive level of A-VAS before TDR was examined.

**Results and discussion:** Sixty patients scheduled for TDR, 25 women and 35 men, aged 52 +/-16 years, were treated respectively with per-oral (G1 - n=31) or epidural analgesia (G2 - n=29).

	VAS mm	A-VAS mm	SCR per sec	HR	RR
G1	51 +/- 27	43 +/- 33	0,23 +/- 0,14	92 +/- 18	22 +/- 7
G2	27 +/- 24	27 +/- 27	0,23 +/- 0,15	89 +/- 11	22 +/- 7
P-value	0,001	0,053	NS	NS	NS

[The values for the different groups during TDR]

Furthermore, before TDR 27 % of the patients in G1 had A-VAS > 30 mm and 17 % in G2 had A-VAS > 30 mm. A-VAS > 30mm before TDR was followed with VAS 55 +/-29 mm during TDR, and A-VAS ≤ 30 mm before TDR was followed with VAS 21 +/-19 mm during TDR for G2 ( $p=0.019$ ). The A-VAS before TDR did not influence the VAS during TDR for G1. Interestingly, during TDR, A-VAS and VAS did not differ between the patients who had been exposed to thoracotomy or thoracoscopy.

**Conclusion:** Epidural analgesia gives less reported pain compared to per-oral analgesia. High A-VAS before TDR was followed by high VAS during TDR for patients with epidural analgesia. SCR per sec, HR, and RR were not influenced by the analgesia treatment. Patients with per-oral analgesia have higher pain perception during TDR than patients receiving epidural analgesia.

## 8AP3-8

### Impact of anesthetic technique on the stress response elicited by laparoscopic cholecystectomy

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**Background and Goal of Study:** To elucidate the impact of general anaesthesia alone (GA) or supplemented with epidural anaesthesia (EpiGA) on surgical stress response during laparoscopic cholecystectomy (LAP), using stress hormones, glucose and C-reactive protein, as potential markers.

**Materials and methods:** Sixty patients (ASA 1-2, aged 47.9±9.6 yrs, M/F:1/2), scheduled to undergo elective LAP were recruited in this prospective randomized trial. Demographics and Hamilton test were recorded in all participants, who were randomly assigned into two groups of 30 patients each to receive either GA or EpiGA. Blood samples for stress hormones [cortisol (COR), human growth hormone (hGH), prolactin (PRL)], glucose (Glu) and C-reactive protein (CRP) determination, were collected on the day prior to surgery (baseline), intraoperatively and on the first postoperative day (POD1). Postoperative analgesia was achieved by patient-controlled (PCA) for GA group or continuous epidural (CEA) analgesia for EpiGA group, while visual analog scale (VAS) was assessed 6 hours postoperatively and on POD1. Repeated ANOVA and

Mann Whitney U test were used for data analysis.

**Results and discussion:** Both groups were comparable regarding patients' demographics and Hamilton score. The study course of plasma mediator concentrations is presented in Table (as mean±SD). Significant between-groups differences were detected for COR and glucose either intraoperatively ( $P < 0.01$  and  $P < 0.001$ , respectively) or postoperatively ( $P < 0.05$  and  $P < 0.01$ , respectively), but not for hGH levels. PRL was more prominently elevated in GA group only intraoperatively ( $P < 0.05$ ). VAS was significantly lower ( $P < 0.001$ ) in the CEA compared to PCA group at rest, 6 hours postoperatively ( $1.7 \pm 1.1$  and  $3.1 \pm 1.6$ , respectively) and on POD1 ( $1.3 \pm 0.4$  and  $2.1 \pm 0.6$ , respectively).

Table.	Baseline		Intraoperative		POD1	
	GA	EpiGA	GA	EpiGA	GA	EpiGA
COR (µg/dL)	12.1±4	10.8±5	27.3±9 <sup>***</sup>	19.9±7 <sup>***</sup>	15.9±6 <sup>**</sup>	12.8±4
hGH (ng/dL)	1.3±1.2	1.2±0.9	3.2±2.9 <sup>***</sup>	2.8±2.2 <sup>***</sup>	1.5±1.6	1.4±0.8
PRL(ng/dL)	10.3±6	8.9±5	29.1±14 <sup>***</sup>	21.5±10 <sup>**</sup>	10.9±7.3	9.5±4.3
Glu (mmol/L)	91±12	89±10	126±21 <sup>***</sup>	105±19 <sup>***</sup>	106±12 <sup>***</sup>	98±10 <sup>**</sup>
CRP (mg/L)	3.1±0.7	3.2±0.9	4.9±1.1	4.6±1.1	49.7±19 <sup>***</sup>	48.1±12 <sup>***</sup>

[\* $P < 0.05$ , # $P < 0.01$ , † $P < 0.001$ ; each setup vs baseline]

**Conclusion(s):** Hormonal and metabolic stress response is slightly modulated by the use of epidural block supplemented by general anaesthesia, in patients undergoing LAP. Nevertheless, inflammatory reaction assessed by CRP, seems to be unaffected by the anaesthesia regimen.

### 8AP3-9

#### Comparison between manual palpation versus ultrasound method to identify the sacrococcygeal hiatus for caudal block in infants

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**Background and Goal of Study:** The insertion of needle for epidural block in pediatric population may lead to the risk of spinal cord injury (1). Manual palpation is often used to identify the sacrococcygeal hiatus and the sacral cornua. The use of ultrasound technique to better identify the landmarks is assuming great importance (2). We conducted an observational study to compare the accuracy, safety and efficacy of manual palpation and ultrasound for determining the sacrococcygeal hiatus.

**Methods:** After IRB approval fifty pediatric patients 0 to 1 years of age undergoing caudal anesthesia for genitourinary and abdominal surgery were enrolled. For each patient was used the landmark palpation method to determine the sacrococcygeal hiatus and the sacral cornua. After identifying the space an ultrasound scanning over the sacral area was performed as a different method to identify the exact point at which to insert the needle to perform the anesthetic block. The proportion of inaccurate measurements were compared and the inaccurate measurement was defined as the over-coming of 0.5 mm from the correct anatomical position of the center point of the sacral hiatus.

**Results:** 42% of measurements by the landmark palpation method were inaccurate by  $\geq 0.7$  mm respect to the exact point. 28% of measurements performed by ultrasound method were inaccurate by  $\geq 0.5$  mm. In patients who had an overweight compared to age and growth percentile we recorded for each method an higher failur rate in the execution of the block.

**Conclusions:** This observational study demonstrated that not significant differences were recorded using both the landmark palpation or ultrasound methods even if the ultrasound method was slightly more accurate. Ultrasound does not offer a significant advantage especially from a clinical point of view.

#### References:

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- Liu JZ et al. A comparison of ultrasonography versus traditional approach for caudal block in children. Zhonghua Yi Xue Za Zhi 2012; 92:882-885

### 8AP3-10

#### Incidence of accidental dural puncture and post-dural puncture headache as markers of quality in anesthesiology in HCPB. Results 2011-Sep/2013

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#### Background and Goal of Study:

1) To know the incidence of accidental dural puncture (ADP) and post dural puncture headache (PDPH) in patients undergoing anesthetics and analgesics neuroaxial procedures (AANP) at H. Clínic Barcelona and the Maternitat Hospital Clínic during 2011 until September of 2013

2) Compare the results with the literature.

**Materials and methods:** A prospective and descriptive study of all patients undergoing anesthetics and analgesics neuroaxial procedures in the H. Clínic and the Maternitat including obstetric activity. The morbidity committee of the Anesthesiology department has chosen as a marker of anesthetic quality the incidence of ADP and PDPH during the period between 2011 and 2013. In order to do so, it is been designed a template with de variables that could influence the appearance of ADP and PDPH. This template was added to the computerized history of anesthesia with de objective that each anesthesiologist that performs a AANP could complete it. The Acute Pain Unit and the Obstetric Anesthesia Unit detected and treated the PDPH reported. Once the data collection was ended, was calculated the incidence of ADP and PDPH, and then compared the obstetric area with the rest of operating rooms.

**Results and discussion:** During this period it is been reported 17 PDPH at central H. Clínic, that represents 0.2% of the AANP (2011:7, 2012: 6, 2013:4); 83% of PDPH was caused by intradural technique which represents 85% of AANP. It was reported 14 ADP (1.22% of the epidural technique). The Maternitat reported 6 PDPH (0.8% of the ANNP), 85% was caused by peridural technique which represent 87.5% of AANP in this center. In 2011 19 PDPH, 2012: 22, September 2013 19. It is been reported 36 ADP (0.63% of peridurals techniques).

**Conclusion(s):** The incidence of PDPH and ADP are similar to that reported in the literature. The difference found between the central H. Clínic and the Maternitat Center regarding the incidence of PDPH of 0.2% vs 0.82% could be caused for the type of patients, the technical difficulty of a pregnant patient with pain and edematous. It could also be due to pregnant women shortly after birth is standing, while surgical patient is bedridden frequently at least 24 hours.

The PDPH caused by intradural technique in the H.Clinic is 82,35% vs 15% in the Maternitat, this may be because in the H.C the intradural technique represents 85% of AANP vs 22,5% in the Maternitat.

### 8AP3-11

#### Comparison of the addition of fentanyl 10 or 20 µg to plain articaïne 60 mg for spinal anaesthesia in knee arthroscopy patients

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**Background and Goal of Study:** Articaïne has been found safe in subarachnoid administration in dogs<sup>1</sup> and suitable for day-case spinal anaesthesia.<sup>2</sup> Although the short action of articaïne is generally appreciated, patient comfort may be improved by prolonging the sensory block without influence on the motor block, e.g., by adding fentanyl to articaïne, an addition found useful in bupivacaine spinal anaesthesia.<sup>3</sup> We evaluated how the addition of 10 and 20 µg of fentanyl to a plain articaïne solution affects spinal anaesthesia and analgesia.

**Methods:** After ethics committee and national medical authority approval ninety adult patients, scheduled for knee arthroscopic surgery, consented to be randomised into three groups for spinal anaesthesia with articaïne 60 mg: AF0 (fentanyl 0), AF10 (fentanyl 10 µg added), and AF20 (fentanyl 20 µg added). The block and analgesia parameters were assessed by a blinded assistant. A telephone interview was performed on the first and seventh post-operative day. Statistics: Mann-Witney U-test (ordinal variables) and repeated measures ANOVA (development of block parameters).

**Results and discussion:** Intraoperative analgesia was good and similar be-



tween the groups. The duration of sensory analgesia at, or above the Th10 dermatomal level was significantly longer in the AF10 (median 69 min) and AF20 (69 min) groups than in the AF0 group (41 min) ( $P=0.013$ ). The duration of motor block was the same (median 120 min) in all groups. Pruritus occurred most frequently in the AF20 group ( $P=0.04$ ). No haemodynamic, urinary or neurological side-effects were seen. All but one patient in each group were satisfied with their anaesthesia. This study on articaine in day-case spinal anaesthesia conforms with the generally accepted view that useful additive sensory analgesia can be achieved with a very small dose of intrathecal fentanyl. **Conclusions:** A similar prolongation (68%) of spinal sensory analgesia at the Th10 level was achieved by adding 10 or 20  $\mu\text{g}$  fentanyl to plain articaine. Motor block was unaffected by fentanyl. The lack of clinical benefit from adding the larger fentanyl dose was further emphasized by the occurrence of disturbing pruritus.

#### References:

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## 8AP4-1

### Short beveled sharp cutting needle is superior to facet tip needle for ultrasound-guided rectus sheath block in children with umbilical hernia

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**Background:** Umbilical hernia repair, a common day-case surgery procedure in children, is associated with significant postoperative pain.

The most popular peripheral nerve blocks used in umbilical hernia repair are rectus sheath block and caudal block.

The rectus sheath block may offer improved pain relief following umbilical hernia repair with no side effects such as lower limb motor weakness, and urinary retention seen with caudal block.

Ultrasound guidance of peripheral nerve blocks has reduced the number of complications and improved the quality of blocks. The aim of this case series is to assess the post rectus sheath block pain relief in pediatric patients, and to evaluate the easiness of soft tissue puncture and ultrasonic appearance of two different needle types.

**Methods:** Twenty two (22) children (age range: 1.5-8 years) scheduled for umbilical hernia repair were included. Following the induction of general anaesthesia, the ultrasonographic anatomy of the umbilical region was studied with a 5-16 MHz linear probe. An ultrasound-guided rectus sheath block in the lateral edge of both rectus abdominis muscles (RMs) was performed (total of 44 punctures). 20 gauge short beveled sharp cutting needle 1.1x 30 mm (BD Insite - W, Vialon material, Spain, used in one side, on the other side Stimuplex A insulated Needle 22G 50mm).

Surgical conditions, intraoperative hemodynamic parameters, and postoperative analgesia by means of the modified CHEOPS scale were evaluated.

**Results:** Ultrasonographic visualization of the posterior sheath was possible in all patients. The ultrasound guided rectus sheath blockade provided sufficient analgesia in all children with no need for additional analgesia except for one patient who postoperatively requested morphine 0.1 mg/kg intravenously.

**Conclusions:** Ultrasound guidance enables performances of an effective rectus sheath block for umbilical hernia in the lateral edge of the rectus muscle. Use of the sharp short beveled needle of 20 gauge intravenous (IV) cannula stylet provides easy, less traumatic skin and rectus muscle penetration and better needle visualization by the ultrasound. The bilateral placement of bupivacaine 0.25% 0.5ml/kg-1 in the space between the posterior aspect of the rectus abdominis muscle and its sheath. Under real-time ultrasonographic guidance provides sufficient analgesia for umbilical hernia repair.

## 8AP4-2

### A novel approach of iliohypogastric and ilioinguinal nerve block for postoperative pain management of total abdominal hysterectomy patients: a randomized controlled clinical trial

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**Background and Goal of Study:** In this study we aimed to determine whether iliohypogastric and ilioinguinal (IHII) nerve blockade from intraabdominal approach for the postoperative pain management of total abdominal hysterectomy patients could be a reliable and effective alternative compared to percutaneous block of IHII nerves.

**Materials and methods:** In this randomized controlled double blinded prospective study, 87 women undergoing total abdominal hysterectomy were enrolled in this study but 82 completed the study. Patients were divided into three groups ( $n=29$  in each), as control group (group C), percutaneous IHII block group (group PB) and intraabdominal IHII block group (group IB). Group C patients received no block procedure. The percutaneous bilateral IHII nerves block was performed after abdominal closure to group PB and intraabdominal IHII block was performed before abdominal closure to group IB. Mean arterial pressure, heart rate, visual analogue score (VAS) for pain, satisfaction scores, morphine consumptions and side effects were recorded at the 2nd, 6th, 12th and 24th postoperative hours.

**Results and discussion:** No differences were found about demographic data. VAS scores at all postoperative hours were found to be significantly lower in the block groups PB and IB than control group while there were no significant differences in pain scores between group PB and IB at any time point. Morphine consumption data were found to be significantly lower in the PB and IB groups than in the control group.

**Conclusion(s):** Intraabdominal IHII blockade just before closure of the abdomen for relieving postoperative pain in total abdominal hysterectomy patients is as effective method as conventional percutaneous IHII blockade.

#### References:

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2. Vaisman J. Pelvic hematoma after an ilioinguinal nerve block for orchialgia. *Anesth Analg*. 2001; 92: 1048-1049.

## 8AP4-3

### Evaluation of an articulated needle alignment device in a peripheral nerve block training phantom

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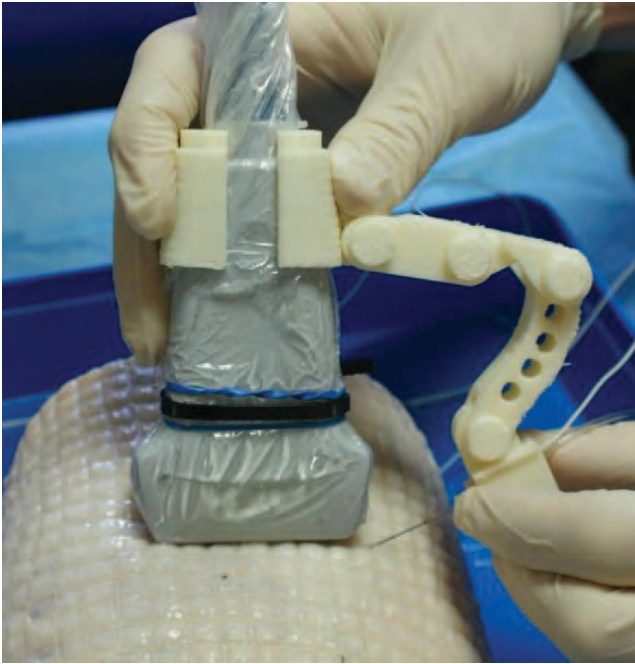
**Background and Goal of Study:** Ultrasound guided regional anaesthesia (USGRA) is increasingly popular in current clinical practice. Continuous visualisation of the needle improves the safety profile and success[1,2]. Our articulated arm guide keeps the needle in plane with the ultrasound beam improving needle visualisation. We tested the efficacy of the device in a phantom model by novice users.

**Materials and methods:** Local research ethics committee provided an exemption. Novice volunteers viewed a presentation explaining the basics of ultrasound followed by a 10 minute supervised practice. A porcine phantom with a metal rod 2 cms deep was used as a target[2]. The task involved guiding a stimuplex 5cm needle (Bbraun, Melsungen) to contact the rod with the shaft fully visualised on the ultrasound. The task was performed freehand or with guide with the ultrasound transducer placed at 90° and 60° to the skin. A recording of the ultrasound image was analysed by a blinded observer. Volunteers rated the ease of use of both techniques. Percentage time of full needle visualisation and time to initially visualise needle (lead in time) were analysed with a paired student's t test and usability scores with a paired Wilcoxon's test. **Results and discussion:** 10 volunteers participated.

Angle of transducer	Percentage needle visualisation [mean(sd)]		Lead in time in seconds [mean(sd)]	
	Arm guided	Freehand	Arm guided	Freehand
90°	54.2 (44.9)	42.76 (44.3)	21 (2.7)	9.2 (11.2)
60°	42.6 (33.9)	15.6 (27.2)*	22.4 (30.6)	31.4 (33.1)

[Table 1]

There was no difference shown between arm and freehand groups at 90° but there was a significant difference in percentage time of full needle visualisation at 60° ( $p < 0.05$ )\*.



[Image 1: Arm guide on ultrasound probe with needle in situ]

**Conclusion(s):** The arm guide helps USGRA novices to keep full needle visualisation when performing blocks at 60° in a phantom model. The limitation of needle movement in relation to the ultrasound probe improves needle visualisation but may not be liked by practitioners. This arm needs to be further evaluated as part of an USGRA teaching program for anaesthetic trainees.

**References:**

1. Van Geffen G-J et al. *Anaesthesia* 2008;63:986-990
2. Xu D et al. *Reg Anaes and Pain Med* 2005;30:593-4

## 8AP4-4

### An innovative laser guide to improve needle visibility in ultrasound guided regional anaesthesia

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**Background and Goal of Study:** Safe performance of Ultrasound guided regional anaesthesia (USGRA) needs continual needle tip visualisation<sup>1</sup>. Physical guidance devices restrict needle movement but improve visualization by novices. A LASER guide can assist with needle perception by providing a visual marker, without impairing needle movements<sup>2</sup>. We present a novel LASER guide and assess its efficacy in facilitating needle visualisation in novices.



[Laser guide being used with 60 degree support]

**Materials and methods:** Local research ethics committee provided an exemption. The LASER guide was attached to a standard ultrasound (US) probe. 10 novice USGRA volunteers reviewed a presentation and had a 10min practical session on ultrasound skills. Using an S-Nerve (Sonosite, Bothell, WA) and 5cm stimplex needle (Braun, Melsungen) participants guided the needle to contact an embedded target in a porcine phantom with the probe at 90 and 60°. US images were recorded and analysed for percentage time for full needle visibility, time to first visualisation and analysed with a paired t test. A usability questionnaire was analysed with paired Wilcoxon's test.

**Results and discussion:** 10 volunteers with no USGRA experience performed the study. No significant difference was shown in visualisation times. This may be due to improper device use with volunteers refocusing prematurely onto the US screen after skin puncture.

Transducer Angle	Percentage needle visualisation (mean(sd))		Time from start to needle visualisation (mean(sd))	
	LASER guided	Freehand	LASER guided	Freehand
90 Degrees	57(27)	67(32)	5(6)	6(5)
60 Degrees	27(25)	36(26)	15(10)	18(16)

[Needle visualisation Results]

A significant difference ( $p < 0.05$ ) was found in median usability scores LASER 3, Freehand 4.5 (10 difficult -1 easy).

**Conclusion:** A LASER guide subjectively improves ease of needle visualisation during USGRA in a phantom. As expected 60° angulation increased the difficulty of the task, but the low percentage visualisation in both groups highlights the difficulty of this skill in US novices. Further work is needed to analyse the effect of LASER guidance on anaesthetic trainee in an USGRA program.

**References:**

1. Barrington et al. *Reg Anes and Pain Med*. 2012;37(3):334-9.
2. Tsui et al. *Pain Med*. 2007;32(1):84-8.

## 8AP4-5

### Ultrasound differences of six needles of regional anaesthesia and software Multibeam in animal tissue and phantom models

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**Background and Goal of Study:** To evaluate and compare ultrasound visualization of different types of needles plexus with and without software Multibeam designed to improved needles visualization.

**Materials and methods:** Observational study on ultrasound experimental fresh porcine tissue model consisting of skin, subcutaneous and muscle tissues, and Blue phantom models. Six types of plexus needles were studied (22G 80 mm): Polymedic-Polyplex US (I); Vigon - Echoplex (II); Nanoline Pajunk (III); Sonoplex Pajunk (IV); Uniplex Pajunk (V); Braun Stimuloplex D (VI) After optimizing Sonosite S-Nerve echograph parameters, only one expert anesthesiologist performed in-plane punctures with each needle at 30°, 40° and 50° in 2D mode and software Multibeam (multibeam) Sonosite 2010 mode without changing position. Only four centimeters of each needle were introduced into biology and phantom models. The best final quality images were recorded and blindly evaluated by experienced anesthesiologists in ultrasound from different hospitals. Score measured from 0 to 10 of quality assessment and visualization of the needles. Images were grouped according to the angle, biological and phantom models. Statistics were processed with chi<sup>2</sup>, t students and ANOVA with PPSS 12.00.

**Results and discussion:** Participated 38 experienced anesthesiologists from 2 hospitals, which evaluated 72 static images.

Images with the multibeam software improved the visualization of all needles in both biological and phantom model  $p < 0.01$ , with no differences among needles when this system is applied. However we found decreasing scores with increasing needle angle  $p < 0.016$ .

The differences with and without Multibeam of biological tissue were -5.29 (-5.48, -5.10), phantom -2.72 (-2.91, -2.93) and between biological and phantom Multibeam -0.47 (-0.67, -0.28)  $p < 0.001$

**Conclusion(s):** Not significant differences were found among needles strategies with the Multibeam software. Multibeam software improved the visualization of all types of needles in both models.

## 8AP4-6

### Peripheral blocks for analgesia in breast cancer surgery

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**Background and Goal of Study:** Breast surgery is one of the most common forms of surgery conducted in hospitals. Even relatively minor breast surgery can be associated with significant postoperative pain. Moreover prospective studies are trying to show the role of peripheral analgesia to prevent the recurrences of cancer. Our goal is to get to know the analgesia quality in patients who are treated in our hospital for breast surgery with peripheral blocks.

**Materials and methods:** We have performed 15 interpectoral blocks in tumor-ectomies. With a lineal ultrasound probe we identify pectoralis major muscle, pectoralis minor muscle and the pectoral branch of the thoracoacromial artery between the pectoralis muscles. We use a standard 50 mm block needle to infiltrate the interfascial plane with 0.4-0.5 ml/kg of 0.25% bupivacaine. In 2 patients we have performed paravertebral block with ultrasound because the surgery include lymphadenectomy and in another case we performed a thoracic peridural block because it was a bilateral surgery.

**Results and discussion:** The 15 interpectoral blocks performed has provided a good analgesia with levels EVA8 (visual analogue scale) under 3-4 and without important complications. In two cases patients have noticed a light paresthesia in one finger just after surgery. Another patient presented nausea. Women were discharged because it was ambulatory surgery and the nurse of this area telephoned them the next day and the patients studied had a good level of analgesia. In the group of peridural and paravertebral blocks the analgesia showed also visual analogue scale less than 3-4.

**Conclusion(s):** Peripheral blocks provide a good level of analgesia without significant complications.

#### References:

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 Can Anesthetic Technique for primary breast cancer surgery affect recurrence or metastasis? *Anesthesiol* 2006

## 8AP4-7

### Ultrasound-guided inguinal field block performed by anesthesiologists compared to field block infiltration performed by surgeons in inguinal hernia surgery: a randomized, double blind, controlled trial

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**Background and Goal:** Inguinal field block performed by surgeons remains an underused technique worldwide (< 18% of cases) although is recommended for hernia repair (1). In a prospective, randomized, double blind, controlled study, we evaluated intraoperative pain after an ultrasound-guided inguinal field block (UGIB) performed by anesthesiologists before surgery and compared it with stepwise field block (IFB) performed by surgeons.

**Materials and methods:** After Institutional Board approval, 45 male adults, ASA I-III, sedated with midazolam 0.035mg/kg, were allocated to receive UGIB (iliohypogastric and ilioinguinal nerve block+inguinal canal block+incision line infiltration) with Ropivacaine 5 mg/ml, up to 225 mg (22 patients) or IFB with Trabucco's solution (Bupivacaine 90 mg+Mepivacaine 30 mg in 61 ml volume) (23 patients).

Pain rating through verbal Numerical Rating Scale was evaluated at incision, during spermatic cord traction, and at skin closure. At the end of surgery the patients rated the overall intraoperative pain experience.

Sample size was 23 patients for a 37% reduction in mean(SD) = 2.7 (2) pain scores with a SD=1, a power of 80% at the 0.05 significance. Analysis was performed with Mann-Whitney test for non-parametric data. Results are median(Interquartile range; range). Effect size was calculated when appropriate with *r* test for non-parametric data.

**Results and discussion:** Pain scores at incision showed no differences. Pain during spermatic cord traction was 0(1; 0-6) in UGIB group vs 1(4; 0-4) in IFB group (p 0.004, *r* 0.15 - small effect).

Pain at wound closure was 0(3.75; 0-8) in UGIB group vs 4(4; 0-8) in IFB group

(p 0.047, *r* 0.30 - medium effect). Overall intraoperative pain experience rating was 0(3.25; 0-8) in UGIB group vs 4(4; 0-8) in IFB group (p 0.015, *r* 0.41 - large effect).

Postoperative pain scores were not different except dynamic pain at 6 h that was 2(3.25; 0-4) in UGIB group vs 3.5(3; 0-6) in IFB group (p 0.003, *r* 0.46 - large effect).

**Conclusion(s):** In this study, pain scores during surgery were lower with UGIB with a large effect size compared to IFB. UGIB performed by anesthesiologists may represent a valid alternative in facilities where IFB is not performed routinely by surgeons.

#### References:

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## 8AP4-8

### A randomized, controlled trial on the superiority of inguinal field block compared to subarachnoid block for pain control after inguinal hernia repair

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**Background and Goal of Study:** There is currently little evidence on the superiority of inguinal field block compared to subarachnoid block (SAB) for pain control during the first 24 hours after hernia surgery (1).

In a prospective, randomized, controlled study, we evaluated pain scores after an ultrasound-guided inguinal field block (UGIB) compared to SAB.

**Materials and methods:** After Institutional Board approval, 74 male adults, ASA I-III, sedated with midazolam 0.035mg/kg, were randomly allocated to receive UGIB (iliohypogastric and ilioinguinal nerve block+inguinal canal block+incision line infiltration) with Ropivacaine 5 mg/ml, up to 225 mg (37 patients) or SAB with hyperbaric Bupivacaine 10 mg/ml, 10-12 mg at L3-4 level (37 patients).

Pain rating through verbal Numerical Rating Scale was evaluated in the PACU, at 4 hours and the morning after surgery. Analgesic consumption was recorded during hospital stay (Acetaminophen+/-Ketorolac+/-Tramadol) and up to seven days after surgery at home (Acetaminophen).

Sample size was 37 patients for 50% reduction in mean(SD) = 4(2.5) pain scores with a SD of 2.5, a power of 80% at the 0.05 significance. Analysis was performed with Mann-Whitney test for non-parametric data. Results are median(Interquartile range; range). Effect size was calculated when appropriate with *r* test for non-parametric data.

**Results and discussion:** Static pain at 4 hours control was 0(2; 0-10) in UGIB group vs 4(3.5; 0-8) in SAB group (p 0.000, *r* 0.45 - large effect). Dynamic pain at 4 hours control was 2(4; 0-10) in UGIB group vs 6(4; 0-10) in SAB group (p 0.000, *r* 0.50 - large effect). There were no differences at other intervals. Analgesic doses during hospital stay were 1(1; 0-7) in UGIB group vs 3(1.5; 0-6) in SAB group (p 0.001, *r* 0.31 - medium effect). Analgesic doses at home were 2(4.5; 0-10) in UGIB group vs 4(5.5; 0-25) in SAB group (p 0.02, *r* 0.26 - medium effect). Total analgesic doses were 3(5; 0-13) in UGIB group vs 7(5; 0-25) in SAB group (p 0.001, *r* 0.34 - medium effect).

**Conclusion(s):** In this study, inguinal field block provided better pain scores 4 hours after surgery and reduced analgesic consumption for seven days after hernia repair compared to SAB.

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1. Joshi GP, Rawal N, Kehlet H; PROSPECT collaboration, et al. Evidence-based management of postoperative pain in adults undergoing open inguinal hernia surgery. *Br J Surg*. 2012; 99:168-185.

## 8AP4-9

### Plasma concentration of ropivacaine after abdominal truncal blocks with or without epinephrine

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**Background:** Rectus sheath block (RSB) and transversus abdominis plane block (TAP block) require large amounts of local anesthetic and have the potential to produce systemic toxicity(1). Epinephrine is often added to reduce plasma levels but this remains controversial(2). In this study, we have evaluated ropivacaine pharmacokinetics following RSB or TAP block with or without epinephrine (1:300,000).

**Methods:** With the approval of our University ethics committee and informed consent, 26 adult patients undergoing lower abdominal surgery with RSB



(RSB group) and another 26 adult patients undergoing open prostatectomy with TAP block (TAP group) were enrolled. Patients were randomly assigned to receive 20ml of ropivacaine solution with epinephrine (E(+)) group: n=13) or without epinephrine (E(-)) group: n=13). Epinephrine mixture solution was made from 0.75% ropivacaine and 1% lidocaine containing epinephrine (10mg/ml; 1:100,000) in the ratio of 2:1. For the solution of without epinephrine 0.75% ropivacaine and plain 1% lidocaine was used in the ratio of 2:1. Arterial plasma samples were collected 15, 30, 45, 60, 90, 120, 180 min after completion of TAP block or RSB. Plasma ropivacaine concentrations were measured by gas chromatography mass spectrometry (GC/MS) (inter and intra assay coefficient of variation and minimum sensitivity was 3.6%, 3.7% and 10ng/ml respectively). Data are presented as mean±SD. Statistical analysis was performed using paired t-test.

**Results:** The peak concentrations (Cmax) and times to peak concentration (Tmax) were significantly different between TAP-E(+) and TAP-E(-) groups ( $p < 0.5$  and  $p < 0.001$ , respectively), while there were no significant differences between RSB-E(+) and RSB-E(-) groups.

**Conclusion:** Epinephrine could attenuate the early phase of ropivacaine absorption from the injected site in TAP block, but not in RSB. Adding epinephrine to ropivacaine may be beneficial for TAP block but not for RSB in clinical use.

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## 8AP4-10

### Effectiveness of continuous wound infiltration-based technique in the treatment of acute and persistent post surgical pain after major incisional breast surgery: a prospective cohort study

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**Background and Goal of Study:** Both acute and persistent post surgical pain are significant problems following breast cancer surgery (BCS). Pain complicates recovery following BCS and contributes to delayed hospital discharge. Regional anaesthesia, as a component of multimodal analgesia, reduces both acute and chronic pain after BCS. Continuous wound infiltration (CWI) may have comparable analgesic efficacy to paravertebral block. The aim of this study is to assess the effect of CWI-based analgesia on acute and chronic pain and on the attainment of milestones of recovery following major breast cancer surgery.

**Materials and methods:** Following ethical approval and informed consent, we performed a prospective cohort study of women undergoing major breast cancer surgery in a national breast cancer centre in Ireland. A standardised propofol total intravenous anaesthesia (TIVA) technique was used, combined with systemically administered multimodal analgesics. At the end of surgery, the wound was soaked with 40 ml of bupivacaine 0.25%. Two multipointed wound infiltration catheters were placed within the wound and connected to an elastomeric infusion pump delivering bupivacaine 0.25% at a rate of 5 ml/h for 48 h. Pain, post-operative nausea and vomiting and both PACU and hospital discharge readiness was assessed post-operatively. The presence of persistent post surgical pain at 3 and 6 months was sought. Results are given in percentage, mean and SD.

**Results:** Interim analysis of 39 women [(mean ± SD) age (56.5 ± 9.2); weight (72.9 kg ± 16.85)] show that acute pain was present in 26% [NRS (Mean ± SD)] (1.43 ± 2.58) on PACU admission, 43% at PACU discharge (1.43 ± 2.22), 26% at 8 AM (0.74 ± 1.72). Only 3 cases of PONV were noted. 79.5% of women fulfilled PACU discharge criteria [Aldrete Score (mean ± SD)] (9.1 ± 1.16) within 15 min and 79.5% attained hospital discharge criteria [PADS scores (mean ± SD)] (9.2 ± 0.84) at 8 PM. At 3 months 72.2% of women reported persistent pain [mild (50%), moderate (50%); [Total Pain Rating Index (T-PRI)] (mean ± SD)] (5.18 ± 4.7) and at 6 months 71.43% [mild (40%), moderate (60%)] (5 ± 4.3).

**Conclusion(s):** CWI and multimodal analgesia facilitates the early attainment of PACU and hospital discharge readiness following major breast cancer surgery. Persistent pain was mild to moderate with low T-PRI scores.

## 8AP5-2

### Sciatic nerve block in popliteal fossa using ropivacaine 0.15% provides adequate analgesia and less motor block after total knee arthroplasty

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**Background and Goal of Study:** Postoperative pain after total knee arthroplasty (TKA) is a major concern. Our standard practice in providing analgesia after TKA is to provide sciatic nerve block (SNB) in the popliteal fossa combination with continuous femoral nerve block (CFNB). Orthopedic surgeons, however, have expressed concern that SNB, especially sciatic motor block might obscure the diagnosis of peroneal nerve injury postoperatively. The purpose of this study was to determine the appropriate local anesthetic concentration of SNB that provides adequate analgesia postoperatively for popliteal pain and to determine the concentration of ropivacaine to minimize postoperative sciatic motor block.

**Materials and methods:** This is a retrospective study of 57 patients who underwent TKA with CFNB, SNB and general anesthesia from July 2011 to July 2012. The patients had received SNB in the popliteal fossa under ultrasound guidance with either 20ml of ropivacaine 0.15% (n=29, Group A) or 20ml of ropivacaine 0.375% (n=28, Group B). We evaluated posterior and overall knee pain at rest on POD 0, 1 and 4, and dynamic pain (knee flexion) on POD 1 and 4 using the visual analog scale (VAS; range: 0-100mm). We also evaluated the motor block immediately after surgery as measured by weakness or disappearance (manual muscle testing [MMT] = 1/5 or 0/5) of the plantar and/or dorsiflexion of the foot. VAS scores were presented as median and the level of significance was set at  $P < 0.05$ .

**Results and discussion:** Median VAS scores for posterior knee pain were 0, 39, and 32 for Group A and 0, 47 and 3 for Group B on POD 0, 1 and 4, respectively. Median VAS scores for overall knee pain were 0, 53 and 35 for Group A and 0, 48 and 0 for Group B on POD 0, 1 and 4, respectively. VAS scores for dynamic pain were 80 and 63 for Group A, and 75 and 50 for Group B on POD 1 and 4, respectively. The difference in VAS scores was not statistically significant between the two groups except for overall knee pain on POD 4 (35 vs. 0,  $P=0.004$ ). Ten patients (34.5%) in Group A versus 25 patients (89.3%) in Group B had sciatic motor block. Sciatic motor block was found to be statistically significantly higher in Group B compared with Group A ( $P < 0.0001$ ).

**Conclusion(s):** Our experience suggests that a low concentration of anesthetic (0.15% ropivacaine) is better for SNB in the popliteal fossa to minimize postoperative sciatic motor block, while providing adequate analgesia after TKA.

## 8AP5-3

### Evaluation of continuous peripheral nerve block on the microcirculation of patients with critical limb ischemia

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**Background and Goal of Study:** Continuous popliteal sciatic catheter infusion with local anesthetic (CPSC) is an efficient method for pain management in patients with critical limb ischemia. This analgesic technique could also improve microcirculatory conditions. This study aims to assess impact of CPSC on the microcirculation.

**Materials and methods:** After local Ethic committee approval, ultrasound guided CPSC was positioned for analgesia in patients with Leriche stage III or IV peripheral obliterating arteriopathy. Patients with CPSC received a first 20ml bolus of ropivacaine (R) 7.5mg/ml followed by a continuous infusion of R 2mg/ml at 5 ml/h. An evaluation of microcirculation before and 48h after CPSC was made by measurements of transcutaneous oximetry (TcPO<sub>2</sub>) and skin perfusion pressure (SPP) by Laser Doppler on both limbs. In parallel, a measurement of tissue oxygen saturation (StO<sub>2</sub>) by INVOS monitor™ was performed before and after CPSC on lateral surface of leg and forefoot on both limbs. Morphine consumption, Visual Analogic Scale (VAS) scores were collected and analyzed. Results were expressed as mean±SD. Comparisons between groups used a Wilcoxon test with  $p < 0.05$  as statistically significant.

**Results and discussion:** From September 2012 to April 2013, 14 patients were included (8 women, 6 men). Mean age was 78±15 years. On critical ischemic limb, TcPO<sub>2</sub> before and after CPSC were 19±17mmHg and 33±17

mmHg ( $p = 0.005$ ); on the non ischemic limb,  $TpO_2$  was  $43 \pm 16$  mmHg and  $47 \pm 11$  mmHg respectively ( $p = 0.36$ ). Mean SPP before and after CPSC on limb ischemia were  $38 \pm 21$  mmHg and  $60 \pm 31$  mmHg ( $p = 0.03$ ); on the other limb, mean SPP was  $58 \pm 19$  mmHg and  $53 \pm 17$  mmHg respectively ( $p = 0.34$ ). Mean  $StO_2$  before versus after CPSC on lateral leg and forefoot of ischemic limb were respectively  $56 \pm 15\%$  versus  $60 \pm 20\%$  ( $p = 1$ ) and  $52 \pm 23\%$  versus  $59 \pm 16\%$  ( $p = 1$ ). Mean morphine consumption before CPSC was  $97 \pm 80$  mg/d and became zero mg/d in all patients after CPSC. Median VAS scores were 9 and 1 before and after CPSC, respectively. No systemic toxicity of local anesthetic was observed. No amputation was necessary. No surgery was done for 7 patients, endovascular surgery was required for 4 patients and vascular bypass for 3 patients..

**Conclusion:** These results show a significant improvement of microcirculation after CPSC for critical limb ischemia. Mechanisms remain unclear. It could be due to a sympathetic blockade. However there was no change in  $StO_2$  in these conditions.

## 8AP5-4

### Efficacy of adductor canal block following knee surgery: a systematic review

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**Background and Goal of Study:** Knee surgery is associated with significant postoperative pain. Adductor canal block (ACB), predominantly a sensory block involving the saphenous nerve, nerve to vastus medialis and the articular branch of obturator nerve<sup>1</sup>, reduces postoperative pain after knee surgery but there is conflicting evidence regarding its efficacy. This systematic review examines current evidence regarding the efficacy of ACB for knee surgery.

**Materials and methods:** Randomised controlled trials (RCTs) on MEDLINE and EMBASE with no year or language restrictions were sought using the following keywords and text words: adductor canal, subsartorial and saphenous nerve block. Bibliographies and published abstracts from 2000-13 were also reviewed. Full manuscripts were rated for quality using the Jadad scale. We included RCTs comparing ACB using the local anaesthetics bupivacaine or ropivacaine, with or without epinephrine versus saline as control. RevMan statistical software utilised inverse variance, random effect to calculate mean difference (MD) with 95% confidence intervals (CI) for continuous variables, odds ratio and Mantel-Haenszel method for dichotomous variables. Primary outcome was 24 hr opioid consumption. Secondary outcomes were pain scores at 0, 2, 4, 6 and 24 hrs at rest postoperatively and incidence of postoperative nausea and vomiting (PONV).

**Results and discussion:** Six RCTs published between 2008-13, Jadad scale 2-5, were identified and 289 patients met the inclusion criteria. Three trials used ACB for arthroscopic surgery and three studied ACB for total knee arthroplasty. Four trials used single shot ACB and two trials used intermittent boluses via a catheter. There was no statistical significance noticed in 24 hour opioid consumption (MD -4.83; 95% CI -11.80, 2.15;  $P=0.17$ ) or in postoperative pain scores at 0, 2 and 4 hrs at rest. In contrast, there was statistical significance in favour of ACB at 6 hrs ( $P=0.02$ ) and 24 hrs ( $P=0.006$ ) at rest. There was no difference in the incidence of PONV.

**Conclusion:** This systematic review suggests that the benefit of ACB for knee surgery for postoperative analgesia is inconclusive but this may be due to small sample sizes or performance bias. We recommend larger RCTs in order to confirm or refute the findings.

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## 8AP5-5

### Usefulness of contrast-enhanced ultrasonography for peripheral nerve block

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**Background and Goal of Study:** Ultrasound guidance has recently become a common technique for nerve block and it allows real-time observation of the nerves, needle and local anaesthetics (LA). To reduce side effects, LA should be provided only to the appropriate location and its spread should be observed. However, the exact distribution of LA is sometimes difficult to observe

because the boundary of LA spread is ambiguous. In recent years, contrast-enhanced techniques have been used in ultrasonography. The purpose of our study was to evaluate the usefulness of contrast-enhanced ultrasonography (CEUS) for peripheral nerve block.

**Materials and methods:** Selective tibial nerve block under ultrasound guidance was attempted in 9 thighs from 5 adult cadavers. An Aplio™ 300 ultrasound scanner, which has imaging methods of CEUS and conventional B-mode, was used for this study. Each cadaver was placed in the prone position and a 22-gauge block needle was advanced toward the tibial nerve using an in-plane approach. Five ml of LA (1% lidocaine) solution with blue dye, containing 0.05 ml of an ultrasound-contrast agent (Sonazoid®) and 1 ml radio-contrast medium, was injected. After these procedures, the longitudinal length of LA spread was measured by 4 different methods: CEUS, radiography, B-mode ultrasonography and anatomical measurement of the blue dye after dissection. We defined the length determined by anatomical dissection as the standard, and agreement between the lengths determined by anatomical dissection and another method was assessed by a Bland-Altman plot.

**Results and discussion:** Compared with anatomical dissection, the biases and limits of agreement were -1.1 (-4.8 to 2.5), 0.9 (-2.5 to 4.3) and -5.0 (-10.6 to 0.5) cm for CEUS, radiography and B-mode ultrasonography, respectively. Longitudinal lengths measured by CEUS and radiography agree well with that determined by anatomical dissection. In contrast, longitudinal length measured by B-mode ultrasonography was underestimated compared to that determined by anatomical dissection.

**Conclusion(s):** This cadaver study revealed that CEUS was useful for observing the distribution of LA for tibial nerve block, whereas evaluation by conventional B-mode ultrasonography was difficult. CEUS has potential to be used in many other peripheral nerve blocks and would enable the amount of LA injection to be minimized.

## 8AP5-6

### Comparison of the effect of periarticular local infiltration analgesia and continuous epidural analgesia after total knee or unicompartmental knee arthroplasty

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**Background:** Periarticular local infiltration analgesia (LIA) has recently introduced as postoperative pain management for the patient undergoing knee arthroplasty, because it can avoid muscle weakness caused by the widely used postoperative continuous epidural anesthesia (PCEA). However, little was known about the difference in analgesic effect between total knee (TKA) and unicompartmental knee arthroplasty (UKA). This retrospective study was conducted that firstly to clarify the effect of LIA for first 3 days after surgery compared with PCEA and secondly to assess the difference in its postoperative analgesic effect between TKA and UKA.

**Methods:** Sixty-six patients (Pts) underwent knee arthroplasty (31 Pts with TKA (LIA-T), 35 with UKA (LIA-U)) were received LIA. Their anaesthesia was maintained with intrathecal injection of isobaric bupivacaine and single femoral nerve block of ropivacaine. Just before skin closure, the mixed solution (ropivacaine, morphine, methylprednisolone and ketoprofen) were infiltrated around knee. After surgery, postoperative pain (numeric rating scale), the rescue analgesia requirements, adverse reaction (postoperative nausea and vomiting, etc.), passive rotation of mobilization (p-ROM) were examined for first 3 days after surgery. As the historical control, 60 Pts underwent knee arthroplasty (30 Pts with TKA (PCEA-T), 30 with UKA (PCEA-U)) and treated postoperative pain with PCEA were also examined. Statistical analysis was performed by T-test, Chi-square test and ANOVA. P value less than 0.05 was defined as significant.

**Results and discussion:** There was no difference in patient characteristics among these four groups (LIA-T, LIA-U, PCEA-T and PCEA-U). In Pts with LIA, rescue analgesia requirements first 24 hours after surgery were significantly less than that in Pts with PCEA. Especially in first 12 hours, rescue analgesia requirements in LIA-T Pts were much less compared with that in Pts with PCEA-T, whereas there was no difference in that in UKA Pts. There was no difference in p-ROM or PONV among four groups. It was assumed that postoperative pain of TKA was greater than that of UKA. Therefore, LIA as the localized and reliable analgesia might be more useful in TKA Pts than UKA Pts.

**Conclusions:** In Pts after knee arthroplasty, LIA had more beneficial effect on postoperative analgesia than PCEA during first 24 hours. Postoperative analgesic effect of LIA seemed to work exceedingly well in TKA Pts compared with that in UKA Pts.

## 8AP5-7

### Plasma concentrations of ropivacaine following ultrasound-guided or nerve-stimulator-guided femoral nerve block: a prospective study

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**Background:** Even correctly performed peripheral nerve blocks lead to systemic absorption, and local anesthetic systemic toxicity remains a concern. Data on the maximum admissible dose of local anesthetic using different techniques is old and does not take into account the technique used to perform the block, whether it be neurostimulation (NS) or ultrasound (US) guidance.

**Objective:** Our aim was to establish a plasma concentration curve of ropivacaine for femoral nerve blocks and to ascertain whether the resulting plasma concentrations differ significantly depending on the nerve localization technique used (US vs. NS).

**Methods:** Sixteen patients receiving a femoral nerve block as part of their anesthetic for unilateral lower extremity surgery were enrolled in this prospective study. They were randomized to undergo either US or NS guidance. All blocks were performed with 20 mL of 5 mg/mL ropivacaine. Blood samples were drawn before the nerve block and 20, 30, 40, 50, 60, 70, and 80 minutes after the block. Plasma levels of ropivacaine were analyzed by high performance liquid chromatography (HPLC).

**Results:** All blocks were successful and no patient showed signs or symptoms of local anesthesia toxicity. The plasma concentration of ropivacaine peaked at 30 minutes in both arms. There was no significant difference in peak levels between US and NS-guidance ( $0.325 \pm 0.186$  vs.  $0.356 \pm 0.106$  mcg/mL; ns). Between 50 and 70 minutes, there was a trend toward higher plasma concentrations of ropivacaine in the US group than in the NS group but it did not reach significance.

**Conclusion:** Plasma concentrations of ropivacaine peak around 30 minutes after femoral nerve block regardless of the technique used. No significant difference was found between US- and NS-guidance, despite a trend toward higher levels in the US group between 50 and 70 minutes. We will repeat this study with other nerve blocks, such as the interscalene block, to investigate whether plasma levels differ depending on the technique.

**Acknowledgements:** Richard Kline, PhD, assisted with data analysis.

## 8AP5-8

### Local anesthetic spread in the adductor canal block: a cadaver study

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**Background:** The "adductor canal" block, consisting in an injection of about 30 mL of local anesthetic at the mid-thigh level, has been proposed to provide analgesia following knee procedures<sup>1-3</sup> without the significant quadriceps motor block that results from a femoral nerve block<sup>4</sup>. Such analgesia is unlikely to result solely from saphenous nerve blockade. We investigated in six fresh cadaver lower extremities what the actual spread of local anesthetic injected in the adductor canal was, and what other nerve branches, if any, would be blocked besides the saphenous nerve.

**Material and methods:** Six fresh adult cadaver lower extremities were studied. A mixture of 27 mL of 2% lidocaine and 3 mL of methylene blue was injected under ultrasound guidance in the adductor canal. Three of the thighs were surgically dissected plane by plane, while the other three were frozen, cut into 2-cm thick slices, and then thawed. In two legs, the mixture also included 2 mL of radio-opaque dye. These two legs were imaged by computed tomography prior to dissection or freezing. Dye spread was examined to determine nerve branches that would likely be blocked by a similar injection in vivo.

**Results:** The dissection showed that the dye was mainly confined to the adductor canal, with only a small amount of dye seen anterior to the adductor magnus, reaching the posterior branch of the obturator nerve. Except in one case, there was no dye following the femoral vessels as they traveled through the adductor hiatus to become the popliteal vessels, in close proximity with the sciatic nerve. Instead, the dye remained with the saphenous nerve and the descending genicular artery on the more distal cuts. In one case, the dye spread proximally, reaching the femoral nerve.

**Conclusion:** This study demonstrates that the spread of local anesthetic during an adductor canal blockade involves, besides the saphenous nerve, the posterior branch of the obturator nerve during its course anterior to the adductor magnus, but does not typically extend to the popliteal area, or laterally or proximally to other branches of the femoral nerve.

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## 8AP5-9

### Comparison of two preparations of 1.5% mepivacaine with different sodium content for ultrasound guided popliteal block: preliminary results

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**Background and Goal of Study:** Dhir et al. demonstrated an earlier onset of brachial plexus block when ropivacaine was prepared using a dilution in 5% dextrose (D5), due to a decrease of Sodium Chloride (NaCl) concentration. Our hypothesis is that a preparation of 1.5% mepivacaine (MPV) using 2% MPV plus D5 (NaCl 89.84 mmol/L, group D5) can improve the efficacy compared to mix of 2% plus 1% MPV (NaCl 128.34 mmol/L, group N), for ultrasound guided popliteal block (USGPB).

**Materials and methods:** After local ethics committee approval, 53 patients scheduled for hallux valgus surgery were included in this prospective, randomized, double blind study. They were assigned to one of the two groups, and an USGPB was performed. We calculated the Minimum Effective Anaesthetic Volume in 50% patients (MEAV<sub>50</sub>) of 1.5% MPV in both groups following the up and down staircase design of Dixon<sup>1</sup>, starting with 25 ml in each group. Sensory and motor blocks were assessed every 5 min until 30 min; a complete sensory block at 30 min or earlier was considered as success. We measured also onset time, block duration, incidence of adverse effects, and satisfaction of the patients. The sample size was calculated at 33 patients per group, based on a previous study<sup>2</sup>. Results were analyzed with Mann Whitney test for quantitative data and Chi-2 test or Fischer's exact test for qualitative one. A p < 0.05 was considered significant.

**Results and discussion:** Since April 2013, 26 patients in group D5 and 27 in group N has been included. No statistically significant differences in demographic data were found. We only have 3 of the minimum of 5 deflections of volume we predetermined to calculate MEAV<sub>50</sub>. 3/26(11.5%) failures were registered in group D5 versus 4/27(14.8%) in ND (p=0.7). Onset time in D5 is 15[2-25] min, and 15[5-30] min in N (p=0.8). Block duration was 345[205-720] min in D5 vs 375[130-550] min in N (p=0.55). No adverse event was registered, and satisfaction was not different.

**Conclusion:** These preliminary results do not seem to confirm an advantage of D5 dilution of 1.5% MPV for USGPB.

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## 8AP5-11

### 3D Ultrasound estimation of the effective volume for popliteal block at the level of division

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**Background and Goal of Study:** Ultrasound guided popliteal block at the level of división of the sciatic nerve between the two branches results in an optimal and predictable diffusion of local anesthetic. Ultrasound volumetric acquisition before and after the block may be useful to estimate the volume in contact with the nerve. Using 3D ultrasound, we quantified the visible volume surrounding the nerve along a 5 cm segment.

**Materials and methods:** We included 20 consecutive patients scheduled for bunion surgery. Ultrasound guided popliteal block was performed using a posterior, out of plane approach. Nerve stimulation was used to avoid injection at intensities below 0.3 mA. Thirty mL of mepivacaine 1.5% and levobupivacaine 0.5% were slowly injected while assessing the injection pressure. The



diffusion of the local anesthetic and the presence of intraneural injection criteria were evaluated. Volumetric acquisition was performed before the block to measure the volume of the sciatic nerve and repeated after the block to quantify the volume of the hypochoic halo surrounding the nerve contained inside the epineurium in a 5 cm segment at the level of its division.

**Results and discussion:** All blocks were uneventful and successful within 20 min after the injection. Motor response was present in 16 patients (80%) at a mean intensity  $0.6 \pm 0.2$  mA (range 0.4-0.9). High injection pressure was not detected. Intraneural injection criteria were present in all cases. The sciatic nerve volume increased significantly after block ( $3.4 \pm 0.2$  to  $5.9 \pm 2.3$  cm<sup>3</sup>;

$p < 0.001$ ) which was attributed to a mean  $2.4 \pm 1.7$  cm<sup>3</sup> of local anesthetic that diffusing intraneurally. The volume of the halo around the nerve was  $4.4 \pm 1.7$  cm<sup>3</sup>. The total estimated volume inside and around the nerve in a 5cm segment was  $6.8 \pm 2.6$  cm<sup>3</sup>.

**Conclusion(s):** The volume of local anesthetic contained within the epineurium in a 5 cm segment of the sciatic nerve after injecting 30 mL of local anesthetic at the level of division was easily assessed by volumetric acquisition and was less than 25% of the injectate. Our results suggest that the volume of local anesthetic needed for a successful sciatic popliteal block could be reduced.

## Pharmacology

### 9AP1-2

#### Pharmacodynamic modelling of NRS pain ratings during postoperative pain therapy with hydromorphone

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**Background and Goal of Study:** Postoperative pain is commonly assessed by the NRS-11 scale (0: no pain, 10: maximum pain). As this is not an interval scale but an ordinal scale, the standard sigmoid  $E_{max}$  model may be inappropriate for pharmacodynamic modelling (1). We investigated the use of a multinomial logistic regression model for the analysis of pain ratings in the early postoperative phase.

**Materials and methods:** We analyzed data from a clinical study with IRB approval and written informed consent in patients undergoing coronary artery bypass surgery (EudraCT 2011-003648-31). Intraoperative analgesia was performed with sufentanil. Postoperatively, hydromorphone (HM) was administered as target controlled infusion. Plasma concentrations of HM and sufentanil were measured from arterial blood samples. Pain under inspiration was assessed using the NRS-11 scale. Three levels of pain were defined: level 1 (no or very weak pain) with NRS scores  $\leq 1$ , level 2 (mild to moderate pain) with NRS scores of 2, 3 or 4, and level 3 (severe pain) with NRS scores  $\geq 5$ . Pharmacodynamic modelling was performed by population analysis with a multinomial logistic regression model for the probability  $P_m$  to obtain a NRS value  $\leq m$ :  $\log(P_m/(1-P_m)) = a_m + b_1 \cdot C_{Hydromorphon} + b_2 \cdot C_{Sufentanil}$

**Results and discussion:** Data of 45 patients (age: 40-81 y., 33 male) were analyzed. The observation period was  $9.2 \pm 1.6$  h. Total amount of HM was  $3.1 \pm 1.9$  mg. Mean HM concentration was  $3.3 \pm 2.3$  ng/ml. Sufentanil concentration decreased from  $0.13 \pm 0.05$  to  $0.05 \pm 0.02$  ng/ml during the observation period. Observed incidences of the pain levels 1, 2 and 3 were 33%, 48% and 19% with a median NRS score of 3. Pain levels were well described by the multinomial logistic regression model. For a NRS score  $\leq 4$ , the  $EC_{50}$  of HM was 2.5 ng/mL (interquartile range: 1.4 to 4.5 ng/ml). For a NRS score  $\leq 1$ , the  $EC_{50}$  of HM was 4.7 ng/mL (interquartile range: 3.5 to 7.2 ng/ml). A concomitant sufentanil concentration of 0.1 ng/ml reduced the  $EC_{50}$  values of HM by 1.9 ng/ml. **Conclusion(s):** Postoperative pain ratings could be well described by a multinomial logistic regression model. Residual intraoperative opioid concentration had a significant contribution to postoperative analgesia. The proposed model may be helpful for dosing in postoperative pain therapy.

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### 9AP1-3

#### Comparison of allele frequencies in opioid receptor gene OPRM1 (6q24-25, A118G) among different racial population groups, and the effects of the genetic polymorphism on $\mu$ -opioid receptor agonist requirements

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**Background:** Prior findings concerning the effects of genetic polymorphism on  $\mu$ -opioid receptor agonist requirements have not been in accord. Possible reasons for this are that (1) the subjects with a homo-variant showed a low frequency, and (2) the comparison of the drug requirements was performed

using only two groups (i.e., one is wild-type vs. hetero-variant and homo-variant). A118G polymorphism is the most extensively studied polymorphism with regard to sensitivity to opioid analgesics. In addition, the frequencies of A118G polymorphism vary considerably by race. The allele frequencies of A118G among different racial population groups have been not fully elucidated. Here we compared allele frequencies in A118G among different racial population groups, and we assessed the effects of the polymorphism on the requirements of remifentanil among three groups (wild-type, hetero-variant, and homo-variant).

**Materials and methods:** The study was approved by the Ethics Committee. Informed consent was obtained from each subject. We prospectively assessed the effects of the A118G SNP on remifentanil requirements in ASA PS I female patients who had undergone an elective mastectomy. We also assessed allele frequencies among native racial population groups. A118G DNA was extracted from the patients' saliva or blood. The data were analyzed with the Chi-squared test or ANOVA with the Scheffe F-test as the post-hoc test.

**Results and discussion:** The frequencies of A118G in Japanese patients (n=63) were AA=19, AG=36, and GG=8. The remifentanil requirement in the GG group was significantly higher than that in both the AA group and the AG group ( $p < 0.05$ ). The samples were as follows: Ivory Coast, n=57; Colombia, n=61; France (Caucasian), n=48; USA (Caucasian), n=60; Myanmar, n=60; China, n=67; and Japan, n=1,300. The G allele frequency was significantly higher in Japan (frequency 0.449) compared to all of the other countries: frequency 0.079 in the Ivory Coast to 0.313 in China.

**Conclusion(s):** The G allele frequency was significantly higher in Japan than in seven other countries. The number of GG subjects only in Japan could meet the eligibility criteria for a power analysis (power (1- $\beta$ ) = 0.9). Our assessment of the effects of A118G polymorphism on remifentanil among the wild-type, hetero-variant, and homo-variant groups revealed that the remifentanil requirement in the homo-variant group was significantly higher than those in the wild-type and hetero-variant groups.

### 9AP1-5

#### Remifentanil associated static hyperalgesia may be attenuated by the avoidance of sudden infusion cessation

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**Background:** Opioid-induced hyperalgesia is an unwanted occurrence and Remifentanil (Remi) is strongly associated with it. Remi infusions are usually stopped abruptly at the end of surgery and morphine is given before that. We hypothesized that Remi associated hyperalgesia could result from its abrupt cessation and that Remi gradual discontinuation in the recovery room could attenuate it.

**Methods:** An observational study was conducted in patients subjected to spinal surgery, taking advantage of the fact that at our institution different anesthesiologists use different opioid protocols: Remi with abrupt cessation before extubation, Remi gradually discontinued in the recovery room over 90 minutes and fentanyl only. Morphine was given 30 min before Remi abrupt cessation and post-op in the 3 groups at the discretion of the anesthetist. Pre and post-operative peri-incisional hyperalgesia was assessed using von Frey filaments. Pain perception pre and post surgery was assessed using standardized pain scales, together with psychological testing (Hospital Anxiety and Depression Scale). Investigators were not aware of the type of anesthetic

protocol. Ethics committee and informed consent were obtained. Statistics used Kruskal Wallis and Wilcoxon test.

**Results:** There were 49 patients included in this study, aged 54,  $61 \pm 12$ . Hyperalgesia occurred with abrupt cessation of Remi; there was a significant difference between the three groups Table 1. When comparing abrupt cessation of Remi with gradual discontinuation or anesthesia with fentanyl, significant differences were found Table 2

Wilcoxon test evaluating occurrence of hyperalgesia		Static Evaluation			
		Superior point	Middle point	Inferior point	Grouped Points
Abrupt cessation	Z	-3.071	-1.997	-1.887	-3.988
	Asympt. Sig (2-tailed)	0.002	0.046	0.059	0.000
Gradual cessation	Z	-1.601	-2.331	-1.883	-3.383
	Asympt. Sig (2-tailed)	0.109	0.020	0.063	0.001
Without remifentanyl	Z	-0.157	-0.78	-0.968	-0.436
	Asympt. Sig (2-tailed)	0.875	0.937	0.333	0.663

[Table 1]

Table 2 - Kruskal-Wallis Comparing the three groups		Table 3 - Kruskal-Wallis Comparing abrupt and gradual cessation	
Static Evaluation		Static Evaluation	
	Superior Point	Middle Point	Inferior Point
Abrupt cessation	Median: 0.000	Median: 0.000	Median: 0.000
Gradual Cessation	Median: 0.289	Median: 4.972	Median: 4.611
Without Remifentanyl	Median: 0.816	Median: 0.102	Median: 0.107

Table 4 - Kruskal-Wallis Comparing abrupt cessation with anesthesia without remifentanyl		Table 5 - Kruskal-Wallis Comparing gradual cessation with anesthesia without remifentanyl	
Static Evaluation		Static Evaluation	
	Superior Point	Middle Point	Inferior Point
Abrupt cessation	Median: -2.000	Median: 0.000	Median: 0.000
Without remifentanyl	Median: 4.933	Median: 3.038	Median: 0.123

[Table 2]

**Discussion and Conclusion:** The use of remifentanyl with abrupt cessation was associated with opioid-induced static hyperalgesia in the post-op period. Our results suggest that it is possible that by using gradual discontinuation of remifentanyl in the recovery room one might reduce the incidence of hyperalgesia.

## 9AP1-6

### Diphenhydramine inhibits NMDA-induced currents - New pharmacological aspects of a well known drug

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**Background and Goal of Study:** Diphenhydramine (2-diphenylmethoxy-N,N-dimethylethylamine) is a well known H1-receptor antagonist that plays a major role in clinical practice. It disposes antiallergic, antiemetic and sedative properties. Nowadays, diphenhydramine is primarily applied in the case of nausea, but also its sedative effect is of vital clinical importance. Even though the H1-antagonism might explain the sedative property of diphenhydramine, it is not unlikely that other receptors contribute to this quality. As other drugs mediating sedative properties partly operate via the inhibition of glutamate receptors, we tested the hypothesis if diphenhydramine interacts with excitatory ionotropic glutamate receptors.

**Materials and methods:** Electrophysiological experiments were performed by means of the patch-clamp technique at glutamate receptors heterologously expressed in human TsA cells.

**Results and discussion:** Diphenhydramine selectively blocked NMDA-receptors whereas AMPA- and kainate receptors were hardly affected. The inhibition occurred in a non-competitive manner. Diphenhydramine did not compete with NMDA or glycine for their binding sites. Half-maximal inhibition was obtained around 25  $\mu\text{M}$  diphenhydramine, independent of the subunit

composition. The inhibition was caused by a classical open channel blocking mechanism as there was no interaction in the absence of agonists. Furthermore, the inhibitory efficacy varied strongly with the membrane potential. It is shown that diphenhydramine most probably interacts via the  $\text{Mg}^{2+}$  binding site or a very closely related area of the channel pore.

**Conclusion(s):** Diphenhydramine inhibits NMDA-mediated membrane currents in a reversible and concentration-dependent manner at clinical relevant concentrations. The data of our study provides evidence that the NMDA receptor antagonism of diphenhydramine may contribute to its sedative effects.

## 9AP1-7

### A mixture of three peptidase inhibitors increases antinociceptive effects of dynorphin A (1-17) or dynorphin A (1-13) by intracerebroventricular administration in rats via mainly $\mu$ - and $\kappa$ -opioid receptors

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**Background and Goal of Study:** Our previous in vivo studies showed that a mixture of three peptidase inhibitors, amastatin, captopril and phosphoramidon, increased antinociception induced by dynorphin A (1-17) or dynorphin A (1-13) without neurotoxicity. Goal of this study is to investigate the effect of opioid receptor antagonists on dynorphin A (1-17) or dynorphin A (1-13)-induced antinociception in the presence of a mixture of three peptidase inhibitors.

**Materials and methods:** All the present animal experiments were performed in strict accordance with the Guidelines for Tokai University. Male wistar rats weighing 180-220g were anesthetized with nitrous oxide, oxygen and isoflurane (2%), mounted on a stereotaxic frame, and implanted with stainless-steel injection cannulae (external diameter of 0.30 mm). The lower end of the injection cannula was aimed at the third cerebral ventricle according to the atlas of Paxinos and Watson. The antinociception was measured by the tail immersion assay with 55°C as the nociceptive stimulus. A cut-off time of 5 seconds was used to prevent any injury to the tail. The percent of maximal possible effect (MPE) for each animal at each time was calculated using the following formula:  $\%MPE = [(test\ latency - baseline\ latency)/(5 - baseline\ latency)] \times 100$ . The AUC (area under the curve) value for the anti-nociception of an opioid on each rat was calculated for some experiments. CTOP, naltrindole hydrochloride and nor-BNI were administered as  $\mu$ ,  $\delta$  and  $\kappa$  opioid receptor antagonists.

**Results and discussion:** Pretreatment of the mixtures of three peptidase inhibitors increased antinociception of dynorphin A (1-17) or dynorphin A (1-13) dose dependently. This antinociception attenuated significantly by CTOP and nor-BNI, but naltrindole hydrochloride. Low-dose intracerebroventricular administration of dynorphin A (1-17) or dynorphin A (1-13) under pretreatment with three peptidase inhibitors increased antinociception. This antinociception was mainly mediated by  $\mu$  and  $\kappa$  opioid receptors.

**Conclusion(s):** The data obtained in present study showed that a mixture of three peptidase inhibitors on antinociceptive action of dynorphin A (1-17) or dynorphin A (1-13) increased significantly by intracerebroventricular administration in rats and this action was mainly mediated by  $\mu$  and  $\kappa$  opioid receptors.

## 9AP1-8

### 5-HT1A-receptor-agonist repinotan fails to counteract remifentanyl-induced ventilatory depression in healthy volunteers - a double blind, randomized controlled trial

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**Background and Goal of Study:** 5-HT1A-R-agonists increase spontaneous breathing and to counteract an opioid-induced ventilatory depression in rats. Small doses of 8-OH-DPAT and Repinotan, increased nociceptive responsiveness, but medium doses, sufficient to stimulate spontaneous breathing, did not have antinociceptive effects. The unselective 5-HT1A-R-agonist Buspirone was not confirmed to have respiratory and anti-nociceptive effects in men. This study was performed to verify, whether Repinotan (1) counteracts a

remifentanyl-induced ventilatory depression in men, and (2) to simultaneously measure nociceptive effects.

**Materials and methods:** In this prospective, randomised, double-blind, three-fold cross-over single-center trial, Repinotan was infused at doses of 75 µg/h or 150 µg/h or placebo for 5:33 hrs, respectively. Four hours after the start of the infusion, remifentanyl was given in ascending steps until a profound ventilatory depression (apnea > 60s, SpO<sub>2</sub> < 85%) was established. Ventilatory parameters were recorded with a Draeger EVITA® ventilator. Nociception was assessed with the Thermal Sensory Analyzer (TSA-2001).

**Results and discussion:** Repinotan failed to counteract remifentanyl-induced ventilatory depression, while analgesia was not impaired. Repinotan caused hyperalgesia, after the first hour of application, but not thereafter.

An initial hyperalgetic effect of repinotan confirmed animal data. Higher plasma levels, sufficient to stimulate spontaneous breathing were not reached due to unpleasant side-effects. Repinotan did not interfere with opioid-analgesia.

**Conclusions:** Maybe, the expected effect could have been uncovered using a study design with preliminary established opioid-induced respiratory depression and an additional loss of awareness.

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## 9AP1-9

### Central administration of CXCR4 antagonist prevents the development of peripheral neuropathic pain and modulates the spinal expression of neuropeptides and pro-inflammatory cytokines in mice

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**Background and Goal of Study:** C-X-C chemokine receptor type 4 (CXCR4) is receptor of chemokine CXCL12 with wide distribution and multiple functions in the central nerve system. We firstly reported that central administration of AMD3100, a CXCR4 antagonist, attenuated peripheral neuropathic pain (PNP). However, the effects of central administration of AMD3100 on the development of PNP and its underlying mechanism are still unknown. Therefore, this study aimed to explore the molecular events involved in anti-nociceptive effect of intrathecal AMD3100 on PNP at the early stage following peripheral neuropathic injury.

**Materials and Methods:** Partial sciatic nerve ligation surgery (pSNL) was performed on adult male C57BL/6 wild-type mice in order to induce PNP. A single dose of AMD3100 (10µg / 5µl) was injected intrathecally in mice 1 hour prior to pSNL surgery, on post-operative day (POD) 1, POD 2 and POD 3 consecutively, while saline was given in control group. Pain response of mice to mechanical stimuli was assessed by Von Frey test (AMD3100 group n=10 and Saline group n=6). After 4-consecutive-day treatment of AMD3100 (n=8) or saline (n=6), L3-L5 spinal cord segment of pSNL-injured mice was harvested for examining spinal mRNA expression of neuropeptides and pro-inflammatory cytokines by real time PCR analysis.

**Results and Discussion:** pSNL surgery produced PNP in mice of control group, which was manifested as significantly reduced paw withdrawal threshold (PWT) ( $p < 0.001$ ). Intrathecal AMD3100 attenuated the development of PNP and increased PWT as compared to the control group for 6 days ( $p < 0.05$ ). Among mRNA levels of neuropeptides and pro-inflammatory cytokines contributing to the development of PNP, intrathecal AMD3100 upregulated adrenomedullin (AM,  $p < 0.001$ ) and downregulated tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ,  $p < 0.05$ ) and interleukin-6 (IL-6,  $p < 0.05$ ). However, it has no effect on mRNA levels of calcitonin gene-related peptide ( $\alpha$ CGRP), substance P (SP), enkephalin (ENK1) and interleukin-1 $\beta$  (IL-1 $\beta$ ).

**Conclusion:** Our study showed that intrathecal AMD3100 given before and immediate after pSNL for 3 consecutive days attenuated the development of PNP. It was associated with downregulation of TNF- $\alpha$  and IL-6 and upregulation of AM. CXCR4 signaling pathway appears to be important for the development of PNP. Central CXCR4 antagonist administrated at early stage following nerve injury would potentially be an effective way to prevent neuropathic pain development.

## 9AP2-1

### Anti bacterial activity of tramadol associated with levobupivacaine: an *in vitro* investigation

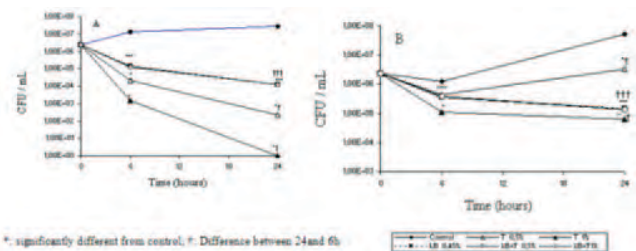
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**Background and Goal of Study:** In our institution, tramadol is frequently used as adjuvant with levobupivacaine to enhance the duration of analgesia for our regional blocks. The individual antibacterial activity of each of these agents was previously reported. This *in vitro* study was performed to investigate the antibacterial activity of tramadol added to levobupivacaine against *E. coli* and *S. aureus*, and to know whether this association can reduce more significantly the risk of a probable nosocomial infection.

**Materials and methods:** Bacterial cultures [approximately 5x10<sup>6</sup> colony forming units (CFU)] were added to levobupivacaine (0.45%), alone and in combination with 0.5 and 1% of tramadol solutions, then incubated for 6 or 24h at 37°C. The numbers of viable bacteria in the presence and absence (control) of the tested solutions were counted. ANOVA and Mann-Whitney test was performed for a comparison between the groups. Data are expressed as log<sub>10</sub> values of the colony counts (mean  $\pm$  SD)

#### Results and discussion:



[Figure]

The bactericidal effect of tramadol on *E. coli* (7 log<sub>10</sub> = 100% bacteria kill) ( $p < 0.001$ ) and its antibacterial action on *S. aureus* (>2 log<sub>10</sub> reduction) ( $p < 0.001$ ), in a concentration and time-dependent manner, was shown in Figs A and B respectively. Levobupivacaine had an antibacterial activity against the two strains in a time-dependent manner. It decreased by >3 log<sub>10</sub> the *E. coli* and by >2 log<sub>10</sub> the *S. aureus* growths ( $p < 0.001$ ) after 24h exposure (Figs. A, B).

In combined solutions, a total loss of tramadol antibacterial activity against two strains was observed (Figs. A, B). These findings could be due to a disturbance in the microbial cell membrane by the interaction of levobupivacaine with the cytoplasmic membrane which induced an alteration of tramadol's liaisons with its receptors.

**Conclusion(s):** In mixed solutions with levobupivacaine, tramadol was unable to confirm its strong antibacterial property when used alone thus this association was not able to reduce the risk of probable nosocomial infection.

Solutions tested	Microorganism	Number of bacteria, CFU/mL at 6h and 24h	
Control	<i>E. coli</i>	1.4 x 107 ± 0.3	2.8 x 107 ± 0.3
Levobupivacaine 0.45%		1.4 x 105 ± 0.2*	1.2 x 104 ± 0.1* †
Levobupivacaine+tramadol 0.5%		1.4 x 105 ± 0.2*	1.2 x 104 ± 0.2*
Levobupivacaine+tramadol 1%		1.3 x 105 ± 0.4*	1.2 x 104 ± 0.1*
Control	<i>S. aureus</i>	2.6 x 106 ± 0.3	5.5 x 107 ± 0.6
Levobupivacaine 0.45%		3.6 x 105 ± 0.5*	1.3 x 105 ± 0.4* †
Levobupivacaine+tramadol 0.5%		3.4 x 105 ± 0.4*	1.3 x 105 ± 0.3*
Levobupivacaine+tramadol 1%		3.7 x 105 ± 0.6*	1.4 x 105 ± 0.3*

\* Significantly different from control ( $p < 0.01$ ), and † from 6h ( $p < 0.01$ )



## 9AP2-2

### Inhibitory effects of propofol or midazolam on PDGF-BB-induced vascular smooth muscle cell migration

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**Background:** Intravenous anesthetics, such as propofol or midazolam, are commonly used during the perioperative and/or postoperative period in critically ill patients. Intravenous anesthetics have direct effects on vascular smooth muscle cells (VSMCs), resulting in maintaining vascular tone. VSMCs play important roles in vascular injury repair, angiogenesis, development of atherosclerosis lesions or restenosis after angioplasty or by-pass graft surgery by their migration and proliferation. We previously reported that platelet-derived growth factor (PDGF)-BB induces VSMC migration via extracellular signal-regulated kinase (ERK) 1/2 and Akt in a VSMC line, A10 cells. Additionally, it has been reported that stress-activated protein kinase/c-Jun N-terminal kinase (SAPK/JNK) and p38 mitogen-activated protein kinase (MAPK) regulate the PDGF-BB-induced VSMC migration. In the present study, we investigated the effects of propofol or midazolam on PDGF-BB-induced VSMC migration and the mechanism.

**Material and methods:** Cultured A10 cells were stimulated by PDGF-BB. Migration of A10 cells was assessed using Boyden chamber, and phosphorylation of each protein kinase was analyzed by Western blotting. The data were analyzed by ANOVA followed by Bonferroni's method for multiple comparisons between pairs. Values of  $P < 0.05$  were considered to be statistically significant.

**Results:** Propofol or midazolam suppressed PDGF-BB-induced migration in a concentration-dependent manner (10-100  $\mu\text{M}$  or 1-100  $\mu\text{M}$ , respectively). Propofol or midazolam failed to affect PDGF-BB-induced phosphorylation of ERK 1/2 or Akt. On the other hand, propofol or midazolam attenuated PDGF-BB-induced phosphorylation of p38 MAPK, but did not affect phosphorylation of SAPK/JNK.

**Discussion:** We demonstrated that propofol or midazolam inhibits A10 cell migration by PDGF-BB via suppression of p38 MAPK activation. PDGF-induced VSMC migration promotes not only vascular injury repair, angiogenesis or wound healings but also development of atherosclerosis or restenosis after angioplasty or by-pass graft surgery. It might be depends on the patient's situations whether inhibition of VSMC migration is advantage or not.

**Conclusion:** These results strongly suggest that propofol or midazolam inhibits VSMC migration by PDGF-BB via suppression of p38 MAPK activation, and may affect VSMC function in critically ill patients.

## 9AP2-4

### Preventive effects of butylscopolamine for catheter-related bladder discomfort: a prospective, randomized, multicenter study

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**Background and Goal of Study:** Catheter-related bladder discomfort (CRBD) is a severely distressing complication in patients who have urinary catheters during recovery from anesthesia. The present study aims to investigate effects of butylscopolamine on prevention of CRBD in patients receiving various surgeries.

**Materials and methods:** Adult male patients undergoing elective surgery with urinary catheter were enrolled and randomly distributed into two groups. The butylscopolamine group (Group B, n=49) received butylscopolamine 20 mg intravenously at extubation, whereas no medication was given to the control group (Group C, n=50). The presence and severity of CRBD were assessed at 1, 2 and 6 h after extubation. Adverse effects of butylscopolamine were also evaluated.

**Results and discussion:** The overall incidence of CRBD was lower in butylscopolamine group than in control group (31% vs. 66%, 95% C.I. 0.098 to 0.528,  $P = 0.001$ ). The incidences of CRBD

at 1, 2, and 6 h after surgery was also lower in butylscopolamine group (27% vs. 54%,  $P = 0.006$ ; 22% vs. 42%  $P = 0.040$ , and 10% vs. 26%,  $P = 0.048$ , respectively).

In addition, the average severity of CRBD during 6 hours after surgery was significantly lower in butylscopolamine group: median (interquartile range), 0 (0-15) versus 22 (0-47) ( $P = 0.002$ ). Adverse effects were comparable be-

tween the two groups. Mean total amount of fentanyl was 226  $\mu\text{g}$  in Group C and 228  $\mu\text{g}$  in Group B, which showed no statistical difference ( $P = 0.952$ ).

**Conclusion(s):** Intravenous administration of butylscopolamine at the end of surgery is effective in reducing the incidence and severity of postoperative CRBD without adverse effects.

Therefore, we suggest that intravenous administration of butylscopolamine is a safe and effective modality for prevention of CRBD in various kinds of surgeries.

## 9AP2-5

### Impact of intra and postoperative Terlipressin infusion in patients undergoing living donor liver transplantation

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**Background and Goal of Study:** End stage Liver disease is usually accompanied by a decline in systemic vascular resistance (SVR) and haemodynamic changes that can be of significance when combined with anaesthesia during liver transplantation. Assessment of the impact of intra-operative and post-operative Terlipressin infusion in respect to Haemodynamics and renal parameters is the goal.

**Materials and methods:** After ethics committee approval for this prospective hospital based comparative study. Fifty recipients were allocated into Controls (n = 25) and Terlipressin (n = 25) with simple random method, Terlipressin (Vasopressin analogue) infusion at beginning of surgery (1.0  $\mu\text{g}/\text{kg}$  / hr), rate later titrated (1.0 - 4.0  $\mu\text{g}/\text{kg}$  / hr) to maintain mean arterial pressure (MAP) > 65 mmHg and systemic vascular resistance index (SVRI) < 2600 dyne/cm<sup>5</sup> / m<sup>2</sup> till day 4. Nor-epinephrine infusion was used as appropriate in both groups. Haemodynamic and Oesophageal Doppler parameters, Renal function, Peak Portal Vein Blood flow velocity (PPV), Hepatic Artery Resistive Index (HARI), Urine output, Liver enzymes, catecholamine support and ICU stay were compared intraoperatively and 4 days postoperatively. General anaesthesia maintained with Desflurane to keep Entropy between 40-60

**Results and discussion:** Terlipressin was able to maintain better MAP and SVR ( $P < 0.01$ ) during reperfusion compared to Controls (66.5 + 16.08 versus 47.7 + 4.7 mmHg and 687.7 + 189.7 versus 425.0 + 26.0 dyn.sec/cm<sup>2</sup>), respectively. Noradrenaline was only used in 5 patients out of 25 versus 20 in controls. Urea, Creatinine, urine output, liver enzymes and ICU stay were significantly better with Terlipressin. Peak Portal Vein velocity was reduced with Terlipressin post-reperfusion compared to Controls (44.8 ± 5.2 vs. 53.8 ± 3.9 ml/sec, respectively,  $P < 0.01$ ) without affecting HARI (0.63 ± 0.06 vs 0.64 ± 0.05, respectively,  $P > 0.05$ ). This change was sustained postoperatively.

**Conclusion(s):** Terlipressin infusion significantly improved low SVR and blood pressure with less need for catecholamine support and with better renal functions particularly postreperfusion. Terlipressin reduced PPV without hepatic artery vasoconstriction and with better liver graft function tests. Further multicenter studies on a larger scale is recommended before using Terlipressin as a protocol for Liver transplantation.

## 9AP2-6

### Chest pain during caesarean section in relationship with carbetocine and an anomalous right coronary artery

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**Background:** Myocardial ischemia is increasing in the obstetric population, probably due to greater maternal age, increasing obesity and more women with congenital heart diseases reaching fertile age (1). Chest pain during labour can be related with multiple diseases, most importantly myocardial infarction (0,01%) (2).

**Case report:** 38 y.o. ASA I secundipara woman scheduled for elective caesarean section. Standard intra-operative monitoring and spinal anaesthesia were performed (12mg hyperbaric bupivacaine plus 15 $\mu\text{g}$  fentanyl). After umbilical cord clamping she received 100mg Carbetocine and 6 minutes later complained about bilateral clavicle pain, tachycardia and hypotension. EKG showed ST segment depression in V3-V6. 15 minutes later in the post anaesthesia recovery unit she was pain free and EKG normalized. Haemoglobin, troponin levels, chest X-ray and transthoracic echocardiogram were normal. She reported a similar episode during previous C-section. Stress transesophageal echocardiogram showed left ventricle hypercontractility but no isch-

emia. AngioCT showed an anomalous origin of the right coronary artery with an abnormal course from left coronary sinus between aorta and pulmonary artery.

The patient was discharged from the hospital asymptomatic; only advised to avoid intense physical activity.

**Discussion:** Incidence of anomalous right coronary artery ranges from 0.1 to 0.9% and clinical implication depends on its origin, however if it crosses between pulmonary artery and aorta, myocardial ischemia and sudden death can occur (3).

The cardiovascular effects of uterotronics, even the new ones, include vasodilatation, hypotension, tachycardia and increased cardiac output, increasing the demand of blood flow to the heart, which might not be possible to achieve in patients with cardiac abnormalities.

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**Learning points:** Uterotronics effects, including carbetocine, can be harmful in women with cardiac abnormalities. Diagnosis of coronary aberrancy is difficult and can go unnoticed in commonly used diagnostic tests, although angioCT and cardiac MIR show higher sensitivity. Chest pain during caesarean sections must always be investigated until a diagnosis is reached.

## 9AP2-7

### Palmitoylethanolamide, an endogenous ligand of PPAR- $\alpha$ , suppresses glutamate release through inhibition of voltage-dependent calcium influx in rat cerebral cortex nerve endings

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**Background:** The nuclear hormone receptor, peroxisome proliferator activated receptor (PPAR)- $\alpha$ , and its endogenous ligands, have been found to play an important role in pain modulation. Several recent studies have also demonstrated that the agonists of PPAR- $\alpha$  can protect against neurodegeneration. It is believed that excessive glutamate release can cause neuronal excitotoxicity and subsequent neuronal death and neurodegeneration. Therefore, we investigated whether PPAR- $\alpha$  could modulate glutamate release from isolated nerve endings (synaptosomes) in the present study.

**Materials and methods:** Truncated nerve endings (synaptosomes) purified from Sprague-Dawley rat cerebral cortex were used to examine the effect of palmitoylethanolamide, an endogenous ligand of PPAR- $\alpha$ , on glutamate release evoked by 4-aminopyridine (4-AP). The effects of palmitoylethanolamide on the synaptosomal membrane potential and Ca<sup>2+</sup> entry were also examined by DiSC<sub>5</sub>(6) and Fura-2, respectively. Additionally, pharmacological activators and inhibitors of protein kinase cascades were used to investigate the downstream signaling pathway.

**Results:** Results showed that palmitoylethanolamide exhibited a dose-dependent inhibition of 4-AP-evoked release of glutamate. In addition, this inhibition was prevented by chelating the intrasynaptosomal Ca<sup>2+</sup> ions and by the vesicular transporter inhibitor, but was insensitive to the glutamate transporter inhibitor. Moreover, palmitoylethanolamide decreased depolarization-induced increase in intrasynaptosomal Ca<sup>2+</sup> without changing the synaptosomal excitability. The inhibition of evoked glutamate release was abolished by blocking the Cav2.2 (N-type) and Cav2.1 (P/Q-type) channels, but not by blocking intracellular Ca<sup>2+</sup> release. Combined inhibition of protein kinase C (PKC) and protein kinase A (PKA) also prevented the inhibitory effect of palmitoylethanolamide on evoked glutamate release.

**Conclusion:** Our results suggest that palmitoylethanolamide inhibit glutamate release from rat cortical synaptosomes through the suppression of presynaptic voltage-dependent Ca<sup>2+</sup> entry and PKA and PKC signaling cascade. These findings may delineate the possible neuroprotective mechanism of PPAR- $\alpha$ .

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## 9AP2-8

### Administration of lipid emulsion antagonized the hypnotic activity of propofol in ddY mice - comparison with thiamylal

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**Background and Goal of Study:** We previously reported that the dilution with crystalloid solution of Diprivan(R) enhanced the hypnotic potency of propofol (Pro). In the current investigation, the volume or dilution effect and another pharmacodynamic effect (e.g. lipid sink) were evaluated in the comparison with thiamylal (Thi).

**Material and methods:** Male adult ddY mice (35 - 45 g) were given Pro or Thi intravenously. Anesthetics were diluted with physiological saline, 10% and 20% soy bean oil. Each injection volume was set at 10 ml/kg and 2.5 to 15 mg/kg of drugs was administered. Acquiring of hypnosis was defined as a loss of the righting reflex (LRR) and the time from LRR to recovery of reflex was defined as the anesthetic time. The 50% effective doses (ED<sub>50</sub>) were calculated by probit analysis. Thereafter, another mouse was administered 2-fold dose of Pro and Thi followed by each additional injection and measured the anesthetic time. For the investigating volume effect, the animal was administered 0, 10, 20 ml/kg of saline, and for the evaluating the effect of lipid, the animal was administered 10 ml/kg of saline, 10%, 20% of soy bean oil.

**Results and discussion:** ED<sub>50</sub> of Pro was 5.79 (0.61) (mean and SE) and of Thi was 8.83 (0.84) mg/kg (Table. 1). Both saline and lipid dilution increased ED<sub>50</sub>, however, the effect was apparent in Pro. The anesthetic time was 125 (35) (mean and SD) for Pro and 102 (38) sec for Thi (Table 2). Additional injection failed to change the time except for 20% soy bean oil administration after Pro anesthesia. Supplemental administration of soy bean oil shortened the anesthetic time of Pro. The results of current investigation suggested that the dilution with crystalloid solution could change the pharmacodynamics of Pro by increasing non-emulsified free Pro in aqueous phase. Following administration of lipid solution could antagonize the enhancing effect.

Propofol			
Simultaneous administration with (Mixture)	Saline	5.79 ± 0.61	**
	10% soy bean oil	9.46 ± 0.59	}
	20% soy bean oil	12.08 ± 1.00	
Pretreatment with	Saline	5.79 ± 0.61	*
	10% soy bean oil	8.02 ± 0.85	}
	20% soy bean oil	13.14 ± 1.54	
Thiopental			
Simultaneous administration with (Mixture)	Saline	8.83 ± 0.84	*
	10% soy bean oil	12.00 ± 0.64	}
	20% soy bean oil	13.46 ± 1.09	
Pretreatment with	Saline	8.65 ± 0.93	*
	10% soy bean oil	12.12 ± 0.92	}
	20% soy bean oil	15.12 ± 1.01	

[Table 1. 50% effective dose of propofol and thiopental in each administration (mg/kg) Data are expressed as mean ± SE. \*: p < 0.05 between groups.]

Propofol			
Additional volume injection	None	125 ± 35	}
	Saline 10 ml/kg	150 ± 31	
	Saline 20 ml/kg	135 ± 26	
Additional lipid injection (10 ml/kg)	None (saline)	150 ± 31	*
	10% soy bean oil	118 ± 38	}
	20% soy bean oil	107 ± 18	
Thiopental			
Additional volume injection	None	102 ± 38	}
	Saline 10 ml/kg	107 ± 19	
	Saline 20 ml/kg	111 ± 29	
Additional lipid injection (10 ml/kg)	None (saline)	107 ± 19	}
	10% soy bean oil	105 ± 28	
	20% soy bean oil	100 ± 25	

[Table 2. Hypnotic duration after the administration of two fold of 50%-effective dose of propofol and thiamylal (sec) Data are expressed as mean ± SD. \*: p < 0.05 between groups]

**Conclusion:** Not only simple dilution effect but also another pharmacodynamic development, e.g., lipid sink, might modify the hypnotic potency of intravenous anesthetics.

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## 9AP2-9

### Hyperthermia induced by intrathecal baclofen resembling sepsis in a patient with Wilson disease

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**Background:** Hyperthermia induced by drugs is a frequently complication seen in the intensive care unit (ICU) and commonly confused with septic status, involving iatrogenic interventions. We report a case of hyperthermia in a patient diagnosed with Wilson disease during intrathecal Baclofen therapy, who was initially unsuccessfully treated as septic shock.

**Case report:** A 19-year-old men diagnosed with Wilson disease 10 months ago with a fast progression of the disease suffering different symptoms like severe generalized dystonia and pain. It was decided to implant a Baclofen pump reservoir through intrathecal catheter system as long-term treatment for dystonia and chronic pain associated, after failure of different treatments like plasmapheresis and oral baclofen, but being positive to baclofen test. At the beginning of the intrathecal therapy persistent hyperthermia up 39°C, a progressive deterioration of mental status, tachycardia and finally, respiratory and hemodynamic failure occur. Patient was admitted to ICU and treated as a septic shock with clinical suspicion of meningococemia. Despite resuscitation with fluids and drugs, included empirical broad-spectrum antibiotic and antipyretics multiorgan failure did not improve. All microbiological cultures, including cerebrospinal fluid were negative for infection. Fever only dropped, associated with improvement of general status with cessation and withdrawal of baclofen pump. Signs of infection in subcutaneous reservoir and catheter insertion point were not found.

**Discussion:** Clinical symptoms associated with intrathecal Baclofen are more suited to the syndrome of baclofen withdrawal, which is commonly confused with sepsis, meningitis or neuroleptic malignant syndrome but nothing has been published about severe hyperthermia during this therapy. In this case, hyperthermia ceased with baclofen withdrawal, so we pose the possibility of inappropriate actions and iatrogenia in patients with hyperthermia induced by drugs mimicking septic status, even more important in the ICU where large number of drugs are administrated. Patient symptoms during intrathecal Baclofen therapy were similar to septic symptoms. A differentiation between these two entities is basic for an appropriate management. More studies are needed to know if intrathecal Baclofen can also be a potential cause of malignant hyperthermia.

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## 9AP2-10

### Nasal oxytocin as anxiolytic agent before stomatology treatment

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**Background and Goal of Study:** Oxytocin is used mainly for its peripheral effects on pregnant uterus and breasts. After nasal administration, central effects are more prominent: anxiolytic effect, decreased level of social stress and increased empathy (1-3). The aim of our study was to assess if nasal oxytocin can be used as anxiolytic premedication before dental treatment.

**Materials and methods:** After ethic committee and patients' consent, patients scheduled for extraction of lower third molar were included in an open study. Exclusion criteria were pregnancy and ASA classification >2. Oxytocin 5 IU (10 mcg) was administered by MAD100 micronebuliser to both nostrils. Visual analogue scale (0 - 10) was used for measuring level of anxiety before administration and in 15 minutes intervals. Blood pressure, pulse, SpO<sub>2</sub> and

changes in skin resistance were measured in 5 minutes intervals during study. All measurements were performed for 2 hours. Paired t-test and ANOVA test were used for statistical analysis. P value < 0.05 was considered significant.

**Results and discussion:** 20 patients (15 women and 5 men), aged 27 - 42 years were included in the study. There was a significant decrease of anxiety in all patients (from VAS 5.6±1.7 to VAS 1.5 ± 0.3, p< 0,001). The difference was significant only in the first measurement compared to pre-administration value; the results were not significant during next measurements compared with the value obtained in the 15<sup>th</sup> minute. All patients were during treatment calm with minor sedation and increased empathy to medical professionals. This was accompanied by a dynamic course of decreased skin resistance. The psychic effects of oxytocin gradually subsided in 2 hours. Compared to pre-administration values, there was a non-significant decrease in heart rate (average 15 beats/min) and in systolic blood pressure (10 - 15 torr) with no changes in SpO<sub>2</sub>. No side effects were noticed.

**Conclusion(s):** To our best knowledge, this is the first use of oxytocin as an anxiolytic agent in this clinical setting. Nasal oxytocin can be used as pre-medication before dental treatment.

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## 9AP2-11

### A randomized evaluation of patient-controlled propofol sedation without opioids for ERCP - is it comparable to anesthetist-controlled sedation?

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**Background and Goal of Study:** Propofol for moderate sedation during endoscopic retrograde cholangio-pancreatography (ERCP) have been evaluated worldwide the last 15 years.<sup>1,2</sup> To optimize the doses of propofol and to minimize the risk for sedation-related complications, patient-controlled propofol sedation (PCS) can be used without adding any opioids. The aim of this study was to evaluate feasibility, safety, recovery, and patients' experiences by comparing PCS with anesthetists-controlled sedation (ACS) and midazolam sedation (MS) given by the ERCP team.

**Materials and methods:** In a prospective study, 309 patients were randomized to use a PCS pump programmed to give boluses of propofol 5 mg (zero lock-out time), or ACS according to patient's weight, or boluses of midazolam 1-3 mg, given by the ERCP team according to the routine. The ease of the ERCP performance, safety interventions, propofol consumption, patients' experiences, and the recovery period were recorded.

**Results and discussion:** The data analysis is not finished and the trends are therefor displayed. The preliminary results indicate that: PCS and ACS is superior MS in ease of performance, numbers of interrupted ERCP procedures and time for recovery period. The interrupted ERCP procedures with MS can be performed with the use of PCS, when a reprocedure is held a week afterwards. The mean consumption of propofol was over 300 mg in the ACS group and between 200-250 mg in the PCS group. All procedures were completed in group ACS and 4 procedures in group PCS had to be managed with extra doses of propofol given by the anesthetists. The numbers of interventions made to assure safety were for all groups low. Recovery period is shorter for the patients in group PCS. Patients' evaluation of comfort during and after the two propofol sedation regimen seems to be comparable.

**Conclusions:** Propofol PCS for ERCP procedures seems to be feasible without the use of any opioids, and the conditions for performance of ERCP with the use of PCS seems to be comparable or almost comparable to ACS regarding patients evaluation, safety, and recovery.

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## 9AP3-1

### Optimal dose of dexmedetomidine for attenuating cardiovascular response during extubation in patients undergoing total laparoscopic hysterectomy

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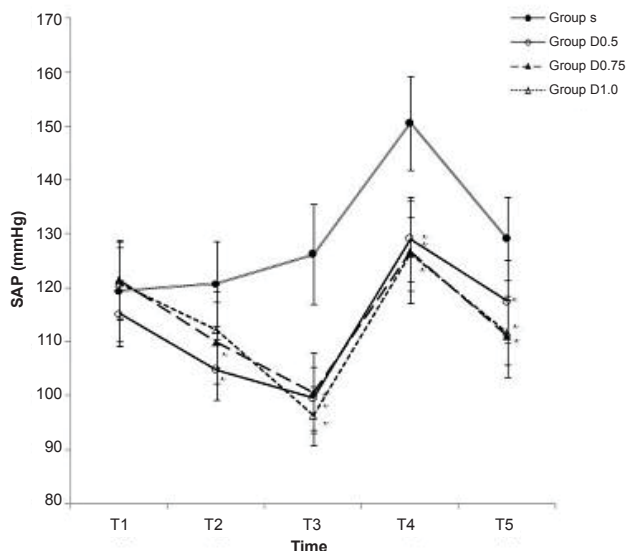
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**Background and Goal of Study:** Emergence from anesthesia and tracheal extubation is commonly associated with hyperdynamic cardiovascular responses. The  $\alpha$ -2 agonist dexmedetomidine has dose-dependent effects on reducing heart rate and blood pressure. We investigated the optimal dose of dexmedetomidine for attenuating hemodynamic response after extubation.

**Materials and methods:** One hundred thirty two patients scheduled for laparoscopic total hysterectomy were included in this prospective, randomized, double-blind study. Patients were randomly allocated to receive dexmedetomidine in four groups: group S (0.9% normal saline), group D0.5 (dexmedetomidine 0.5  $\mu$ g/kg), group D0.75 (dexmedetomidine 0.75  $\mu$ g/kg), and group D1.0 (dexmedetomidine 1.0  $\mu$ g/kg). Heart rate, systolic arterial pressure, diastolic arterial blood pressure were recorded before and after drug administration (T1, T2), 10 minutes after drug administration (T3), after extubation (T4), and 5 minutes after extubation (T5). Extubation time was measured. The SPSS 18.0 program was used to analyze statistical data. Repeated-measures ANOVA and Student's t-test were used.

**Results and discussion:** In all dexmedetomidine groups SAP was significantly lower than in the control group at all times starting from 10 min after drug administration ( $P < 0.001$ , Fig. 1). In all dexmedetomidine groups, DAP was significantly lower than in the control group at 10 min after drug administration ( $P < 0.05$ ). HR was significantly lower in all dexmedetomidine groups than in group S at all times starting from drug administration except for group D0.5 at 5 minutes after extubation ( $P < 0.05$ ). Extubation times in group D0.75 and D1.0 were significantly longer than in group S ( $P < 0.05$ ). Dexmedetomidine 0.5  $\mu$ g/kg during the intraoperative period was effective for attenuating cardiovascular responses.

**Conclusion:** Intraoperative intravenous infusion of dexmedetomidine 0.5  $\mu$ g/kg attenuated the cardiovascular responses during emergence without prolonging extubation time in patients undergoing laparoscopic total hysterectomy. Dexmedetomidine doses higher than 0.5  $\mu$ g/kg did not exert additional positive effects.



[Fig. 1. Changes in systolic arterial pressure]

## 9AP3-2

### Effect of target-controlled infusion of Propofol-Fentanyl versus Desflurane in cirrhotic patients undergoing major hepatic resection

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**Background and Goal of Study:** Choice of general anaesthesia can have an effect in cirrhotic patients undergoing major liver resection concerning haemodynamics, hepatocellular & kidney functions. The aim is to compare Target controlled infusion (TCI) of Propofol-Fentanyl versus Desflurane (Des) in this category.

**Materials and methods:** A prospective comparative study included 50 adult cirrhotic patients (Child A) in 2 groups with simple random technique (TCI n=25 and Des n=25). In TCI, before induction Fentanyl 3  $\mu$ g/kg for 30 sec, then infusion of 2  $\mu$ g/kg/h for 30 min, 1.5  $\mu$ g/kg/h from 31–150 min & 1  $\mu$ g/kg/h until 30 min before end. Propofol administered with a syringe pump integrated with Navigator software (GE, Helsinki, Finland). Propofol blood target concentration (C<sub>t</sub>) for induction set at 4  $\mu$ g/ml. During maintenance increase or decrease of Et Des by 1% or Propofol (C<sub>t</sub>) by 0.5  $\mu$ g/ml to keep Entropy between 40-60. Haemodynamics monitored by invasive blood pressure & Transoesophageal Doppler. Liver and kidney functions tests, Urinary Microalbuminuria (Microalb) & blood Glutathione-S-transferase (GST) were assayed. Extubation time, consumption & cost, intensive care & hospital stay were recorded.

**Results and discussion:** Post-resection systemic vascular resistance (SVR) was better preserved with Des than with TCI (836  $\pm$  8 vs 779  $\pm$  36 dyn.sec.cm<sup>-5</sup>,  $P < 0.01$ ). Des associated with a higher mean blood pressure and stroke volumes (91  $\pm$  3 vs 81  $\pm$  5 mmHg and 86  $\pm$  3 ml vs 78  $\pm$  5 ml, respectively,  $P < 0.01$ ). ALT and AST peaked in both groups post resection, Des. 378  $\pm$  8 and 407  $\pm$  3 U/L, TCI 467  $\pm$  38 and 413  $\pm$  39 U/L respectively, this increase was less in Des group  $P < 0.05$ . No significant difference between Des and TCI regarding both GST & Microalb. Post resection (GST: 441.0  $\pm$  20.8 vs 437.5  $\pm$  22.2 IU/ml,  $P > 0.05$  & Microalb. 17.7  $\pm$  2.5 vs 18.64  $\pm$  1.19  $\mu$ g/ml, respectively,  $P > 0.05$ ). Similar ICU/hospital stay (Des 1.5  $\pm$  0.5 vs TCI 1.6  $\pm$  0.5 & 6.4  $\pm$  1.5 vs 6.8  $\pm$  1.6 days,  $P > 0.05$ , respectively). Extubation time prolonged in TCI 15.2  $\pm$  2.6 vs 9.7  $\pm$  1.5 min in Des, ( $P < 0.05$ ). Des was more economic than TCI, 33.5  $\pm$  8.2 vs 69.1  $\pm$  8.1 US \$ ( $P < 0.05$ ) respectively during same surgical time.

**Conclusion:** Des is more appropriate choice than TCI Propofol-Fentanyl in cirrhotic patients undergoing major liver resections regarding haemodynamics, recovery & costs, but neither is superior regarding effects on liver & kidney functions.

## 9AP3-3

### Effective dose of dexmedetomidine for inducing adequate sedation in elderly patients under spinal anesthesia

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**Background and Goal of Study:** Dose requirement of dexmedetomidine for adequate sedation may be reduced in elderly patients under spinal anesthesia, because its clearance may decrease in the elderly<sup>1</sup> and spinal anesthesia itself produces sedative effect.<sup>2</sup> We aimed to determine the effective dose (ED) of dexmedetomidine for adequate sedation in elderly patients under spinal anesthesia.

**Materials and methods:** In this prospective, double-blind study, 47 patients aged 65 years or older, ASA physical status I or II, undergoing spinal anesthesia were included. After spinal anesthesia, patients were randomly allocated into five groups depending on the dexmedetomidine loading dose: 0.1  $\mu$ g/kg, 0.3  $\mu$ g/kg, 0.5  $\mu$ g/kg, 0.7  $\mu$ g/kg and 1.0  $\mu$ g/kg for group I, II, III, IV, and V, respectively. Loading dose of dexmedetomidine was infused intravenously for 10 minutes, then maintenance infusion was continued at a rate of 0.3  $\mu$ g/kg/hr for the following 10 minutes regardless of groups. We measured vital signs and depth of sedation using Ramsay sedation scale every five minutes. Ramsay sedation score  $\geq 3$  was considered to be adequate sedation. ED<sub>50</sub> and ED<sub>95</sub> of dexmedetomidine for the adequate sedation at the completion of loading dose were calculated with logistic regression. Level of spinal anesthesia, vital signs were compared among groups. The occurrence of oversedation (Ramsay sedation score  $\geq 5$ ) was also assessed.

**Results and discussion:** Level of spinal anesthesia, vital signs were not

different among groups. Dexmedetomidine ED<sub>50</sub> and ED<sub>95</sub> for the adequate depth of sedation were 0.29 µg/kg (SE: 0.08, 95% CI : 0.14 - 0.44 ) and 0.86 µg/kg (SE: 0.17, 95% CI: 0.52 - 1.20), respectively. The frequency of oversedation was 0%, 10%, 33%, 78% and 60% in group I, II, III, IV and V, respectively (group I, II vs group III, IV, V: P = 0.02).

**Conclusion(s):** Adequate sedation can be attained based on the effective dose of dexmedetomidine from this study in elderly patients under spinal anesthesia.

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## 9AP3-4

### PACU effect-site fentanyl levels after laparoscopic surgery

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**Background and Goal of Study:** Fentanyl is not included in the data set of commercial TCI systems but is modelled in commercial interaction displays systems and several "apps". This creates the opportunity for using effect-site (C<sub>eff</sub>) guidance for fentanyl delivery. We have presented data (1) showing an association between intraoperative and PACU C<sub>eff</sub>-fent levels. C<sub>eff</sub>-fent of 1.4-2.0ng/ml has been suggested to provide adequate postoperative analgesia (2). The aim of this study was to further explore C<sub>eff</sub>-fent in patients undergoing laparoscopic surgery.

**Materials and methods:** Study approved by regional ethics committee. Nov 2012 to Jan 2013 observed 69 patients undergoing laparoscopic surgery where fentanyl was the only opioid. Timing and doses of fentanyl were noted. An Excel spreadsheet using the Scott model (3) was used to calculate C<sub>eff</sub>-fent levels over time. Data from laparoscopic surgery patients from our previous study used for comparison (N=13).

**Results and discussion:** The mean intraoperative and PACU C<sub>eff</sub>-fent were 1.16 (sd 0.31) and 0.67 (0.24) ng/ml. There was a weak correlation between intraop and PACU levels (R<sup>2</sup> 0.34, regression line slope 0.45). This suggests an initial PACU C<sub>eff</sub>-fent target of 50% of the intraoperative levels may be useful. Patients arrived in PACU with a mean C<sub>eff</sub>-fent of 0.69 (0.24)ng/ml. At discharge C<sub>eff</sub>-fent was 0.56 (0.22) ng/ml (95%CI diff 0.04 to 0.18, p=0.0026). C<sub>eff</sub>-fent levels are significantly lower than 2 years earlier (intraop: 1.24ng/ml, 95%CI diff 0.03 to 0.42ng/ml, p=0.025; PACU 0.88ng/ml, 95%CI diff 0.20 to 0.51ng/ml p< 0.0001). We speculate that this relates to shorter operating times and increased use of multiple analgesic modalities by both surgical and anaesthetic staff.

**Conclusions:** Our data further characterise the pattern of C<sub>eff</sub>-fent in the peri-operative period and support the concept of using intraoperative opioid requirements to help plan analgesia for the postoperative period. We also found a significant decrease in intra- and post-operative C<sub>eff</sub> over a two year period.

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2. Iwakiri H et al *Anesthesia and Analgesia* 2003. 96:1651-5
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**Acknowledgements:** Tish Kench and Doug Winter were Summer Students supported by the Christchurch Anaesthetist's Instrument Pool Ltd.

## 9AP3-5

### Patients with a positive history of non-anaesthetic drug allergy have a high incidence of positive allergological skin tests for atracurium

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**Background and Goal of Study:** We have previously reported a high incidence of positive allergy tests for neuromuscular blocking agents in patients with a positive history of non-anaesthetic drug allergy. The goal of this study was to compare the skin tests' results for atracurium for patients with a positive history of non-anaesthetic drug allergy to those of controls without previous drug allergies.

**Materials and methods:** The study was approved by the University Ethics Committee (No. 6/2008). 371 patients with a positive history of non-anaesthetic drug allergy, from which 101 presented atopy, and 111 controls, from which 57 presented atopy, were included in this prospective study. Skin tests (STs) included the skin prick test (SPT) and the intradermal test (IDT) for atracurium and were performed by an allergologist who was blinded regarding the patients' history. Fisher test was used to compare categorical data.

**Results and discussion:** We found 91 positive STs (6 positive SPT and 85 positive IDT) from the 371 (24.52%) performed in patients with previous non-anaesthetic drug allergies and 14 positive STs (2 positive SPT and 12 positive IDT) from the 111 (12.61%) performed in controls (p= 0.0084). The relative risk for having positive STs for atracurium for patients with previous non-anaesthetic drug allergies versus controls was 1.94 (95%CI: 1.15-3.27). Patients with a positive history of non-anaesthetic drug allergy have a higher incidence of positive STs for atracurium compared to controls. There were 36 positive intradermal tests from the 156 (23.07%) performed in patients with atopy and 61 positive intradermal tests from the 318 (19.18%) performed in patients without atopy (p=0.33).

**Conclusion(s):** Patients with a positive history of non-anaesthetic drug allergy have a higher incidence of positive skin tests for atracurium compared to controls. Atopy does not seem to be an independent risk factor for positive skin tests for atracurium.

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2. Hagau N. Is a positive history of non-anaesthetic drug allergy a predictive factor for positive allergy tests to anaesthetics? *Br J Clin Pharmacol*;2011;73(3):460-6.

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## 9AP3-6

### Regression modelling and pharmacokinetic simulation of concentrations of propofol and alfentanil at the effect site in patient-controlled sedation

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**Background and Goal of Study:** Patient-controlled sedation (PCS) has been studied for over two decades, but still our knowledge of reasons for giving doses is limited. Detailed understanding is essential so that we can program the PCS pump to give the most clinical benefit. We therefore evaluated the association between the characteristics of patients and the procedure, the doses given, and the calculated effect site concentrations of drugs.

**Materials and methods:** In a prospective double-blind study, 165 patients were randomized to have propofol or a mixture of propofol and alfentanil as PCS for gynaecological outpatient procedures. The PCS pump was programmed to deliver 4.25 mg of propofol with or without the addition of 0.0375 mg of alfentanil on every demand from the patients. No lock-out periods were used and the pump had the capacity to give 5 doses per minute. We collected data on cardiorespiratory function and the need for anaesthetic interventions during the procedures. Pharmacokinetic simulation of doses and multiple regressions aided the search for correlation between the patients' characteristics and the doses.

**Results and discussion:** 155 patients used PCS for the entire procedure. The duration of the procedure, the addition of alfentanil, and the patient's age and weight correlated best with delivered doses (β=0.10; -7.1; -0.64 and 0.88; R=0.75; adjusted R<sup>2</sup>=0.55). In total, five patients receiving alfentanil became apnoic and manually ventilation had to restore oxygen saturation levels. Although the number of required doses decreased with older age, age (p=0.03), propofol C<sub>e</sub> (0.04) and alfentanil C<sub>e</sub> (p=0.02) could explain the respiratory events from the estimated concentrations of drugs. The calculated concentrations of alfentanil displayed a longer profile than those of propofol, and the respiratory impaired patients tended to reach higher doses after the period of induction (not significant).

**Conclusions:** A mixture of propofol and alfentanil for PCS results in high estimated concentrations of these drugs after patients' induction. We propose that alfentanil should be given as separate boluses at specific painful moments as a complement to propofol. For refinement of the PCS method, patients' age and weight seems to affect the number of doses.

**Acknowledgements:** The study was conducted with professional support from the staff at the gynaecology outpatient clinic, Linköping University Hospital, 581 85 Linköping, Sweden.

## 9AP3-7

### Reevaluation of the plasma-effect relationship of Propofol in volunteers

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**Background:** It is assumed that the atemporal propofol Cp-effect relationship behaves as a bidirectional sigmoid curve, corresponding one effect to one Cp<sup>1</sup>. Our hypothesis proposes that a real steady state model would show an intrinsic pharmacodynamic hysteresis with different Cp at loss of command (LOC) and the recovery of the response (ROC).

**Method and Study Subjects:** To represent equilibrium Cp-Ce steps, 14 healthy volunteers, after IRB approval and written informed consent form, monitored with ECG, NIBP, CO2et, SaO2, and BIS, received propofol TCI in effect mode Schnider PK model in stepped plateaus 0.5 ug / ml of 7 minutes each, except at (LOC) plateau at which lasted 14 minutes. After this we scaled two steps further reaching the maximal EEG depression. Then we proceeded to declines equal in magnitude and duration than the increases until reaching less than Cpcalc of 0.5 ug / ml.

Venous samples were taken at the end of each step or every 7 min, to evaluate Propofol PK model performance<sup>2</sup> by HPLC. We evaluate Explicit Amnesia, dropping a 60ml water syringe, loss of eyelash reflex, loss (LOC) and recovery (ROC) of consciousness, BIS during the entire process. The AnestFusor<sup>TM</sup> software<sup>3</sup> was used to control the syringes, to store the EEG data and calculate the Cp every one second. Student t test for multiple comparison was used.

**Results:** Basal BIS value was 97 and maximal depression 36 (23-50). The propofol Schnider PK performance was MDPE or bias of 0% and MDAPE or imprecision of 26%. The measured Cp at LOC was 2.06 ug/ml and 1.46 ug/ml at ROC (p < 0.05), with similar BIS (N.S). The BIS pre ROC was (49 [74-42]) statistically lower than the BIS value at LOC (64 [76-53]) (p < 0.05), but with similar measured Cp (N.S).

**Conclusions:** Our results did not behave as a sigmoidal unique curve. We observed an intrinsic pharmacodynamic hysteresis between induction and emergency, reflecting probably the bistable characteristic of each neurologic condition.

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## 9AP3-8

### Decrease of emergence time from anaesthesia with additional use of sevoflurane to propofol: a simulation study

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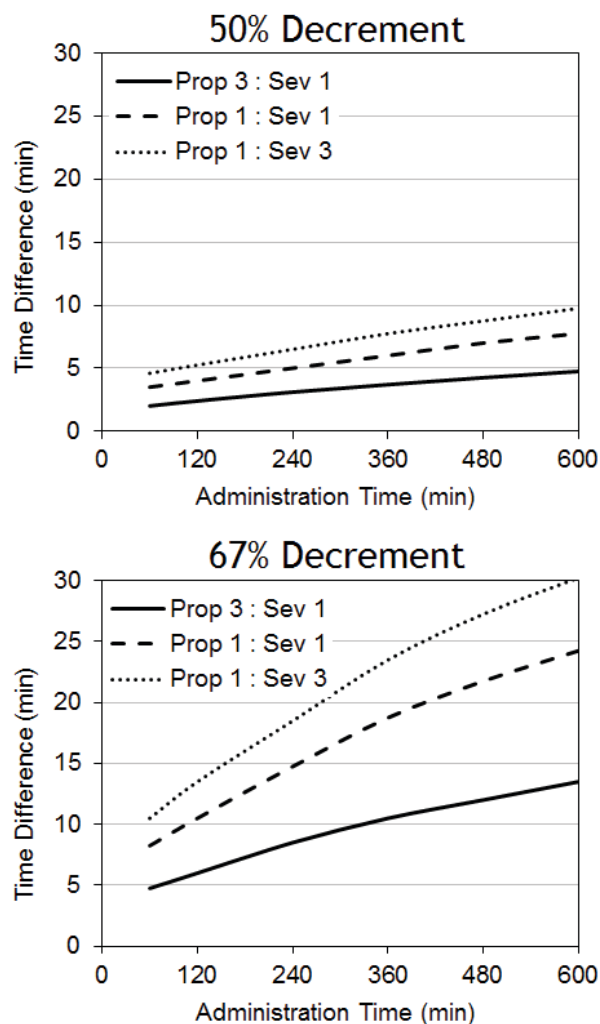
**Background and Goal of Study:** Anaesthetic actions of propofol and sevoflurane are reported to be additive. Because context sensitive decrement times of sevoflurane are constantly shorter than those of propofol irrespective of duration of administration and a fraction of decrement, a possible advantage of coadministration of propofol and sevoflurane over propofol alone is faster emergence from anaesthesia. In this simulation study, we have examined decrement times of propofol-sevoflurane combination in various situations.

**Materials and methods:** We used Marsh model and Yasuda's 5-compartment model<sup>1)</sup> for pharmacokinetic simulation of propofol and sevoflurane, respectively. We assumed that 20 percent of exhaled sevoflurane was rebreathed. Times to 50 and 67 percent decrement of combined effect-site concentration, which is an equivalent sum of propofol effect-site concentration and sevoflurane concentration in vessel-rich-group compartment, after 60 to 600 minutes of administration were calculated. Simulations were performed under three different ratios of sevoflurane to propofol in equivalent concentration; 3 to 1, 1 to 1, and 1 to 3. Differences of decrement times between combined propofol-sevoflurane anaesthesia and propofol alone were obtained.

**Results and discussion:** The results of the simulation are summarized in Figure. Data in graphs are presented as differences of decrement times from propofol alone anaesthesia. In these simulations, an addition of sevoflurane to propofol has reduced decrement times after discontinuation of anaesthetics, depending on the ratio between propofol and sevoflurane and administration time. The reduction was small in 50 percent decrement. The effects of ad-

ditional use of sevoflurane were more distinct when the ratio of sevoflurane to propofol was high and administration time was extended.

**Conclusion(s):** The results suggest that an addition of sevoflurane to propofol may be useful in reducing the time to emergence from anaesthesia. However, the ratio of two anaesthetics and administration time should be taken into consideration when applying these results.



[Figure]

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## 9AP3-9

### Influence of epidural anaesthesia on the relationship between the effect-site concentration of sevoflurane and BIS values after the end of surgery

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**Background and Goal of Study:** Several studies revealed that epidural anaesthesia reduced the requirement of anaesthetics in patients under the experimental settings. In this study, the goal of the study to examine the influence of epidural anaesthesia on the relationship between the effect-site concentration of sevoflurane and BIS values after the end of surgery.

**Materials and Methods:** After obtaining the approval of the institutional ethics committee, we collected the following data retrospectively from the patients anaesthetised using sevoflurane and opioids with or without epidural anaesthesia: the effect-site concentration (Ce) of sevoflurane, remifentanyl, and fentanyl at the first time when the BIS values recovered to higher than 65 or 80 over 10 seconds after the end of surgery (Ce during emergence); age; body



weight, height, sex. The effect-site concentration of opioids were calculated as the remifentanyl Ce plus the fentanyl Ce multiplied by 0.79. Exclusion criteria were BIS value >60 at the end of operation, younger than 16, the operation time < 30 minutes or > 15 hours, bleeding >3000 ml, body mass index >35, and cardiac surgeries.

The dataset included the same number of the patients with or without epidural anaesthesia using the matching criteria of both remifentanyl Ce and fentanyl Ce because opioid may influence the relationship between the effect site concentration of sevoflurane versus BIS value. Multiple regression analysis was applied to find the significant explanatory variables on sevoflurane Ce during emergence. Tested possible explanatory variables included age, sex, weight, height, body mass index, and with or without epidural anaesthesia. A P value less than 0.05 was regarded as significant.

**Results and discussion:** We included 214 (16-99 yr, 33-97 kg) or 234 (16-92 yr, 33-97 kg) patients for BIS values of 65 or 80, respectively. Age was the only significant explanatory variables to predict the sevoflurane Ce for BIS values of 65 and 80 ( $P < 0.001$  and  $P = 0.001$ , respectively). The sevoflurane Ce was expressed as the following equations:  $0.84 - 0.0049 \times (\text{Age} - 60)$  for BIS 65 and  $0.64 - 0.0038 \times (\text{Age} - 60)$  for BIS 80. The presence or absence of epidural anaesthesia was excluded as explanatory variables.

**Conclusion:** Epidural may not influence on the relationship between the effect-site concentration of sevoflurane and BIS values in daily clinical practice.

### 9AP3-10

#### Effect of dexmedetomidine on postoperative glucose levels and insulin secretion in obese patients with impaired glucose tolerance

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**Background and Goal of Study:** Obese patients often develop postoperative hyperglycemia (1). Since the  $\alpha_2$  agonist dexmedetomidine (Dex) reduces production of insulin (2), we examined the effect of Dex on postoperative glucose levels and insulin secretion pattern in obese patients with impaired glucose tolerance undergoing bariatric surgery.

**Materials and methods:** In a double-blind, prospective trial, 40 obese patients with impaired glucose tolerance, undergoing bariatric surgery, were randomized to receive Dex 1  $\mu\text{g}/\text{kg}$  bolus and 0.5  $\mu\text{g}/\text{kg}/\text{h}$  infusion during surgery (Dex Group;  $n=20$ ) or placebo (Control Group;  $n=20$ ). Patients were sampled for measuring baseline HgbA1c, glucose, insulin and subsequently glucose and insulin from onset of study drug infusion frequently for 12 h. Intraoperative fentanyl, postoperative morphine, pain, emesis and sedation level were recorded.  $\chi^2$  and mixed linear model, adjusted by glucose/insulin and HgbA1c were used for statistical analysis. A p value < 0.05 was considered statistically significant.

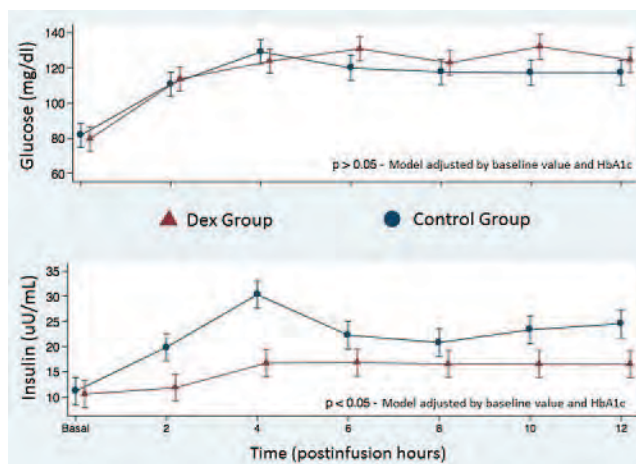
**Results and discussion:** There were no differences in demographic, intraoperative fentanyl, baseline HgbA1c, glucose and insulin, between groups. No significant changes were found in the intra and postoperative blood glucose levels between the groups ( $p=0.31$  group\*time interaction), without hyperglycemia. However, the interaction was significant for insulin secretion pattern ( $p=0.02$ ). In the post hoc analysis, the effect of DEX on the slope of insulin curve, was significant from the 4<sup>th</sup> postoperative hour (Figure). While, there were no differences in PONV incidence, morphine consumption and pain, between groups, patients in the Dex Group were significantly more sedated during the first 6 postoperative hours.

**Conclusion(s):** Administration of Dex in obese patients with impaired glucose tolerance, undergoing bariatric surgery, produces a mismatch between the observed glucose level and the expected insulin secretion pattern without hyperglycemia.

This study does not support a sparing effect of Dex on intra and postoperative opioids.

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2. Venn R, et al. *Br J Anaesth* 2001; 86: 650-6.



[Glucose levels and insulin pattern]

### 9AP3-11

#### Evaluation of the BIS index response in a stable Cp after loss of consciousness in volunteers

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**Background:** It is assumed that in the propofol Cp-Ce (plasma concentration vs effect) relationship one Cp corresponds to one effect, meaning that if we maintain a stable Cp we will see stable effects in absence of perturbations. Most of the data to support this statement have been obtained using non-steady state conditions<sup>1</sup>. The aim of this study was to assess the effect observed in the BIS index while maintaining a stable Cp during 15 minutes after loss of command (LOC).

**Method:** To obtain equilibrium Cp-Ce steps, in 14 healthy volunteers, after IRB approval and written informed consent, monitored with ECG, NIBP, CO<sub>2</sub>t, SaO<sub>2</sub>, BIS, and 36 channels EEG, received propofol TCI using the effect mode Schnider PK model in stepped 0.5  $\mu\text{g}/\text{ml}$  plateaus of 7 min duration each. Once reaching LOC we maintained TCI Cp<sub>plateau</sub> during 14 minutes to evaluate BIS behavior. Venous samples were obtained at the end of each step or every 7 min during the LOC plateau to evaluate propofol PK model performance<sup>2</sup> by HPLC.

The steepness of the population BIS curve was analysed. Using 20 of 1 sec EEG epochs from the final period of each stepped plateau, the cortical electrical sources were obtained using eLORETA<sup>3</sup> open access software before, during, and after LOC.

**Results:** LOC was reached with a BIS of 64(76-53) and a measured Cp of 2.06  $\mu\text{g}/\text{ml}$  (0.9-3.5). After LOC and during the next 14 minutes, the BIS dropped a mean of 15 points (paired t test < 0.05). The pharmacokinetic calculated model performance vs measured concentrations were MDPE -8.3% and MDAPE 8.3%<sup>2</sup>. Electrical source analysis using eLORETA revealed a statistically significant drop in beta (13-21 Hz) activity localized in posterior mesial cortex between the 0.5  $\mu\text{g}/\text{ml}$  steps previous to and after LOC. We did not find significant differences in source activity to explain the drop in BIS during LOC plateau.

**Conclusion:** Despite maintaining stable concentrations it is not possible to guarantee stability in the effect using BIS. Whole brain EEG source analysis could not explain the observed drop in the BIS value; analysis focalized to the frontal cortex may aid in understanding this result.

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## 9AP4-1

### Efficacy and safety of deep neuromuscular block reversal with different doses of sugammadex after continuous infusion of rocuronium

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**Background and Goal of Study:** Sugammadex is a safe, efficient reversal agent for rocuronium-induced neuromuscular blockade (NMB). This study compares the quality of recovery from this block using various doses of sugammadex.

**Materials and methods:** A prospective, observational study including 32 patients. NMB was induced with a bolus of 0.6 mg kg<sup>-1</sup> rocuronium followed by the continuous infusion of 0.3-0.6 mg kg<sup>-1</sup> h<sup>-1</sup> rocuronium to maintain a deep block with a train-of-four (TOF) response of zero, and a post-tetanic count of less than 10 responses. After surgery was finished, doses of 2 mg kg<sup>-1</sup> or 4 mg kg<sup>-1</sup> sugammadex were randomly administered at first twitch response (T<sub>1</sub>) 3-10% to Group A and Group B, respectively. The primary clinical variable was the time between the administration of sugammadex and recovery of a TOF ratio of 0.9.

**Results and discussion:** The results of both groups were comparable. The mean time between the administration of sugammadex and recovery of the TOF ratio to 0.9 was 1.98 min in Group A, and 1.61 min in Group B, which was not clinically significant. Sugammadex was well tolerated and no residual recurarization was recorded.

**Conclusions:** A dose of 2 mg kg<sup>-1</sup> sugammadex administered at a NMB to T<sub>1</sub> of 3-10% after continuous infusion of rocuronium, is useful for recovery from NMB, and is as effective as a dose of 4 mg kg<sup>-1</sup>, without increased risk of residual recurarization or adverse events.

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## 9AP4-2

### The dose effect of ephedrine on the onset time and intubating conditions after cisatracurium administration

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**Background and Goal of Study:** The aim of this randomized, double-blind, placebo-controlled study was to evaluate dose effects of ephedrine pretreatment on the onset time and intubating conditions after cisatracurium administration.

**Materials and methods:** A total of 140 adult patients were randomized into 4 groups to receive either 30 µg/kg ephedrine (Group 30, n = 35), 70 µg/kg ephedrine (Group 70, n = 35), 110 µg/kg ephedrine (Group 110, n = 35), 3 ml normal saline (Group C, n = 35) as pretreatment given 30 s before anesthetic induction. Neuromuscular block was achieved with 0.15 mg/kg cisatracurium, evaluated accelomyographically with train-of-four (TOF) stimulation. An anesthesiologist blinded to patient grouping assessed the intubating conditions 1.5 min after cisatracurium administration.

**Results and discussion:** An onset time of 70 s was obtained in the ephedrine groups compared to Group C after 0.15 mg/kg of cisatracurium ( $P < 0.001$ ). Ephedrine doses of either 70 or 110 µg/kg for pretreatment significantly improved intubating conditions ( $P < 0.05$ ). Systolic and diastolic blood pressure and heart rate at 1 min after tracheal intubation were significantly increased than other times in all groups ( $P < 0.001$ ), with no differences among the groups. However, 5 patients in Group 110 experienced marked hypertension (systolic/diastolic blood pressure:  $>200/100$  mmHg) 1 min after tracheal intubation.

**Conclusion(s):** We conclude that pre-treatment with ephedrine 70 µg/kg improved intubating conditions 1.5 min after cisatracurium administration and facilitated the onset of neuromuscular block (70 s) without adverse hemodynamic effects.

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## 9AP4-3

### The use of sugammadex three times for the reversal of rocuronium-induced neuromuscular blockade in a patient with post-tonsillectomy hemorrhage - a case report

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**Background:** Post-tonsillectomy hemorrhage (PTH) is the most frequent complication of tonsillectomy, and occasionally results in a lethal outcome.

**Case report:** A 21-year-old man (height 180 cm, weight 95 kg) was scheduled for a bilateral tonsillectomy and uvulopalatopharyngoplasty for treatment of obstructive sleep apnea. He required 5 rounds of general anesthesia due to recurrent PTH. The anesthesiologist used sugammadex a total of 3 times to achieve the successful reversal of the deep neuromuscular blockade (NMB) induced by rocuronium. After sugammadex 2 mg/kg was administered, the NMB was reversed in 2 minutes each time.

**Discussion:** Re-administration of rocuronium within a short time interval after sugammadex may result in unpredictable effects of neuromuscular junction blocking agents.

#### References:

1. Windfuhr JP, Schloendorff G, Baburi D, Kremer B. Lethal outcome of post-tonsillectomy hemorrhage. *Eur Arch Otorhinolaryngol* 2008; 265: 1527-34.

**Learning points:** Re-administration of rocuronium within a short time interval after sugammadex.

## 9AP4-4

### Reversal of a continuous deep neuromuscular blockade with sugammadex in morbidly obese patients: lean body weight or total body weight as dosing scalar?

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**Background and Goal of Study:** In the morbidly obese patient the optimal dose of sugammadex still remains to be determined. Dosing sugammadex on ideal body weight (IBW) can be insufficient and unsafe after deep and moderate block in morbidly obese patients<sup>1</sup>. Dosage based on Lean Body Weight (LBW) might be more logical since LBW changes with total body weight, gender and height. It correlates with cardiac output, metabolic activity. Drug clearance increases with LBW.<sup>2</sup> The aim of the present study was to evaluate reversal times of continuous deep neuromuscular blockade when sugammadex dose was calculated using LBW compared to using TBW.

**Materials and methods:** After ethical committee approval and written informed consent, 39 patients undergoing laparoscopic bariatric surgery were randomly assigned to receive 2 or 4 mg/kg sugammadex according to either LBW or TBW. Primary endpoint was the time of reversal (train-of-four ratio  $> 0.9$ ). If reversal was inadequate, a rescue dose of 2 mg/kg LBW was administered. Anesthesia was standardized (propofol and remifentanyl). Neuromuscular blockade was achieved with rocuronium 1 mg/kg LBW bolus at induction and titrated to achieve a post-tetanic count of 1 - 2 using continuous infusion of rocuronium. At the end of surgery, sugammadex was administered according to the group assignment. Data were analyzed using one-way analysis of variance.

**Results and Discussion:** In the group receiving 2 mg/kg LBW of sugammadex, time to reversal was  $318 \pm 156$  sec, which was significantly higher compared to 2 mg/kg TBW ( $187 \pm 87$  sec;  $p < 0.05$ ). Two patients in the 2 mg/kg LBW group necessitated a rescue dose of sugammadex. In the group receiving 4 mg/kg no difference was observed in reversal time between LBW and TBW group ( $177 \pm 68$  vs  $111 \pm 50$  sec;  $p = ns$ ) and was comparable to the reversal times with 2 mg/kg TBW.

**Conclusion:** These data indicate that in the present study population, sugammadex 2 mg/kg TBW yielded similar reversal times as 4 mg/kg LBW or TBW. Sugammadex 2 mg/kg LBW significantly increased reversal times compared

to the other dosage schemes and proved to be unsafe in the reversal of prolonged deep neuromuscular block.

#### References:

1. Llaurodo et al. *Anesthesiology* 2012; 117: 93 - 98
2. Janmahasatian et al. *Clin Pharmacokin* 2005; 1051 - 65

### 9AP4-5

#### The effect of sugammadex vs. neostigmine on the postoperative respiratory complications following laparoscopic sleeve gastrectomy

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**Background and Study Purpose:** Laparoscopic sleeve gastrectomy surgery requires an appropriate use of muscle relaxation.

Postoperative residual curarization has been repeatedly documented, reflecting either incomplete reversal or recurarization and it may be associated with significant airway & pulmonary morbidity. Sugammadex has been found to be a safe and effective reversal agent. We investigated the correlation between the type of muscle relaxant reversal agent and the development of postoperative critical respiratory events and pulmonary complications in patients undergoing laparoscopic sleeve gastrectomy surgery.

**Methods:** In a prospective randomized study from September 1, 2012 to February 28, 2013, 57 patients undergoing laparoscopic sleeve gastrectomy received two muscle relaxant reversal agents at the end of surgery: either sugammadex 2 mg/kg (32 patients) or neostigmine 2.5 mg (25 patients). Minimum SpO<sub>2</sub> values in the PACU, airway & pulmonary morbidity, unexpected ICU admission, incidence of reintubation and duration of hospitalization were compared by the type of the reversal employed.

**Statistics and Results:** Distribution of continuous variables was assessed for normality by Kolmogorov-Smirnov test. The primary outcome, (complications) was compared by reversal type using chi square. Continuous variables were compared by reversal agent using the t-test for or the Mann-Whitney U. Categorical variables were compared using the chi square test. Demographic data were similar between the two groups. SpO<sub>2</sub> was lower with neostigmine - 95.80 (±0.014) vs. with sugammadex - 96.72 (±0.011) p < 0.01. Also, the minimal SpO<sub>2</sub> was significantly lower in the PACU in the NEO group: 93% vs. 94% (p = 0.01). Respiratory complications and other outcome variables were not significantly different between the studied groups.

**Conclusions:** The use of sugammadex (compared to neostigmine) as reversal agent following laparoscopic sleeve gastrectomy surgery was associated with higher postoperative oxygen saturation despite the lower TOF count before the administration of reversal agent.

The lack of difference in the other measured variables may stem from the small patients' groups sizes studied.

### 9AP4-6

#### Prolonged recovery time from muscle relaxation due to rocuronium in patients with severe chronic renal disease using sugammadex

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**Background:** It is well known that renal dysfunction, estimated by plasma creatinine concentrations, increased the risk of residual neuromuscular block (RNMB) induced by rocuronium and that there are possibly no relationships between the dose of Sugammadex (SGDX) and recovery from neuromuscular block under renal dysfunctions under various degrees. However, there are no reports, based on the renal function estimated by Glomerular Filtrating Ratio (e GFR), on the relationship between RNMB and renal dysfunction. Therefore, based on the chronic renal disease (CKD) severity classification by e GFR, we examined the effect of the SGDX towards the rocuronium in patients under sevoflurane (SEV) anesthesia. We evaluated by comparing the time required for recovery by determining the time interval between Train of four (TOF) count 1 and TOF ratio 100% using TOF monitoring.

**Methods:** We selected 27 adult patients for present study in our hospital, underwent surgery under general anesthesia. We divided the subjects into 2 groups: patients with severe renal failure (R group, n = 13, patients currently undergoing dialysis in the red zone of the severe CKD group with e GFR values < 15) and a control group comprising of patients with normal renal function (N group, n = 14, e GFR value >90).

Anesthesia was induced in both groups with 2 mg/kg propofol and 0.8 mg/

kg rocuronium for tracheal intubation and maintained with SEV anesthesia. The TOF count 1 state was sustained by administration of an appropriate rocuronium dosage. After confirming the TOF count 1 value at the end of the surgery, pure oxygen was administered, and then 4 mg/kg SGDX was slowly intravenously injected over 5 s. The time interval between TOF count1 and TOFRatio100% was measured.

**Results:** No significant differences were observed between both groups with regard to the patient's age, height, and weight. A statistically significant difference (t-test) was observed between the time taken by the muscles to recover from relaxation induced by SGDX in the R group and that in the N group [266 ± 186 (mean ± SD) s vs. 146 ± 87 s; P = 0.039].

**Conclusion:** The muscle relaxation recovery time interval from TOF count 1 to TOF ratio 100% was found to be more prolonged in patients with severe CKD than in the normal group patients recovering from rocuronium during SEV anesthesia when using SGDX based on the e GFR values. Thus, we recommend that rocuronium should be used with caution in patients with severe CKD.

### 9AP4-7

#### Transient complete atrioventricular block following anaphylaxis due to sugammadex

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**Background:** The heart is a target organ of anaphylaxis. Coronary spasms are well known, and various mediators are responsible for anaphylactic angina. On the other hand, these mediators also have strong heart conduction blocking actions (1), which are not widely recognized. The present report describes a man undergoing surgery who subsequently developed complete atrioventricular block (AVB) following sugammadex administration.

**Case report:** A 78-year-old man with chronic atrial fibrillation was admitted to undergo thoracic aortic repair. He had no drug allergies. General anesthesia was administered using sevoflurane, remifentanyl and rocuronium. The operation was completed uneventfully in 2.5 hours. Postoperatively, 2mg/kg of sugammadex was administered. Two minutes later, cardiac arrest suddenly occurred. Cardiac resuscitation was immediately initiated with administration of epinephrine. He showed rapid circulatory recovery. Then, erythema of the skin of the trunk was noticed. Anaphylaxis caused by sugammadex was highly suspected. Several hours later, he had recovered without sequelae. The ECG monitor in the operating room during cardiac arrest showed small f waves and no QRS waves. Therefore, complete AVB was considered to have occurred suddenly.



[ECG]

**Discussion:** Chemical mediators following an anaphylactic reaction have been implicated as possible triggers for AVB (2). Studies using guinea pigs have shown histamine to induce AVB (1)(3). In our present case, anaphylaxis exerted a direct action on the AV node. Cardiac arrest then occurred due to the AVB.

#### References:

1. Effect of adenosine on histamine release and atrioventricular conduction during guinea pig cardiac anaphylaxis. *Circ Res.* 1988;62:1147-58
2. Transient 2:1 atrioventricular block following anaphylactic reaction to low-ionic strength computed tomography contrast agent. *Can J Cardiol.* 2008 ;24:e96-98
3. Effect of histamine H1- and H2-receptor antagonists on cardiovascular function during systemic anaphylaxis in guinea pigs. *Agents Actions.* 1991;32:245-52



**Learning points:** The onset of anaphylaxis may trigger severe heart block, attributable to the direct actions on the heart of chemical mediators.

## 9AP4-8

### Sugammadex: an important role in Steinert's disease

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**Background:** Steinert's Disease (SD) is a multisystem disorder with muscular and extramuscular involvement. Considering anaesthesia, risk of triggering a myotonic crisis or malignant hyperthermia and increased sensitivity to anaesthetics are major concerns<sup>1</sup>. Sugammadex rapidly reverses neuromuscular block (NMB) by rocuronium and avoids residual block facilitating ventilatory dynamics. We present a case in which general anaesthesia was conducted for a laparoscopic cholecystectomy, discussing its implications and successful use of sugammadex.

**Case report:** 39-year-old woman, ASA III, diagnosed with SD 10 years before, proposed for elective laparoscopic cholecystectomy. She had cognitive impairment, alopecia, ptosis, moderate muscle weakness and no target organ involvement. Anaesthetic history reported need for postoperative mechanical ventilation. Routine preoperative evaluation was normal. Patient was premedicated with ranitidine.

Standard, depth of anaesthesia and NMB monitoring were applied. Prevention of hypothermia was accomplished. A rapid sequence induction anaesthesia was conducted with remifentanyl, propofol and rocuronium. Maintenance was performed with propofol and remifentanyl infusions in oxygen and air and reversal of NMB with sugammadex. Patient was successfully extubated in the operating room and had an uneventful 6-hour period in the recovery room. She was transferred to ward and discharged 24h later without complications.

**Discussion:** SD frequently courses with anaesthetic complications not proportional to disease severity. Myotonic triggers like hypothermia, shivering, succinylcholine and neostigmine should be avoided. Non-depolarizing muscle blockers are usually not used because a prolonged action might be observed. Sugammadex effective reversal of NMB without relying on inhibition of acetylcholinesterase seemed an asset approach. Besides, it could minimize respiratory complications. Short-acting drugs like remifentanyl and propofol also appeared to be a prudent choice to minimize complications and bypass the use of inhalation agents associated with malignant hyperthermia.

#### References:

1. M. Bennum et al. *Br J Anaesth* 2000;85:407-9.

**Learning points:** Facing the unpredictable response to drugs and significant perioperative complications in patients suffering from myotonic dystrophy, anaesthetic management should consider short-acting agents and the recent reversal agent sugammadex. Avoidance of triggers and close perioperative monitoring are crucial.

## 9AP4-9

### Effects of magnesium sulfate on the pharmacodynamics of low-doses rocuronium and atracurium

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**Background and Goal of Study:** Magnesium has an impact on neuromuscular transmission. This effect would be of great benefit to patients scheduled for short abdominal laparoscopic surgeries with low-dose non-depolarizing neuromuscular relaxants. We investigated the impact of an intravenous infusion of magnesium sulphate 45 mg/kg, given before the administration of low-dose rocuronium and atracurium, on the speed of onset, intubation conditions and the recovery time.

**Materials and methods:** 87 patients aged 18-65 yr scheduled for laparoscopic cholecystectomy (time of duration 25-35 min), were enrolled in the prospective randomized study. All patients were randomly allocated to the 4 groups: magnesium-rocuronium group (MRG) and magnesium-atracurium group (MAG), which received 45 mg/kg of MgSO<sub>4</sub> in 5 minutes and rocuronium or atracurium 0,3 mg/kg; rocuronium group (RG) and atracurium group (AG), which received the same volume of saline and rocuronium/atracurium 0,3 mg/kg. Magnesium sulfate was given intravenously 1 min before induction of anaesthesia with propofol and fentanyl. Dose of neuromuscular relaxants was calculated on ideal body weight. Anaesthesia maintenance was made by inhalation of sevoflurane in oxygen-air mixture. Neuromuscular transmission was measured using by acceleromyography and train-of-four (TOF) stimulation.

**Results and discussion:** Onset time (to TOF=0) was 90 s (80-140) (Me(25%-75%)) in MRG and 240 s (120-300) with saline (RG) ( $p < 0,001$ , Mann-Whitney Test). In those groups in 90-120 s all patients underwent tracheal intubation. Five patients in the RG had poor intubating conditions versus none in the MRG ( $p < 0,05$ ,  $\chi^2$ -test). In magnesium-atracurium group onset time was 240 s (170-300). Whereas in AG it was 380 s (210-520) ( $p < 0,001$ ). Patients in those groups were intubated at 120-240 s. In 12 cases in atracurium group the intubation conditions were poor versus 2 patients in the MAG ( $p < 0,05$ ). Duration of action (to TOF 25%) was 25 min (22-30) in MRG and 27,5 min (22,5-33) in RG ( $p > 0,05$ ).

Atracurium duration of action was statistically shorter in MAG (40 min (33-49) in comparison with 32 min (25,5-36,5) in AG,  $p < 0,001$ ).

**Conclusion:** Magnesium sulphate, in the dose 45 mg/kg, reduces onset time of low-dose rocuronium and atracurium and improves conditions for tracheal intubation. Magnesium prolongs duration of action low-doses atracurium, but doesn't affect on low-doses of rocuronium.

## 9AP4-10

### Residual neuromuscular block in bariatric surgery

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**Background and Goal of Study:** Bariatric Surgery (BS) is an effective way to maintain weight control over time in morbidly obese patients. These patients have a greater incidence of postoperative complications and residual neuromuscular block (RNMB) is also associated with a worse outcome in the Post-Anaesthesia Care Unit (PACU) 1. The aim of the study was to assess the incidence of RNMB in morbidly obese patients after BS and evaluate the outcomes.

**Materials and methods:** After obtaining ethics committee approval and consent, a prospective observational study was conducted for 3 months in the PACU. Fifty three adult patients submitted to BS were eligible to the study. Exclusion criteria: inability to give consent and pulmonary disease. The primary outcome was RNMB at PACU admission. RNMB was defined as train-of-four ratio  $< 0,9$  and was objectively quantified using acceleromyography. Demographic data and perioperative variables were collected. Arterial blood gases (ABG) parameters were recorded as well as the occurrence of adverse respiratory events (ARE), pain and postoperative nausea and vomiting (PONV). Variables with and without normal distribution were compared, respectively, with T Student or Mann-Whitney test and categorical variables with Chi-square. Continuous variables were analyzed using Pearson correlation.

**Results and discussion:** At PACU admission the incidence of RNMB was 64%. Both groups were similar regarding age, gender, comorbidities and type of surgery. Attending to the neuromuscular agent used, in patients with RNMB cisatracurium was more often used than rocuronium (61,8% vs. 29,4%,  $p = 0,004$ ) and medium TOF values were  $71,7\% \pm 18,3$  vs.  $86,9\% \pm 14,0$ , respectively ( $p = 0,006$ ). Patients with RNMB had a prolonged extubation time (10,5 min vs. 8 min,  $p = 0,026$ ). During they stay at PACU, these patients needed treatment for arterial hypertension more frequently (62,5% vs. 27,8%,  $p = 0,034$ ) and presented more ARE (82,4% vs. 55,6%,  $p = 0,038$ ). There were no significant differences in ABG parameters and PACU length of stay between patients with or without RNMB.

**Conclusion(s):** The incidence of RNMB was very high and was associated with occurrence of ARE.

#### References:

1. *Rev Bras Anesthesiol.* 2006 Jun;56(3):205-22

## 9AP4-11

### Does the residual blockade after administration of neostigmine and atropine is reversible with the use of sugammadex?

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**Background and Goal of Study:** Our goal was to investigate the use of sugammadex for reversal of residual neuromuscular blockade (NMB) after administration of neostigmine and atropine (1).

**Materials and methods:** Sixty patients at ages between 40 to 65 years of age undergoing lower abdominal surgery were randomly divided into two groups

in a prospective, randomized study. Induction with propofol, 2-2.5 mg/kg IV, and maintained with sevoflurane 1-2 % end-tidal minimum alveolar concentration (MAC), in a 1:1 oxygen:air mixture, in combination with a fentanyl 5 µg/kg. Intravenous rocuronium 1 mg /kg, followed by 0.07 mg/kg. Anesthesia was maintained by a sevoflurane volatile anesthetic together with fentanyl 0.1 to 0.2 µg/kg every 30 minutes. In Group N (Neostigmine)(n=15) patients received standard intravenous neostigmine 0.07 mg/kg and atropine 0.02 mg/kg doses before extubation. In Group N+S(Neostigmine+Sugammadex) (n=15) patients received an intravenous bolus dose of 1 mg/ kg of sugammadex five minutes after standard reversal dose. In both groups, reversal agents of blockade was provided if there is at least one twitch at TOF monitor. The time to recovery of the train-of-four (TOF) ratio to 0.9 was recorded. The primary efficacy variable was the time from the start of administration of neostigmine/atropine or sugammadex to recovery of the T4/T1 ratio to 0.7 and 0.9. Extubation times, recovery times, after extubation tidal volumes, respiratory rate, arterial oxygen saturation (SaO<sub>2</sub>) values were collected at 5, 10, and 30 min.

**Results and discussion:** Age, sex, gender, operation types and duration of operations were not different between groups ( $p > 0.05$ ). The time to achieve TOF ratios of 0.7 and 0.9 were significantly shorter in Group N+S in comparison to Group N ( $p = 0.0001$ ). In Group N, the extubation time ( $13.8 \pm 7.3$  minute) was longer than Group N+S ( $4.8 \pm 3.3$  min) ( $p = 0.0001$ ). In Group N, the recovery time (Aldrete score  $> 9$ ) after reversal of neuromuscular blockade ( $36.7 \pm 11.2$  minute) was longer than Group N+S ( $13.2 \pm 5.4$  min) ( $p = 0.0001$ ). In Group N, tidal volumes after extubation was smaller ( $178.4 \pm 33.8$  ml) in comparison to Group 2 ( $212.4 \pm 31.8$  ml) ( $p = 0.0001$ ).

**Conclusion(s):** Sugammadex can be safely used after administration of neostigmine and atropine atropine for reversal of residual NMB without any significant adverse events.

#### References:

1- Debaene B, Plaud B, Dilly MP, Donati F *Anesthesiology* 2003;98:1042-8.

## 9AP5-1

### The effect of different storage temperature on the pharmacodynamic dose-response of cisatracurium besylate

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**Background and Goal of Study:** To evaluate the pharmacodynamic dose-response of cisatracurium besylate stored under refrigeration or at room temperature when given as abolus under total IV anesthesia with propofol.

**Materials and methods:** 120 ASA I or II patients aged 18-65 yr undergoing elective procedures were randomly divided into three groups (n=40 each): group 1 cisatracurium stored at 4-8°C; group 2 cisatracurium stored at room temperature for 30 days and group 3 cisatracurium stored at room temperature for 60 days. Anesthesia was induced with TCI of propofol (Cp 3µg/ml) and remifentanyl (Ce 3-5 ng/ml). A bolus of cisatracurium 0.2mg/kg was given IV over 5-10 s as soon as the patients lost consciousness. Neuromuscular block was monitored with TOF-Watch SX (Oaganon, the Netherlands). Single stimulation (0.1 Hz) was applied to the ulnar nerve at wrist. The maximal degree of neuromuscular block, onset time, clinical duration and recovery index were recorded. The patients were intubated and mechanically ventilated when neuromuscular block reached the maximal degree. The intubation condition was evaluated.

**Results and discussion:** The maximum block was 100% in all patients except one in group 3 was 95%. There was no significant difference among groups with regard to the frequency of excellent or good intubation condition. Compared with group 1 and 2, the onset time was significantly longer, clinical duration and 75% recovery time were significantly shorter in group 3, while recovery index varied no significance.

**Conclusion(s):** Compared with that stored under refrigeration, the onset time was significantly longer, clinical duration and 75% recovery time were significantly shorter when cisatracurium besylate was stored at room temperature for 60 days, recovery index was independent of storage temperature.

## 9AP5-2

### Alanine minimises liver injury after ischemia reperfusion: influence of adenosine nucleotides

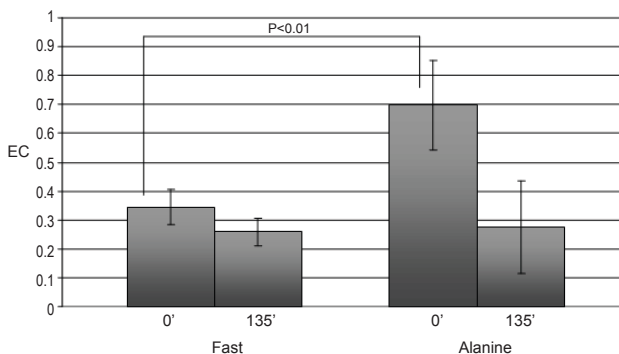
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**Background and Goal of Study:** The pre-existing nutritional status of the liver, *i.e.* fasting, is known to contribute to the extent of tissue injury and primary non-function after different insults (1, 2). Different exogenous substrates have been evaluated to provide energy to livers. The aim of this study was to determine the role of alanine (Al), the most important amino acid precursor of glucose, on hepatic injury after ischemia-reperfusion (IR) in *ex vivo* perfused rat liver.

**Materials and methods:** After University Animal Care Committee approval, female Wistar rats were fasted for 18 hours with free access to tap water. Animals were anaesthetised, the portal vein cannulated, the liver removed and immediately perfused in a closed *ex vivo* system with HBSS supplemented with insulin, HEPES and O<sub>2</sub> at 37°C at a flow rate of 5 ml/min. The experiment consists of three phases: perfusion for 15 min, ischemia for 60 min, and reperfusion during 60 min. Animals were randomly divided into two groups: control in which rat livers were perfused with the HBSS enriched solution containing 1 g/l glucose and Al group in which 25 g/l Al (concentration based on previous results) was added to perfusate (without glucose) from the start of the experiment (n = 10 in each group). Glucose, lactate, potassium, and enzymes were analysed in perfusate samples at different time-points. The energy charge ( $EC = [ATP] + 1/2[ADP]/[ATP] + [ADP] + [AMP]$ ) in hepatocytes was determined in tissue biopsies at 0 and 135 min using HPLC technique as described elsewhere. Mean  $\pm$  SD. Student's *t* test.

**Results and discussion:** Al minimises enzymes release after IR. EC in tissue was higher in Al treated-livers when compared to control group at start of experiment (Fig 1). It has been shown that Al improves the recovery of ATP through pyruvate and the Krebs cycle and the gluconeogenic capacity of livers from fasted animals (2, 3).



[Figure 1]

**Conclusion(s):** The infusion of Al might protect against liver IR injury in fasting patient by increasing ATP level.

#### References:

1. Stadler *et al.* *Anesthesiology* 2005;103: 978-86;
2. Sankary *et al.* *Transplantation* 1992;54:170-2;
3. Arnault *et al.* *Transpl Int* 2002;15:89-95.

### 9AP5-3

#### Addiction of neurokinin 1 receptor antagonist aprepitant to double antiemetic prophylaxis improves control of postoperative nausea and vomiting in oncologic patients undergoing laparoscopic procedures: a double-blinded randomized controlled trial

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**Background and Goal of Study:** Postoperative nausea and vomiting (PONV) is thought to be multifactorial origin, such as individual risk, anesthetic and surgical factors and is a common occurrence with a reported incidence between 60% and 80% in high risk patients. Recent studies suggest that neurokinin-1 antagonists (NK1-A) might be able to address limitations of current prophylactic measures once it is fully incorporated into the multimodal antiemetic approach. We hypothesized that the combination of an NK1-A (aprepitant), ondansetron and dexamethasone will decrease the incidence of postoperative nausea and vomiting when compared with the combination of placebo, ondansetron and dexamethasone in high and very-high risk PONV patients.

**Materials and methods:** High or very-high PONV probability (Apfel's Score 3 or 4) oncologic patients scheduled to pelvic or abdominal videolaparoscopic surgeries under total intravenous anesthesia and neuroaxial anesthesia were enrolled in this double blinded randomized controlled trial. Patients were randomized to receive either oral aprepitant 10mg or matching placebo one to two hours before induction of anesthesia. All patients received intravenous dexamethasone 4 to 10 mg and intravenous ondansetron 4 to 8 mg after the induction of anesthesia. The anesthetic technique was a standardized combined anesthesia. The study data was collected at regular intervals by blinded personnel at two and 24 hours after the end of the surgery. Statistical analysis was performed using Fisher's Exact Test and the null hypothesis was ruled out if  $p < 0.05$ .

**Results and discussion:** Forty-seven patients were enrolled and 38 completed the study. Four patients from aprepitant group and five from control group were excluded due to conversion from laparoscopic to open surgery. The incidence of vomiting in the first 24 hours was 4.7% in the aprepitant group and 30.4% in the placebo group ( $p=0.04$ ). The null hypothesis could not be ruled out for the difference in nausea incidence (14.2% in treatment and 36.6% in control group) in the first 24h ( $p=0.151$ ) and could neither for the difference in mean nausea intensity scores ( $p=0.08$ ) between groups.

**Conclusion(s):** The NK1-RA (aprepitant) improves vomiting prophylaxis in oncologic adult patients undergoing pelvic and abdominal videolaparoscopic surgeries.

**Acknowledgements:** FAPESP

### 9AP5-4

#### Awake paralysis in patients with prolonged duration of action of succinylcholine and mivacurium

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**Background and Goal of Study:** Patients with butyrylcholinesterase (BChE) deficiency may experience awake paralysis if anaesthesia is terminated before the prolonged effects of succinylcholine or mivacurium have subsided. In patients with BChE deficiency referred to the Danish Cholinesterase Research Unit (DCRU) the use of quantitative neuromuscular monitoring reduced the incidence of premature termination of anaesthesia from 100% to 14% (1). In this study we examined if the same group of patients had experienced awake paralysis at termination of anaesthesia.

We hypothesized that the use of neuromuscular monitoring reduced the incidence of experienced paralysis.

**Materials and methods:** Patients referred to DCRU in 2004-2012 were contacted. A structured telephone interview was conducted after informed consent. The interview consisted of a Brice awareness interview, multiple choice questions about the postoperative experience and supplementary open questions.

Clinical information, i.e. premature termination of anaesthesia and the use of neuromuscular monitoring, was available from an earlier study (1). Interviewees were blinded to these data.

**Results and discussion:** Of 100 eligible patients 70 were interviewed. The use of neuromuscular monitoring significantly reduced the incidence of experienced paralysis at termination of anaesthesia ( $P=0.0025$ , Fisher's exact test) (Table). In 6 cases neuromuscular monitoring was applied, but anaesthesia was terminated despite paralysis because measurements were misinterpreted or not relied on. Eight of the 35 patients who had not initially experienced paralysis in the operating room later experienced paralysis in the intensive care unit.

As the BChE deficiency is rarely known before a muscle relaxant is administered the use of quantitative neuromuscular monitoring is imperative, even when using short acting neuromuscular blocking agents.

Experienced awake paralysis	Neuromuscular monitoring applied (n=24)	No neuromuscular monitoring applied or applied when paralysis was suspected (n=46)
Yes (n=31) or maybe (n=4)	6 (25%)	29 (63%)
No (n=35)	18 (75%)	17 (37%)

[Experienced paralysis and the use of neuromuscular]

**Conclusion:** Correctly applied neuromuscular monitoring reduces the incidence of experienced paralysis in patients with BChE deficiency. Patients suspected of BChE deficiency should be sufficiently sedated until neuromuscular monitoring shows full recovery of neuromuscular function.

#### References:

1. CV Nielsen. Eur J Anaesth 2013; Suppl 51:30:9AP3-10

### 9AP5-5

#### Effects of remifentanyl on factors associated with the proliferation and differentiation of osteoblasts under hypoxia-reoxygenation conditions

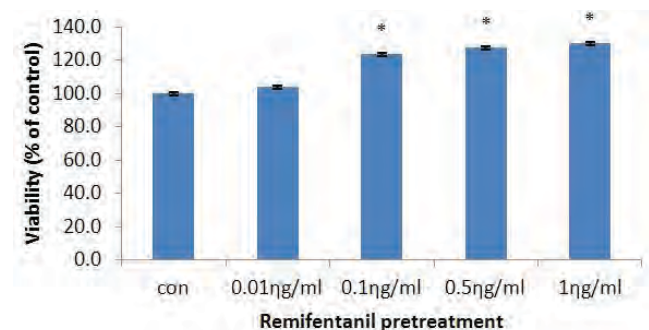
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**Background and Goal of Study:** Ischemia-reperfusion of bone occurs in a variety of clinical conditions, such as orthopaedic arthroplasty, plastic gnathoplasty, spinal surgery, and amputation. Usually, cellular models of hypoxia-reoxygenation reflect in vivo models of ischemia-reperfusion. With respect to hypoxia-reoxygenation condition, the effects of remifentanyl on osteogenesis have received little attention. Therefore, we investigated the effects of remifentanyl on the proliferation and differentiation of osteoblasts during hypoxic-reoxygenation condition.

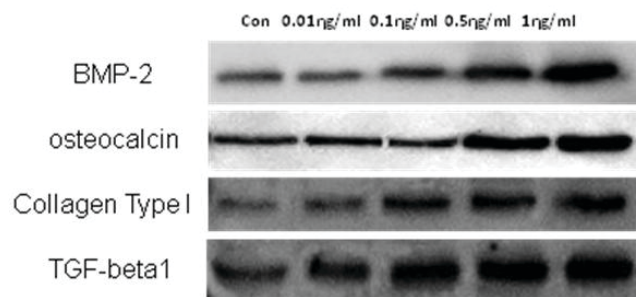
**Materials and methods:** After remifentanyl (0.01, 0.1, 0.5, 1 ng/ml) preconditioning for 2 h, hFOB 1.19 human fetal osteoblast cells were cultured under 1% oxygen tension for 24 h. Thereafter, the cells were reoxygenated for 12 h at 37 °C. We measured cell viability via MTT assay. Quantitative real-time PCR and western blot methodologies were used to determine osteocalcin, BMP-2, type-I collagen and TGF-β1 expression levels.

**Results and discussion:** Cells treated with remifentanyl (0.1, 0.5, 1 ng/ml) showed significantly increased cell viability compared to controls. During hypoxic-reoxygenation condition, remifentanyl treatment induced the expression of osteocalcin, BMP-2, type-I collagen and TGF-β1 in osteoblasts.

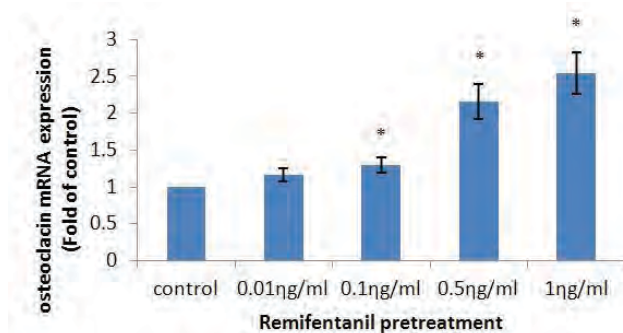


[Effect of remifentanyl on cell viability]





[Western blot assay]



[Expression of osteocalcin through RT-PCR]

**Conclusion(s):** Under hypoxia-reoxygenation condition, remifentanyl preconditioning enhanced the osteoblast proliferation rate and stimulated proliferation and differentiation of osteoblasts through enhanced expression of osteocalcin, BMP-2, type-I collagen and TGF- $\beta$ 1. Our results suggest that remifentanyl might help in treatment of bone stress injury.

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## 9AP5-6

### Effects of sugammadex and rocuronium-sugammadex association on coagulation in rats: prospective randomized experimental study

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**Background and Goal of Study:** The sugammadex is related to several adverse effects, including possible coagulation disorders. The aim of this study was to assess the effects of the higher recommended human clinical dose of sugammadex on coagulation in rats.

**Materials and methods:** After ethical approval, 28 male rats were randomly distributed into 4 groups of 7: SHAN- surgical preparation without IV drug infusion; Control - IV saline 0.5 ml; Sugammadex- IV sugammadex 100 mg.kg<sup>-1</sup> (equivalent to human dose of 16mg/kg) in 0.5 mL of saline and; Rocuronium-Sugammadex - IV dose of rocuronium 3.75 mg.kg<sup>-1</sup> (equivalent to a human dose of 0.6 mg.kg<sup>-1</sup>) and sugammadex 100 mg.kg<sup>-1</sup> (equivalent to a human dose of 16mg.kg<sup>-1</sup> of) in 0.5 ml saline. Anaesthesia - O<sub>2</sub>; Isoflurane. Blood samples were collected at two moments: (1)- 10 minutes after the end of the surgical preparation (before infusion of drugs or saline), and (2)- 30 minutes after infusion of drugs or saline (corresponding to group randomly selected treatment). Profile Analysis was performed to study the effect of group, moment and interaction moment x group. For fibrinogen variable that showed no homogeneity of variance, the Kruskal-Wallis test was performed when comparing the groups at all moments and the Wilcoxon comparison of moments in each group. Significance was 5%.

**Results and discussion:** Tables 1,2 and 3 show the parameters studied. Platelet count - There is moment effect ( $p < 0.001$ ), no group effect ( $p =$

0.029) and no moment x group effect ( $p = 0.13$ ); Prothrombin time - There is moment effect ( $p < 0.001$ ), no group effect ( $p = 0.18$ ) and no time x group effect ( $p = 0.70$ ); Activated partial thromboplastin time - There is group effect ( $p = 0.012$ ), no moment effect ( $p = 0.08$ ) and no time x group effect ( $p = 0.20$ ). Capital letters compare overall group means.

	Platelet count (mm3)			Prothrombin time(sec)			Activated partial thromboplastin time (seg)		
	Moment 1 Mean/SD	Moment 2 Mean/SD	Overall group Mean/SD	Moment 1 Mean/SD	Moment 2 Mean/SD	Overall group Mean/SD	Moment 1 Mean/SD	Moment 2 Mean/SD	Overall group Mean/SD
Shan	525196/120063	499950/81754	512573/99547 AB	40.3/1.9	37.7/2.0	39.0/2.3	37.3/11.1	44.4/8.3	40.9/10.1 AB
Control	589046/77273	509328/112956	549187/101763 A	40.7/1.1	38.0/0.6	39.4/1.6	42.1/7.4	45.2/6.6	43.6/7.0 A
Sugammadex	522314/50255	454139/51240	488226/60239 AB	39.7/3.4	36.9/2.5	38.3/3.2	41.3/3.5	47.0/8.5	44.2/6.9 A
Rocuronium/Sugammadex	428528/58489	412732/65081	420630/60008 B	40.4/1.8	38.0/1.6	39.2/2.1	31.9/11.4	28.8/13.3	30.4/12.0 B
Overall moment	516271/96182	469037/85985		40.3/2.1	37.6/1.8		38.2/9.4	41.4/11.6	

[Platelet Count (mm3), PT (seg), APTT (seg)]

The median values of fibrinogen were similar when comparing the median values between the two moments in each group. There was time x group effect at the moment 2 ( $p = 0.04$ ).

**Conclusion(s):** There was significant difference in Platelet count and Prothrombin time after the use of sugammadex.

## 9AP5-7

### Protective effect of propofol against hypoxia-reoxygenation injury in HaCaT human keratinocytes

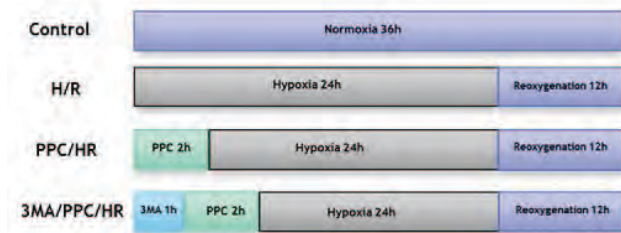
Yoon J.-U.<sup>1</sup>, Baik S.-W.<sup>1</sup>, Lee S.H.<sup>2</sup>, Kim Y.-H.<sup>3</sup>, Kim C.-H.<sup>4</sup>, Yoon J.-Y.<sup>4</sup>

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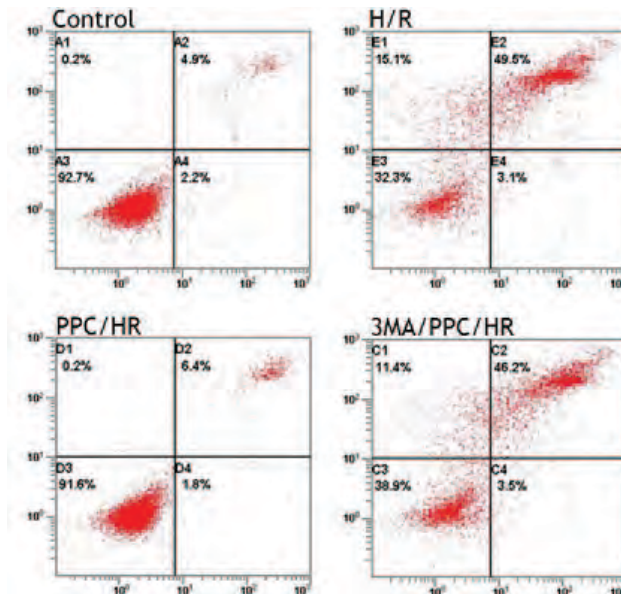
**Background and Goal of Study:** Tissue hypoxia-reoxygenation damage is a feature common to lots of skin diseases including pressure ulcer and cancer. Propofol widely used intravenous anaesthetic drugs, has been demonstrated to have protective properties in several in-vitro and in-vivo models of various hypoxia-reoxygenation injury. However, detailed apoptosis and autophagy mechanisms underlying the effect of propofol on H/R-induced keratinocyte remain unknown. In the present study, we investigated how propofol influences the intracellular autophagy and apoptotic cell death during the hypoxia reoxygenation process in the HaCaT cells.

**Materials and methods:** The cultured human keratinocyte cells were exposed to 24 h hypoxia (5% CO<sub>2</sub>, 1% O<sub>2</sub>, 94% N<sub>2</sub>) followed by 12 h reoxygenation (5% CO<sub>2</sub>, 21% O<sub>2</sub>, 74% N<sub>2</sub>). And propofol was added to the culture medium 2h prior to the treatment. The experiment was divided into 4 groups : (1)Control=Normoxia (2)H/R=Hypoxia Reoxygenation ; (3)PPC+H/R=Propofol Preconditioning+ Hypoxia Reoxygenation; (4)3MA+PPC+H/R=3MA-Methyladenine+Propofol Preconditioning+Hypoxia Reoxygenation. In addition, Western blot analysis was performed to identify the expression of apoptotic pathway parameters. Autophagy was determined by transmission electron microscopy, MDC staining, AO staining and western blot.

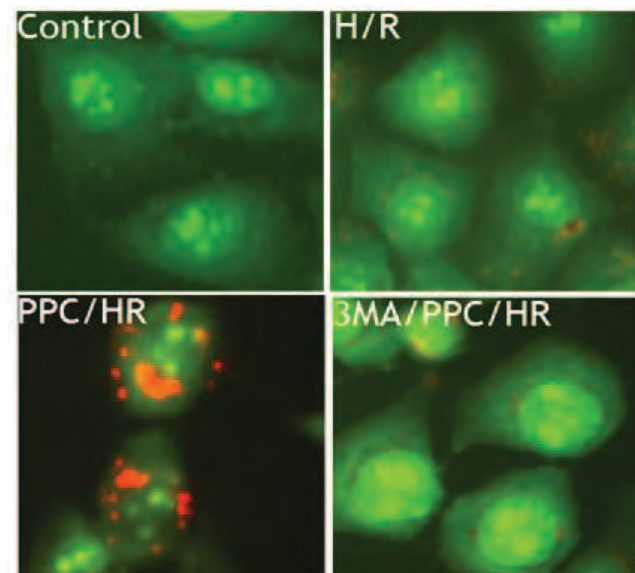
**Results and discussion:** H/R produced dramatic injuries in keratinocyte cells. In our study, the viability of Propofol in H/R induced HaCaT cells was first studied by MTT assay. The treatment with Propofol in H/R induced HaCaT cells enhanced cell viability in a dose-dependent manner and 100  $\mu$ M was the most effective dose. The morphological change of apoptosis was found, while the apoptotic rate and the expression of proteins involved in mitochondrial stress pathways increased. ATG5 and Beclin-1, LC-3 II, P62 was elevated in PPC group cells but H/R-induced group significantly reduced in HaCaT cells. The Atg5 were increased when autophagy was induced by Propofol, and they were decreased when autophagy was suppressed by 3MA.



[The experiment protocols]



[Detection of apoptosis and necrosis]



[Fluorescence microscopic analysis of autophagosome]

**Conclusion(s):** This study provided evidence that propofol preconditioning induced autophagy and reduced apoptotic cell death in H/R model of HaCaT cells. Although the current study could not represent the protection by propofol preconditioning in vivo, our results can contribute to the body of knowledge regarding the relationship between apoptosis and autophagy.

## 9AP5-8

### Propofol preconditioning protects against COS-7 Cell apoptosis in hypoxia/reoxygenation injury by induction of autophagy

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**Background and Goal of Study:** Apoptosis is the best described form of programmed cell death. Autophagy is an evolutionary conserved process of "self-eating" involved in degradation of long-lived or damaged proteins and organelles. Propofol is a widely used agent for the induction and maintenance of anesthesia during surgical procedures and has a structural similarity to the endogenous antioxidant vitamin E and exhibits antioxidant activities. Here we investigated how propofol influences the intracellular autophagy and apoptotic cell death during the (H/R) process in the COS-7 cells.

**Materials and methods:** Propofol (2, 6-diisopropylphenol) was diluted with dimethyl sulfoxide (DMSO). COS-7 cells were obtained from the American Type Culture Collection (ATCC, Manassas, USA). Cell viability was measured using a quantitative colorimetric assay with thiazolyl blue tetrazolium bromide (MTT, AMResco), showing the mitochondrial activity of living cells. Flow cytometer analysis, fluorescence microscopy and western blot analysis was used for observation the cellular change

**Results and discussion:** There are three principal findings of these studies. First, the propofol preconditioning before H/R significantly increased COS-7 cell viability and reduced the proportion of cell apoptosis. Second, the anti-apoptotic effect of propofol preconditioning in isolated COS-7 cells was probably related to induction of intracellular autophagy. And third, the intracellular autophagy pathway inhibitor 3-MA blocked the protective effect of propofol preconditioning on cell apoptosis, suggesting a key role of intracellular autophagy in propofol preconditioning. Together, these findings indicate that propofol preconditioning stimulated endogenous cellular protection of COS-7 cells against H/R injury through the induction of intracellular autophagy.

**Conclusion(s):** These data provided evidence that propofol preconditioning-induced autophagy and reduced apoptotic cell death in H/R model of COS-7 cells, which was in agreement with the autophagy played very important role in cell protection by propofol preconditioning demonstrated in isolated COS 7-cells exposed to H/R injury.

## 9AP5-9

### Effect of sugammadex versus neostigmine/atropine combination on cognitive function of adult patients after elective surgery: preliminary results

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**Background and Goal of Study:** To identify the possible effect of sugammadex versus neostigmine/atropine combination on cognitive function of adult patients after elective surgery.

**Materials and methods:** This prospective, randomized, double-blind trial was conducted after Institutional Research & Ethics Committee approval. Patients >40 years old, ASA I-III, who received general anaesthesia for elective surgery were included in the study, after written informed consent. Preoperatively, as well as 1 hour postoperatively, cognitive function was assessed using the Mini-Mental State Evaluation test (MMSE) and the Clock Drawing Test. Anaesthesia was induced and maintained with propofol, rocuronium, fentanyl/remifentanyl and sevoflurane, while reversal of neuromuscular function occurred randomly with sugammadex or neostigmine/atropine combination after reappearance of T2 in TOF sequence. Statistical analysis was performed using t-test paired analysis, with p set as < .05.

**Results and discussion:** The study included 114 patients, aged 61.1(10.8) years, scheduled for elective surgery, of mean duration 137.2(67.2) min. One hour postoperatively the cognitive function, as assessed by the MMSE, was declined by  $\geq 1$  SD in 26% of patients, and as assessed by Clock test in 67% of the total number of patients. However, no significant difference was observed regarding both tests, between the two groups ( $p_{\text{MMSE}}=0.25$ ;  $p_{\text{CLOCK}}=0.06$ ) (Table 1). Among all patients,

a significant correlation was revealed regarding decline in cognitive function related to age ( $p=0.002$ ) and duration of surgery ( $p < 0.001$ ).

	Neostigmine	Sugammadex	Total
MMSE preop	27.1(2.5)	27.4(2.2)	27.2(2.3)
MMSE postop	26.7(2.5)	26.8(2.7)	26.7(2.6)
MMSE reduction (points)	0.9 (1.1)	1.2(1.4)	1.01(1.3)
Clock preop	3.6(0.8)	3.2(1.0)	3.4(0.9)
Clock postop	2.3(1.2)	2.4(1.1)	2.4(1.1)
Clock reduction (points)	1.4(1.3)	1.0(0.9)	1.2(1.1)

[Table 1]

**Conclusion(s):** No significant difference was observed regarding cognitive function after receiving neostigmine/atropine combination or sugammadex for reversal of rocuronium-induced neuromuscular blockade for elective surgery.

## 9AP5-10

### The effect of the combination of dexamethasone with ondansetron versus dexamethasone with aprepitant to prevent postoperative nausea and vomiting in patients undergoing laparoscopic surgery

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**Background and Goal of Study:** The incidence of postoperative nausea and vomiting (PONV) can be as high as 80 percent in high-risk patients. We designed this randomized, double-blind, single-center study to compare the efficacy of the combination of dexamethasone with ondansetron and dexamethasone with aprepitant undergoing laparoscopic surgery.

**Material and methods:** Seventy, ASA I-II, age 18-60 years patients scheduled for laparoscopic surgery were included in this study. Anesthesia was induced with propofol, fentanyl, and rocuronium, and maintained with sevoflurane in oxygen / air mixture, and remifentanyl infusion in all patients. Patients were randomly divided into two groups. Patients in the dexamethasone-aprepitant group (group DA, n=35) received 40 mg aprepitant orally 1 to 2 hours before induction of anesthesia and 2 ml saline intravenous (iv) within the last 30 minutes of surgery. Patients in the dexamethasone-ondansetron group (group DO, n=35) received an oral placebo identical to aprepitant 1 to 2 hours before induction of anesthesia and 4 mg ondansetron iv within the last 30 minutes of surgery. All patient received iv 8 mg dexamethasone after induction of anesthesia.

PONV and postoperative opioid consumption were assessed for 24 hours postoperatively. The primary outcome was complete response (no PONV, no need for rescue antiemetic). The secondary outcomes were incidence of nausea, retching or vomiting, the need of rescue antiemetic and opioid consumption. Statistical analyses were performed using Mann-Whitney U test, Chi-square test, and Fisher's Exact test.  $P < 0.05$  was considered statistically significant.

**Results and discussion:** 67 patients [group DO (n=34), group DA (n=33)] completed the study. There were no differences in patient demographics, Apfel risk factors, and duration of surgery between the two groups. Complete response was not significantly different between the two groups (group DO: 67%, group DA: 69%) at 24 hours ( $p=0.93$ ). The incidence of PONV and postoperative opioid consumption was similar among the groups.

PONV is related to the patient, anesthetic and surgical factors. Although antiemetic prophylaxis might not eliminate the risk of PONV, it can significantly reduce the incidence of nausea and vomiting.

**Conclusion:** The antiemetic efficacy of the aprepitant and dexamethasone combination was similar with the ondansetron and dexamethasone combination following the laparoscopic surgery in our study.

## 9AP5-11

### Incidence of PONV-comparison between high flow and low flow anesthesia

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**Background and Goal of Study:** PONV still remains the "big little challenge" for anesthesiologists in their everyday practice in anesthesia. The aim of this study was to compare the incidence and severity of PONV, antiemetic requirement and patient satisfaction, after high flow vs. low flow sevoflurane anesthesia without antiemetic prophylaxis.

**Materials and methods:** Forty four patients, ASA physical status I-II, aged 18-65, weighing between 40-90kg, scheduled for elective maxillofacial surgery under general anesthesia that was expected to last from 1-2 hours, were enrolled in this prospective, randomized, double-blinded study. Patients were randomly allocated in two groups: group HF n=22 using High Flow Anesthesia and group LF n=22 - using Low Flow Anesthesia with Sevoflurane. Anesthesia was induced with propofol, fentanyl and succinylcholine. After tracheal intubation, the fresh gas flow (FGF) was set to 4 L.min and sevoflurane 1-1.5 MAC for 10 min in LF group whereas in HF group continues with same flow during all time of anesthesia. When the target gas concentrations have been achieved, FGF in HF group remained 4 L/min, whereas in LF group were reduced to 1.0 L/min, with the relative proportion of O<sub>2</sub> and N<sub>2</sub>O titrated to maintain the FiO<sub>2</sub> above 0,35. The incidence and severity of PONV was evaluated for 24 h postoperatively based on scoring system: 0=no emetic symptoms, 1=nausea, 2=vomiting. Nausea severity was recorded on a Likert scale: 0 = none, 1 = mild, 2 = moderate, 3 = severe. Patients rated their satisfaction with the control of PONV by using a five-point scale 24 h postoperatively.

**Results and discussion:** There were no significant differences between groups with respect to demographic data, ASA score and Apfel score. The incidence of moderate to severe nausea in the HF group 40.9% compared to the LF group 27.3% in early post-operative period (0-6 hrs) ( $P=0.525$ ). During late postoperative period (6-24 hrs) no significant difference was found ( $P=0.698$ ) between group HF 22.7% compared with 13.6% in group LF. The number of patients who were very satisfied with PONV management approximately 24 h after anesthesia was superior in the LF group compared with the HF group, but with no significant difference between groups ( $P=0.685$ ).

**Conclusion:** Low flow sevoflurane anesthesia has advantages regarding to incidence of PONV and satisfaction rate, but with no significant difference between groups.

## 9AP6-1

### Analysis of isoflurane for dioxins and furans

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**Background and Goal of Study:** The Forane liquid for inhalational anaesthesia contains isoflurane, which is fluorinated ether containing a single chlorine atom in its molecule.

Forane as volatile anaesthetic was target analysed for the determination of contents of chlorinated dibenzo-p-dioxins and furans (PCDDs/Fs). PCDDs/Fs are a group of more than 100 individual compounds with possible carcinogenic effects. They were never produced intentionally in large volumes. They are by-products of combustion processes or industrial production of chlorinated phenols. These syntheses usually occur at temperatures in the range of 250°C to 450°C. Out of this large group of individual compounds, 2,3,7,8-tetrachlorodibenzo-p-dioxin is IARC Group 1 carcinogen.

**Materials and methods:** Forane sample was directly analysed by gas chromatography high resolution mass spectrometry (Thermo DFS dual GC system, Thermo Bremen, Germany). Instrumental quantification limits for individual compounds are in the orders of femtograms of individual compounds injected into the system, which represents contents of less than 10<sup>-13</sup> % in the liquid solution. During the analysis the sample is loaded to a hot inlet (280°C).

**Results and discussion:** No individual compound from the large group of dioxins and furans was identified during the analysis.

Production of dioxins and furans is usually connected with high temperatures as it was mentioned above. However vaporizer for isoflurane works at room



temperature and maximal temperature in lungs can be about 40°C. And analysis of isoflurane at temperature 280°C for dioxins and furans was negative.

**Conclusion(s):** We can conclude that inhalation of Forane as volatile anaesthetic is highly unlikely to be connected with the risk of inhalation of dioxins and furans.

## 9AP6-2

### Antistress and adaptive effects of xenon in Wistar rats

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**Background and Goal of Study:** Stress and hypoxic conditions are connected with free radical processes activation. In anaesthesiology hyperoxic gas mixtures may induce oxidative stress. The investigations show antistress effect of xenon (Xe) but its mechanisms are not studied [1]. We evaluated the effects of repeated action of Xe/O<sub>2</sub> mixture on behavior of the animals, activity of free radical processes and antioxidant protection enzymes.

**Materials and methods:** Xe inhalations were performed in male Wistar rats by gas mixture with Xe:O<sub>2</sub>:N<sub>2</sub> = 50%:40%:10% during 13 days one hour per day (13Xe/O<sub>2</sub> group) in comparison with O<sub>2</sub> without Xe (13O<sub>2</sub> group). On the 14<sup>th</sup> day elevated cruciform labyrinth test (ECL) was performed. We assessed the rate of accumulation of free radical oxidation products by induction in vitro and antioxidant protection enzymes activity. Statistical analysis was performed by the Mann-Whitney U-test.

**Results and discussion:** In the 13O<sub>2</sub> group in comparison with control group the ECL test revealed increase of general run of the animals (from 800 to 1200 cm; P < 0.05), duration of the presence in the open sleeves (from 6 to 23 sec; P < 0.05) and in the center of the labyrinth (from 12 to 56 sec; P < 0.05) and quantity of approaches into the open sleeves (from 2 to 8; P < 0.05). Xe contributes to significant decrease of these variables (respectively to 580 cm, P < 0.05; to 1 sec, P < 0.05; to 18 sec, P < 0.05 and to 1 approach, P < 0.05). The results reflect activation of orient and exploratory reactions and increase of anxious component of behavior in the 13O<sub>2</sub> group. Xe compensates these changes. O<sub>2</sub> enhances free radical oxidation and activation of antioxidant protection enzymes in the tissue of liver. In the 13O<sub>2</sub> group in comparison with control group catalase (Cat) increased from 0.232 to 0.27 nmol H<sub>2</sub>O<sub>2</sub>/min/mg (P < 0.05); glutathione reductase (GR) from 0.048 to 0.11 nmol, NADPH/min/mg (P < 0.05); superoxide dismutase (SOD) from 1.5 to 2.27 conditional units (c.u.) (P < 0.05). Xe prevents these processes and the activity of antioxidant protection enzymes do not differ from the control group (Cat 0.24 nmol H<sub>2</sub>O<sub>2</sub>/min/mg, GR 0.048 nmol, NADPH/min/mg, SOD 1.27 c.u.).

**Conclusion(s):** The obtained results allow to suggest that xenon possesses significant antistress and adaptive effects.

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## 9AP6-3

### The effects of gender on general anesthesia and fentanyl-induced bispectral index (BIS) changes

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**Background and Goal of Study:** Higher bispectral index (BIS) values during maintenance of general anesthesia in female have been reported, despite similar amounts of anesthetic drug administration. Moreover, it is widely reported that opioid analgesics acting display quantitative and qualitative differences in effect in male and female. These sex-related differences are not restricted to the analgesic properties of opioids. In addition, it has been reported that opioids increases BIS values under sevoflurane-nitrous oxide (N<sub>2</sub>O) anesthesia. Therefore, we examined the effects of gender on general anesthesia and fentanyl-induced BIS changes under sevoflurane- N<sub>2</sub>O anesthesia.

**Materials and methods:** ASA physical status I or II patients (n=35, male and female were 14 and 21, respectively), scheduled for elective oral surgery were enrolled in the trials. Premedication was not used. Anesthesia was induced with thiopental and vecuronium bromide and maintained with N<sub>2</sub>O (64-67%)-sevoflurane (1%). Fentanyl (2 µg/kg) was administered intravenously 15min after

the intubation. Fifteen min after the intubation, mean arterial blood pressure (MAP), heart rate (HR), and BIS values was recorded as baseline values. MAP, HR, and BIS values were measured every 5 min after the intubation up to 30 min. All data were expressed as the mean ±SD. Unpaired Student's t-tests were applied to compare normally distributed variables between genders. A P value of less than 0.05 was considered statistically significant.

**Results and discussion:** The patients were similar in terms of age, body temperature, expired CO<sub>2</sub> tension, expired sevoflurane concentration, and expired nitrous oxide concentration except of weight and height. As results, there were no differences between genders for BIS values, MAP, and HR under N<sub>2</sub>O-sevoflurane anesthesia at baseline. Moreover, there were no differences between genders for MAP and HR after fentanyl administration. However, fentanyl induced BIS increases in female were significantly higher than those in male at 10 and 15 minutes after fentanyl administration (P = 0.019), despite similar amounts of anesthetic drug administration. Similar BIS values between genders at baseline suggest that sensitivity to the hypnotic effect of anesthetic drugs is same between genders in contrast to previous reports.

**Conclusions:** We found that gender was an important factor influencing fentanyl induced BIS increases in patients undergoing general anesthesia.

## 9AP6-4

### Target controlled inhalation anaesthesia: a cost-benefit macro-economic analysis

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**Background:** End-tidal target-controlled inhalational anaesthesia (TCIA) with halogenated agents (HA) affords a faster and more accurate anaesthesia as compared to manual-controlled anaesthesia. TCIA economic advantages have been shown only in randomized small-sized well-controlled studies (1). There is no reported data at the scale of a whole hospital. Thus this study aimed to measure the macro-economic cost-benefit ratio of TCIA as compared to manual-controlled anaesthesia.

**Methods:** In this retrospective and descriptive study, 2011 to 2012 direct drug spending was compared between two hospitals [HUD, a general hospital with 17 operating rooms (OR) and HME, a gynaecologic and paediatric hospital with 6 OR] following the establishment of TCIA at HME OR. The direct costs were obtained from the pharmaceutical department and the number of patients and duration of anaesthesia from the computer files of the hospital.

**Results and discussion:** Expenses in HA and number of vials used are show on table I. Average times of surgery at the HME were shorter (80 vs 107 min). A wider use of desflurane has trained an additional cost of k€ 31. That has not been observed to HME, due to overall decrease in quantity of volatile agent used, while activity and propofol consumption remained stable. The cost of one minute of inhalational anaesthesia was thus reduced (0,138 to 0,121 €/min) in HME but not in HUD (0,044 to 0,060 €/min).

	2011 HUD, 21 452 actes	2012 HUD, 21 714 actes	2011 HME, 7432 actes	2012 HME, 7171 actes
Sevoflurane vials	640	511 (-20 %)	454	327 (-28%)
Desflurane vials	68	531 (+680 %)	34	118 (+247 %)
Isoflurane vials	294	258 (-12 %)	45	0 (-100 %)
Volatile agent cost (€)	74 442	105 532 (+41,8 %)	48 954	42 883 (-12,4 %)
Total pharmaceutical spending (% part of volatile agent).	233 692 (31,9%)	264 195 (39,8%)	75 837 (64,5 %)	63 281 (67,8 %)

[Table 1 : Volatil agent spending]

TCIA appears to be cost-benefit favourable however the savings appear less than predicted by literature. Shorter duration of surgery (1) and mask induction at HME may influence the savings. Increased desflurane choice should have led to a 1329% increase in desflurane consumption in HME but only 247 % was measured (2). The extra cost savings of the 3 anaesthesia machines implementation could be paid off with the resulting savings over 6 years.

**Conclusion:** TCIA is cost-benefit effective but this may be hampered by clinical reasons.

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## 9AP6-5

### Alteration of phagocytic activity of leukocytes under the influence of different variants of general anesthesia

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**Background and Goal of Study:** The aim of research is to analyze the influence of general anesthesia with isoflurane/nitrous oxide/phentanyl (group I), sevoflurane/nitrous oxide/phentanyl (group C) and propofol/phentanyl (group P) on phagocytic activity of polymorphonuclear leukocytes.

**Materials and methods:** The analysis of phagocytic activity of leukocytes during general anesthesia in laparoscopic cholecystectomy was done in 50 patients (51,5±12,4 years old) at 3 stages: before anesthesia (1<sup>st</sup> stage), during the surgery (2<sup>nd</sup> stage), after anesthesia (3<sup>rd</sup> stage). Phagocytic activity was studied with the help of E.Coli bacteria tagged with FITC using the method of flow cytometry (Cell Lab Quanta SC cytofluorometer). The phagocytic index of leukocytes was calculated as percentage of FITC-positive cells of total number of polymorphonuclear leukocytes. The change of activity of phagocytic function was assessed according to the change of fluorescence intensity FITC.

**Results and discussion:** In the group I at the first stage the phagocytic index was 80,25±11,14%; at the 2<sup>nd</sup> stage there was observed a significant reduction of this index to 73,54±13,47% ( $p < 0,05$ , Wilcoxon Pairs Test). At the 3<sup>rd</sup> stage the phagocytic index returns to the initial level - 79,64±10,82%. In the group C there were no significant differences at all stages of the study (79,22±9,99% vs 78,32±14,32% vs 79,86±18,2% respectively). In the group P the phagocytic index at the first stage was 83,32±10,14%; then there was observed a significant reduction of the phagocytic index at the 2<sup>nd</sup> stage (77,23±12,16%,  $p < 0,05$ ) and the 3<sup>rd</sup> stage (73,65±13,19%,  $p < 0,05$ ) in comparison with the initial level. In the analysis of phagocytic activity there was observed a significant difference between the group C and group P at the 2<sup>nd</sup> stage (587,4 (190,4-789,5) (Me(25%-75%) points in the group C and 281,8 (190,8-561,3) points in the group P,  $p < 0,05$ , Mann-Whitney Test).

**Conclusion(s):** Phagocytosis is significantly lower in patients during the surgery when propofol/phentanyl is used in comparison with the usage of sevoflurane/nitrous oxide/phentanyl. Intraoperative reduction of phagocytic function should be taken into account by anesthesiologist while performing general anesthesia.

## 9AP6-6

### Intravenous droperidol decreases the bispectral index during general anesthesia using sevoflurane and desflurane with remifentanyl

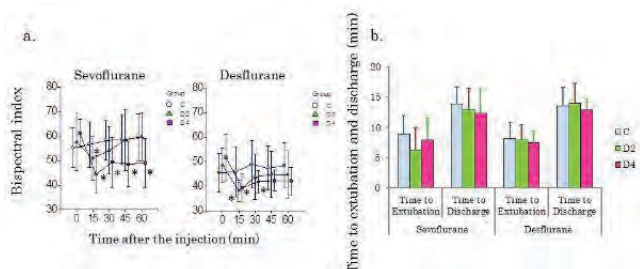
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**Background:** The administration of Droperidol (Dro) was reported to decrease the required dose of propofol for achieving hypnosis at the induction of anesthesia (1) and to reduce the Bispectral Index (BIS) in propofol-sedated patients during spinal anesthesia (2). We previously reported that the supplemental administration of Dro decreased the values of BIS during general anesthesia with sevoflurane and remifentanyl (3). In the current investigation, we compared the dose response of Dro in both sevoflurane and desflurane anesthesia.

**Materials and methods:** The cases were divided into six groups following to the common anesthetic regimen with or without the supplemental administration Dro 20 and 40 mg kg<sup>-1</sup> (group C, D2 and D4). The patient's trachea was intubated and mandatory ventilation was applied. The anesthesia was maintained constant administration of sevoflurane (0.6 - 1.5%) or desflurane (2 - 4.5%), and remifentanyl (0.2 mg kg<sup>-1</sup> min<sup>-1</sup>) during the surgery. About 1 hour before the end of surgery, Dro was infused to the patient by a decision of anesthesiologist in charge. The change in circulatory parameters including heart rate and blood pressure, value of BIS, the time course after the end of surgery were analyzed.

**Results and discussion:** 91 cases were enrolled into the study. Characteristics of patients' background, circulatory parameters and BIS values before administration of Dro showed no significant difference among six groups. After the administration of Dro, the values of BIS were significantly decreased in group D2 and D4, and the decreases lasted 60 min in group D4 (Fig. a) in sevoflurane group. The time from the end of surgery to the extubation was similar in all groups (Fig. b).



[Figure. (a) The change in bispectral index (BIS) after the injection of droperidol \*:  $p < 0,05$  vs. control group. (b) The time to extubation and discharge from the end of operation. There is no significant difference among each group. c: control, D2: droperidol 20 µg/Kg, D4: droperidol 40 µg/Kg]

**Conclusions:** Supplemental Dro might enhanced the depth of anesthesia, however, the recovery time from general anesthesia was not changed. Thus, Dro showed a possibility to reduce the required dose of sevoflurane and desflurane in a dose dependent manner for maintenance of anesthesia without delay of emergence.

#### References:

- 1 Adachi YU, et al. Eur J Anaesthesiol 2000; 17: 126.
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- 3 Adachi YU, et al. Masui 62: 71.

## 9AP6-7

### Xenon and breast cancer cell function *in-vitro*

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**Background and Goal of Study:** Breast cancer is one of the most common causes of cancer death among women, usually from metastasis. Several peri-operative factors may influence the development of metastasis. Volatile agents have been implicated in metastasis-enhancing effects on cancer cell biology. The noble gas Xenon is an anaesthetic with many desirable properties, but its effects on cancer cell biology are unknown. Therefore, we investigated the effect of Xenon and Sevoflurane on proliferation, migration and expression of angiogenesis biomarkers in breast adenocarcinoma cell cultures *in-vitro*.

**Materials and methods:** MDA-MB-231 (estrogen receptor negative, ER-) and MCF-7 (estrogen and progesterone receptor positive, ER+) breast cancer cells were seeded in 96-well plates and exposed to experimental or control gas concurrently in two hermetic chambers. The Xenon cylinder contained O<sub>2</sub> 25%, CO<sub>2</sub> 5% and Xenon 70%. The Control gas cylinder contained O<sub>2</sub> 25%, CO<sub>2</sub> 5% and N<sub>2</sub> 75%. Sevoflurane 2.5% was administered in control gas. Methylthiazolyl-diphenyl-tetrazolium-bromide (MTT) assay evaluated the effect of Xenon on cell viability. Cancer cell migration was determined using the Oris™ Cell Migration Assay, its mechanism with addition of glycine or glipizide. Human Angiogenesis Array C1 quantified the expression of angiogenesis markers in the cellular supernatant.

**Results:** Cell exposure to each gas mixtures for 1, 3 or 5 hr had no effect on cell viability in either cell. Xenon reduced ER- migration to 59±13% following 1 hr exposure,  $P=0.02$ ; to 64±10% at 3 hr,  $P=0.01$ ; and 71±9% at 5 hr,  $P=0.04$ . Similar results were observed in ER+ cells. Sevoflurane had no effect on migration. Glycine, a NMDA receptor agonist, competitively reversed Xenon inhibition of migration, increasing ER- migration to 190±44%,  $P=0.02$  and ER+ migration to 173±17%,  $P=0.02$ . No effect was observed with addition of glipizide. Examination of the angiogenesis array film in Xenon exposed media showed decreased RANTES cytokine compared with Sevoflurane and Control (mean dot density 2.05±0.20 vs 2.95±0.07 and 3.1±0.28 respectively,  $P=0.02$ ).

**Conclusion:** Xenon inhibits breast cancer cell migration in both ER+ and ER- breast cancer cells by an NMDA receptor mediated mechanism, whereas Sevoflurane does not. Xenon decreases expression of breast cancer angiogenesis factor RANTES compared with Sevoflurane.

**Acknowledgements:** Funded by an unrestricted research grant from Air Liquide, manufacturers of Xenon.

## 9AP6-8

### Prolonged apnea after general anesthesia in a 83 year-old woman with an unknown plasma pseudocholinesterase's deficiency - the ICU approach and management

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**Background:** Apnea after general anesthesia(GA) can be caused by mechanical, hemodynamic or pharmacologic factors. Pseudocholinesterase(PCE) deficit is an unusual cause for apnea after GA but should be considered when succinylcholine(Sch) is used. PCE is a plasmatic enzyme that hydrolyzes Sch. Its deficiency can be caused by genetic (inherited condition: heterozygous 1:25 and homozygous 1:2000)<sup>1</sup> and non genetic (advanced age, renal disease and in critical ill)<sup>2</sup> factors and results in prolongation of Sch's neuromuscular blockade(NMB)<sup>1</sup>.

**Case report:** A 83-year-old women(50kg/150cm), ASA 3,with high blood pressure and atrial fibrillation, undergoes GA for a laparotomy in a small hospital. Initial creatinine level was 3,2 mg/dL. ASA standard monitors were used and induction proceeded with midazolam, fentanyl(50ug) and Sch(75mg). Maintenance was with midazolam and 50+20mg of rocuronium (20 min after Sch) but no NMB monitor was used. Surgery underwent uncomplicated and no more opioids were used. NMB was reversed with 4 mg/Kg of sugammadex about one hour after de last dose of rocuronium. The patient was extubated, but due to apnea/respiratory paralysis, reintubation was needed. Naloxone and flumazenil were given but apnea persisted. Due to lack of ICU beds, the patient was transferred to our hospital. On arrival, suspecting of residual neuromuscular block, we monitored NMB with TOF ratio and there were no TOF or post-tetanic responses. PCE assay showed 828 U/L (normal:5320-12920 U/L) and dibucaine number suggested a common phenotype for this enzyme. CT Scan was normal. So, we assign the apnea to a PCE deficit, which explains the prolonged action of Sch. We kept monitoring the NMB until we obtained TOF>90% ( $\pm$ 20h after Sch administration). Then, sedation was stopped and ventilatory withdrawing progressed successfully until extubation.

**Discussion:** Although this is a rare condition and an uncommon anesthetic complication, it is potentially fatal. In this case, prolonged muscle paralysis may be due to administration of Sch in a patient with PCE deficit (possibly non genetic), delayed elimination of rocuronium due to kidney injury and use of NMB agents without monitoring.

Anesthetists should be aware of this condition and write an identification card for PCE deficiency that the patient should carry. NMB monitor should be used whenever we use NMB agents.

#### References:

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2. International Journal of Pediatric Otorhinolaryngology 76(2012)149-153

## 9AP6-9

### Volatile anaesthesia efficiency and desflurane usage in bariatric surgery

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**Background and Goal of Study:** The most frequently used agent for maintenance of anaesthesia in UK bariatric surgery is Desflurane. The advantages of very low solubility and hence speed of recovery (compared to propofol TIVA and Sevoflurane) are to a degree negated by a relatively low potency, and concerns over cost, plus a theoretical environmental impact; all of which can be minimised by efficient usage.

We present here our experience of low-flow anaesthesia and the efficiency that can be achieved even in morbidly obese patients, using a standard Draeger Primus anaesthetic machine.

**Materials and methods:** Analysis was performed on prospectively collected data of all bariatric patients anaesthetised by the authors between June 2012 and Nov 2013 at our regional centre. Patient demographics, length of stay and procedural data were collected from anaesthetic charts, theatre records and the Hospital Information System, then collated on an anaesthetic database. Volatile usage was obtained from the built-in logbook facility on the Draeger Primus machines used on every bariatric case.

**Results and discussion:** Data was available from 101 patients (73% female). The average age was  $45 \pm 7$  yrs, average weight  $137 \pm 14$  kg, average BMI  $48 \pm 9$  kg/m<sup>2</sup>. The volume of volatile administered and the overall efficiency is shown in the table below.

	Desf Admin	Desf Uptake	Efficiency (Admin: Uptake)	Duration	Admin rate
Median	33 mls	21 mls	1.6	151 mins	14 mls/hr
Interquartile range	23-49	16-28	1.4-1.8	106-178	11-18

[Table 1]

**Conclusion(s):** Volatile efficiency, that is wasting as little as possible, is best achieved using ultra-low flows. However, even a relatively insoluble agent such as desflurane will be absorbed into the 70 or 80 kg of fat in a morbidly obese patient.

This study has quantified just how much volatile a morbidly obese patient does absorb. An efficiency ratio of 1.6 matches very favourably the efficiency reported in other studies. With a UK price of around 20p/ml, the cost of volatile anaesthesia in this series was under £3/hr.



## Paediatric Anaesthesia and Intensive Care

### 10AP1-1

#### Neonatal pneumothorax pressures: determination in a randomised experimental study in a *in vivo* animal model

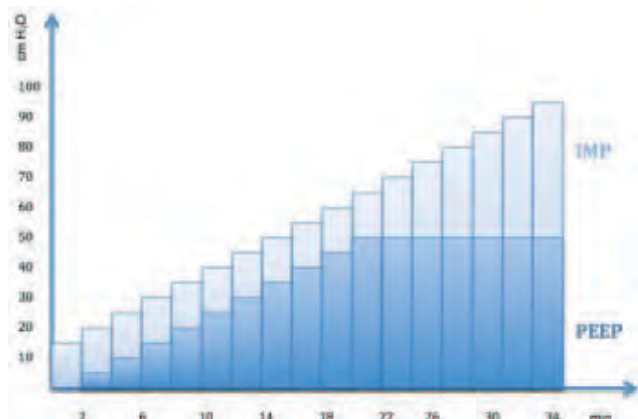
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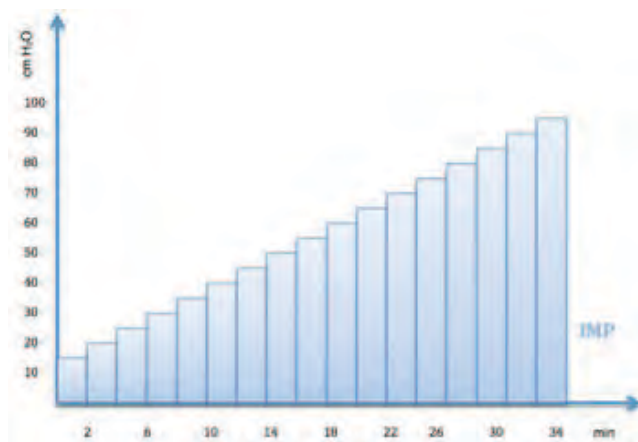
**Background:** Recruitment maneuvers (RM) pursue reversing atelectasis during general anesthesia but are associated with potential risks such as pneumothorax

**Objective:** To determine pneumothorax pressures in newborns using healthy piglets less than 48 hours old.

**Animals and Methods:** Ten healthy Landrace-Large White piglets (weight  $3.2 \pm 0.5$  kg) were put under anesthesia with bilateral chest tube catheterization and then randomly allocated into two groups: one with positive end-expiratory pressure (PEEP) and fixed inspiratory driving pressure (IDP) of 15 cm H<sub>2</sub>O (PEEP group), and the second one with ZEEP (PEEP = 0 cm H<sub>2</sub>O) and non-fixed IDP (ZEEP group). Both groups had pressure-controlled ventilation. Maximal inspiratory pressure (MIP) was raised at two-minute intervals with steps of 5 cm H<sub>2</sub>O until air leak was observed through the chest tubes. PEEP group raised MIP through 5 cm H<sub>2</sub>O PEEP increments (Fig1) and ZEEP group through 5 cm H<sub>2</sub>O MIP increments (Fig2)



[Figure 1]



[Figure 2]

**Results:** MIP causing pneumothorax was  $90.50 \pm 15.71$  cm H<sub>2</sub>O with no statistically significant difference between the two groups.

Pressure	PEEP group	ZEEP group	General
Mean $\pm$ SD (cm H <sub>2</sub> O)	$92 \pm 14.83$	$89 \pm 18.16$	$90.50 \pm 15.71$
Median (cm H <sub>2</sub> O)	95	85	90
Maximum (cm H <sub>2</sub> O)	105	115	115
Minimum (cm H <sub>2</sub> O)	70	65	65

[Pneumothorax pressures by groups]

This MIP matches pneumothorax pressures previously described in adult cadavers and are similar to the ones described in a *ex vivo* open thorax rabbit model. Several limitations apply to our study such as no CT confirmation of barotrauma or absence of histological study.

**Conclusions:** To our knowledge this is the first study done determining pneumothorax pressures in a *in vivo* model. Performing RM in healthy newborns is a safe procedure in terms of pneumothorax within the usual pressure range described in the literature.

### 10AP1-2

#### Gas induction for pyloromyotomy: a service evaluation

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**Background and Goal of Study:** Infants with pyloric stenosis are considered to be at high risk of aspiration on induction of anaesthesia. Traditionally, texts have recommended classic rapid sequence induction (RSI) or awake intubation (AI). AI is associated with a high incidence of failed intubation and has fallen out of favour, while the components of RSI have become increasingly controversial. Infants are at high risk of hypoxaemia if ventilation is not maintained while waiting for neuromuscular blockade to establish. The efficacy of cricoid pressure (CP) to prevent aspiration has not been proven; it can also impair visualisation of the glottis and make intubation difficult. A modified RSI technique (MRSI) has been described in infants, which omits CP and permits mask ventilation at low pressure. This has been found to reduce hypoxaemia, unsafe actions and operator stress in a simulator based study<sup>1</sup>. It is debatable whether any RSI technique is needed for pyloromyotomy. A recent retrospective review of 235 infants reported no aspiration events<sup>2</sup>. These children were anaesthetised with a variety of techniques, including RSI, gas induction and AI. In our institution, we prefer a gas induction. A nasogastric tube is used to empty the stomach and anaesthesia induced with sevoflurane and oxygen (+/- nitrous oxide). A non-depolarising muscle relaxant (NDMR) is administered and ventilation maintained at low pressure until neuromuscular blockade is established and intubating conditions are optimal. We evaluated this technique to establish any incidence of aspiration.

**Materials and methods:** After approval from the local research ethics committee, we conducted a retrospective notes review of all patients undergoing pyloromyotomy between 2005 and 2012.

**Results and discussion:** There were 269 patients (84.4% male, mean weight  $3.74 \pm 0.74$ kg). 252 (93.7%) received gas inductions and 17 (6.3%) intravenous (IV) inductions. Two children received an RSI. No patient specific factors could be identified to explain operator choice in those receiving IV inductions. There were no recorded aspiration events.

**Conclusion:** Gas induction can be safely considered for children undergoing pyloromyotomy.

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## 10AP1-3

### Reversal of rocuronium-induced neuromuscular block by sugammadex in neonates

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**Background and Goal of Study:** Rocuronium is a commonly used neuromuscular blocking agent in clinical anaesthesia and it is administered in all age groups, including neonates. Sugammadex is the first selective relaxant binding agent designed to reverse a neuromuscular block induced by either rocuronium or vecuronium. Sugammadex has been investigated in adults and children older than 4 years of age.<sup>1,2</sup> However, there are no data available about the efficacy and safety of sugammadex reversal of a rocuronium-induced neuromuscular block in neonates. The goal of the study was to investigate the efficacy and safety of the use of sugammadex in neonates.

**Results and discussion:** Twenty three patients were enrolled in the study and these patients were divided into two age groups, 1 day (n=8), mean weight (SD) 2.8 kg (0.1) and 1-7 days (n=15), mean weight (SD) 2.4 kg (0.8) respectively.

The neuromuscular characteristics are shown in table 1. At the time of the end of surgery neuromuscular monitoring showed profound neuromuscular block in all patients. Accordingly sugammadex was administered in a dose of 4.0 mg/kg. Reversal of a profound rocuronium-induced neuromuscular block with sugammadex was fast in both age groups. The train-of-four ratio recovered to 0.9 within a few minutes. Residual curarization or re-curarization was not observed. Adverse events and changes in vital signs were not observed after sugammadex administration.

**Table 1.** Summary of the total rocuronium dose, time of from the start of the administration of sugammadex (4.0 mg/kg) to recovery of the TOF ratio to 0.9 and the final TOF value by age group.

	Total Rocuronium Dose (mg)	Recovery Time (min)	Final TOF
1 day (n=8)			
Mean (SD)	1.6 (0.1)	1.4 (0.1)	105 (20)
Median (range)	1.7 (1.5-1.7)	1.3 (0.6-3.0)	90-152
1 day - 7 days			
Mean (SD)	1.4 (0.5)	1.2 (0.5)	103 (8.2)
Median (range)	1.6 (0.5-0.8)	1.2 (0.4-2.2)	97-112

[Table 1]

**Conclusion(s):** The reversal of a (profound) rocuronium-induced neuromuscular block in neonates was fast and complete. Sugammadex was safe and well tolerated.

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## 10AP1-4

### Predictors of delayed awakening after remifentanyl-propofol TIVA in infant day hernia surgery

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**Background and Goal of Study:** Infant laparoscopic inguinal herniorrhaphy in the day-surgery setting is increasing in our institution. Adult day surgery is often performed under propofol-remifentanyl TIVA but is considered improper for infants due to the possibility of delayed recovery. The purpose of our study was to clarify any independent factors for delayed awakening and to estimate correlations between remifentanyl-propofol dose and awakening time in order to reduce delayed recovery and complications.

**Materials and methods:** A retrospective review was conducted on infants undergoing day laparoscopic inguinal herniorrhaphy under TIVA between 2009 and 2013. We divided the infants into two groups. Group D, awakening time  $\geq$  20 minutes; group S awakening time < 20 minutes. We checked patient characteristics, duration of surgery, and the amount of anesthetics as potential

predictor variables. Additionally, we looked at the recovery time, frequency of adverse events and unplanned hospital admissions. Potential factors affecting delayed awakening were examined with multivariate analysis.

**Results and discussion:** A total of 113 infants were involved in this study; 31 in Group D and 82 in Group S. Except for age and weight, there was no significant difference between the groups. There were 2 (1.8%) unplanned hospital admissions because of respiratory depression. Serious complications were not observed in any cases. After logistic regression modeling, age was found to be a significant and independent predictor of delayed awakening ( $p=0.013$ ). The adjusted odds ratio for age was 0.81 (95%CI 0.69-0.96). Our study pointed to only age as an independent predictor of delayed awakening. Unexpectedly, the anesthetic dose and birth weight were not associated with awakening time. Further study is needed to examine the effect of dose and other potential predictors.

	Group D (n=31)	Group S (n=82)
age (months)	2 (1-2)	3 (2-8)
weight (kg)	5.4 (5-6)	6.0 (5.2-7.5)
low-birthweight (n)	10	25
duration of surgery (min)	35 (23-49)	28 (21-38)
total-propofol (mg/kg)	8.4 (6.5-10.6)[	7.4 (5.9-9.2)
total-remifentanyl ( $\mu$ g/kg)	30 (20-50)	30 (20-40)

[Patients' characteristics and anesthetic doses]

**Conclusion(s):** In our study only age was a predictor of delayed awakening in remifentanyl-propofol TIVA with day case infants and the frequency of unplanned admissions with TIVA in infants was 1.8%. TIVA in infants may be feasible for day surgery, but careful patient selection based on age is necessary.

## 10AP1-5

### The practice of general anesthesia for the retinopathy of prematurity neonates: a retrospective analysis

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**Background and Goal of Study:** Premature retinopathy (ROP), a disease of premature and low birth weight babies, is seen in 70% of babies whose weight is less than 1000 gr and approximately 25-30 % of babies whose weight is less than 1500 gr. The anesthesia of these premature babies who are candidates for laser photocoagulation is particularly important due to increased risks of mortality. In this retrospective article we reviewed our experience of general anesthesia applications in premature babies with premature retinopathy.

**Materials and methods:** The charts of 35 patients who underwent laser photocoagulation in two years were reviewed retrospectively.

**Results and discussion:** In preoperative evaluation, 23 patients (65.7%) had respiratory distress syndrome, 15 (42%) patients had preoperative apnea, 25 patients (71.4%) had treatment of oxygen. The ventilation was established by endotracheal tube application in all of the 35 patients. Following the surgical procedure 9 patients (25.7%) were transferred to the intensive care unit with their endotracheal tubes on and extubated later after stabilization in the intensive care unit. In postoperative evaluation, 10 patients (28.5%), had early period apnea, 5 patients (14%) had desaturation, 1 patient (2.8%) had convulsion, 1 patient (2.8%) had bradyarrhythmia. We observed that the 14 premature babies (87%) in whom complications arised weighed under 2500 gr while the operation was performed, and the postconceptional week of 12 of these babies (75%) was under 36 weeks.

**Conclusion:** We observed serious intraoperative and postoperative complications in premature babies who underwent laser photocoagulation for retinopathy preferable under general anaesthesia via orotracheal intubation. We decided that special attention should be paid to assure optimal intraoperative and postoperative care conditions for premature babies, especially for those who weigh under 2500 gr and whose postconceptional age is under 36 weeks, should be considered by all attending physicians, like the anaesthetist, ophthalmologist and neonatologist.

#### References:

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- Chen SDM, Sundaram V, Wilkinson A, Patel CK. Variation in anaesthesia for the laser treatment of retinopathy of prematurity—a survey of ophthalmologists in the UK. *Eye* 2007;21:1033-6.

## 10AP1-6

### The GAS study: success rates practicalities and complications of spinal anaesthesia for neonates and infants

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**Background:** The GAS study is a randomised trial designed to compare regional and general anaesthesia in infants. The primary objective of this trial is to determine whether regional and general anaesthesia, given to infants undergoing inguinal hernia repair result in equivalent neurodevelopmental outcomes. Secondary objectives are to describe the frequency and characteristics of apnoea and other complications in the post-operative period. The present abstract focus on practical issues and complications spinal anaesthesia in the perioperative phase.

**Methods:** The study was performed at 27 sites in 7 countries. 722 infants < 60 weeks PMA, requiring inguinal hernia repair were randomised to general anaesthesia or awake spinal anaesthesia. Spinal blocks were carried out as per the clinicians' normal practice; isobaric bupivacaine or levobupivacaine up to 1mg/kg was administered into the subarachnoid space. Depending on clinician preference, additional local anaesthetic techniques were used for post-operative analgesia. The patient's condition and behaviour was recorded regularly intra-operatively and in the early postoperative period up to discharge from hospital. Parents were also contacted about 5 days postoperatively & questioned regarding potential complications of the technique.

**Preliminary results:** Awake spinal anaesthesia was the predominant choice in the regional group with 339/355 patients receiving this technique, of these 109 also had an additional caudal block. For 279/339 (82%) cases the spinal (+/- caudal) was sufficient on its own for the completion of surgery, in 18/355 (5%) cases some form of additional sedation or brief exposure to sevoflurane was required and in 42/355 (12%) cases the block was a complete failure and a full general anaesthetic was required. The mean systolic and diastolic blood pressure in the regional group was  $83 \pm 14$  and  $40 \pm 9$  mm Hg resp. and  $65 \pm 11$  and  $30 \pm 7$  in the general anaesthesia group.

**Conclusion:** Spinal anaesthesia offers a practical alternative to general anaesthesia with a good overall success rate. It has a different range of potential perioperative complications and further analysis will define risk groups to guide patient selection.

*Note that these data are preliminary and further details will be presented at the meeting including complication rates of spinal anaesthesia and the factors that increased the risk of spinal failure.*

## 10AP1-7

### Total intravenous anaesthesia with propofol/remifentanyl in preterms undergoing lasertherapy for retinopathy of prematurity (ROP)

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**Background and Goal of Study:** Due to the improvements in Neonatal Intensive Care Unit (NICU), the survival rate of prematures needing surgery has drastically increased. Since vaporizers for halogenated are not yet available in the NICU, the aim of this study was to evaluate the safety and efficacy of propofol/remifentanyl anaesthesia. This technique offers many advantages in adults and in children, but it is not still widely considered as an alternative choice in neonates.

**Materials and methods:** This is a retrospective study performed on 46 patients (pts) who underwent lasertherapy for ROP. Average patients data were: birth post-conceptual age (PCA) 26 weeks, birth weight 751g, PCA at time of surgery 33.7 weeks, weight at day of surgery 1490g. 36 pts were in spontaneous ventilation (5 in CPAP), 10 pts were intubated. EKG, NIBP, SpO<sub>2</sub>, EtCO<sub>2</sub> were monitored before (T0) and after induction (T1), after IOT (T2), during the procedure (T3-T6), at the end of surgery (T7) and after extubation (T8).

A 3-4mg/Kg propofol bolus was administered to facilitate intubation in patients who were in spontaneous ventilation. Maintenance was obtained with

an infusion of remifentanyl 0.2-4 mcg/Kg/min, and propofol 2-20 mg/Kg/h, and adapted according to the haemodynamic changes and to the surgical stimulus. Near the end of surgery the infusions were gradually reduced until suspension, and where possible the extubation time was evaluated.

**Results and discussion:** "Student's t-test" was used for statistical analysis.

All the patients maintained the haemodynamic stability during the procedure.

	T0	T1	T2	T3	T4	T5	T6	T7	T8
HR (bpm)	160.87 ± 20.76	148.76 ± 21.44	140.51 ± 20.27	138.47 ± 19.61	134.33 ± 20.89	131.47 ± 23.68	134.42 ± 20.06	139.73 ± 21.62	145.51 ± 21.34
MAP (mmHg)	58	46	45	44	45	45	46	49	52

[Haemodynamic parameters]

21/36 patients in spontaneous ventilation before surgery were extubated within 24h (58.3%), whereas 14/36 were extubated after 24h (38.8%). Only one patient could not be extubated. The patients extubated within 24h had an average weight of 1621g and an average PCA of 35 weeks; whilst the patients extubated after 24h had an average weight of 1373g and an average PCA of 33.5 weeks. The differences for both parameters were statistically significant ( $p < 0.04$  and  $p < 0.02$ , respectively).

**Conclusion(s):** This retrospective study shows the safety of propofol/remifentanyl anaesthesia in maintaining the haemodynamic stability in preterms, and the efficacy in allowing an early extubation even in these tiny babies. It provides the basis for further prospective investigations.

## 10AP1-8

### Risk factors contributing the failure of extubation after surfactant administration with INSURE method

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**Background and Goal of Study:** The INSURE method (intubation- surfactant- extubation) is effective in decreasing the need for mechanical ventilation and its related adverse events. The aim of this study was to determine the risk factors involved in the failure of INSURE method.

**Materials and methods:** A prospective descriptive - analytic study was conducted in a tertiary level NICU between March 2012 and December 2012. All preterm neonates who received intratracheal surfactant were enrolled in this study and allocated in INSURE failure and INSURE success groups according to their need for intubation and mechanical ventilation.

**Results and discussion:** One hundred forty seven infants were eligible to the study. Forty five (30.6%) of them were categorized as failure group because of need for reintubation in first 72 hours of intra tracheal surfactant administration. The mean birth weight and gestation age in INSURE failure group were  $1342 \pm 545$  g and  $28.7 \pm 2.9$  wk respectively that was significantly lower than INSURE success group ( $p < 0.001$ ). The Apgar score at 1 and 5 minutes were significantly lower in failure group ( $5.7 \pm 2.1$  and  $7.5 \pm 1.3$  vs.  $7.6 \pm 1.5$  and  $8.8 \pm 1$  respectively  $p < 0.001$ ). Respiratory distress syndrome (RDS) score was  $8.8 \pm 1$  in failure group and  $7.1 \pm 1.3$  in success group ( $p < 0.001$ ). The need for repeated doses of surfactant in failure group was more than success group (OR=8.24, 95%Confidence interval (3.10-21.86). The patent ductus arteriosus ( $p=0.003$ , Odd ratio= 3.42, 95% Confidence Interval 1.46-8.01) and intra ventricular hemorrhage ( $p < 0.001$ , Odd Ratio 4.56, 95% confidence interval 1.90-10.93) were significantly more common in failure group.

**Conclusion:** Preterm infants with lower birth weight and gestation age, severe respiratory distress syndrome with higher RDS score are at more risk for INSURE method failure.



## 10AP2-1

### Tolerance to pneumoperitoneum in paediatric patients undergoing laparoscopic renal surgery. Preliminary results

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**Background:** Our aim is to evaluate the tolerance to pneumoperitoneum of pediatric patients during laparoscopic renal surgery and to determine the risk factors of perioperative complications.

**Methods:** From January to November 2013, we collected ventilatory, hemodynamic and temperature data, before and during insufflation, of all patients undergoing laparoscopic renal surgery. Paired data were analyzed using the Wilcoxon test and independent data with U-Mann-Whitney test.

**Results:** We studied 21 patients with a mean age of 47.2 months and mean weight of 20.8Kg. All patients had a good preoperative status. Mean operative time was 135.24 minutes. Mean insufflation pressure was 12.1mmHg at an average speed of 3L/min.

Volume-controlled ventilation was set in 81% of patients and pressure-controlled in 19%. Respiratory rate was increased in 71% of patients with a mean of  $1.6 \pm 2.6$  rpm. Recruitment manoeuvres were performed in 57% patients. Compliance decreased in all patients with a mean of  $-3.1 \pm 2.9$  ( $p < 0.05$ ). Peak inspiratory pressure increased in 90% of patients with a mean of  $4.3 \pm 3.7$  cm-H<sub>2</sub>O ( $p < 0.05$ ), plateau pressure increased in all the patients with a mean of  $5.33 \pm 4.3$  ( $p < 0.05$ ).

ETCO<sub>2</sub> increased in 90% of patients by an average of  $3.95 \pm 2.7$  mmHg ( $p < 0.05$ ). The increased was considered mild, always  $< 10$  mmHg. The greater variations were in cases of lower values of ETCO<sub>2</sub> before the insufflation ( $p = 0.001$ ). Oxygen saturation was over 97% in all patients.

Mean arterial pressure increased in 90% of patients by an average of  $8.10 \pm 9.5$ . Heart rate decreased in 76% of patients by an average of  $7.76 \pm 8.7$  ( $p < 0.05$ ). The evolution of hemodynamic and respiratory parameters was not related to the length of surgery, the pressure applied to the pneumoperitoneum, the weight of the patient nor the ventilation mode applied ( $p > 0.05$ ).

Warming measures were applied in 81% of patients. Temperature decreased an average of  $0.15^\circ\text{C}$ .

There were no surgical or anaesthetic complications and postoperative critical care was not required in any case.

**Conclusion:** Literature recommend an intrabdominal pressure  $< 6$  mmHg in infants under 4 months of age and  $< 10$  mmHg in other infants. Nevertheless, in our study there was a good tolerance to higher insufflation pressures. Hemodynamic, respiratory and temperature parameters remained within physiological ranges.

We are continuing our study in order to define the risk factors for development of complications in laparoscopic surgery in children.

## 10AP2-3

### Comparison of fentanyl-propofol and sevoflurane for preventing cardiovascular response and quality of recovery in cleft patients maxillofacial surgery

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**Background and Goal of Study:** Propofol a well-known drug for adults for total intravenous anaesthesia. Since 1999, the use of propofol has been approved for children under 3 years age. The purpose of this study was designed to compare the haemodynamic changes, emergence and recovery characteristics of fentanyl-propofol as total -IV anaesthesia (TIVA) and sevoflurane anaesthesia on cleft lip and palate repair in pediatric patients.

**Materials and methods:** After obtaining the approval of the hospital Ethics Committee, 30 children, aged  $2 \pm 1.6$ , ASA physical status I-II undergoing cleft and palate repair under general anaesthesia, were randomly assigned to receive TIVA ( $n = 15$ ). In both groups, anaesthesia was induced with propofol and fentanyl and maintained either with infusion of propofol-fentanyl or sevoflurane with 50% N<sub>2</sub>O in oxygen. End tidal CO<sub>2</sub> concentration (ETCO<sub>2</sub>) and oxygen saturation (SaO<sub>2</sub>) were mentioned. Ventilation was controlled to maintain normocapnia. Heart rate, systolic-diastolic blood pressure were measured before and after the induction, after tracheal intubation, at the be-

ginning of the incision and at the end of the surgery.

**Results and discussion:** There were no differences in patients demographics among the groups. Both of the anaesthesia methods could not provide stable haemodynamics at the time of intubation or at the start of surgery, but heart rates and blood pressures were significantly higher with sevoflurane ( $p < 0.05$ ).

Times to restoration of spontaneous ventilation and extubation were significantly faster and mean scores of the quality of emergence scale were higher in the sevoflurane group than in the TIVA group ( $p < 0.05$ ). There was a significant greater incidence of postoperative agitation in patients who received sevoflurane (100%) compared with those who received TIVA (46.7%) ( $p < 0.05$ ).

**Conclusion(s):** The TIVA provided less postoperative agitation and lower perioperative heart rates and blood pressures than sevoflurane-based anaesthesia.

## 10AP2-4

### Comparison of propofol and dexamethasone in PONV prevention after adenotonsillectomy in children

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**Background and Goal of Study:** Adenotonsillectomy is one of the most common surgical procedures performed in children. We have compared propofol and dexamethasone for prevention of emesis after tonsillectomy.

**Materials and methods:** Fifty children were scheduled for an elective adenotonsillectomy. General anaesthesia was introduced by inhalation anaesthetic (Sevoflurane in O<sub>2</sub>/N<sub>2</sub>O mixture) on the face mask. After an intravenous line was inserted, 3 mcg/kg of fentanyl and diclofenac suppository 1 mg/kg were given to all of the children. The dexamethasone group received 0.15 mg/kg of dexamethasone IV at the induction. The propofol group received 20 mg/kg of propofol before the second tonsil was removed. PONV were monitored and recorded postoperatively during 24 hours.

**Results and discussion:** Fifty children ASA I and II status, aged 3 to 8 years old were enrolled in the study. There were 25 children in both groups. Two children presented with PONV in dexamethasone group and one child in propofol group. The differences between the two groups were found not to be of statistical relevance.

**Conclusion(s):** Propofol and dexamethasone are both successful for PONV prevention after adenotonsillectomy in children. An additional effect of propofol is a smoother and calmer emergence from anaesthesia that could be rather beneficial.

## 10AP2-5

### Correlation between environmental factors and carboxyhemoglobine levels in pediatric patients

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**Background and Goal of Study:** COHb (carboxyhemoglobin) is formed from the displacement of oxygen by CO (carbonmonoxide) in hemoglobin. Potential sources of CO are tobacco smoke, heaters, cooking stoves, fireplaces, automobiles. 39-71% of the children in the world is regularly exposed to SHS (secondhand smoking) in their houses. The contribution of smoking and the other environmental factors to postoperative adverse outcomes is well documented in adults but it is not clear for secondhand smoking children. We performed this observational study to measure COHb levels and environmental factors in children undergoing elective tonsillectomy operations.

**Materials and methods:** We enrolled 100 ASA I-II pediatric patients scheduled for tonsillectomy under general anaesthesia. The parents were asked to complete a 7-item questionnaire about the child's environmental air quality including major sources of CO, highlighting secondhand smoke and also coal using at home. The preoperative COHb levels of the children were assessed noninvasively using a CO-Oximeter (Radical-7 Rainbow SET Pulse CO-Oximeter; Masimo, Irvine, CA, USA).

**Results and discussion:** The mean CoHb of all 100 patients was  $4.98 \pm 2.8$ . When the all environmental factors were evaluated, the significant correlation was between coal use at home and high COHb levels ( $p < 0.001$ ). CO exposure of the children was high in our study because of intense coal use at home

with the ratio of 83% and mother smoking 15%, father smoking 39%, caregiver smoking 5%, guest smoking was 30%, windows of the house do not open everyday 13% and no statistical difference between all other environmental factors.

**Conclusion:** This study provides limited insight into the COHb levels of children exposed to environmental sources and especially there was a correlation between coal use at home and high preoperative COHb levels. Preoperative high COHb levels may be alerts about intraoperative and postoperative anaesthesia and surgery complications.

**Reference(s):**

Yee B, Ahmed I.M, Brugge D et al. Second-hand smoking and carboxyhemoglobin levels in children: a prospective observational study. *Ped Anesth* 2010; 20:82-89

## 10AP2-6

### Correlation of carboxyhemoglobin levels and secondhand smoking related complications in pediatric tonsillectomy patients

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**Background and Goal of Study:** Surveys estimate that 39-71% of children are exposed to secondhand smoking (SHS) all over the world. SHS has negative effects on airway inflammatory responses, structural and also lung functional development. Furthermore there is a relationship between the level of CO exposure and the risk of secondhand smoking related complications during postoperative period. We thus hypothesized that perioperative carboxyhemoglobin levels are correlated with postoperative complications.

**Materials and methods:** 100 ASA I-II pediatric patients were enrolled for tonsillectomy under general anaesthesia. The intraoperative COHb levels of the children were assessed noninvasively using a CO-Oximeter (Radical-7 Rainbow SET Pulse CO-Oximeter; Masimo, Irvine, CA, USA).

Patients were divided into two groups according to CoHb levels: 1) CoHb  $\leq 3$  as low group; or, 2) CoHb  $\geq 4$  as high group. The parents circled level of pain using Wong-Baker-Faces pain scale and we recorded Ramsey sedation scale, heart rate, non-invasive blood pressure, respiratory rate, and SpO<sub>2</sub>, complications (bronchospasm, laryngospasm, persistent coughing, desaturation, re-intubation, hypotension, postoperative bleeding, reoperation) in the postoperative period.

**Results and discussion:** Complications are occurred significantly lower in low CoHb group upon arrival in the post-anaesthesia care unit (13.9% vs 86.1%,  $p < 0.001$ ) and at the sum of postoperative 7 days (23.5% vs 54.5%,  $p < 0.001$ ). The most common complication was persistent coughing (during longer than 15 sec). VAS scores were significantly lower in low CoHb group upon arrival in the post-anaesthesia care unit (2(0-5), 3(0-5)  $p = 0.200$ ) and post-operative first hour (2(0-4), 2(0-5)  $p = 0.026$ ).

**Conclusion:** Children exposed to environmental CO and who are scheduled to undergo general anaesthesia have increased complications and pain in the postoperative period. A history of SHS in any child may have significant implications for the anesthesiologist. Careful evaluation of SHS in perioperative anaesthesia assessment should be established.

**Reference(s):**

Hampson NB, Scott KL. Use of a Noninvasive Pulse CO-Oximeter to Measure Blood Carboxyhemoglobin Levels in Bingo Players. *Respir Care*. 2006;51(7):758-60

## 10AP2-7

### Does the anaesthetic technique influence the incidence of post-operative respiratory complications in children with recent URTI?

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**Background and Goal of Study:** Respiratory adverse events (RAE) remain one of the major cause of perioperative morbidity and mortality in children undergoing general anaesthesia in the context of recent upper respiratory tract infection (URTI). Recent observations indicated that the anaesthetic technique might influence the risk of RAE (1). The aim of this prospective, randomized, double-blind study was to assess the effect of anaesthetic technique on the incidence of RAE in children undergoing elective tonsillectomy and/or adenoidectomy within 4 weeks of URTI.

**Materials and methods:** After institutional EC approval and parental written informed consent, 50 ASA I-II children aged 1-8 years undergoing adenoidectomy and/or tonsillectomy, with a positive history of URTI within 4 weeks of surgery were included. Induction of anaesthesia and tracheal intubation was performed with sevoflurane. Then, patients were randomized to receive maintenance anaesthesia with either propofol or sevoflurane until the end of the procedure. The incidence of laryngospasm and bronchospasm, decrease in SpO<sub>2</sub> below 90%, major cough, length of postoperative O<sub>2</sub> supplementation, and length of post-anaesthetic care unit (PACU) stay were recorded by a blinded observer. Data were compared using Mann-Whitney or chi-square. A  $p < 0.05$  was considered significant.

**Results and discussion:** Demographic data were similar between groups.

	Propofol (n=22)	Sevoflurane (n=28)	P values
Age (years)	4 (3-4)	4 (3-4)	0.66
Male (%)	13 (60)	17 (61)	0.91
URTI > 2 weeks (%)	4 (18)	5 (18)	0.98
SpO <sub>2</sub> < 90% (%)	5 (23)	1 (4.5)	0.04
Laryngo-bronchospasm (%)	2 (9)	0 (0)	0.10
Cough (%)	4 (18)	3 (10)	0.49
Time to Recover (min)	19 (5)	18 (7)	0.53
PACU LOS (min)	160 (65)	172 (86)	0.56
Duration O <sub>2</sub> suppl. (min)	56 (39)	50 (41)	0.60

[Table 1 - Results]

In hospital length of stay was not different between groups.

**Conclusion(s):** In the conditions of our study propofol based anaesthesia was associated with a higher incidence of oxygen desaturation immediately after extubation of the trachea. However this phenomenon had no significant impact on the immediate postoperative recovery. Further well-powered studies are needed to confirm that anaesthetic technique could influence the incidence of RAE in children undergoing ENT surgery with a positive history of URTI.

**References:**

1. von Ungern-Sternberg et al. *Lancet* 2010;376:773-83

## 10AP2-8

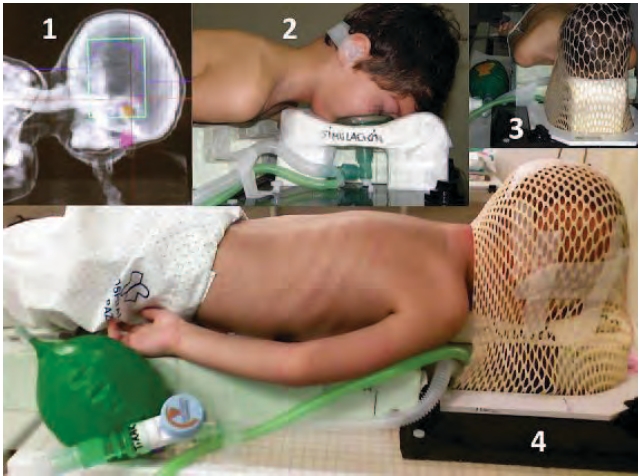
### Ventilation with facial mask in the prone position for radiotherapy procedures in children

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**Background:** Ventilation of patients undergoing procedures in the prone position represents a challenge for the anaesthesiologist, especially when trying to avoid tracheal intubation.

**Case report:** We report 3 children scheduled for 35 sessions each of craniospinal radiation according to the International Society of Paediatric Oncology protocol. 6 and 4 y.o. males with posterior fossa desmoplastic medulloblastomas and 4 y.o. male with neuroblastoma in the temporal area. None had difficult airway predictors. First a cervico-cranial tomography was performed and a polyethylene cast was made. During radiotherapy sessions patients were sedated with sevoflurane in the supine position and set in prone for the treatment, their heads were placed on the cast which held the facial mask. The patient's head weight on the facial mask helped to adapt to it and prevent leakages.



[Figure]

During the 105 sedations, all patients maintained oxygen saturation levels above 95%, and no airway management complications were reported.

**Discussion:** Airway control in the prone position is crucial. Balance between a fully secure airway with tracheal intubation and a satisfying oxygenation without a deep anaesthesia plane can be hard. Laryngeal masks are widely used for these procedures, but patients must be in a deeper anaesthesia plane (1). The facial mask allows preservation oxygenation with a superficial anaesthesia plane, avoiding the intrinsic complication of intubation and the utilization of a laryngeal mask. As the facial masks are transparent, the anaesthesiologist is also able to observe the patient face and to identify pressure points (2).

#### References:

1. Raphael J. Emergency airway management with a laryngeal mask airway in a patient placed in the prone position. *J Clin Anesth* 2004 Nov;16(7):560-1
2. Möllmann M. A foam-cushion face mask and a see-through operation table. *BJA* 2007 Oct;99(4):597-8

**Learning points:** Airway control in children in the prone position can be achieved using a face mask, in which the child weight helps prevent leakage, provides good adaptation and more importantly allows to maintain a superficial anaesthesia plane and avoid complications of tracheal intubation.

### 10AP3-1

#### Value of postoperative cardiac Troponin-I in predicting mortality after congenital cardiac surgery

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**Background and Goal of Study:** Little is known about the value of postoperative cardiac Troponin-I (cTn-I) levels in predicting mortality at mid- and long-term after congenital cardiac surgery. We therefore aimed to determine the sensitivity and specificity of cTn-I to predict mortality.

**Materials and methods:** This study is a subanalysis of an ongoing prospective trial (NCT1616394). All children between 0-10 years undergoing first or redo normothermic cardiac surgery with or without cardiopulmonary bypass (CPB) were prospectively included after obtained informed parental consent. cTn-I levels were measured after the induction of anaesthesia but before the surgery, at the Paediatric Intensive Care Unit (PICU) arrival and at 4,12 and 24h postoperatively. Follow-up phone call was realized at 3 and 6 months. ROC curves were realized on the entire postoperative cTn-I concentrations for the whole group and for the CPB group separately. Mann Whitney test was used to compare CPB vs no CPB group.

**Results and discussion:** In total 146 children were analyzed. There were 6 deaths of whom 5 intra-hospital and 1 extra-hospital. All deaths occurred in the CPB group. Data are expressed as median (IQR). \*P < 0,05 between both groups

	CPB (N=123)	no CPB (N=23)
Age (days)	193(113-806)*	27(16-124)
Age (months)	6,4(3,8-26,9)*	0,9(0,5-4,1)
Weight (kg)	6,5(4,3-11,0)*	3,6(2,9-5,4)
CPB time (minutes)	115(73-172)	0
Aortic Cross Clamp time (minutes)	61(39-95)	0
PICU stay (days)	3(1-7)	2(1-5)
Hospital stay (days)	11(8-15)	10(7-15)

#### [Peri - and postoperative data]

	CPB (N=123)	no CPB (N=23)
Postinduction anaesthesia	0,02(0,01-0,04)*	0,06(0,02-0,09)
PICU arrival	30,14(13,99-45,90)*	0,12(0,05-0,29)
4h postoperatively	24,01(12,12-37,93)*	0,19(0,08-0,40)
12h postoperatively	11,45(5,02-22,10)*	0,22(0,06-0,36)
24h postoperatively	8,35(4,23-18,35)*	0,18(0,06-0,46)

#### [cTn-I concentrations (ng / mL)]

In the CPB group the area under the ROC curve (AUC) for cTn-I as a predictor of mortality was poor and not significant (AUC=0,630; P=0,086). When analyzing the entire group, the AUC was 0,685 (95%CI: 0,522-0,848; P=0,014). cTn-I concentrations > 20 ng/mL predicted long-term mortality with 66,7% sensitivity and 61,5% specificity in the entire group.

**Conclusion(s):** Our preliminary results show that postoperative cTn-I concentration is a poor predictive marker of mortality at long-term after normothermic congenital surgery.

### 10AP3-2

#### Cerebral oxygen saturation before cardiopulmonary bypass in pediatric cardiac surgery for cyanotic congenital heart disease differs according to age

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**Background and Goal of Study:** The clinical significance of cerebral oximetry in pediatric cardiac surgery has not been determined yet. In this study, we evaluated the absolute rSO<sub>2</sub> values in the pediatric cardiac surgery for the cyanotic congenital heart disease. Our hypotheses are that absolute rSO<sub>2</sub> values before cardiopulmonary bypass (CPB) were different according to age, which may be one of the reasons for the low reliability of its monitoring.

**Materials and methods:** Fifty children under 6 years old, who underwent cardiac surgery with CPB for the cyanotic congenital heart disease were evaluated retrospectively. The patients were divided into 2 groups: 33 infants (< 1 year-old) and 17 preschool children (1-5 years-old). The rSO<sub>2</sub> was measured with an INVOS 5100B. Average rSO<sub>2</sub> value from the start of surgery until just before the initiation of CPB (preCPB rSO<sub>2</sub> value) was calculated. Physiological data were collected at the start of surgery. As the early outcomes, the length of intubation after surgery and the nights of ICU stay were evaluated. Comparisons of preCPB rSO<sub>2</sub> values and physiological data were made using the student's t-test. The Receiver operating characteristic (ROC) curve was used to test the ability of the preCPB rSO<sub>2</sub> to predict the early outcomes. Data are expressed as mean(SD) and P < 0.05 was considered significantly different.

**Results and discussion:** The value of preCPB rSO<sub>2</sub> in the infant group was significantly lower than that in the preschool groups (57.3(10.6) % vs. 73.4(9.0) %). In the infant group, SaO<sub>2</sub> at the start of surgery was significantly lower than the preschool group, (80.8(9.6) % vs. 91.5(7.0) %), while MAP and hemoglobin concentration were not significantly different. The values of the area under the curve (AUC) to predict whether intubation time after surgery was more than median hours were 0.53 in the infant group and 0.53 in the preschool group. The values of the AUC to predict whether ICU stay after surgery was more than median nights were 0.54 in the infant group and 0.52 in the preschool group.

**Conclusions:** The absolute value of rSO<sub>2</sub> before CPB in the infant group with cyanotic heart disease was significantly lower than the preschool children, which may be related to lower SaO<sub>2</sub> values. Even after the patients were divided by age, the predictive ability for early outcomes was low, which may reflect the complexity of the hemodynamics in the cyanotic congenital heart disease.



### 10AP3-3

#### Massive transfusion in children - a mixed bag? A survey of UK practice and guidelines

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**Background:** Paediatric trauma needing massive transfusion is a serious but relatively rare event in the UK. Early recognition of massive blood loss and effective actions are key to avoid hypovolemic shock and the consequences. Few studies have investigated the appropriate amounts and ratios of blood products needed in treating paediatric trauma patients. Many paediatric protocols use scaled down adult trauma algorithms and draw on military adult experience (1,2). With the formation of UK Trauma networks we wished to investigate massive transfusion practice in paediatric trauma patients in the UK.

**Methods:** We contacted every major trauma centre in the UK and the Defence Medical Services for their massive transfusion protocols in paediatric trauma patients (3). These protocols were analysed for ratios of blood products and volumes in (mg/kg), use of tranexamic acid, recombinant factor V11a and use of bedside testing to guide transfusion. A comparison table was constructed.

**Results:** We obtained 15 protocols and guidelines, 15/18 (83%). Variation occurred in protocols within same geographical regions. All guidelines had a flowsheet, contained in a larger document in 3/18. RBC transfusion amounts ranged from 10-40ml/kg, FFP ranged 10-30ml/kg. 11 centres used a ratio of RBC:FFP of 1:1 or 1:2. 2 centres did not advise use of tranexamic acid. 4 centres advised the use of recombinant factor V11a. 6/18 (33%) of centres recommended use of bedside testing to guide transfusion.

**Conclusions:** Currently there is no national guideline for management of massive transfusion in paediatric trauma patients. Current guidelines used by UK centres have wide variation in the volumes of RBC and FFP alongside the use of adjuncts. Only 50% of centres use bedside testing to guide transfusion. We propose initiating a working group to come to a consensus to develop a national guideline for these patients.

#### References:

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### 10AP3-4

#### Anesthetic management and perioperative complications of scoliosis surgery in children with univentricular heart

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**Background and Goal of Study:** Idiopathic scoliosis occurs in 2-3% of the general population. The association between congenital heart disease (CHD) and scoliosis is well studied. The Fontan procedure is the final stage to palliate a variety of complex cardiac congenital defects with functional single ventricles. The survival rates in these children have improved in the last two decades, so more patients with univentricular functional heart require scoliosis surgery.

The goal of the study is to present our experience in the anesthetic management and perioperative care in patients with scoliosis and Fontan physiology.

**Materials and Methods:** We reviewed the medical records of eight patients with univentricular heart who had undergone surgical treatment for spinal deformity. Data were abstracted regarding cardiac history, intraoperative management and perioperative complications.

**Results and Discussion:** Mean age at surgery was 14,5 years, mean Cobb angle was 66°. The types of CHD were: 5 single ventricle, 2 double outlet ventricle with transposition of great vessels, and 1 pulmonary atresia.

Six patients were cyanotic. American Society Anaesthesiologists score was III in seven patients and IV in one and New York Heart Association score ranged was found between I and III. All patients were instrumented with segmental instrumentation and allograft by posterior procedures. Spinal cord monitoring was used in all patients. Transesophageal echocardiography was used in six patients. Anaesthesia time, intubation time and ICU stay were respectively: 355 minutes; 290 minutes and 3,2 days. Perioperative mean blood loss was 2283

ml. All patients were treated with antifibrinolytic drugs. Perioperative blood salvage was used in four patients. Transfusion requirements were: packed red blood cells 3,3 units; fresh frozen plasma 381 ml; platelet concentrates 67 ml. Perioperative complications were: 1 atrial fibrillation, 1 low cardiac output with pulmonary hypertension and 1 left pulmonary artery thrombosis. One patient died intraoperatively as a result of ventricular dysfunction that progressed to cardiac arrest

**Conclusions:** Anaesthetic management and operative treatment of scoliosis in these patients may be successful. The priority is to maintain sufficient intravascular volume for adequate pulmonary blood flow and cardiac output. However, complications are frequent and significant.

### 10AP3-5

#### Determination of a sevoflurane dosing formula for AnaConDa device in children

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**Background:** The Anesthetic-Conserving-Device AnaConDa® allows the administration of sevoflurane for patients on mechanical ventilation in intensive care units. The manufacturer provides tables for dose control for patients over 50kg and tidal volume over 350ml. Doses for pediatric patients do not exist and only isolated cases are described.

The aim of this study was to use the AnaConDa device in children, know the variables that affect it and to try to find a formula for dosing of sevoflurane in the pediatric population.

**Material and methods:** A protocol was design for children undergoing long duration surgeries using high flows through a Däger primus® respirator to assure an open circuit ventilation and avoid sevoflurane recirculation. After an inhalation induction of anaesthesia with sevoflurane and maintenance with propofol and remifentanyl set to patient's weight and height, the AnaConDa® device was placed on the inspiratory ending and different infusion rates were measured adjusting the propofol infusion according to the BIS® index, maintaining it between 40 and 60. We performed linear regression statistical analysis, applied the Snedecor F statistical contrast analysis and a cross validation model afterwards;  $p < 0.001$  was considered significant.

**Results:** 71 measurements from 12 children ranging from 5 month to 13 years of age 5 to 40kg of weight. With 3 parameters: minute volume in liters (MV), sevoflurane concentration at the end of expiration (ETs) and weight in kg (Kg) we could define 84% of the variability of the sevoflurane flow (FI) ( $p=0.000$  each), and through regression statistics we could construct the following dosing formula:  $FI (ml/h) = -4.63 + (MV(l) \times 4.54) + (ETs(\%) \times 5.64) - (Kg \times 0.26)$ . The cross validation showed a shrinkage of 6.5%, making the model a reliable dosing method.

**Discussion and conclusions:** The utilization of AnaConDa® device is possible in children when placing it on the inspiratory ending. The proposed formula can positively predict dosing in children. The dose of sevoflurane depends not only of MV and ETs, but weight plays an determining factor.

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### 10AP3-6

#### Managing emergencies in pediatric anesthesia (MEPA): evolution of an international simulation training collaboration to improve the management of pediatric anesthetic emergencies

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**Background:** The ability to manage anesthetic emergencies is an essential part of safe anesthetic practice but encountering anesthetic crises during training is rare. To provide experience managing anesthetic emergencies in children a simulation based training course: Managing Emergencies in Pediatric Anesthesia (MEPA) was created.

**Methods:** Based on competencies defined by the Royal College of Anaesthetists UK, course-content and structure was agreed by a committee of paediatric anaesthetists from 9 simulation centres. Uniquely each scenario and presentation fulfilled key educational goals, was evidence-based and collaboratively peer-reviewed creating a robust curriculum.

**Results and discussion:** The MEPA network rapidly expanded and by 2010 the MEPA course was available in every post-graduate anesthesia training program in the UK.

To ensure consistent course content and delivery quality, faculty from start-up centres observed an established MEPA course, experienced faculty from this site then visited the new site and assisted in provision of their first course. This "ambassador model" ensured standards were maintained and the spirit of the original course was preserved. This model worked well and migration of senior MEPA faculty to Canada, allowed MEPA to advance to Toronto and throughout Ontario.

Confronting Canada's large inter-hospital distances the MEPA project evolved: MEPA-Canada pioneered "telesimulation" using secure video-conferencing to allow established centres to broadcast their course to new centres and remotely observe the new centres' first course giving faculty guidance and support, assisting candidate debriefing and promoting content conformity. This consistency allowed important simulation research questions to be addressed e.g. validity of simulation as an assessment tool. Telesimulation, publication of presentations and networking at international meetings resulted in proliferation of the MEPA course into USA, Australia, New Zealand, Singapore and Africa. Course content has expanded, an allied course for practicing anaesthetists with occasional paediatric anaesthesia commitments (MEPA-FC) has been developed and runs in the UK, Australia and Africa.

**Conclusion:** The MEPA group meet annually and at international anaesthesia/simulation conferences maintaining connectivity via the website: <https://mepa.org.uk>. We continue to seek new centres to join our collaboration in what we believe is the largest paediatric anaesthesia simulation network worldwide.

## 10AP3-8

### The relationship between postoperative chylothorax and adverse outcomes following pediatric cardiac surgery

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**Background and Goal of Study:** Chylothorax, the accumulation of the lymphatic fluid in the thoracic space is a complication with 4 % occurrence after pediatric cardiac surgery. We hypothesized that chylothorax was associated with increased mortality and morbidity.

**Materials and methods:** Using propensity score analysis, 48 patients with chylothorax between 2002 and 2012 were matched to 48 patients who did not have chylothorax from a database of 1,002 consecutive pediatric patients below 5 year of age who underwent cardiac surgery between January 2004 and December 2008 at a single center. The association between chylothorax and outcome was analyzed after propensity score matching of perioperative variables.

**Results and discussion:** Among the 48 patients (27 male and 21 female; median age 29 days) who developed postoperative chylothorax, 32 recovered with conservative therapy, such as a low-fat diet, medium chain triglyceride-enriched diet, or total parenteral nutrition (13 patients), 11 patients needed octreotide treatment and 5 needed surgical intervention. Five patients died. The two matched groups were well balanced in terms of measured perioperative variables. Mortality rate was 5 patients in the chylothorax and one patient in the matched control group ( $p=0.42$ ). The occurrence of pulmonary complication ( $p=0.01$ ) and postoperative infection ( $p=0.04$ ) were significantly higher and duration of mechanical ventilation ( $p=0.007$ ) and length of hospital stay ( $p=0.014$ ) were significantly longer compared to the matched control group.

**Conclusion(s):** Chylothorax was independently associated with an increased occurrence of postoperative complications but not with mortality after pediatric cardiac surgery.

## 10AP3-9

### The association between regional weather changes and the outcome of pediatric cardiac surgery

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**Background and Goal of Study:** Recently several associations have been discovered regarding the effects of significant changes in meteorological parameters and higher risk of cardiovascular diseases<sup>1,2</sup>. However, there is lack of data concerning pediatric cardiac surgery. This study investigated the relationship between postoperative outcomes and sudden change in meteorological parameters preceding pediatric cardiac surgery.

**Materials and methods:** We have retrospectively analyzed the data of 1665 consecutive pediatric patients undergoing open-heart surgeries between January 2004 and December 2008. Meteorological data was obtained via the national meteorological survey database. Parameters used included average, minimum and maximum daily temperature, barometric pressure, wind speed, and relative humidity. Four preoperative 48h time windows have been created and analyzed for meteorological parameters and 72 postoperative hours were recorded for clinical variables and major outcomes. Meteorological event was defined by a change of at least 10% in the parameter compared to the average of the previous 30 days. For statistical analysis multivariable logistic regression and Spearman-correlation was used.

**Results and discussion:** After adjustment for CPB time, intraoperative blood transfusions (ml/kg), logarithmic transformation of age, body weight (kg), aprotinin, nitric oxide, delayed sternal closure and DHCA, multivariable analysis showed positive relationship in the occurrence of postoperative infection and change in the average temperature in the 2-3 days before surgery ( $p=0.01$ , AOR: 4.15 95%CI: 1.4-12.3). Positive correlation was observed between changes in relative humidity 4-5 days before surgery and intraoperative blood transfusion (ml/kg) ( $p < 0.001$ ,  $r=0.094$ ) and between changes in barometric pressure 6-7 days before surgery and length of ICU-stay ( $p < 0.001$ ,  $r=0.113$ ).

**Conclusion:** Our results suggest, that while further investigations are needed, meteorological parameters might play an important role in the planning of pediatric cardiac surgeries.

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## 10AP4-1

### The effect of dexmedetomidine memory acquisition, amnesia and recall

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**Background:** The effect of dexmedetomidine on memory function has never been studied in children. A standardized visual picture naming task was used to assess memory during dexmedetomidine sedation for MRI studies. The purpose of our study was to determine whether dexmedetomidine sedation elicits memory impairment.

**Materials and methods:** After informed consent, 38 children started dexmedetomidine infusion, with 29 requiring no additional medication and 27 (4-12 years, 22.4 kg, 24F) completing all study tasks. As per our institutionally approved sedation protocol, 2 mcg/kg dexmedetomidine was infused over 10 minutes followed by a continuous infusion of 1.5 mcg/kg/hr until termination of MRI study. During the induction of sedation, children viewed and named simple line drawing pictures, 1 each 5 seconds. Any verbal response within this time frame was scored as positive. After recovery (minimum Modified Aldrete Score of 10 which is maintained after 30 minutes) yes/no recognition was performed using equal numbers of previously shown pictures intermixed with novel pictures. Individual sedation and memory thresholds of 50% of were calculated from verbal responsiveness (present/absent) and picture recognition (yes/no) using a cumulative link model with a complementary log-log link

function to accommodate potentially skewed binomial proportions.

**Results and discussion:** 71 +/- 12 pictures of 100 pictures total shown during induction of sedation were recognized. The hypothesis tested was that no significant memory impairment would be present when the child was still responsive during induction of sedation. This was quantitated by measuring when 50% memory impairment occurred in relation to 50% chance of loss of verbal responsiveness. 50% thresholds occurred at 4:16 ± 1:14 min for memory and 5:37 ± 1:13 min for sedation. T-test of group threshold differences were significantly different from 0 ( $t=7.93$ ,  $p < 0.001$ , mean difference 94.27 ± 60.87 sec.).

**Conclusion:** Similar to previous reports, the use of dexmedetomidine alone was successful for inducing sedation in 76% of children for MR imaging. In this group of patients, memory impairment occurred before loss of responsiveness. Thus dexmedetomidine is effective at preventing recall of these non-emotive visual stimuli even when responsiveness is present. The mechanism underlying this effect (sedation producing inattention vs. amnesic induced forgetting of memories) needs to be clarified in future studies.

## 10AP4-2

### Effectiveness of electrical stimulation generated by a neuromuscular transmission monitor to the heart 7 acupuncture point in preventing emergence agitation in children: a prospective double-blind randomized controlled trial

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**Background and Goal of Study:** Emergence agitation (EA) is a common phenomenon in children recovering from general anesthesia, and EA frequency was reported to be more than 50%. EA increases the risk of adverse phenomena; therefore, treating EA is a challenge in pediatric anesthesia. Previous studies have reported that EA was effectively prevented by stimulating the heart 7 (HT7) acupuncture point using a capsicum plaster or needle. However, anesthesiologists are not familiar with these techniques. Therefore, the objective of this study was to examine the effectiveness of electrical stimulation to the HT7 using a neuromuscular transmission monitor in preventing EA in pediatric patients.

**Materials and methods:** This was a prospective, randomized, double-blind controlled study, in which 50 children (age, 18-96 months) were scheduled to undergo surgery under general anesthesia with sevoflurane. Children with developmental delays and psychological or neurological disorders were excluded. The enrolled subjects were randomly assigned to one of the following two groups via a computer-generated random number table and sealed envelope method:

(1) HT7 group: bilateral stimulation of the HT7 acupuncture point located on the ulnar side of the wrist by a single-twitch electrical stimulus (1 Hz, 50 mA) throughout the surgery, and

(2) control group: only electrodes were attached to the HT7; electrical stimulus was not applied. The primary outcome was incidence of EA.

The incidence and severity of EA were evaluated using the pediatric anesthesia emergence delirium (PAED) scale, and a score  $\geq 10$  demonstrated presence of EA. Nurses, blinded to the group allocation, recorded the PAED score in the recovery room. The preoperative anxiety scores and duration in the recovery room were also recorded.

**Results and discussion:** All enrolled 50 subjects completed the study. No statistically significant intergroup differences were observed in the preoperative anxiety score and durations of anesthesia and surgery. The incidence of EA in the HT7 group was significantly lower than that in the control group (16% vs. 64%;  $P = 0.001$ ). There was no statistical difference between the two groups with regard to the duration spent in the recovery room. Electrical stimulation to HT7 lowered the EA incidence without prolonging recovery time.

**Conclusion(s):** Electrical stimulation to HT7 during surgery under sevoflurane anesthesia decreased EA incidence in pediatric patients.

## 10AP4-3

### Prevention of emergence agitation by melatonin premedication after general anesthesia in children: meta-analysis of randomized controlled studies

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**Background and Goal of Study:** Emergence agitation (EA) is a frequent phenomenon in children recovering from general anesthesia. Although several drugs such as fentanyl or propofol have been reported to be effective in preventing EA, they are associated with side effects such as respiratory depression and delayed emergence from anesthesia. In a study with a small sample size, melatonin administered preoperatively was shown to decrease the incidence of EA with fewer side effects; however, no consensus on the effect of preoperative melatonin on EA has been reached.

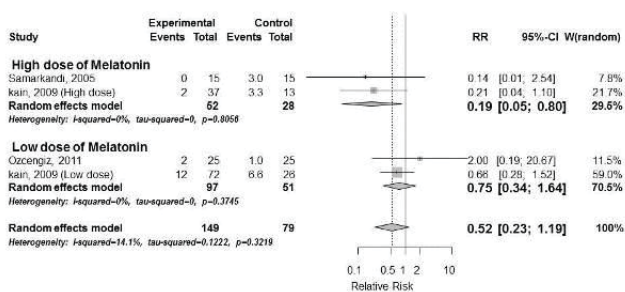
In this study, we conducted a meta-analysis of randomized controlled studies to evaluate the effectiveness of melatonin premedication in preventing EA in children.

**Materials and methods:** A literature survey was performed using MEDLINE, EMBASE, The Cochrane Central Register of Controlled Trials, and Web of Science databases. This study included randomized controlled trials that reported the effect of melatonin premedication in preventing EA compared with midazolam premedication in children. Dichotomous data obtained were summarized using risk ratios with a 95% confidence interval (CI). Heterogeneity was assessed using the  $I^2$  test, and subgroup analysis was performed based on the melatonin dosage administered. In this study, a high dose was defined as  $>0.3$  mg/kg of melatonin.

**Results and discussion:** Of the initial 1,014 trials evaluated, 3 trials comprising a total of 228 subjects met the inclusion criteria. The combined results showed that melatonin premedication did not have a statistically significant effect in preventing EA compared with midazolam premedication (Relative risk [RR] at 95% CI = 0.52, [range, 0.23-1.19]; Figure 1). However, subgroup analysis revealed that a high dose of melatonin was effective in preventing EA compared with midazolam (RR at 95% CI = 0.19 [range, 0.05-0.80]) (Figure 1).

**Conclusions:** Our meta-analysis indicated that high-dose melatonin significantly reduced EA incidence as compared with midazolam. However, our results may not be robust, because of the limited number of RCTs and subjects included. More studies are needed to substantiate our conclusion.

Melatonin vs Midazolam



[Figure 1]

## 10AP4-4

### Use of intravenous dexmedetomidine in pediatric patients undergoing magnetoencephalography. Preliminary results

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**Background:** Magnetoencephalography (MEG) is increasingly used in the pre-surgical evaluation of epileptic children with a seizure focus. Many paediatric patients require sedation or anaesthesia to tolerate these exams. Some drugs, such as propofol or sevoflurane, may produce adverse effects on interictal activity. However, the available literature on anaesthetic management in this population is very limited.



**Methods:** We studied 70 epileptic patients (aged 6 months-15 years old) undergoing simultaneous MEG-EEG scanning at our institution. All patients received dexmedetomidine (0.5-1 $\mu$ g/kg initial dose in 10 minutes followed by continuous infusion of 0.5-0.7 $\mu$ g/kg/h) during the exam. Heart rate and peripheral oxygen saturation were recorded during the study. The number of MEG-EEG spikes during anaesthesia recording (Aspike/min ratio) has been compared to the number of epileptic events during pre-MEG-scan video EEG recording (Vspike/min ratio).

**Results:** There were no statistical differences between Aspike/min and Vspike/min ratios. Dexmedetomidine provided excellent sedation in most of the children and prevented patient movement without any significant reduction of epileptiform events. No common side effects were recorded. There were no signal artifacts interfering with the identification of epileptiform discharges.

**Conclusion(s):** In our experience, our preliminary results suggest that dexmedetomidine infusion is an effective and safe anaesthetic management technique in these types of studies.

## 10AP4-5

### Properties of the MEG-EEG signal recorded during anaesthesia with sevoflurane and dexmedetomidine compared to basal video-EEG recording

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**Background:** Magnetoencephalography (MEG) is increasingly used in the pre-surgical evaluation of epileptic children with a seizure focus. Many paediatric patients require sedation or anaesthesia to tolerate these exams. Some drugs, such as propofol or sevoflurane, may produce adverse effects on interictal activity. However, the available literature on anaesthetic management in this population is very limited. In this study we compared the properties of MEG-EEG signal recorded during anaesthesia with sevoflurane and dexmedetomidine to pre-MEG-scan video-EEG recording.

**Methods:** We studied 80 epileptic patients (aged 6 months-15 years old) undergoing MEG scanning at our institution. 40 patients received intravenous dexmedetomidine (0.5-1 $\mu$ g/kg initial dose in 10 minutes followed by continuous infusion of 0.5-0.7 $\mu$ g/kg/h) during the exam; and 40 patients inhaled sevoflurane anaesthesia (induction at 8% and maintenance at 2%). Heart rate and peripheral oxygen saturation were recorded during the study. Changes in time and frequency domain MEG features during anaesthesia with dexmedetomidine and sevoflurane have been analysed and compared to pre-MEG-scan video-EEG recording.

**Results:** Both anaesthetics caused an increase of anterior beta MEG-EEG activity and suppression of posterior MEG-EEG alpha activity. Both anaesthetics induced the increase of general MEG-EEG slow wave activity. Sevoflurane produced clear epileptiform events: slow delta waves with spikes (30% of patients), polyspikes (20% of patients), and burst suppression with spikes pattern (34% of patients) not seen in control video EEG recording. Dexmedetomidine produced burst suppression with spikes pattern in only 5% of patients and no other false positive/negative events have been recorded.

**Conclusions:** Sevoflurane affected MEG-EEG activity. Dexmedetomidine had a minimal effect on MEG-EEG recording. Our results suggest that the use of dexmedetomidine is more suitable for the MEG-EEG studies and the identification of epileptiform discharge.

## 10AP4-6

### Parental satisfaction assessment after pediatric procedural sedation: there are still issues to address

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**Background and Goal of Study:** As pediatric sedation practices are becoming safer and more feasible procedures day by day, they have been widely used for diagnostic and therapeutic procedures. Today, the primary purpose of the medical procedures is to reduce cost, protect the resources and improve patient satisfaction without compromising patient safety. This study intended to determine the relation between parental satisfaction and the branches applying procedural processes, demographic data of the patients and their families, physicians, nurses and the healthcare personnel in the room.

**Materials and methods:** This study was approved by the Ethics Committee of our University Medical Faculty (no: B.30.2.MAR.0.01.02/AEK/120118660, date: 06/14/2012), and patients' parents provided written consents for the study. This study was conducted between March, 2012 and October, 2012 in the services of our University Medical School Hospital where pediatric ambulatory sedation was performed. Successive 224 patients under 18 years of age undergoing diagnostic or therapeutic procedural process in pediatric pulmonary diseases, gastroenterology, cardiology, and invasive radiology units were included in the study. The satisfaction level of the patients' parents was determined through a questionnaire of 22 questions.

**Results and discussion:** Mean satisfaction scores for pediatric bronchoscopy and endoscopic interventions varied between 7.06 and 9.30 while the satisfaction scores of the interventions for cardiovascular system, hepatic system and renal system as well as the invasive radiologic interventions varied between 7.5 and 9.6. There was statistically significant negative correlation between the ages of parents and children and the necessity for a playground in the waiting area. A significant correlation was found between the age of children and the adequacy of the anesthetist's behaviors.

**Conclusion(s):** Satisfaction levels of the parents were high at the units where pediatric sedation was applied. However, the expectations of young patients and their parents were higher. When the physical conditions and the communication with patients and their relatives are improved, and the process schedules are more precisely followed, the clinical results will increase in a positive way.

## 10AP4-7

### Emergence delirium - simplified

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**Background and Goal of Study:** Early postoperative negative behavior (e-PONB) includes emergence delirium (ED), pain, agitation, and fear and is a common problem in children undergoing general anaesthesia.<sup>1</sup> Despite the introduction of the Paediatric Anaesthesia Emergence Delirium-(PAED) scale the different component of e-PONB are frequently confused. <sup>2</sup> It has been suggested that almost all children with ED demonstrate 'No eye contact' and 'No awareness of surroundings' <sup>3</sup> whereas the items 'restlessness' and 'inconsolability' had lower sensitivity for the diagnosis of ED.<sup>4</sup>

The aim of this prospective service audit was to analyze individual items of the PAED scale and their ability to identify ED in children following ENT surgery.

**Materials and methods:** This was a prospective service audit and included consecutive children aged 1-14, ASA 1-2 attending for ENT surgery under general anaesthesia. ED was assessed using the PAED scale and the individual scores ('eye contact', 'awareness of surroundings') every 5 min after awakening and discharge from recovery. Patients were deemed to have ED if PAED score was  $\geq 10$  or if both individual scores for 'eye contact' and 'awareness of surroundings' were  $\geq 2$ .

**Results:** A total of 52 consecutive patients were included. A total of 18 children (35%) displayed ED at 5 minutes after waking (median PAED score 12, range 10-20). A further 14 children had 'No eye contact' and 'No awareness of surroundings'. The incidence of ED decreased after 10 minutes after waking (6 - (11%) but remained higher when measured using the individual scores (16 - 31%). Only 2 children demonstrated ED at 15 min none after 20 min.

Three children required treatment for ED in recovery room: parental intervention for 2 cases and propofol 1.75mg/kg for one child.

**Discussions and conclusions:** The individual scores for 'No eye contact' and 'No awareness of surrounding' confirmed the diagnosis of ED in all cases. However, during the first 15 min after awakening the individual scores would suggest a diagnosis of ED even when the PAED score did not. The use of the individual scores may be a more sensitive but much simpler tool to identify ED.

#### References:

1. Paediatr Anaesth. 2002;12:293-5.
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## 10AP4-8

### Does playing dough attenuates premedication anxiety?

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**Background and Goal of Study:** Many children undergoing surgery experience substantial anxiety in the preoperative holding area and the operating room before induction of anesthesia. Preoperative anxiety may be caused by separation from parents, unfamiliar environments and people, and negative anticipation of surgical procedures. Oral midazolam is effective and used with great frequency for preoperative anxiety. But administration of oral midazolam to children is often met with reluctance and refusal. The aim of this study is to determine whether giving a playing dough to child would decrease anxiety associated with taking oral premedication.

**Materials and methods:** Institutional Ethics Committee approval and written informed consent (Ref no 4/65, 24/09/2012) were obtained and the study was prospectively registered in Australian New Zeland Clinical Trial Registry (ACTRN12613000928718). We enrolled 104 ASA I, 2-7 year old patients undergoing elective urogenital surgery. The children were randomized into two equal groups by computer generated random number table. At preoperative holding area after waiting for 3 minutes with their parents one group received playing dough and the other group did not. MYPAS was performed immediately after patients were invited to preoperative holding area (T0), 6 minutes after getting in the room (after 3 minutes playing with dough)(T1), and 5 minutes after the second MYPAS while administering 0.5 mg/kg midazolam. All scores were performed by the same trained anesthesiologist who was not familiar with the aim of the study.

**Results and discussion:** There were no difference in T0 scores between the groups ( $p=0.876$ ). T1 and T2 scores of PD group was lower than C group ( $p < 0.001$ ). At three time points MYPAS scores were significantly different in groups for two groups ( $p < 0.001$ ). In PD group T1 and T2 scores were similar and significantly lower than T0 scores ( $p < 0.001$ ). At C group T2 score was higher than T1 and it was higher than T0 scores ( $p < 0.001$ ).

**Conclusion(s):** In our study we demonstrated that playing doughs attenuated premedication anxiety in children. Children's who are not playing with dough had a increase in anxiety scores while waiting and taking medication. In conclusion we can suggest that giving playing dough is an easy, safe, economical, creative and a toy without gender preference to attenuate premedication anxiety.

## 10AP4-9

### Distraction of children to attenuate the sedation or general anesthesia rate in magnetic resonans imaging

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**Background and Goal of Study:** MRI in children is hard to complete with high resolution due to noise during the imaging procedure, the long duration of procedure and the need to stand still. Due to these difficulties sedation or general anesthesia is commonly used but these anesthesia techniques increase the cost and the complication rates significantly. Thus newer approaches to minimize the cost and the complication are investigating. The aim of the study is to investigate the ratio of patients who received any form of anesthesia to the ones who did not. In order to preclude patients from anesthesia we breast fed the babies and to distracted childrens anxiety with toys or candies were used.

**Materials and methods:** In this retrospective study we retrospectively analyzed the files of patients with 1 to 4 years who were asked to receive MRI. There were 34 boys and 26 girls were included in the study. In order to reduce the conception of noise the external ear canals were plugged with cotton. All children were accepted into the machine with their parents. Toys or candies were used to distract the anxiety of children to keep them stay still. Children less than 12 months were breast feed and slept before introducing to the MRI. If all the above were unsuccessful only than patients were sedated or given anesthesia.

**Results and discussion:** There were only five patients that were less than 12 months old and all of them were successfully imaged with breast feeding and going to sleep. In patients who are one year or older 36 of them (%65.5) successfully completed the imaging without receiving anesthesia. Seven of

the patients (%12.7) received sedation and twelve (%21.8) received general anesthesia.

**Conclusion(s):** In our studies in the babies (less than 12 months old) satisfying the physiological needs or sleeping, in patients more than 12 months old distractive activities such as offering toys or candies or being close to parents is very effective in decreasing the need of the patients to receive sedation or general anesthesia in MRI.

## 10AP4-10

### Dexmedetomidina in children

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**Background and Goal of Study:** Preoperative period is a stressing occurrence for most of the people undergoing surgery and in particular for children. Approximately 50%-75% of children undergoing surgery will develop great anguish and anxiety and this is associated with distress on emergence from anaesthesia and with later postoperative behavioural problems. Premedication, commonly performed with benzodiazepines, reduces preoperative anxiety, facilitates separation from parents and promotes acceptance of mask induction. Dexmedetomidine is a highly selective  $\alpha_2$ -agonist with sedative and analgesic properties. We decided to perform a meta-analysis of all RCTs on dexmedetomidine versus midazolam to evaluate its perioperative sedative and analgesic effects as a pre-anaesthetic medication in children.

**Materials and methods:** Pertinent studies were independently searched in several databases and updated on September 2013. Inclusion criteria were random allocation to treatment and comparison between dexmedetomidine and midazolam. Exclusion criteria were adult studies, duplicate publications, intravenous administration and no data on main outcomes.

**Results and discussion:** Data from 789 children in 10 randomized trials were analysed. Overall analysis showed no differences in satisfactory sedation at separation from parents (256/356 [72%] in the dexmedetomidine group vs 152/323 [47%] in midazolam group,  $p=0.06$ ) and anaesthesia induction (202/281 [72%] in the dexmedetomidine group vs 163/248 [66%] in the control group,  $p=0.20$ ) between groups. Rescue doses of postoperative analgesic drugs were less required in the dexmedetomidine patients (37/205 [18%] than in 76/207 [37%] in the midazolam arm,  $p < 0.001$ ).

**Conclusion(s):** Dexmedetomidine is effective in decreasing anxiety upon separation from parents and at anaesthesia induction and provides more effective post-operative analgesia when compared with midazolam.

## 10AP5-1

### Anaesthetic parental satisfaction audit in a tertiary level children's hospital

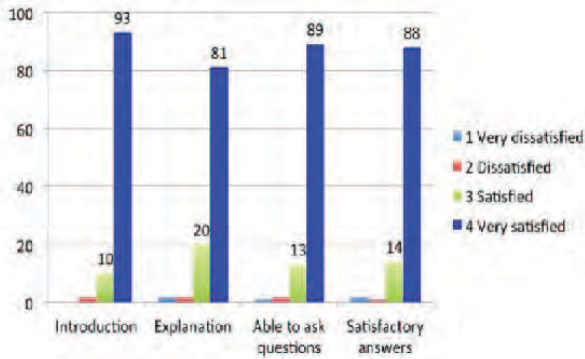
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**Background and Goal of Study:** Parents and children demonstrate a high incidence of anxiety prior to surgery<sup>1,2</sup>. Adequate pre-operative information and preparation helps allay these concerns<sup>3</sup>. Child-centered approach to anaesthesia should be employed with provision for parents to accompany children into the anaesthetic room and recovery area<sup>4,5</sup>. Participation and presence of parents in decision-making increases their satisfaction regarding the care their child receives<sup>6</sup>.

**Materials and methods:** A questionnaire was created regarding Pre-admissions, Ward Care, interactions with the anaesthetist in SDC (Surgical day care) and quality of care received in the anaesthetic room. These questions were randomly distributed to avoid bias and were given to parents on arrival to SDC. It was collected from them prior to patient's discharge. The data was collected over a period of 6 weeks.

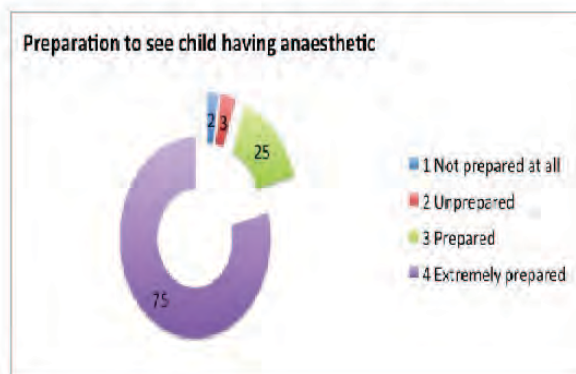
**Results and discussion:** We analysed a total of 105 completed forms. 100% of parents who attended the pre-admission clinic found it helpful and were very satisfied. 95% of parents were adequately prepared regarding the events on the day of operation. 97% of parents appreciated the support received from the accompanying ward nurse. 96% of parents felt welcome in the anaesthetic room. Parents felt well prepared and satisfied with the way their child was looked after during induction.

### Interaction in SDC



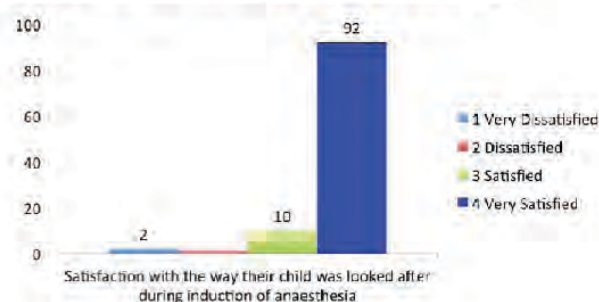
[Interaction with anaesthetist]

### Quality of care in the Anaesthetic room



[Quality of care 1]

### Quality of care in the Anaesthetic room



[Quality of care 2]

**Conclusion(s):** This audit highlighted the importance of pre-admission clinics and helped us understand what we could offer as a tertiary centre to make parents feel more supported when their child has had an anaesthetic.

### 10AP5-2

#### Randomized controlled study of the acetaminophen effectiveness after adenotonsillectomy or tonsillectomy in children

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**Background and Goal of Study:** The aim of this study was to compare analgesic effect of intravenous acetaminophen with ketoprofen or the combination of these drugs in children undergoing adenotonsillectomy or tonsillectomy.  
**Materials and methods:** The prospective clinical study, approved by the Center for Bioethics included 147, 5-15 year old children, admitted to the Hospital of Lithuanian University of Health Sciences for tonsillectomy or adenotonsillectomy.

Children were randomly assigned to one of 3 groups, 49 children in each, using the envelope method. The children received i.v. ketoprofen 2 mg/kg (group K) or acetaminophen 15 mg/kg (group A) or the combination of these 2 drugs (group KA) after induction of anaesthesia.

General anaesthesia was induced with: sevoflurane via face mask or i/v propofol 3mg/kg, followed by atropine 0.02 mg/kg, mivacurium 0.2 mg/kg or atracurium 0.5 mg/kg, phentanyl 2-2.5 µg/kg and dexamethasone 0.15 mg/kg and maintained with sevoflurane.

Pain was assessed using a 5-point scoring system based on the Smiley scale showing various faces from laughing (1: no pain) to very unhappy (5: worst pain) at 30, 60, 120, 180 and 240 min after surgery.

Data were analyzed with software packages of Excel and STATISTICA 7, using Mann-Whitney U test and  $\chi^2$  test, with  $p < 0.05$  regarded as statistically significant.

**Results and discussion:** Median pain scoring was statistically significantly higher in group A (table) compared with lower pain intensity in both other groups at all times of assessment (table).

Variable	Minutes after surgery				
	30	60	120	180	240
Group K	1(1-3)	1(1-4)	2(1-4)	2(1-4)	3(1-3)
Group A	2(1-4)**	2(1-5)**	3(1-5)**	3(2-5)**	3(1-5)**
Group KA	1(1-5)	1(1-4)	1(1-3)*	2(1-3)	2(1-3)

[Median pain intensity according to Smiley scale]

\*  $p < 0.05$  group K vs group KA, U test.

\*\*  $p < 0.05$ , group A vs group K, and group A vs group KA, U test.

The rate of postoperative nausea and vomiting was 8.16% of total cases. The rate of PONV was 16.33% of cases in group K vs 2.04% of cases in group A ( $\chi^2$  test;  $p < 0.05$ ) and 6.12% of cases in group KA ( $p = 0.1$  group KA vs group K and  $p = 0.3$  group KA vs group A). Postoperative bleeding occurred in 1 patient in group K and in 2 patients in group KA.

**Conclusion:** The monoanalgesia of intravenous acetaminophen is less effective for postoperative pain relief compared with ketoprofen or a combination of ketoprofen and acetaminophen after tonsillectomy or adenotonsillectomy in children.

### 10AP5-3

#### Overcoming cultural challenges while instituting a parent present induction program in Saudi Arabia

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**Background:** The value of family-centered care in pediatrics is documented in the literature. Translation of these principles into practice can be a challenge. An important aspect of practicing patient and family-centered care is cultural competence. Women in Saudi Arabia wear hijab (head cover), a cloak (abaya) and veil (niqab) which they could not remove. Our mission was to find a way to achieve parent present induction of anesthesia (PPI) while respecting the local dress code and adhering to infection control measures.

**Case report:** Parent participation is essential to the success of a child's hospital visit. Decision for PPI is individualized according to the child's tempera-



ment and degree of cooperation of the parent. Parental teaching is essential prior to PPI. Parents wear a specially-designed coverall that fits onto street clothes along with hat, mask and shoe cover.

**Discussion:** Patient-Centered Care will make any hospital stand out from the crowd. It promotes institutional pride and employee feeling of accomplishment. To attain this, healthcare professionals must achieve the cultural competence necessary to integrate the practice of medicine with the local culture they are serving. This minimizes disrupting the family unit and increases the satisfaction of the experience.

#### References:

www.archildrens.org/.../Parent-Present-Induction.aspx  
Anesth Analg 2006, v.102,1:81-84  
Anesth Analg 2010 v.110,4:1102-1108

**Learning points:** Success of anesthesia is no longer determined solely by survivability, but by the quality of survival. Family Centered Care Model recognizes that each family is unique and is the expert on the child's needs. Cultural competence is the ability to interact effectively with people of different cultures based on knowledge of the local norms. We were able to apply these principles with a culturally-compliant gown for a positive family experience in the operating room.

### 10AP5-4

#### Inhibition of acetaminophen analgesic action by ondansetron after amygdalectomy in children: the Paratron randomized trial

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**Background:** The mechanism of action of paracetamol is still unclear. One hypothesis involves an interaction with the serotonergic system. Furthermore, setrons have antiemetic properties by acting as antagonists at serotonin (5-HT<sub>3</sub>) receptors. Therefore, co-administration of paracetamol and a setron could lead to a decrease or a loss of paracetamol analgesic effects. Therefore, the aim of this study was to demonstrate that the association paracetamol/ondansetron is not as effective as paracetamol/droperidol in the treatment of pain in children following tonsillectomy.

**Materials and methods:** This study was approved by our institutional ethics committee. Paratron trial was designed as a prospective, randomized, double blind, parallel group trial. Children aged 2-7 years old and scheduled for a tonsillectomy ± adenoidectomy were recruited. All patients received intra-operatively acetaminophen together with ondansetron or droperidol. At the end of surgery, patients received i.v. morphine. Pain scores using CHEOPS scores, morphine consumption and the incidence of postoperative nausea and vomiting (PONV) were measured during 24 h. The primary outcome was pain scores at 4 h after administration of paracetamol and ondansetron/droperidol. Secondary objectives were morphine consumption, cumulated incidence of PONV. Comparison of CHEOPS scores and morphine consumption between groups was performed using Student t test or Wilcoxon rank signed test. The level of significance was set at 5%.

**Results and discussion:** From October 2011 to June 2012, 69 patients were included: 35 in the ondansetron group and 34 in the droperidol group. CHEOPS scores were not different at all times during the first 24 h. However, mean morphine consumption (in mg) in recovery was 279.5 ± 271.5 and 97.6 ± 201.5 in the ondansetron and droperidol groups, respectively (p = 0.004). Furthermore, the percentage of patients who received morphine titration was 57.1% and 20.6% in the ondansetron and droperidol groups, respectively (p = 0.008). No significant difference was present for PONV. An interaction between paracetamol and ondansetron did occur with children receiving 3 times more morphine during pain titration in the recovery room.

**Conclusion(s):** This is the first time that the interaction between paracetamol and a setron is reported in a clinical setting. More studies are necessary to evaluate if it is clinically relevant to preclude the simultaneous administration of both drugs in the future.

### 10AP5-5

#### The impact of general anaesthesia for elective adenotonsillectomy in children aged 6-12 years on biomarkers of cerebral injury S100B and NSE

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**Background and Goal of Study:** S100B protein and NSE (neuron specific enolase) can be considered as early markers of cerebral injury. The impact of general anesthesia for elective noncardiac surgery in children on these markers has not been studied before.

The goal was to find out whether these markers can be used to access the short term neurological outcome after general anesthesia.

The secondary goal was to determine whether different types of anesthesia influence the levels of S100B and NSE.

**Materials and methods:** Prospective study was conducted at the University Hospital on 64 children (aged 6-12, ASA I-II) undergoing elective adenotonsillectomy. The children were randomized into 2 groups: TIVA (n=32) and sevoflurane (S) (n=32). In TIVA group anesthesia was induced with propofol, fentanyl and vecuronium and maintained with continuous infusion of propofol. In S group, anesthesia was induced with fentanyl, sevoflurane and vecuronium and maintained with sevoflurane. S100B and NSE were measured before and after the surgery. S100B and NSE assays were performed using the electrochemiluminescence immunoassay "ECLIA" used on Roche Cobas e601 immunoassay analyzer (Roche Diagnostics GmbH, Mannheim, Germany). Statistical significance of the differences was accessed by two-tailed asymptotic Wilcoxon Signed Rank test. The 95% CI for median difference was calculated by bootstrapping on 1000 samples in IBM SPSS Statistics version 21.

**Results and discussion:** There was statistically significant increase of S100B median value after surgery with regard to preoperative values (P< 0.001). Median (interquartile range) values of S100B before and after surgery were 0.08 (0.064-0.102) and 0.1 (0.072-0.179), respectively. There was no statistically significant change of NSE median value after surgery regarding preoperative values (P=0.567). The prevalence of elevated S100B (≥0.105 ug/l) after the surgery was statistically significantly higher than before (McNemar test, two sided exact P=0.003). There were 12/60 children (20.0%; 95% CI=(10.5%-29.8%)) with elevated S100 B before and 28/60 (46.7%; 95% CI=33.3%-59.6%) after surgery.

	S 100B				Absolute difference	P 95% CI
	before		after			
	n (%)	95 % CI	n (%)	95 % CI		
normal	48 (80.0)	(70.2-89.5)	32 (53.3)	(40.4-66.7)		0.003
elevated	12 (20.0)	(10.5-29.8)	28 (46.7)	(33.3-59.6)	16 (26.7)	(15.2-38.2)
total	60 (100.0)		60 (100.0)			

[Table 1]

**Conclusion(s):** The values of neurological biomarker S100B, but not of NSE, were significantly increased after general anesthesia for elective adenotonsillectomy in children, indicating possible cerebral injury. There were no differences regarding 2 types of anaesthesia, TIVA or inhalational.

#### References:

Cata JP, et al. *Br J Anaesth* 2011;107:844-58.

## 10AP5-6

### Combination of oral tramadol and midazolam versus midazolam alone as a premedication in children undergoing adenoid or tonsil surgeries

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**Background and Goal of Study:** The aim of this study was to compare the tramadol and midazolam combination to oral midazolam alone, in children undergoing adenoid or tonsil surgeries, as an oral premedication, regarding also sedation and postoperative pain relief.

**Materials and methods:** This randomized, controlled prospective study conducted in 60 children who were randomly allocated into two groups. Group "M" (n=30) received 0.5 mg.kg<sup>-1</sup> oral midazolam and group "MT" (n=30) received 0.2 mg.kg<sup>-1</sup> oral midazolam with 1 mg.kg<sup>-1</sup> oral tramadol as a premedication 30 minutes preoperatively. Standard general anesthesia technique was used. A five points-sedation score (1 asleep to 5 agitated) on arrival to the operating room, a three points-acceptance score of separation from the parents and a three points-mask cooperation score at induction of anesthesia (1 easy to 3 markedly resistant) were used. Extubation time, Aldrete score and intraoperatively consumption of remifentanyl were also noted. Pain intensity was assessed using a modification of the Hannallah et al. pain score scale at 30 min, 6 h and 24 h postoperatively. If pain score was higher than 4, additional analgesics were provided. Cumulative analgesic consumption in 24hrs was also recorded. Statistical analysis was performed with Student t-test and chi-square test. Statistical significance was set at p < 0.05.

**Results and discussion:** A satisfactory level of sedation scores were recorded in both groups. Group "M+T" showed significant lower sedation scores compared to group "M" (p < 0.05). There were also statistically significant higher scores in group "M" regarding mask cooperation and total score of premedication assessment in children (p < 0.05). Time to extubation was significantly lower in group "M+T" (p < 0.05). Pain scores and Aldrete score were comparable between the two groups. The amount of remifentanyl consumed intraoperatively was significantly lower in group "M+T" (p < 0.05). Postoperative analgesic consumption was lower in group "M+T" compared to group "M" with no statistical significance.

**Conclusion(s):** Adding oral tramadol to midazolam as a premedication in children following adenoid or tonsil surgeries provides good quality of sedation and decreases perioperative analgesic requirements.

## 10AP5-7

### The factors affecting satisfaction level of parents before and after pediatric surgery

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**Background and Goal of Study:** In today's world, the healthcare services are adopting new policies that target providing services for a greater number of patients. In this context, it becomes crucial to increase patient satisfaction while at the same time considering the hospital costs without compromising patient safety. Parental satisfaction plays a key role in determining pediatric patient satisfaction.

The purpose of the present study was to determine the level of satisfaction for parents and indicate the factors affecting.

**Materials and methods:** The study was conducted between January and December 2012 in our University Hospital with the approval of the research ethics committee of our University School of Medicine after taking written consents of patients' parents. The study included the families of 205 patients aged between 1.5 months and 18 years that were undergoing surgical in-

tervention for several reasons. The patients were categorized into 2 groups: patients undergoing a major operation (n=150) and patients undergoing a minor operation (n=55). Parents were asked their opinion on preoperative and postoperative environment and the people they met, with a questionnaire consisting of 21 questions.

**Results and discussion:** The satisfaction scores were high in respect of information provided by the surgeon and the anesthetist before the operation (8.3 and 7.5 respectively). The satisfaction scores regarding the surgical team and the anesthetists reduced mainly because the surgical team was unclear in communications and the anesthetists were usually in hurry. There was a statistically significant negative correlation between the child's age and the level of satisfaction regarding the information provided by the surgeon preoperatively. There was also a statistically significant negative correlation between the parent's age and the information provided by the anesthetist and the hygiene of the operating room. Also, a statistically significant positive correlation was observed between the number of surgeries the patients underwent and the level of satisfaction regarding the importance attached to the privacy of the children.

**Conclusion(s):** In general, the satisfaction levels of the parents were high. However, if the surgeons speak more clearly and the anesthetists assume less impetuous attitudes, satisfaction level can be increased.

## 10AP5-8

### Use of intravenous lidocaine in the prevention of postoperative vomiting after elective tonsillectomy in children

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**Background and Goal of Study:** Postoperative vomiting (POV) is one of the most frequent complications of tonsillectomy in children. There is evidence that continuous infusions of intravenous lidocaine can prevent POV in adult patients having laparoscopic colectomies.<sup>1</sup>

There are no studies evaluating this effect in pediatric patients undergoing tonsillectomy. The aim of this study was to evaluate the antiemetic effect of lidocaine infusion, given as an adjunct of general anesthesia, in children undergoing elective ENT surgery.

**Materials and methods:** After IRB approval, we included children between 2-12 years old, ASA I / II, scheduled for tonsillectomy with or without adenoidectomy. Induction and maintenance of anesthesia were standardized with fentanyl, mivacurium, and sevoflurane in N<sub>2</sub>O/O<sub>2</sub>. Patients were randomly allocated into two groups: Lidocaine (L) group (receiving 1.5 mg/kg i.v. lidocaine over 5 min followed by 2 mg/kg/h) or Control (C) group (administered an equal volume of normal saline). Infusions were maintained until the end of the surgery. A venous blood sample was drawn at the end of the surgery to determine plasma levels of lidocaine. All patients received dexamethasone at the induction time.

A multivariable logistic regression was used for assessing the effects of the lidocaine infusion on POV (defined as the presence of retching and/or vomiting). A value of P < 0.05 was considered statistically significant.

**Results:** Ninety-one patients (Group C: 46; 45 Group L: 45) were enrolled. The groups were similar in their demographic and intraoperative data. In the L group, 28/46 patients (60.87%) had vomiting within 24 hours vs 37/45 (82.22%) in the C group (P = 0.024).

In the multivariable logistic regression model, the odds of having POV for a patient in group C was estimated to be **3.5 (P = 0.029) times greater** than the odds of patients receiving lidocaine, adjusted for age and sex. Plasma levels of lidocaine had a median of 3.9 mcg / ml (95% BCI: 3.1, 4.7).

**Conclusion(s):** Our results suggest that using intravenous lidocaine as an adjunct to general anesthesia significantly decreases the incidence of POV in children undergoing elective tonsillectomy with or without adenoidectomy. This reduction results in a number needed to treat of 5, similar to prophylaxis using Ondansetron, but at a fraction of the cost.

#### References:

1. British Journal of Surgery 2008; 95: 1331-1338.

## Obstetric Anaesthesia

### 11AP1-1

#### Breastfeeding: a potential life threat

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**Background:** Breastfeeding anaphylaxis (BFA) is an extremely rare condition characterized by symptoms ranging from urticaria to angioedema, hypotension and syncope, occurring in close relation to lactation. Five cases were reported between 1991 and 2013.

**Case report:** A 29 year-old, Gravida 2 Para 0, with history of idiopathic urticaria was submitted to cesarean section. Epidural anaesthesia with ropivacaine 0.75% was performed. The recovery was uneventful. On postpartum day two facial and members rash, intense pruritus, angioedema and shortness of breath were noted. A second episode, 4h later, with upper airway angioedema, generalized pruritus and urticaria, with predominance on her face, hands and feet occurred. A third episode with cutaneous complaints, but no respiratory symptoms, developed 5h after the second. All 3 episodes began 30-40 minutes after breastfeeding. The symptoms reversed with hydrocortisone and antihistamines. Serum tryptase was negative and total IgE positive. There were no further episodes despite breastfeeding. She was discharged home with antihistamines and referred to Allergy Division. Telephonic contact after 15 days confirmed that breastfeeding remained uneventful.

**Discussion:** She was discharged home with antihistamines and referred to Allergy Division. Telephonic contact after 15 days confirmed that breastfeeding remained uneventful. Discussion The aetiology of BFA remains unclear. Temporal relation with lactation suggests that hormonal influence after delivery predisposes to anaphylactic reaction. Studies found that during the second half of pregnancy there is an increase of the mast cell number and their histamine content in the mammary gland and in the uterus<sup>2</sup>.

#### References:

1. K.K.Mckinney, S. E. Scranton. A case report of breastfeeding anaphylaxis: successful prophylaxis with oral antihistamines, *Allergy* 66(2011) 234-437
2. Villata D. Martelli P. A case of breastfeeding anaphylaxis, *Eur Ann Allergy Clin Immunol* 2007; 39:26-27

**Learning Points:** BFA is a potentially life-threatening condition, where early recognition and treatment are important. It is essential to alert clinicians to potential risks/benefits of maintaining breastfeeding. More investigation is needed to understand this rare phenomenon.

### 11AP1-2

#### Arterialisation of peripheral venous blood in a pregnant patient: an enigma!

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**Background:** Arterialisation of the venous blood gas is a rare phenomenon in which the oxygen in venous blood presents a high partial pressure remarkably similar to the arterial sample. This is the first report of a parturient with arterialized venous blood values with no identifying cause.

**Case report:** A patient with a history of mild pre-eclampsia and gestational diabetes was scheduled for a caesarean section. A vein on the dorsum of the hand was cannulated. Venous blood gas analysis showed a PaO<sub>2</sub> value of 11.1kPa and SaO<sub>2</sub> of 97% on room air. A repeated gas analysis from a different site showed similar results (PaO<sub>2</sub> 11.43kPa, SaO<sub>2</sub> 97.2%). Additional venous samples from a contralateral hand and the foot showed similar PaO<sub>2</sub> and SaO<sub>2</sub>. In order to compare these results with the arterial sample the radial artery was cannulated. The blood analysis showed almost identical values of partial pressure of oxygen and oxygen saturation. The provisional diagnosis of a possible arterio-venous malformation or central shunt was made. An urgent echocardiography was performed but did not reveal any abnormality. The patient had an uncomplicated caesarean section and was discharged home.

**Discussion:** Arterialisation of the venous blood is indicative of cutaneous shunting and may occur in patients with sickle cell disease during vaso-occlusive crisis<sup>1</sup>. Similar arterial and venous values of partial pressure of oxygen occur during a cyanide toxicity due to decreased peripheral extraction<sup>2</sup>. Several methods of obtaining an "arterialised" venous blood sample ("heat-

ed-hand technique") which mimic the values of the arterial blood have been described<sup>3</sup>. None of these pathological conditions or interventions could be applied to our patient and we could not provide any explanation for these unusual findings.

#### References:

1. Nahavandi M et al. Arterialization of peripheral venous blood in sickle cell disease. *J Natl Med Assoc* 2002 May;94(5):320-26.
2. Johnson RP et al. Arteriolization of venous blood gases: a clue to the diagnosis of cyanide poisoning. *J Emerg Med*.1988 Sep-Oct;6(5):401-4.
3. Nauck MA et al. Critical evaluation of the 'heated-hand-technique' for obtaining 'arterialized' venous blood. *Clin Physiol* 1992 Sep;12(5):537-52.

**Learning points:** Unusually high partial pressure of oxygen and oxygen saturation in the peripheral venous blood sample, comparable to "arterialised" blood samples, can be observed in a parturient without any significant metabolic or vascular pathology.

### 11AP1-3

#### Anaesthetic management for caesarean section and craniotomy at the same session in a pregnant patient with spontaneous cerebellar hematomas

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**Background:** The incidence of spontaneous cerebellar hematomas (SCHs) during late pregnancy is very low. Management of parturients with SCHs must balance maternal safety and neonatal considerations.

**Case report:** A 29-year-old Chinese woman at 36 weeks gestation suffered from rapid onset of serious headache localized to bilateral frontal area of the head after a quarrel with her husband two hours before admission, accompanied by giddiness and gait ataxia. Brain magnetic resonance imaging (MRI) scan revealed left cerebellar multiple hematomas (max 32×41mm in diameter). After a multidisciplinary consultation among anesthesiologist, obstetrician, neurosurgeon, and patient and her relatives, it was decided that Caesarean section be performed with a neonatologist on stand-by for the baby delivery under general anesthesia first, followed by craniotomy for the clearance of cerebellar hematomas afterwards. A modified rapid sequence induction with cricoid pressure was done by incremental sevoflurane inhalation and intravenous propofol 1mg/kg, and rocuronium 0.9mg/kg was used to facilitate endotracheal intubation. Anesthesia was maintained by 2~2.5% sevoflurane. After delivery, oxytocin 5 units I.V bolus and 30 units in 500 ml 0.9 % NaCl infusion were started, and mannitol infusion 0.5 mg/kg was administered. Anesthesia was maintained with sevoflurane 2% supplemented with remifentanyl 0.15 to 0.25 µg/kg/min continuous infusion, and craniotomy was performed. The cerebellar hematomas were removed, and the patient's vital signs were kept stable during operation. The postoperative course was uneventful, and the patients were discharged several days later.

**Discussion:** Spontaneous cerebellar hematomas constitute 10% of all intracranial hemorrhages, and early diagnosis and early surgical intervention is essential for a better prognosis. For the patient we present, SCHs happened in late pregnancy. Obstetrical and neuroanesthetic considerations for maternal safety and fetus may be conflicting.

We chose sevoflurane and propofol for anesthetic induction, and remifentanyl to get rapid recovery. Opioid (remifentanyl) was not used before the delivery of baby, so that the neonate did not need any interventions due to the central system depression.

**Learning points:** The key points for Caesarean section and craniotomy in late pregnant patient include rapid induction and smooth recovery, maintenance of hemodynamic stability and cerebral perfusion, and avoidance of fetal depression.



## 11AP1-4

### Anaesthetic management for the delivery of a parturient and definite management of her recurrent epistaxis

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**Background:** Life-threatening epistaxis in pregnancy is rare<sup>1</sup>, and to date there are no specific guidelines or case reports on the anaesthetic management of these patients.

**Case report:** A 37/40 parturient with a past medical history of ulcerative colitis and thalassaemia minor presented to triage with 2 day history of recurrent epistaxis.

Despite bleeding her vitals and cardiocotograph trace remained stable. Failure to cauterise the bleeding vessel resulted in her being admitted with a nasal pack. As she was stable, decision by the ENT surgeons and Obstetricians was to delay definite management until after delivery by lower segment caesarean section (LSCS) at 39/40.

Recurrent epistaxis requiring blood transfusion resulted in expedited delivery a week later. Anaesthetic concerns included the safest choice of anaesthesia and location for delivery, airway management and to ensure safest maternal and neonatal outcome. The multi-disciplinary team decision was to proceed on labour ward under general anaesthesia (GA), with a cohort of consultant specialists and theatre teams. This was to improve outcome should a neonatal emergency or a case of post-partum haemorrhage, of which there is an increased incidence in patients with epistaxis,<sup>2</sup> arise. A difficult airway trolley and tracheostomy set were also available.

Following an uneventful induction and delivery, the ENT surgeons failed to control the bleeding. The nose was packed and the patient was transferred to the intensive care unit where she was later extubated. She returned to theatre 2 days later for an uneventful removal of packs under GA.

**Discussion:** Management of the parturient at term with on-going epistaxis is challenging. The decision about the mode of delivery and the choice of anaesthesia, general versus regional, must take into consideration maintenance of cardiovascular stability and avoidance of exacerbating airway compromise following vasopressor therapy. Multi-disciplinary team involvement and careful planning is mandatory to ensure patient safety.

#### References:

1. Cornthwaite K, Varadharajan K, Oyarzabal M, Watson H. Management of prolonged epistaxis in pregnancy: case report. *J Laryngol Otol* 2013; 217:8:811-8132.
2. Dugan-Kim M, Connell S, Stika C, Wong C, Gossett D. Epistaxis of pregnancy and association with postpartum hemorrhage. *Obstet Gynecol* 2009; 114:1322-5

**Learning points:** Multidisciplinary input is required to ensure clinical effectiveness, patient experience and above all safety.

## 11AP1-5

### Combined spinal epidural anaesthesia for elective caesarean section in a patient with liver transplantation

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**Background:** Although pregnancy does not effect the grefts and survival negatively in patients with liver transplantation, these patients should be evaluated as 'risky' considering the high prevalence of obstetric complications. With the tremendous improvements in transplant surgery, coming across with this group of patients is much more frequent. Due to the hepatotoxic side effects of the anesthetic agents, the anaesthesia management needs special features. In this case report we are presenting the anaesthesia management of a patient with liver transplantation for elective caesarean section.

**Case report:** A 32 years old (Gravida 2 Para 1) woman at 37-38 weeks of gestation was evaluated for the purposes of anaesthesia before elective caesarean. Her past medical history included chronic hepatitis B virus infection, a liver transplantation by reason of fulminant hepatic failure 4 years ago, and thrombophilia. She had been receiving tacrolimus, tenofovir disoproxil fumarate, and LMWH. Physical examination of the patient was unremarkable and in her preoperative laboratory studies there was no abnormality except mild raised liver enzymes. Combined epidural-spinal anaesthesia was performed in sitting position at L4-L5 interspace. For spinal block 10 mg of hyperbaric bupivacaine combined with 20 µg fentanyl was administered intrathecally. 4 minutes after the skin incision; a female infant weighing 2,450 gr was delivered. Her Apgar scores were 9 at one minutes and 10 at five minutes. Postoperative analgesia was maintained with the administration of 2 mg morphine via epidural catheter. In postoperative follow up liver function tests were normal

and the patient was discharged from the hospital at the 3rd postoperative day with full recovery.

**Discussion:** Pregnancy is usually successful after liver transplant and women with stable liver function can usually handle it well (1), but the possibility of preeclampsia, high blood pressure, low birth weight, prematurity and preterm labor is high among these women (2).

#### References:

1. Zahra T, et al. *J Reprod Infertil*. 2009;10:225-9.
2. Casele HL et al. *Transplantation* 1998; 65:581-3.

**Learning points:** Besides the liver transplantation changes the metabolism of the anesthetics, the anesthetic agents has effects on liver. Due to this interaction, we think that it would be better to choose regional anaesthesia in pregnant women with liver transplantation if the conditions are proper.

## 11AP1-6

### Anesthetic management of a parturient with arthrogyrosis multiplex congenita (AMC) for urgent cesarean delivery

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**Background:** AMC, a rare, complex syndrome with multiple joint contractures from birth, is associated with airway, respiratory, cardiovascular and nervous anomalies. Etiology of AMC is unclear but anything that causes reduced fetal movement may lead to congenital contractures. Lumbar/thoracic lordosis and kyphosis and restricted jaw movement are of special concern in anesthetic management<sup>1</sup>. Successful management of a parturient with AMC for cesarean section (CS) under general anesthesia (GA) after failed epidural anesthesia is described.

**Case report:** 26-year-old G3P1 at 25 weeks gestation with AMC presented to triage in labor with fully dilated cervix, transverse lie and bulging membrane for urgent CS. Medical history significant for severe kyphoscoliosis, restrictive lung disease and laryngeal surgery for vocal cord dysfunction. NPO for 6 hours, 150 cm tall and weigh 30.8 kg (BMI 13), had Class I airway with small thyromental distance and stiff temporomandibular joint.



[Chest X-Ray]

Epidural catheter placed at L4-5 with difficulty and failed to achieve surgical anesthesia. CS performed while patient was breathing spontaneously using nitrous oxide/oxygen 50% and sevoflurane 1%. A live baby was delivered with Apgar scores 4/7. The patient was stable throughout the case. She was discharged home 6 days later.

**Discussion:** There are few case reports of patients with AMC with various anesthetic approaches due to a wide spectrum of clinical manifestations of AMC. Epidural anesthesia would be ideal for this patient, especially with a history of restrictive lung disease. The patient had a low risk of aspiration with BMI of 13, 25 weeks gestation, and 6 hours of fasting. Given the patient's history of vocal cord surgery and failed epidural, and the urgency of the delivery, CS was performed under GA with mask induction and maintenance. Mask GA induction in pregnancy has been previously described for difficult airway<sup>2</sup>.

#### References:

1. Rozkowski et al, *Reg Anesth*. 1996;21:5:477-9
2. Que et al, *Anesthesiology*. 1999;90:1475-6

**Learning points:** AMC is a challenging syndrome. Mask GA is a rescue alternative in urgent CS when regional technique fails, especially with an anticipated difficult airway.

**11AP1-7****A severe case of postpartum cardiomyopathy required veno-atrial extracorporeal membrane oxygenation**

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**Background:** Postpartum cardiomyopathy (PPCM) shows pathologies similar to dilated cardiomyopathy, and it happens to women with no history of heart disease. In Japan, the incidence of PPCM is one case per about 20000 deliveries, but it is quite important as a complication for perinatal period since lethal cases are included. Here, we report a case of PPCM that required veno-atrial extracorporeal membrane oxygenation.

**Case report:** A 32-year-old primigravida with no remarkable medical history was admitted to an obstetric clinic for delivery, and an elective cesarean section was performed at 39 weeks and 5 days gestation. On postpartum day 1, the patient developed productive cough and oxygen desaturation. A chest X-ray film showed pulmonary edema. Since her clinical condition was not improved by administration of oxygen and diuretic agent, she was transferred to our facility on postpartum day 3. We suspected PPCM as the cause of her acute heart failure, echocardiography was performed right after her arrival at ER. Echocardiography revealed severely decreased left ventricular (LV) function with an ejection fraction (EF) of 33%. In ICU, tracheal intubation was performed because noninvasive positive pressure ventilation did not improve her oxygenation. In spite of mechanical ventilation and administration of catecholamine, her cardiopulmonary hemodynamics had rapidly worsened. Therefore, veno-atrial extracorporeal membrane oxygenation was initiated. At this point, the LV function also worsened with EF of 25%. Since prolactin blockade therapy has been reported to improve cardiac dysfunction by PPCM, bromocriptine (5mg/day) was administered. On postpartum day 8, the mechanical cardiac assist was terminated, and extubated on postpartum day 10. One month later from the delivery the LV function was improved to the EF of 53%.

**Discussion:** Early diagnosis of PPCM may be difficult because the initial symptoms are not particular. In this case, the clinical condition got worsened very rapidly in several hours after arrival at our facility. We diagnosed PPCM by echocardiography very soon, and promptly initiated cardiopulmonary support and anti-prolactin therapy. We conclude that early diagnosis and treatment contributed to good outcome of this patient.

**Learning points:** Early diagnosis is critical to decrease maternal mortality of PPCM. Mechanical cardiopulmonary supports are required in some cases. Anti-prolactin therapy may be a therapeutic option in the treatment of PPCM.

**11AP1-8****"Eternal vigilance is the price of safety": a case of inadvertent administration of oxytocin via epidural catheter**

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**Background:** <sup>1</sup>The accidental administration of drugs not intended for epidural use through epidural catheter has major implications. We describe a case where oxytocin (Syntocinon<sup>®</sup>) was inadvertently injected epidurally to a patient in labour.

**Case report:** A 25 year old primigravida was admitted to our labour ward during her 37th week of pregnancy, complicated by moderate pre-eclampsia. Her labour was augmented with oxytocin. An epidural catheter was sited and administration of intermittent boluses of bupivacaine 0.1% with addition of fentanyl 2mcg/ml was commenced.

In view of prolonged deceleration in foetal heart rate, a decision for operative delivery was made and the oxytocin infusion was stopped and syringe disconnected. On request of pain relief by the patient in the interim, the midwife accidentally injected the full content of the syringe with 10 units' oxytocin instead of the local anaesthetic mixture.

A sudden profound drop in fetal heart rate followed and the patient was rushed to have an emergency caesarean section under a standard general anaesthetic. The patient remained stable and the baby was delivered with good Apgar scores. Post-operatively the patient was closely monitored and discharged home after 3 days. No significant neurological sequelae were found during follow-up upto 6 months

**Discussion:** Erroneous administration of non -epidural medications into epidural space has been associated with serious consequences, <sup>2</sup> mainly neurological in nature. Once the error has occurred, there is no definitive treatment. Measures intended to reduce the concentration of the drug in the epidural

space include aspiration and flushing of the catheter with saline, insertion of the second catheter for lavage and epidural injection of corticosteroids. None are of proven benefit, and could potentially lead to more harm Therefore, <sup>1</sup> the prevention of drug errors remains the best defence strategy.

**References:**

1. Hew CM, Cyna AM, Simmons SW. Avoiding inadvertent epidural injection of drugs intended for non -epidural use. *Anaesth Intensive Care* 2003;31:
2. Yentis S.M.; Randall K. Drug errors in obstetric anaesthesia: *IJOA*, October 2003, vol./ is.12/4
3. Lin D, Becker K, Shapiro HM. Neurological changes following epidural injection of potassium chloride and diazepam: *Anesthesiology* 1986;65

**Learning point:** To err is human, strict vigilance is the only way to avoid such errors and adhere to our primary duty of *Primum non nocere*.

**11AP1-9****Call Fleming in pregnant: is locoregional anaesthesia a safe option? Case report**

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**Background:** Reversible Cerebral Segmental Vasoconstriction (RCSV), known by Syndrome of Call-Fleming, is a clinical entity that consists of a reversible segmental vasoconstriction of the cerebral arteries (Willis Polygon), with low recurrence, but with several major complications, like subarachnoid hemorrhage (22%) and cerebral stroke (7%) (1). It is characterized by explosive headaches, delusion and focal neurological deficit. It can occur spontaneously or be triggered by several factors (vasoactive substances, sexual activity, pregnancy, postpartum period, pheochromocytoma, porphyria, hypercalcemia) (2).

**Case report:** A 32 years old pregnant term G1P0, proposal to elective cesarean by RCVS, diagnosed in the last month of pregnancy. An epidural technique was performed with placement of catheter in L3 / L4 for locoregional anesthesia (75 mg of Ropivacaine 0.75% + 10ug of Sufentanil). Blocking was installed in 15 minutes without hemodynamic repercussions. Intravenously Nimodipine 1-2 mg/h was given intra-operative. Post-operative: Oral nimodipine 60mg 4h/4h and epidural morphine 3 mg 12/12h. Peri-operative occur without explosive headache.

**Discussion:** Early recognition of this syndrome and its precipitating factors are of utmost importance. Supportive measures should be instituted to prevent systemic hypotension and blood loss. It should not be used sympathomimetic, immunosuppressive agents, serotonergic drugs, erythropoietin and transfusions of packed cells (2), however there is no specific literature about handling this clinical condition. Despite our analgesia protocols to the parturition labour providing a neuroaxial approach by a sequential technique, in this situation we chose to perform epidural technique that allowed hemodynamic stability throughout the entire procedure, plus the avoidance of puncture of the dura, in a patient in which it was intended to avoid triggers factors of headache.

The ideal treatment of this clinical situation is not clear yet, but according to the literature, Nimodipine 4 to 8 weeks is the best scheme (2). In refractory cases, has been described the use of intra-arterial Nimodipine (2).

**References:**

1. *Current Neurology and Neuroscience Rep.* (2012)
2. *Emergency Medicine Int* (2012)

**Learning points:** There are no specific recommendations for anesthetic management of this patients, however it seems that the success goes through a rigorous perioperative strategy, identifying risk factors and avoiding all the triggers.

**11AP1-10****Delivery in Charcot-Marie-Tooth (CMT) disease: neurological exacerbation after epidural anesthesia**

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**Background:** CMT disease is an hereditary condition with chronic peripheral neuromuscular denervation, resulting in muscle atrophy, spinal/lower limb deformities and restrictive respiratory pattern. When pre-existing neuromuscular diseases coincide with pregnancy, a big challenge presents for the anaesthesiologist due to limited literature data regarding the effect of the disease in pregnancy and delivery as well as the effect of pregnancy on the course of the disorder.

**Case report:** A 26 year old primipara with CMT was admitted after onset of labour and requested epidural analgesia. No complications during pregnancy were reported and CMT was not exacerbated. She had during childhood several orthopedic procedures under general anaesthesia (GA) without complications or exacerbations. Neurological deficits were recorded before regional anaesthesia: impairment to walk, jump, squat; distal tetraparesis; no lower limb reflexes. An epidural catheter was placed. Low concentration of ropivacaine with sufentanil was administered, obtaining excellent analgesia. Neurological examination was performed before top ups without clinical worsening. Due to stationary labour work, she was brought for C-section, receiving 9mL of ropivacaine 0,75%. She did not receive epidural infusion for post operative pain. On the 1<sup>st</sup> day she referred dysesthesia of her upper right limb. Subsequent EMG revealed alterations compatible with CMT type I.

**Discussion:** There is a potential for CMT exacerbation during pregnancy: early age onset and severity of disease. Labour and delivery process may also be linked to increased symptomatology. There are reports of uneventful GA in CMT patients. Data available regarding epidural anaesthesia is lacking. Arguments against epidural blockage are based in the experience with multiple sclerosis. The anaesthetic management of pregnant CMT patients is based on the few cases that have been reported. Until now, no significant evidence demonstrated that epidural analgesia affected CMT.

**Learning points:** Before labour the patient should have been orientated to an anesthetic consult in order to inform about the lack of data on provision of labour analgesia in CMT and the influence of epidural analgesia. As CMT is one of the most common hereditary neuromuscular diseases, recommendations and case reports should be made.

#### References:

Brock M. Anesthetic management of an obstetric patient with Charcot-Marie-Tooth disease: a case study. *AANA J.* 2009 Oct;77(5):335

## 11AP2-1

### Inadvertent hypothermia in a large obstetric unit

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**Background and Goal of Study:** NICE define hypothermia as temperature below 36°C and propose that all patients are kept comfortably warm (defined as 36.5-37.5°C) pre and post surgery [1]. Hypothermia has the potential for serious multi system effects and is relatively poorly attended to in obstetric units.

**Materials and methods:** We have audited our current practice over a two month period retrospectively using the medical notes to fill out a questionnaire. All women undergoing a procedure in the delivery suite theatres were included.

**Results and discussion:** A total of 110 women were included. There were 31(28%) elective caesarean sections (LSCS) and 79(72%) emergency procedures [48 LSCS, 21 instrumental deliveries, 7 perineal tear repairs and 3 manual removal of placenta (MROP)]. Preoperative temperature was measured in 101(92%) cases. None had temperature measured or received any form of warming intraoperatively. Average blood loss was 570ml (100-3000ml). An average 1415ml (500-3500ml) fluid was administered. 104(95%) cases had postoperative temperature measured.

Procedure	Total	Preoperatively		Postoperatively	
		Not comfortably warm (<36.5°C)	Hypothermic (<36.0°C)	Not comfortably warm (<36.5°C)	Hypothermic (<36.0°C)
Elective LSCS	31	10	0	21	6
Emergency LSCS	48	14	1	24	7
Instrumental	21	4	0	2	0
Tear/MROP	10	4	1	4	1

[Table 1]

Temperature should be measured in all elective and category 3 LSCS preoperatively. 32% of cases began below the comfortably warm cut off. Ten of these were elective cases and therefore avoidable. Two emergency cases were hypothermic preoperatively. It is inevitable that some emergency cases will be hypothermic hence intraoperative measurement and warming measures are crucial. All women received at least 500mls of fluid but no fluid warming was established. Postoperatively 51(49%) of women were not comfortably warm

and 14(13%) were hypothermic, half of these were elective cases.

**Conclusion(s):** Inadvertent hypothermia should be prevented by instituting temperature measurement and warming in all elective and most emergency cases.

#### References:

1. National Institute of Clinical Excellence. Perioperative hypothermia (inadvertent). Clinical Guideline 65. NICE 2008

## 11AP2-2

### Unidentified systemic mastocytosis complicating cesarean section

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**Background:** Mastocytosis is a rare disorder caused by the proliferation of mast cells in visceral and cutaneous tissues. It has a wide variety of manifestations, including cardiovascular collapse, due to release of vasoactive substances.<sup>1</sup> There is scarce information on systemic mastocytosis complicating pregnancy, and reports are limited to patients known to have this condition prior to the pregnancy.<sup>2</sup> We present a case of a woman with a history of anaphylactic shock due to oxytocin allergy that experienced severe cardiovascular collapse during a second cesarean even though oxytocin was avoided. Systemic mastocytosis was later diagnosed.

**Case report:** A 31-year-old woman presented at 38 weeks' gestation for emergent cesarean due to fetal suffering, under epidural anaesthesia. She had a history of anaphylactic shock in a first cesarean due to oxytocin. Surgery began uneventfully, oxytocin being avoided. After birth of the neonate she complained of throat tightness and rapidly progressed to cardiovascular collapse, needing advanced life support. Propofol and succinylcholine were administered for intubation. The patient was transferred to our intensive care unit for 2 days and had hospital discharge after 6 days. A detailed anamnesis revealed a history of hypersensitivity reactions and *urticaria pigmentosa*. Further investigation diagnosed systemic mastocytosis and propofol allergy.

**Discussion:** Labor is a time of increased maternal pain and stress which can trigger mast cell degranulation. This woman had a history of anaphylactic shock, episodes of rhinitis, contact dermatitis and *urticaria pigmentosa*. Mastocytosis could've been suspected and investigated, and the parturient handled as such. In the operating room we could have administered prophylactic H1 and H2 antihistamine therapy and corticosteroids, potentially avoiding this life-threatening situation.<sup>3</sup>

#### References:

1. *J Gynecol Obstet Biol Reprod.* 2013 Apr;42(2):117-22.  
2. *Obstet Gynecol.* 2012 Feb;119(2 Pt 2):486-9.  
3. *Am Surg.* 2009 Jan;75(1):74-80.

**Learning Points:** Mastocytosis could be suspected in the presence of symptoms associated to histamine release. Ideally these patients should be evaluated pre-operatively by the anesthesiologist and immunoallergologist to elaborate a "customized" anesthetic plan. In this case, if a more detailed anamnesis had been made after the first anaphylactic shock, we could have been more prepared to avoid this life-treating situation.

## 11AP2-3

### From ancient mummies to present-day mums: anaesthetic management of two parturients with Pott's disease

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**Background:** Spinal tuberculosis (Pott's disease) is one of the oldest described diseases of humankind. Although extremely rare in developed countries, the diagnosis should be considered in immigrant populations with low back pain.

We present a case of two pregnant patients with this disease who presented to us within the same week.

**Case report:** The first patient was admitted in labour and only then she revealed the previous history of severe back pain and diagnosis of spinal tuberculosis. It was unclear if she received any treatment or had any neurological complication. It was decided that epidural analgesia was contraindicated and intravenous analgesia was offered. When this became suboptimal patient requested an epidural again. We contacted her physician in India who confirmed that she completed a course of treatment and had no residual neurological deficits. The epidural was therefore sited and provided good pain relief throughout her labour and delivery.



The second patient was referred to the us because of a recent spinal tuberculosis with a paraspinous abscess. She had been on anti-TB therapy for over a year and had no signs of active disease. In order to assess her suitability for regional techniques MRI of her entire spine was requested. It showed some degenerative changes but no signs of an active disease. In view of these findings, it was decided that the regional analgesia is not contraindicated.

**Discussion:** Spinal tuberculosis is a destructive form of tuberculosis affecting the spine, leading to destruction and collapse of the spinal elements. Neurological deficits are common and may progress to complete para- or tetraplegia<sup>1</sup>. The effect of pregnancy on the course of tuberculosis is controversial. Regional anaesthesia for the patient with spinal lesion is not contraindicated but should be approached with caution as the potential for neurological complications is increased<sup>2</sup>.

**References:**

1. Garg RK et al. Spinal tuberculosis: A review. *J Spinal Cord Med* 2011 September;34(5):440-454.
2. Griffiths S et al. Anaesthetic implications of neurological disease in pregnancy. *Contin Educ Anaesth Crit Care Pain*(2011);11(5):157-161.

**Learning points:** A clinical suspicion of spinal tuberculosis should arise in pregnant patients presenting with chronic back pain, especially in immigrant or immunocompromised population. Regional techniques are not contraindicated but should only be considered in parturients with no evident signs of vertebral collapse or cord compression.

## 11AP2-4

### Spinal versus combined - spinal epidural with epidural volume extension in a parturient with Post Polio syndrome

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**Background:** Post polio syndrome (PPS) is new onset weakness, fatigue, atrophy and pain, which can develop in individuals affected by poliomyelitis after decades of stability. We describe two different anaesthetic techniques for a caesarean section in a patient with PPS.

**Case report:** A 34-year old lady with a history of PPS presented to preoperative assessment clinic at 38 weeks gestation prior to elective caesarean section. She had had a previous caesarean section under spinal anaesthesia using hyperbaric bupivacaine 13 mg and diamorphine 0.3 mg. Profound motor blockade persisted for 46 hours postoperatively, resulting in significant distress, anxiety, delayed recovery and difficulties in nursing the baby. She was discharged home on the fourth postoperative day following a complete recovery. In view of this, we elected to perform a low-dose combined spinal epidural (CSE) with hyperbaric bupivacaine 8.5 mg and diamorphine 0.3 mg, followed by an epidural bolus of saline 8 mL. A bilateral sensory block to cold at T4 was obtained at 15 minutes and the surgical procedure was carried out uneventfully. Complete motor recovery was observed at 21 hours post CSE, allowing mobilization and urinary catheter removal. She was discharged home on the second postoperative day.

**Discussion:** There have been no reports to date of prolonged motor blockade with spinal anaesthesia in PPS patients<sup>1</sup>. It is suggested that patients have fewer motor neurons and therefore may be more sensitive to spinal block. We have demonstrated that use of a low-dose sequential CSE with epidural volume extension (EVE) when compared with conventional spinal anaesthesia, allows faster recovery of motor blockade in a parturient with PPS and resulted in improved patient satisfaction.

**References:**

1. Neal JM, Bernards CM, Hadzic A, et al. ASRA practice advisory on neurologic complications in regional anesthesia and pain medicine. *Reg Anesth Pain Med.* 2008; 33:404-415.
2. Lambert DA, Giannouli E, Schmidt BJ. *Anesthesiology*, 2005; 103: 638-44.

**Learning Points:**

1. Individuals with PPS may have prolonged motor block following spinal anaesthesia.
2. A low-dose sequential CSE should be considered in patients with pre-existing neurological disease.

	Dose of Intrathecal Hyperbaric Bupivacaine	Time to Mobilisation	Duration Urinary Catheter Remained In Situ	Length of Hospital Stay
Spinal	13.5 mg	46 hours	48 hours	100.5 hours
CSE with EVE	8.5 mg	21 hours	22 hours	50.5 hours

[Spinal versus CSE with EVE for Caesarean Section]

## 11AP2-5

### Why does my patient have a red eye? - Horner's syndrome after lumbar epidural for labour analgesia

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**Background:** Horner's syndrome (HS) - a combination of miosis, ptosis, anhidrosis, enophthalmus and vasodilation presenting as bloodshot conjunctiva caused by a block of the upper thoracic sympathetic pathways - is a rare complication of epidural anaesthesia. The incidence is increased in labouring women compared to other patient groups.

**Case report:** A 33-year old primigravida underwent induction of labour at 40 weeks following spontaneous rupture of membranes without uterine contractions. Labour was augmented with an oxytocin infusion and an epidural inserted for analgesia. The epidural was sited at L3/4 using a loss of resistance to saline technique with the patient in the sitting position. Through a 16G Tuohy needle, a 20G catheter was advanced 4cm into the epidural space. After negative aspiration, a test dose of 10ml low dose mixture (LDM) of 0.1% bupivacaine containing fentanyl 2mcg/ml was administered. This was followed by another 10ml of LDM after 5 min. The epidural worked better on the left side with a block to sensation for cold to T4 on the left and to T6 on the right, but pain control was satisfactory. An hour later, the lady realised that her left eye was red and felt different. On neurological examination, a ptosis, miosis, enophthalmus and bloodshot conjunctiva were noticeable. No other neurological symptoms could be found. The block was still T4 to cold on the left and T6 to cold on the right. Systolic bloodpressure had dropped from initially well above 100mmHg to 85mmHg. Symptoms resembled left sided HS. The epidural catheter was drawn back to 2.5cm. Use of the epidural catheter was continued under close monitoring of the parturient. Symptoms of HS resolved over the next two hours.

**Discussion:** It remains unclear why HS is more frequent in parturients with epidural analgesia. During pregnancy the epidural space is smaller due to engorged epidural veins and epidural pressure is additionally increased during uterine contractions, possibly leading to higher blocks [1].

**References:**

1. Barbara R, Tome R, Barua A, et al. *Obstet Gynecol Surv.* 2011;66(2):114-9.

**Learning points:** It is of key importance that the obstetric anaesthetist is aware of the rare occurrence of HS after lumbar epidural analgesia. The condition is in most cases benign and correct diagnosis can prevent expensive further workup. However, HS can precede hypotension and possibly cardiac shock due to high sympathetic block. Therefore close monitoring is required.

## 11AP2-6

### Management of a parturient with hydrocephalus for caesarean section under epidural anaesthesia

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**Background:** Women with primary neurological co-morbidities are amongst high-risk obstetric patients in the community. It remains a significant cause of maternal morbidity and mortality with 36 indirect deaths attributed to central nervous system disorders in the 2006-8 CEMACE report<sup>1</sup>. There are limited case reports managed with epidural anaesthesia.

**Case report:** A 35 year-old woman with a history of hydrocephalus presented for elective caesarean section due to her primary neurological pathology and breech positioning of baby. Aqueductal stenosis secondary to viral meningitis led to a diagnosis of hydrocephalus with raised intracranial pressure (ICP) two years ago since the birth of her last child. Multiple lumbar punctures (LP) were performed to investigate the diagnosis of meningitis, each resulting in severe post-dural puncture headaches (PDPH). All were managed conservatively. Prior to conception she was managed successfully with acetazolamide 250mg BD, which upon neurological advice was discontinued upon confirmation of pregnancy. Throughout the pregnancy she had experienced minor self-terminating headaches. The caesarean was performed under epidural anaesthesia. A T4 sensory block was achieved with 140mg of Levobupivacaine, 75mcg Fentanyl and 100mcg adrenaline. The operation and anaesthesia were uneventful, resulting in the birth of a healthy baby boy, Apgar 10. In the first 48 hours post delivery, the woman was asymptomatic for any neurological complications secondary to neuroaxial blockade.

**Discussion:** After balancing the benefits and risks of all techniques, epidural anaesthesia was agreed with the patient in a bid to minimise the risk of PDPH.

Spinal Anaesthesia was avoided as her previous LPs resulted in PDPH. General anaesthesia (GA) was avoided to prevent ICP surges associated with laryngoscopy, maternal request and the airway/ fetal risks associated with obstetric GA.

#### References:

1. Centre for Maternal and Child Enquiries (CMACE). Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006-08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. *BJOG* 2011;118 (Suppl.1):1-203

**Learning points:** A multidisciplinary approach with a planned epidural placed by experienced hands in a safe manner can be used as an alternative to spinal and GA, minimizing fluctuations in ICP in patients deemed at risk of intracranial hypertension.

No conflicts of interest.

## 11AP2-7

### Urgent cesarian delivery in a woman with osteogenesis imperfecta

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**Background:** *Osteogenesis imperfecta* (OI) is a connective tissue disorder whose basic pathology is defective maturation of collagen.<sup>1</sup> There are four clinical types of OI - type 1 OI, is the most prevalent occurring at a frequency of 1:28 000 live births. It is autosomal dominant and affected individuals have brittle bones, blue sclera, dental abnormalities, hearing loss and cardiac dysfunctions. This condition poses several challenges to the anesthesiologist, namely the need for careful positioning, potential difficulties in airway, haemostasis issues, increased risk of malignant hyperthermia and respiratory problems. Difficulties in running regional anaesthesia may also be expected.

**Case report:** Female 34, pregnant (G1P0) with OI type 1 (cardiac pathology discarded), epilepsy and hypothyroidism, at 37th weeks gestation in emergency obstetric department, transferred from another hospital unit, with symptoms suggestive of preeclampsia. Genetic counseling was handled before and during pregnancy, but she missed several appointments of the obstetric surveillance plan. As a consequence of preeclampsia diagnosis, it was proposed an urgent cesarian section following a neuroaxial technique; however some precautions were taken in the case of a need for a general anaesthesia. The patient was carefully positioned and a spinal block was performed at L3-L4 interspace. A solution of local anesthetic and opioid was administered intrathecally (7.2 mg hyperbaric bupivacain and 1.3 mcg sufentanil) producing a T4 sensory level. Cesarean delivery proceeded uneventfully.

**Discussion and learning points:** Facing a pregnant women with OI in need for cesarean delivery and without clotting abnormalities, the best choice is a neuroaxial block but a backup plan for general anaesthesia must be designed if neuroaxial anaesthesia is impossible. It is obvious to conclude that these patients may potentially undergo anesthetic hazards as mentioned above.<sup>2</sup> The authors reinforce the importance of optimal management of any of these anesthetic issues by training through teaching applications (e.g. anaesthesia simulator) and refreshment courses. Since this is a rare condition there is also a need for regular briefings of case reporting. The authors also stress the importance of a multidisciplinary approach in the management of this condition in order to proper planning aiming to a better performance.

#### References:

1. *Semin Cardiothorac Vasc Anesth* 2011, 15(3): 98-102;
2. *AANA J* 2010, 78 (1): 47-53

## 11AP2-8

### Epidural nightmare: the case of a retained catheter

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**Background:** Epidural catheters are positioned and removed everyday and a review of literature shows few cases involving complications. Poor operator technique, faulty design, partial tearing, kinking, knotting and entrapment by the supraspinous and intraspinal ligaments may cause breakage of epidural catheters.<sup>1</sup> When an epidural catheter becomes entrapped, the cause and location of fixation is seldom apparent and there is no consensus about the best approach to its removal.

**Case report:** Female 37 pregnant (G4P1), presented at labor at 38th week of gestation. As she was in pain, an epidural was performed by a consultant anesthetist. A 18G tuohy needle was inserted in L3/L4 interspace and after

loss of resistance, an epidural catheter was advanced. After removing the needle, the anesthesiologist tried pulling the catheter to 10 cm mark, but it become retained at 12 cm. After different trials to draw it out, the team decided to keep it in that position. After childbirth, several attempts were tried to remove the catheter. Meanwhile, patient began to complain of pain of radicular origin during the attempts to dislodge the foreign body. Imaging X-ray, CT scan and MR scan were not useful (could not provide visualization of catheter). At this time, the anesthetic team asked for help of a neurosurgeon who tried first with local anaesthesia and then under general anaesthesia and neuromuscular block. After several fruitless efforts, it was decided to try an exploratory laminectomy. While preparing to remove the catheter, it broke, leaving a fragment of 7 cm in the right paravertebral space. No more attempts were carried out. Patient remained asymptomatic until now.

**Discussion and learning points:** The management of retained catheters should observe certain rules and conservative measures should be attempted before progressing to more invasive techniques. Surgery is indicated only if the patient becomes symptomatic. Current literature suggests that retained epidural catheter fragments are inert and generally safe to leave in place as long as there are no neurological symptoms.<sup>2</sup> Authors stress the importance of providing patient information and education regarding signs of complications. Authors also reinforce the difficulty to track retained fragments by imaging techniques. Therefore, research is required to manufacture catheters with materials improving visualization.

#### References:

1. *Br J Anaesth* 2006, 96(4): 508-9; 2. *J Clin Anesth* 2007, 19(4): 310-4

## 11AP2-9

### Epidural anaesthesia for caesarian in a multiple sclerosis patient

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**Background:** Multiple sclerosis (MS) is a chronic demyelinating disease of central nervous system (CNS), affects primarily women in third and fourth decades.<sup>(1)</sup> Historically, the use of regional anesthetic (RA) techniques in patients with preexisting CNS disorders has been considered relatively contraindicated. The fear of worsening neurologic outcome secondary to mechanical trauma, local anesthetic toxicity or neural ischemia is commonly reported.<sup>(2)</sup>

**Case report:** We report a case of 36 year old pregnant woman with MS submitted to epidural anaesthesia for elective caesarian due to fetopelvic incompatibility. She was 38 weeks pregnant, an uneventful pregnancy. Diagnosed with MS at age 32, main symptoms were visual impairment, paresis, numbness and decreased sensitivity in hands and legs. Her medication included Interferon and azathioprine, which were stopped 1 year before pregnancy. She weighed 68Kg, 1,63m tall, Malampati II, ASA II, GIII/PI. She underwent epidural anaesthesia in lateral position, G18 Tuohy needle, midline approach L4-L5 interspace, single puncture, loss of resistance to air, catheter inserted 4cm. Ropivacaine 95mg and sufentanyl 6mcg in 14ml volume were administered. During procedure, 20mg of ephedrine were given due to hypotension. No other problems were encountered. Baby was born with 3580g, Apgar 10/10. The post-operative period was uneventful. For the next 12 months she was frequently reevaluated without relapses of MS.

**Discussion:** There is few data concerning RA in MS patients due to rarity of the disease. Current literature neither confirms nor refutes the safety of neuraxial anaesthesia in patients with CNS diseases nor does it address definitively the relative safety of spinal vs epidural anaesthesia/analgesia in these patients<sup>(3)</sup>.

We report a case of an epidural anaesthesia in an MS patient submitted to caesarian without disease aggravation nor neurological complications during the following 12 months.

#### References:

1. Dorottai, I. et al. *Multiple sclerosis and anesthetic implications*. *Curr Opin Anaesthesiol*, 2002,15.
2. Hebl, J. et al. *Neuraxial Anesthesia and Analgesia in Patients with Preexisting Central Nervous System Disorders*. *AnesthAnalg* 2006;103.
3. Neal, J. et al. *ASRA Practice Advisory on Neurologic Complications in Regional Anesthesia and Pain Medicine*. *Reg Anesth Pain Med*. 2008,33.

**Learning points:** The report of a successful case using epidural in MS is a reminder that RA can be used and is not contra-indicated in this rare disease.

### 11AP2-10

#### Ultrasonic Doppler measurements and maternal cardiac output indices of morbidly obese term parturients differ from the non-obese

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**Background and Goal of Study:** There is an increasing prevalence of maternal obesity with increased risks of adverse outcomes eg. thromboembolism, preeclampsia, postpartum haemorrhage, and cardiac disease. Cardiac output (CO) and systemic vascular resistance (SVR) already undergo major changes during normal pregnancy.

This study aimed to investigate if maternal cardiovascular indices of term morbidly obese parturients differed from the non-obese, as measured using a non-invasive ultrasonic cardiac output monitor (USCOM).

**Materials and methods:** Ethics approval and patients consent was obtained. We studied 30 ASA physical status I-II morbidly obese parturients (BMI >35) and 30 non-obese (BMI < 25) with term singleton pregnancies (> 36 weeks gestation) in this prospective cohort study. The USCOM uses continuous-wave Doppler ultrasound where CO = Heart Rate (HR) X Stroke Volume (SV). SV is the product of velocity time integral (VTI) and the cross sectional area of the aortic valve. All measurements were taken with patients supine and 15 degrees left lateral tilt. The USCOM transducer was placed in the suprasternal notch to measure transaortic blood flow.

**Results and discussion:** The mean(SD) BMI of morbidly obese vs non-obese was 39.4(4.1) vs 23.1(1.5) kg m<sup>-2</sup>, p< 0.001. The morbidly obese had increased mean arterial pressures (MAP) (94.5 (12.1) vs 85.6(9.3)mmHg), ejection time percentage (49.3 (6.9) vs 43.5(6.3)%), corrected flow time (FTc) (399.3(45.8) vs 370.9(37.7) ms), systemic vascular resistance index (2558.8 (693.5) vs 1820 (390.3) d.s.cm<sup>-5</sup>) all p< 0.001, cardiac power (1.4(0.32) vs 1.24(0.3) W, p=0.04), PKR ratio (32.9 (14.9) vs 25.5(7.8), p=0.01) and bigger babies (3417.8(650.3) vs 2974.1 (574.5) grams, p< 0.01) compared to the non-obese parturients.

The morbidly obese had significantly lower stroke volume index (35.5(8.4) vs 50.9 (20.6), p< 0.001), cardiac index (3.1(0.7) vs 4.2(2.2), p=0.04), inotropy index (1.42(0.4) vs 1.99(1.2), p=0.02), but there was no difference in heart rates and oxygen delivery between the two groups.

**Conclusion(s):** Maternal CO and haemodynamics of the morbidly obese differ significantly from the non-obese. The lower CI is mainly due to a lower SVI (as HR same) despite increase in SVRI. This may reflect increased LV mass and MAP in obese pregnant ladies found previously using TTE which is technically demanding. Using USCOM, maternal cardiac function could be assessed in a simple, reproducible manner.

### 11AP3-1

#### Noninvasive and continuous trending of hemoglobin during labor and in the post-partum period

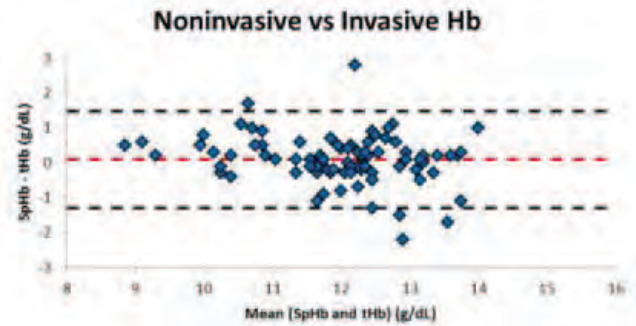
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**Background and Goal of Study:** Postpartum hemorrhage may be associated with significant change in vital signs and/or symptoms, and is usually confirmed with an invasive laboratory hemoglobin test. Intermittent spot checks for total hemoglobin determination can lead to late detection of maternal bleeding. If trending is accurate, noninvasive and continuous total hemoglobin monitoring (SpHb) may provide earlier detection of postpartum hemorrhage. We compared SpHb with values from a central laboratory device in laboring mothers.

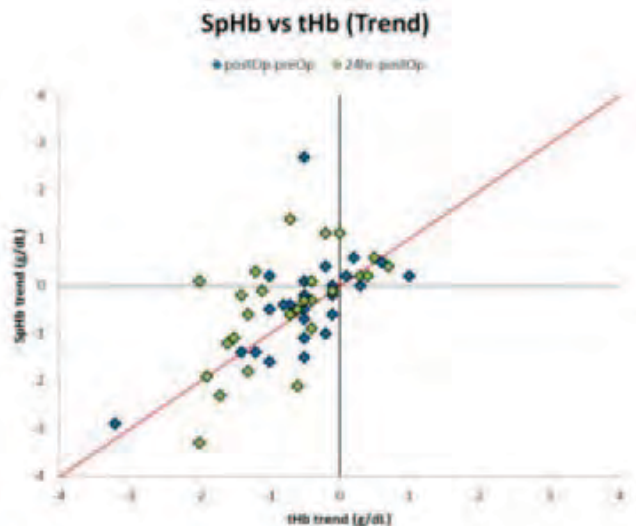
**Materials and methods:** With IRB approval and patient consent, a SpHb sensor (rainbow ReSposable R2-25 Revision K, Masimo) was placed on patient's ring finger and connected to Radical-7 (soft ver.7801). Data were collected (Automated Data Collection software, Masimo) before, after delivery, and 24 hr after delivery. At each of the 3 time periods, a venous blood sample was obtained for total hemoglobin (tHb) measurement on central laboratory device (Horiba Pentra DX120). The bias, precision, and limits of agreement (LOA) of all the differences between SpHb and tHb were calculated. Trend accuracy was determined by comparing directional changes in tHb concentrations to changes in SpHb.

**Results and discussion:** Twenty-nine patients were enrolled (tHb range 8.6 to 14.4 g/dL). A total of 83 data points were used in the analysis. For all SpHb data, SpHb demonstrated bias and precision of 1.010 ± 0.71 g/dL compared to the central laboratory device with LOA of 1.51 and -1.31 g/dL. (Fig 1) More

importantly, SpHb was able to trend changes detected by laboratory readings (Fig 2).



[Fig 1]



[Fig 2]

**Conclusion:** SpHb was able to detect changes in hemoglobin concentration during and after delivery and therefore may provide a means for the early detection of bleeding and postpartum hemorrhage.

### 11AP3-2

#### Programmed intermittent boluses: are we Improving epidural labour analgesia?

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**Background and Goal of Study:** There is evidence that programmed intermittent epidural bolus (PIEB) compared to continuous epidural infusion (CEI) leads to improved analgesia<sup>1,2</sup>. This study's objective was to compare labour outcomes between these labour analgesia techniques in all women with viable pregnancies.

**Materials and methods:** We conducted a prospective, randomized, controlled study, approved by the Clinical Research and Ethics Committee in Funchal's Hospital.

Women with viable pregnancies who requested labour analgesia and provided written informed consent were included (n=108). After epidural loading bolus, parturients were randomly assigned to three regimens: CEI with Ropivacaine 0.15% plus Sufentanil 0.2µg/mL (5mL/h, beginning immediately after the initial bolus); PIEB with the previous solution or PIEB with Ropivacaine 0.1% plus Sufentanil 0.2µg/mL (both at 10mL per hour, beginning 60 minutes after the initial bolus). Rescue bolus was administered by the same infusion pump as patient-controlled epidural analgesia (PCEA) in CEI group or anaesthetist administered in PIEB groups.

Mode of delivery, maternal satisfaction (VNS from 0 to 10), rescue boluses, volume of solution consumed/h and motor block were analysed with SPSS 19, using A-NOVA,  $\chi^2$  test and Kruskal-Wallis test.

**Results and discussion:** We analysed 73 women (CEI n=36; PIEB 0.1% n=20; PIEB 0.15% n=16). There were no statistical differences in patient characteristics between groups. Caesarean delivery rate was higher in CEI



group (16% vs. 2.7% in PIEB groups,  $P=0.002$ ). Patients in CEI group required more rescue boluses ( $P=0.00$ ), which resulted in highest volumes of solution consumed/h. The median VNS for maternal satisfaction was 10 for the CEI group; 8 for the PIEB 0,1% group and 10 for the PIEB 0,15% group ( $P=0,034$ ). The lowest maternal satisfaction in PIEB 0,1% group was possibly from slightly higher need for rescue boluses comparing to PIEB 0,15%. There was no statistic difference in other outcomes.

**Conclusion(s):** Maintenance of epidural analgesia with PIEB is associated with reduced incidence of caesarean delivery plus a lower need for rescue boluses with high maternal satisfaction. PIEB should be considered in the future of epidural labour analgesia, however there is still need for improvement to find the ideal PIEB regiment.

#### References:

1. Anesthesia and Analgesia 2013; 116(1): 133-144;
2. Curr Opin Anesthesiol 2013, 26:261 - 267.

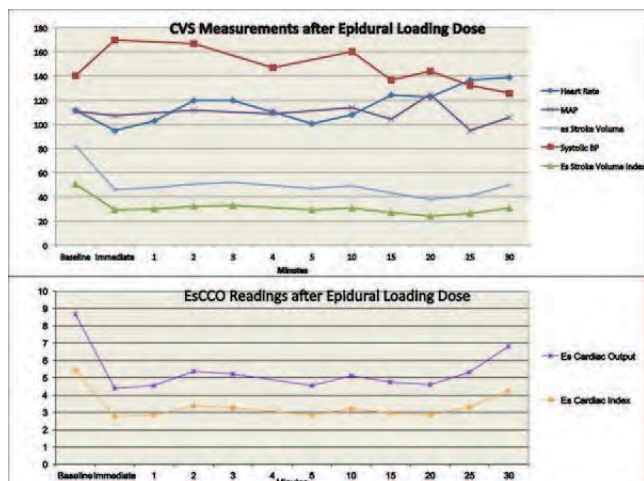
### 11AP3-3

#### The use of pulse wave transit time (PWTT) non-invasive cardiac output monitoring during labour epidural anaesthesia and subsequent fetal distress leading to emergency caesarean section

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**Background:** PWTT analysis for continuous non-invasive cardiac output (CO) measurement is a novel technique using only electrocardiogram (ECG) and plethysmograph. CO monitoring is well validated but its use in obstetrics is an area of current interest. We present a case demonstrating the use of PWTT based CO monitoring using esCCO™ (NIHON KOHDEN, Japan) during epidural labour analgesia, identifying significant changes in CO not identified by routine maternal monitoring resulting in emergency caesarean section.

**Case report:** A 24 year old low risk primiparous woman (BMI 22) with no past medical history was admitted in established spontaneous labour at 41 weeks gestation requesting epidural analgesia. After gaining consent the esCCO monitor was attached, a lumbar epidural sited (L4-5) and a 20ml loading dose (premix 0.125% Bupivacaine, 20mcg/ml Fentanyl) administered. Post loading dose there was a significant drop in the Cardiac Index and Stroke Volume Index which did not recover (see figure). The mean arterial pressure (MAP) and heart rate (HR) remained essentially unchanged. Following these changes the CTG showed a sustained fetal bradycardia that failed to resolve and an emergency caesarean section was performed uneventfully under epidural. The neonate had APGAR scores of 3 and 10 requiring supplemental oxygen for less than 3 minutes.



[CVS parameters after epidural loading dose]

**Discussion:** There is minimal data on the use of CO monitoring in the obstetric population. However, as this case demonstrates, major haemodynamic changes can occur through labour and anaesthetic interventions. The rapid drop in CO after epidural analgesia could be explained by a drop in systemic vascular resistance leading to reduced preload and a subsequent drop in CO. This in turn reduces placental oxygen delivery leading to fetal hypoxaemia. The ease of use and non-invasive nature of the esCCO make it an attractive choice for CO monitoring and we are undertaking a study to validate it in the obstetric population.

#### Learning points:

1. Major cardiovascular changes can occur in parturients after epidural analgesia.
2. Non-invasive CO monitoring is an area of interest in obstetrics and needs further validation.

### 11AP3-4

#### Lumbar paravertebral block as an alternative method of analgesia in the first stage of labor

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**Background and Goal of Study:** Lumbar paravertebral block (PVB) for labor analgesia is considered difficult to perform the technique, which does not provide a sufficient level and duration of pain relief in labor. The authors evaluated the complexity, effectiveness and safety of PVB versus epidural analgesia (EA), and their impact on the stages of labor and delivery mode.

**Materials and methods:** A prospective randomized study of nulliparous women included three groups of patients: the group of 30 patients with EA (0.15% ropivacaine + fentanyl 2 µg/ml); the PVB group of 30 patients (0.75% ropivacaine 10 ml bilaterally); the control group of 30 patients who refused to labor analgesia.

**Results and discussion:** The severity of pain at the opening of the cervix was completely alleviated from the maddening group EA (VAS 82,6 ± 1,9 mm) and PVB (VAS 83,2 ± 1,7 mm) to a small

(5,2 ± 0,9) and ( 14,5 ± 1,8), respectively. However, during the second stage the level of pain in the PVB group was higher (40,3 ± 3,1 vs 14,8 ± 1,5) ( $p=0,017$ ). Time to complete the opening of the cervix in the EA group was more than in the group PVB - 192,5 (145, 302) vs 172, 5 (112, 210) min. ( $p<0,05$ ). Under EA, the second stage of labor was greater 59,8(40,2; 81,5) min than in the control group 40,6(21,3; 55,4) min and in PVB group 30,4(10,2; 46,5) min ( $p<0,05$ ) as by increasing the time lowering the fetal head on the pelvic floor, and by increasing the bearing-down period. There were no statistically significant differences in pH, RvO<sub>2</sub>, RvCO<sub>2</sub> umbilical cord blood of newborns in the first minute of life. Compensated alkalipenia (BE) in the control group was higher -4,6 (-2,4; -7,1) than in the groups with EA-3,3 (-1,6; -5,2) and PVB - 2,5(-0,2; -4,6) ( $p = 0,029$ ). Later retrospective analysis period for 2009 - 2013 years showed 375 cases of dystocia in PVB cervix and induction of labor with oxytocin, when there was a high probability cesarean delivery that 127 (34%) completed vaginally. Complications included unintentional introduction of LA in the spinal space - 3, without dramatic consequences, of short duration back pain - 8.

**Conclusion(s):** According to our study, PVB a simple and safe method of pain relief in labor and can be used in situations with contraindications to the EA, the treatment of cervical dystocia and with limited resources.

### 11AP3-5

#### Maternal epidural pressure changes after programmed intermittent epidural bolus (PIEB) versus continuous epidural infusion (CEI)

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**Background and Goal of Study:** PIEB has been reported as being superior to CEI for labor analgesia (1). The peak pressure generated by the pump in vitro during PIEB was consistently higher than CEI (2). The aim of this study was to measure the in vivo epidural pressure (EP) changes during and after PIEB or CEI.

**Materials and methods:** IRB approval and patient consent were obtained. For the purpose of this randomized, single blind, cross over study we enrolled 43 healthy, at term, pregnant women undergoing elective cesarean section with CSE. After surgery the epidural catheter (Portex 16G), filled with saline, was connected to a pressure transducer (Edwards Lifesciences Pressure Monitor Set, Datex Ohmeda) to determine the EP before, during and after each administration.

All measurements were performed with the patient supine, before (baseline), during the epidural bolus/infusion (PIEB 10 mL in 2 min; CEI 10 mL in 1 hr) and immediately after the completion of the above. The interval of time between the end of the epidural administration and the return to the baseline values was also recorded.

Statistical analysis was performed by standard t-test for independent samples. Separate baselines were used to avoid carryover effects.

**Results:** Maternal demographics were comparable. Results are reported in the Table. Maximum and minimum peak EP were approximately 10 fold greater during PIEB bolus as compared with CEI infusion. In all cases the EP returned to the baseline values within 10 min after the end of epidural administration.

	Baseline	Pmax during bolus/infusion	Pmin during bolus/infusion
PIEB	18,32 (3,06)	311,12 (22,82)	208,66 (27,66)
CEI	18,45 (2,47)	33,28 (3,70)	22,21 (3,38)

[Epidural Pressures (mmHg). Mean (SD). P<0,0001]

**Conclusion:** It is believed that the reason for the analgesic success of intermittent boluses when compared to continuous administration may be that solutions injected into the epidural space tend to spread more uniformly when injected as a bolus, as compared to a continuous infusion. The results of our in vivo study confirm the hypothesis that the greater diffusion of the local anesthetic solution in the epidural space may be due to higher epidural pressure generated by the PIEB technique when compared with the CEI technique.

**References:**

1. Capogna G et Al. *Anesth Analg* 2011; 113:826-31.
2. Stirparo S et Al. *OJA* 2013; 3:214-17

**11AP3-6**

**Epidural pressure changes during labor and during the expulsive period**

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**Background and Goal of Study:** The abdominal pressure changes due to pregnancy are reflected in the corresponding region of the epidural space through the intervertebral foramina or indirectly by blood redistribution (1). The pre-labor epidural pressure (EP) was found to be highest when the parturient is supine, and lowest after uterine displacement and to increase gradually during the course of labor (2,3). The aim of this study was to evaluate epidural pressure changes during labor with the parturient in different positions and during the expulsive period.

**Materials and methods:** IRB approval and patient consent were obtained. In this open, observational study we enrolled 12 healthy women, at term, in active spontaneous labor. During labor the pre saline filled epidural catheter (Portex 16G) was connected to a pressure transducer (Edwards Lifesciences Pressure Monitor Set, Datex Ohmeda) to determine the EP. Measurements were performed with the patient supine, in left and right lateral decubitus, during the Valsalva manoeuvre and during the maternal expulsive efforts. Statistical analysis was performed by standard t-test for independent samples.

**Results and discussion:** Both left and right full lateral position reduced the epidural pressure (P< 0,0001) when compared to baseline values. No differences were observed between either sides. Epidural pressure increased two-fold during Valsalva manoeuvre (P< 0,0001). The typical variations in epidural pressure are shown in the Figure.

Supine	Left lateral	Right Lateral	Valsalva
20,33 (4,99)	11,58 (4,05)	12,5 (3,8)	43,09 (7,21)

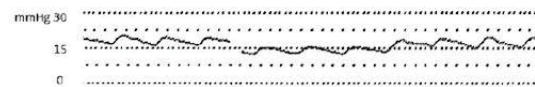
[Epidural pressure. mmHg. Mean (SD)]

Supine



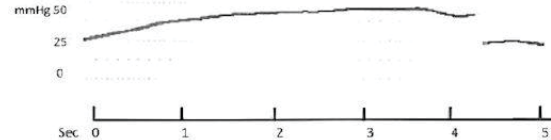
24/21

Left Lateral



17/14

Valsalva



49

[Figure]

**Conclusion:** Keeping the parturient in either the left or right lateral position may reduce epidural pressure much more than performing either side uterine displacement (2). The Valsalva manoeuvre significantly increases epidural pressure. One can speculate that these epidural changes could affect the spread and/or the diffusion of the analgesic epidural solution.

**References:**

1. Bromage PR. *Epidural Analgesia*. WB Saunders, 1978
2. Galbert M and Marx G. *Anesthesiology* 1974; 5: 499-502.
3. Messih MN. *Anaesthesia* 1981; 36: 775-82.

**11AP3-7**

**Comparison of epidural analgesia with combined spinal-epidural analgesia for advanced labour: a retrospective study of 1 year**

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**Background and Goal of Study:** Combined spinal-epidural (CSE) analgesia provides rapid-onset analgesia for labour, although the risk of maternal complications might be increased. The aim of our study was to compare the use of CSE versus epidural analgesia (EA) for advanced labour (> 5cm of dilatation) in a tertiary university hospital. (analgesic efficacy, complications related to technique and maternal satisfaction (MS)).

**Materials and methods:** After local ethics committee approval, our medical database records of all women who underwent neuraxial analgesia for labour pain in 2012 were retrospectively reviewed. Parturients with more than 5cm of dilatation were included as advanced labour (AL). CSE or EA were applied according to women preferences. Anova was employed for quantitative variables and Chi-2 for qualitative variables. A p value < 0,05 was considered significant. Odds Ratio (OR) is shown as mean (95%limits of Agreement).

**Results and discussion:** 3774 patients received neuraxial analgesia for labour pain in 2012. 673 (27,6%) were categorized as AL. 226 (34,2%) received CSE and 447 (65,8%) EA. Unilateral analgesia and need to re-site epidural catheter were higher in EA group. Complications related to technique during puncture, labour and first 24 hours follow up are shown in table 1. MS was higher in CSE than in EA women in AL. (9.1/10 vs 8.8/10 p=0,018). Caesarean section rates weren't different between groups (14.5% EA vs 12.2% CSE). Neonatal wellbeing wasn't different either.

		EA (391n)	CSE (282n)	OR (IC) P=
During puncture and labour 661(%)	None	206 (52,95%)	173 (61,5%)	0,58(0,44-0,76); p<0,0001
	Dural Tap	179 (46%)	60 (21%)	0.47 (0,32-0,69) p<0,001
	Unilateral analgesia	48 (12,45)	17 (6,2%)	0,43(0,26-0,69); p<0,0001
	Catheter resited	14 (3,5%)	1 (0,4%)	0,11(0,01-0,78); p=0,003
	Ineffective analgesia requiring catheter replacement	14 (3,5%)	1 (0,4%)	0,11(0,01-0,78); p=0,003
	Pain at delivery	10 (2,8%)	1 (0,4%)	ND
24 hours follow up	Post-puncture headache	6 (1,5%)	5 (2,2%)	ND

#### [CSE vs Epidural analgesia complications]

**Conclusions:** In our population, complications related to technique occurred less often in CSE women. CSE was associated with a higher efficacy. Dural tap incidence was higher in CSE group, but post-dural puncture headache wasn't different between groups. Nausea-vomiting, and tremor were more often associated to CSE. MS was greater with CSE.

#### References:

Miro M, et al. Int J Obstet Anesth. 2008; 17:15-9.

### 11AP3-8

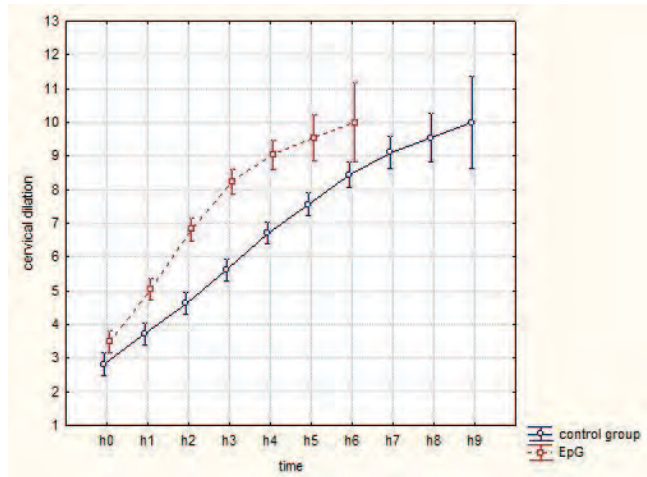
#### The impact of neuraxial analgesia on the duration of the first stage of labour in nulliparous women

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**Background and Goal of Study:** The effects of neuraxial analgesia on the duration of the first stage of labour have conflicting results. The differences are likely owing to variations in the study design, the definition of the start and end-time of the first stage. The aim of the study was to investigate the effect of neuraxial analgesia on the duration of the first stage of labour and the fetus descending in nulliparous women.

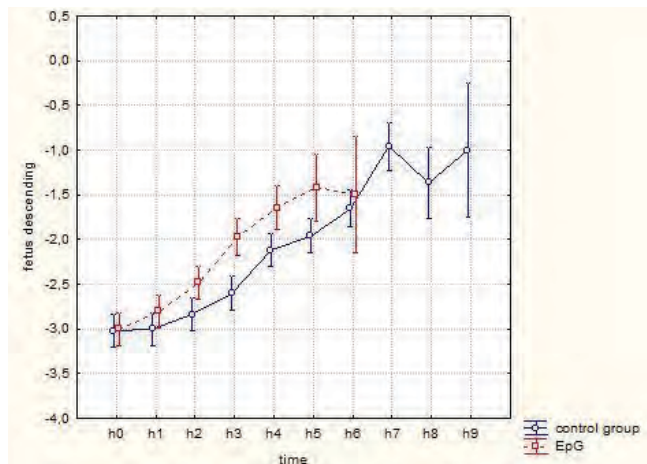
**Materials and methods:** Epidural analgesia was administered to 50 pregnant woman in the experimental group and 50 woman in the control group did not receive analgesia. Nulliparous patients were enrolled in the study, in the experimental group (EpG) the epidural catheter was inserted at L3/4 intervertebral space at Bishop score 0-1 and infusion of Fentanyl 1g/Kg and levobupivacaine 0.0625% (1 mL per 10 cm in height of the patient) was started in active labour with cervical dilatation < 2 cm. Thereafter levobupivacaine 0.0625% (15-20 mL) and Fentanyl 1 g/Kg was given through epidural catheter on demand. Then the cervical dilatation and fetal descending were recorded until complete dilatation was observed. The second stage duration, the total labor time duration, the incidence of caesarean section and instrumental vaginal delivery were also recorded.

**Results and discussion:** All parturients completed the study, the duration of first stage labor results significantly shorter in EpG when compared with control group p< 0.001.



#### [First stage time]

The fetal descending was faster in the EpG compared to control group p<0.02.



#### [Fetus descending time]

The second stage was shorter in control group (p< 0.01), no differences results in total time duration, in incidence of caesarean section and instrumental vaginal delivery.

**Conclusion(s):** Our results suggest a shorter first stage duration and faster fetus descending in labor with neuraxial analgesia with no adverse increase in maternal or neonatal outcomes.

### 11AP3-9

#### Obstetric epidural catheter placement: learning curve

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**Background and Goal of Study:** The practical learning process in anaesthesia is characterized by the rapid success after 20 attempts. The interindividual variability tends to decrease with time suggesting a continuous learning process.

Our study tries to identify and evaluate the difficulty in epidural catheter placement during anaesthesia training and afterwards (specialist level) according to the experience.

**Materials and methods:** We retrospectively collected data from the labor analgesia records of our hospital. A total of 1206 records were analyzed. The number of attempts (NA) executed by 1<sup>st</sup> and 2<sup>nd</sup> years trainees (1<sup>st</sup>/2<sup>nd</sup> Y T), 3<sup>rd</sup> and 4<sup>th</sup> year trainees (3<sup>rd</sup>/4<sup>th</sup> Y T) and specialists with less (Less 5YS) and more than 5 years (More 5YS) of practice were compared.

**Results and discussion:** BMI values were between 19.1 and 52.6, with an average of 28.7±4.3 (31% obese and 2% morbid obese).

Regarding to bone references there is a 4 point BMI difference between the patients with easy and difficult bone references (the last with an average BMI



of 31.1), and the number of attempts is increased when the bone reference is classified as difficult compared to easy references, with a significant level of 5%, the average difference is +0.323.

In overall 7.87% of patients were reported to present difficulties. And this ratio decreases as the differentiation level decreases, excluding the specialist level: 18.06% for the 1st/2<sup>nd</sup> Y T, 8.11% for 3<sup>rd</sup>/4<sup>th</sup> Y T, 2.67% Less 5Y S and 2.72% for More 5Y S.

We found a significant difference in the average of NA when the specialist belongs to the obstetric staff. That is, when the specialist that performs the technique does not belongs to the obstetric staff, it performs in average more 2.24 attempts per 10 patients ( $p < 0.01$ , T-test and Levene test).

**Conclusion(s):** Our study showed a significant learning curve in anaesthesia training with Obstetric epidural placement. The number of reported difficulties decreases dramatically as the differentiation level increases, excluding the specialist level. In the last group, there seems to be a relation with the fact of belonging to Obstetric staff and the NA, that is, when the specialist that performs the technique does not belongs to the obstetric team, performs in average more 2.24 attempts per 10 patients ( $p < 0.01$ ).

## 11AP3-10

### Obstetric analgesia for a parturient with spinal fusion

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**Background:** Neuraxial anaesthesia in obstetric patients with spinal fusion poses a unique challenge to the anaesthetist<sup>1</sup>. We present a case report suggesting the paramedian approach of the epidural space as it optimizes the efficacy of the technique in such patients.

**Case report:** We report a 32 year old female in full term gestation that presented to our hospital in labour and requested an epidural. It was then identified by the anaesthetist that she had previous thoraco-lumbar fusion surgery. X-rays or radiological examinations were not available but she was orally informed by her orthopedic surgeon that an epidural could be performed by an experienced anaesthetist. Once the advantages and complications of the technique were discussed the woman's back was inspected and palpated and an epidural puncture was performed by median approach in the L3-L4 interspace. After two unsuccessful attempts the next attempt was performed by paramedian approach and the epidural space was identified at 5.5 cm. The epidural catheter was left another 5 cm in the epidural space. Analgesia was accomplished within 20 min following a test dose of 2 ml xyl 2% and 15 ml ropivacaine 0.2% with 35 µg fentanyl in 3 intermittent bolus doses. A Patient Controlled Epidural Analgesia (PCEA) was used and delivered a total of 69 ml ropivacaine 0.15% and 70 µg fentanyl in 6 hours till labour. Adequate analgesia was provided throughout the course of labour and vaginal delivery. The patient was discharged two days after with no complications.

**Discussion:** A small percentage of parturients will present with some sort of spinal deformities or prior spinal surgery. The difficulties range from inability to identify the epidural space, multiple attempts before catheter insertion, vascular trauma and the inability of the patient to flex their spine<sup>2</sup>. The paramedian approach is associated with a lower frequency of technical problems compared to the midline approach<sup>3</sup> and might be needed in such patients.

#### References:

1. Smith PS et al. International Journal of Obstetric Anesthesia 2003;12:17-22
2. Krzysztof M, Kuczkowski KM, Arch. Gynecol Obstet 2006;274:373-375
3. Leeda M et al Eur J Anaesthesiol 2005;22:839-42.

**Learning points:** We conclude that the approach of the epidural space in parturients with previous spinal surgery could be more efficient when using the paramedian technique.

## 11AP3-11

### Effects of opioid on foetal acid-base status during epidural analgesia labour

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**Background and Goal of Study:** Labour pain evokes a neuroendocrine stress response that could have effects on the parturient and foetus. The presence of epidural analgesia reduce the deterioration in maternal or foetal acid-base balance but the use of opioids may have deleterious effect on the neonate through prolonged maternal hypotension and desaturation episodes. The aim of the study was to evaluate the effects of epidural analgesia with opioids on neonatal acid-base parameters and wellness.

**Materials and methods:** 100 parturient were enrolled to receive epidural an-

algnesia (EpG) and 100 (control) did not receive analgesia. In the EpG the epidural catheter was inserted at L3/4 intervertebral space and infusion of Fentanyl 1g/Kg and Levobupivacaine 0.0625% (1 mL per 10 cm in height of the patient) was started in active labour with cervical dilation < 2 cm. Thereafter levobupivacaine 0.0625% (15-20 mL) and Fentanyl 0.7-1g/Kg was given through epidural catheter on demand. Apgar score at 1 and 5 minutes after birth was taken and umbilical cord blood gas analysis was done immediately after birth in both groups. Other data like gestational age, birth weight, needs for resuscitation, admission to the neonatal intensive care, incidence of caesarean section, and instrumental vaginal delivery were also recorded.

**Results and discussion:** All parturient completed the study, mean Apgar score at 1 and 5 minutes, pH and Base excess were not different in both group,

	control	EpG	p value
Apgar score 1'	7.87± 0.6	7.95±0.7	0.42
Apgar score 5'	8.88±0.4	8.81±0.4	0.27
pH	7.24±0.05	7.21±0.08	0.15
BE	-6.52±2.2	-7.2±3.5	0.32

[Tab 1: Acid-base status and Apgar score]

according with Pearson coefficient there was a significant correlation between Apgar score at 1 and 5 minutes and umbilical cord pH ( $r$  0.7 and  $r$  0.69,  $p < 0.01$ ). No differences in gestational age, birth weight were found, no infant needed resuscitation, no parturient need for caesarean section. 2% in control group vs 8% in EpG needs for instrumental vaginal delivery without foetal sequels.

**Conclusion(s):** Epidural analgesia with opioids does not determine effects on acid-base status at birth and Apgar score and does not impair newborn wellness.

#### References:

- Capogna, G. and M. Camorcia, Epidural analgesia for childbirth: effects of newer techniques on neonatal outcome. Paediatr Drugs, 2004, 6(6): p. 375-86.

## 11AP4-1

### Rapid detection of obstetric hemorrhage using non-invasive hemodynamic monitoring in a patient with obesity and macrosomic fetus

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**Background:** Massive Obstetric Hemorrhage (OH) is a leading cause of maternal morbidity and mortality. Rapid detection and early treatment could improve patients' outcomes.

**Case report:** A 33-year-old woman was scheduled for Cesarean Delivery (CD). It was her sixth pregnancy (4 previous vaginal deliveries). Anesthetic preoperative risk factors included obesity (BMI 36.8) and Mallampati score III. Intraoperative monitoring included three pad electrocardiogram, pulse oximetry, continuous non-invasive blood pressure and Cardiac Output (CO), using the volume-clamp method (Nexfin®, Edwards). Combined spinal-epidural anesthesia was performed, delivering hyperbaric bupivacaine 0,5% 8 mg and fentanyl 20 mcg. Before fetal extraction, a progressive decrease in CO was observed, associated with hypotension and increased heart rate. These findings were detected before delivery, followed by a massive blood loss. OH protocol was immediately started. An arterial line was canalized, as non-invasive monitoring reliability is disputed in critical patients, and for blood sample extraction. Two packed red cells (PRC) were transfused, as well as 1500 ml of crystalloids and 1500 ml of colloids. Tranexamic acid 1g and Fibrinogen 2 g were used to prevent coagulation disorders. Oxytocin 7,6 IU and metilergothamine 0,2 mg were used for uterine atony prophylaxis. After CD, the patient was transferred hemodynamically stable to the reanimation room. Calculated estimated blood loss was 3784,78 ml. Preoperative hemoglobin (Hb) level was 12,4 g/dL, and 9,7 g/dL after intervention, with no other coagulation abnormalities. Another PRC was transfused 24 hours later. The patient was discharged 48 hours after surgery with Hb 8,3 g/dL.

**Discussion:** Obstetric patients have physiological changes to be considered, such as high CO and low vascular resistance, that can be continuously monitored non-invasively, optimizing patients' management. Fetal delivery with low CO could be interpreted as a complication. In this case, it caused alarm, although bleeding in the surgical field was not evident at that moment. OH was confirmed shortly afterwards. High reliability of intraoperative monitoring can help us to be a step forward, anticipating proper treatments.

**Learning points:**

- Optimization in patient monitoring is important to adequate an individual treatment.
- Non-invasive monitoring can be beneficial in noncritical patients.
- Monitoring parameters and patients' clinic have to be considered altogether.

**11AP4-3****Magnetic resonance imaging study of the volume of the abdominal aorta and inferior vena cava at different angles of lateral tilt in twin and singleton parturients**

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**Background:** When singleton parturients lie supine, the gravid uterus completely occludes the inferior vena cava, which is resolved in the lateral position. There is no information, however, regarding the effect of the pregnant uterus on the inferior vena cava in twin parturients, in whom the uterus is larger than that in a singleton pregnancy. The present study investigated the effect of the twin pregnant uterus on inferior vena cava compression when the parturients is in the supine and left-tilt positions.

**Methods:** Magnetic resonance images of 4 twin (34 weeks gestation) parturients and 4 singleton parturients (34 weeks gestation) were obtained for observation of the inferior vena cava in both the supine and left-lateral tilt positions (15°, 30°, and 45°) with insertion of a 1.8-m long hard V-block constructed of closed-cell polyethylene foam under the right side of the parturient's body from head to toe. Mean arterial pressure and cardiac output were also measured in each position using the thoracic bioimpedance technique.

**Results:** Aortic volume did not differ significantly between twin and singleton parturients in the supine position. On the other hand, the volume of the inferior vena cava was significantly lower in twin parturients than in singleton parturients in the supine position ( $P < 0.05$ ). Aortic volume did not change in either twin or single parturients in any of the left-lateral tilt positions. Inferior vena cava volume in both twin and single parturients was not increased at 15°, whereas the values were significantly increased in both twin and single parturients at 30° and 45° ( $P < 0.05$ ). Mean arterial pressure did not differ significantly among the parturients in any of the positions. Cardiac output was significantly lower in twin parturients than in singleton parturients in the supine position ( $P < 0.05$ ). Cardiac output did not change among the parturients in any of the left-lateral tilt positions.

**Conclusions:** These findings indicate that the compression of the inferior vena cava was greater in twin parturients than in singleton parturients in the supine position and that a left-lateral tilt position of 15° does not reduce the compression of the inferior vena cava in single or twin parturients.

**11AP4-4****Assessment of obstetric epidural analgesia information received in the third quarter of pregnancy**

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**Background and Goal of Study:** Determine the value of the information provided to pregnant women by anesthesiologists.

**Materials and methods:** During 16 consecutive months, 536 pregnant women were scheduled briefings on obstetric epidural analgesia (OEA). The information consisted on a triptych and a PowerPoint slideshow on basic concepts of OEA. After briefing, they assessed the information received by completing a questionnaire about the value of the information received. The questionnaire included demographic data (age, education level, country of birth and level of language comprehension), and five questions related to the information that was given to them: "Did you understand the information given?" (Yes(Y), No (N), Unsure (U)); "Do you feel that you have received enough information?" (Y N U); "Do you consider that the time employed for providing the information was sufficient?" (Y N U); "Have you changed your opinion about OEA after receiving the information?" (Y N U); "How do you value receiving the information in a group?" (I feel uncomfortable, I do not care, it is interesting). Then, a descriptive analysis of the studied variables was performed.

**Results:** 373 out of the 536 pregnant scheduled (71.5%) attended the meetings, and only 265 responded to the questionnaire. The average age of the patients was  $30.2 \pm 5$  years (18-44), with the following levels of education: primary 16.6%, secondary 41.9%, university 37.4%, 4.2% not responding. Country of origin: Spain 47.2%, other 52.8%. The level of understanding of

Spanish was fairly good. The 99.2% of the subjects understood the information given. The 96.2% thought they received sufficient information. The 97.7% considered the time used for the meeting adequate. The 49% of pregnant women changed their idea of OEA after the meeting. Regarding the answers about the acceptance of groups on informing meetings, 4.2% of the subjects looked uncomfortable, 38.5% did not care, and 56.2% rated it as interesting. **Discussion:** Generally, pregnant women are young and their pathology does not require an individualized anesthetic visit. This fact, along with the need to achieve greater efficiency, motivated group information sessions. The review of the data received, the time devoted to it and the understanding of the above was very satisfactory, and led to a change in the previous idea they had about OEA on 49% of them. After receiving the information, they conceive delivery as an easier process for them.

**11AP4-6****Ex utero intrapartum treatment procedure for scheduled repair of moderate-severe isolated congenital diaphragmatic hernia: our experience**

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**Background:** The ex utero intrapartum treatment (EXIT) is a procedure designed to transform a potentially fatal neonatal emergency to a controlled intervention with an improved outcome. The recent enthusiasm for the EXIT procedure needs to be balanced against maternal and foetal mortality and morbidity.

**Patients and methods:** We have reviewed the last eight cases of congenital diaphragmatic hernia (CDH) treated in our Fetal Surgery Program. Only moderate or severe CDH were included based in LHR and O/E LHR index. This protocol allow schedule definitive repair in the hours following surgery in stable hemodynamic condition.

**Results:** We have analyzed nine cases of stabilization EXIT of CDH carrier fetuses treated in our hospital during last 6 years. Data are collected on the Figure 1. All fetuses survived to the EXIT procedure and achieved were scheduled in a good hemodynamic condition. The average time of maternal support ranged from 20 to 25 minutes. The average postoperative hospital stay: 4.76 days. There has been no re-entry. These data do not differ from conventional cesarean.

**Discussion:** The EXIT procedure requires a cesarean section (CS) that specifically differs from the traditional CS in which uterine tone is maintained to minimize maternal bleeding. The keys to prevention-control obstetric haemorrhage in our cases were: no traumatic opening; cutting systems, and automatic sealing of uterine edges; uterine relaxation; avoid abrupt loss of uterine volume and an intensive maternal monitoring during EXIT. Placental times range from an average stand 20 to 25 minutes, indicating that procedures can be done quickly, no prolonging the procedure. Additionally the procedure allows gain time with optimal placental oxygenation to safely perform airway isolation in a baby at high risk of hypoxia. Absence of maternal complications and survival rate support the safety of EXIT procedure in this serious disease.

**Conclusion:** Careful balance to decide between fetal or neonatal intervention is mandatory. Anesthetic considerations for the EXIT are essential. Exit procedure for initial management of CDH is, in this scenario, a safe procedure.

Case	Side	LHR	O/E LHR	GAD	Commentaries
Case 1	Left	LHR 1.3	O/E LHR 29%	21 w	
Case 2	Left	LHR 1.2	O/E LHR 28%	29 w	Twins, Contraindicated balloon
Case 3	Hernia Morgagni	HDC			Morgagni Hernia
Case 4	Left	LHR 1.28	O/E LHR 28%	27 w	Twins, Contraindicated balloon
Case 5	Left	LHR 1.35	O/E LHR 30%	21 w	
Case 6	Left	LHR 1.24	O/E LHR 27%	35 w	
Case 7	Left	LHR 1.1	O/E LHR 28%	<30 w	
Case 8	Left	LHR 1.2	O/E LHR 28%	35 w	
Case 9	Left	LHR 1.2	O/E LHR 26%	31 w	

**[Figure 1]**

L: left LHR: prenatal lung to head ratio (LHR values, when measured at 24 to 26 weeks gestation, less than 0.85 had poor survival despite extracorporeal membrane oxygenation, ECMO, and those with values greater than 1.4 survived with few requiring ECMO) O/E: foetal observed to expected (O/E LHR in isolated diaphragmatic hernia, provides useful independent prediction of subsequent survival; the prediction is independent of the timing of assessment) (<15% extremely severe risk; 15-26 severe; 27-45% moderated; >45 mild). GAD: gestational age diagnosis. W: weeks

## 11AP4-7

### Do prepartum fibrinogen levels and thromboelastometry derived parameters correlate with hemorrhage after vaginal delivery? A prospective observational clinical pilot trial

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**Background and Goal of Study:** After vaginal delivery postpartum hemorrhage (PPH) is defined as blood loss greater than 500 ml (1). Decreased fibrinogen levels (Fbg) were reported to be associated with PPH (2), but the predictive validity of prepartum Fbg and viscoelastic parameters of coagulation for the occurrence of PPH is still unknown. Therefore, the aim of this study was to investigate the predictive value of prepartum Fbg and the maximum clot firmness (MCF- Fibtem<sup>®</sup>) for blood loss (BL) during vaginal delivery.

**Materials and methods:** 217 singleton pregnant women were prospectively enrolled at admission to the labor ward for delivery. Fbg (measured according to Clauss) and MCF-Fibtem<sup>®</sup> (thromboelastometry, TEM<sup>®</sup> Munich, Germany) were measured prepartum at admission to the labor ward (generally < 24 h before delivery). A second blood sample was drawn within 1 hour after delivery. Intrapartum BL was measured systematically by a calibrated drape under buttocks until active bleeding ceased. Statistical analysis was performed using the Mann-Whitney-U-test in a paired comparison and Spearman-Rho-Coefficient.

**Results and discussion:** There was no significant correlation ( $r_s = -0.105$ ,  $p = 0.167$  ( $n = 175$ )) between prepartum Fbg (Median 4.57 g/l) and intrapartum BL (Median 250 ml), neither was prepartum MCF Fibtem<sup>®</sup> (Median 23 mm) correlated with intrapartum BL ( $-0.105$ ,  $p = 0.169$  ( $n = 173$ )). In women with a BL > 500 ml ( $n = 18$ ) the prepartum Fbg (4.23 g/l vs. 4.58 g/l) and MCF Fibtem<sup>®</sup> (22 mm vs. 23 mm) were not different ( $p = 0.227$  for Fbg and  $p = 0.415$  for MCF Fibtem<sup>®</sup>) compared to women with a BL < 500 ml ( $n = 155$ ). The intrapartum Fbg (Median 4.22 g/l) was significantly lower in women with a BL > 500 ml ( $p = 0.021$  ( $n = 146$ )) while the intrapartum MCF Fibtem<sup>®</sup> (Median 22 mm) was not different ( $p = 0.169$  ( $n = 138$ )) between these groups.

**Conclusion(s):** This prospective clinical pilot trial does not show a correlation between prepartum Fbg and MCF Fibtem<sup>®</sup> measurements and intrapartum BL. Furthermore neither prepartum Fbg nor MCF Fibtem<sup>®</sup> were associated with the occurrence of PPH. Further prospective and sufficiently powered studies are needed to confirm our results.

#### References:

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## 11AP4-8

### History of the evolution of anesthesia for obstetrics in a European Hospital

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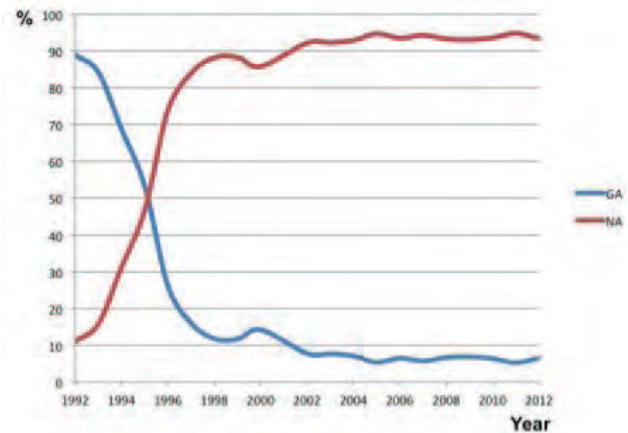
**Background and Goal of Study:** Neuraxial techniques are a safe and effective method of pain relief during labor<sup>1</sup>, as well as the method of choice of anesthesia for cesarean section.

The aim of our work was to characterize the evolution of the anesthesia for obstetrics in a department of anesthesiology at a European hospital.

**Materials and methods:** Retrospective study of the annual series of analgesia for labor and anesthesia for cesarean section in a department of anesthesiology at a European hospital since its opening in 1992 until 2012.

**Results and discussion:** The percentage of neuraxial techniques for pain relief during labor was 19.6% ( $n = 436$ ) and 64.3% ( $n = 1575$ ) in 1992 and 2012, respectively. Until now 34416 deliveries were performed under neuraxial analgesia. The analgesia with remifentanyl, initiated in 2007, recorded 13 cases in 2012.

In 1992, 88.9% cesarean sections were performed under general anesthesia (GA) ( $n = 401$ ) and 11.1% under neuraxial anesthesia (NA) ( $n = 50$ ); in 1995 the percentage of GA and NA was similar and, since then, the NA has increased significantly, accounting for 93.4% in 2012 ( $n = 608$ ) (graph 1). The combined spinal-epidural technique, introduced in 1994, was the main method of anesthesia for cesarean section.



[Graph 1-Anesthesia for cesarean section]

**Conclusions:** The anesthesia for obstetrics has changed in the last 20 years. The increased percentage of analgesia for labor reflects an improvement in the quality of health care provided to pregnant woman. The increased neuraxial anesthesia for cesarean section, as has happened in other countries<sup>2</sup>, has also proven to have several advantages<sup>3</sup>.

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## 11AP4-9

### Management of fetal pain during invasive fetal procedures. Lessons learned from a sentinel event

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**Background:** During fetal open surgery, the fetal anesthesia is of significant importance despite placental transfer of anesthetic agents. Evidence regarding the capacity for fetus to feel pain is limited but indicates that fetal perception of pain is unlikely before the third trimester. Little or no evidence addresses the effectiveness of direct fetal anesthetic or analgesic techniques[1].

**Cases report serie:** In recent years, our group has developed an extremely rigid protocol[2] in the management of myelomeningocele (MM) patients operated by open fetal surgery with excellent results of surgical reconstruction and fetal tolerance to the procedure. In the case to which we refer, at 4 minutes of exposure it is evident fetal bradycardia with transplacental flow maintenance. The evaluation procedure was initiated, discarding cord compressions, massive loss of amniotic fluid and maternal general alterations, identifying the transgression of the protocol. Once untethering spinal reconstruction and made you opt for guided closure biomaterials and the procedure is completed in 9 minutes. The postoperative period was uneventful, bradycardia disappeared after cessation of surgical stimulus with satisfactory long-term evolution. Data from the last five cases treated in our center are shown in Figure 1.

Case	Gest Age	Fetal Anaest	Maternal Anaest	Scheduled procedure?	Neurosurgical Repair Time	Optimal Postop Results?
1	29	Yes	Sevoflurane + Remifentanyl	Yes	27	SI
2	27	Yes	Sevoflurane + Remifentanyl	Yes	23	SI
3	26	Yes	Sevoflurane + Remifentanyl	Yes	29	SI
4	27	Yes	Sevoflurane + Remifentanyl	Yes	32	SI
5	26	No	Sevoflurane + Remifentanyl	No	9	SI

[Figure 1]



**Discussion:** Adherence to rigid protocols is essential in the development of these complex and multidisciplinary interventions.

**Learning points:** The administration of anesthesia directly to the fetus is critical in open fetal surgery procedures. Fetal pain response with bradycardia should make us consider that the fetus is not adequately anesthetized.

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## 11AP4-10

### Obstetric high dependency unit admission: a four year retrospective study

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**Background and Goal of Study:** The need for critical care in the obstetric patient is infrequent, with a reported incidence of admission to a high dependency unit(HDU) ranging between 0,17 and 2,6 per 1000 deliveries.<sup>1</sup> Difficulties in recognizing critical illness and delay or reluctance in admitting obstetric patients to HDU's results in high morbidity and mortality.<sup>2</sup>

Our aim was to report the pattern of HDU patient admission from a tertiary maternity.

**Materials and methods:** Retrospective study conducted at the Obstetrics Department from a Central University Hospital. Clinical reports of women admitted in HDU between 1<sup>st</sup> January 2010 and 30<sup>th</sup> November 2013, were reviewed. Data included: demographic data, pre-existing medical conditions, indications for admission, length of stay, monitoring employed, main interventions and outcome. Statistical analysis was performed with SPSS20.0®

**Results and discussion:** Of the 10737 deliveries during the last 4 years, 32 women were admitted to a HDU, an admission rate of 2,98/1000 deliveries. Mean age was 30,7 (±6,52; 17-42) years. There was 1 abortion, 22(69%) pre-term, and 9(28%) term deliveries. 50% of the women were previously healthy, 19% and 16% had cardiac complex and hematologic disorders, respectively. The most common indication was pregnancy related hypertension(53%, n=17), followed by maternal pre-existing disease(28%, n=9) and postpartum hemorrhage(22%, n=7). There were only 2 anesthesia related admissions: an aspiration pneumonitis and an anchored catheter needing spinal surgery. There was 1 sepsis by *clostridium sordelli*, and 1 acute liver failure, demanding liver transplantation after caesarean. Most women only required a short stay in an HDU: 6(28%) patients stayed for less than 24h and 8(31%) stayed for more than 48h.

Mechanical ventilation was needed in 4(12,5%), inotropic support in 3(9%) and 17(53%) needed invasive monitoring. During this period, 3(9%) women died, giving an overall incidence of 0,28/1000deliveries (immediate and late deaths).

**Conclusion(s):** Some pregnant women develop life-threatening complications that require HDU care. We found an high ratio comparing to the literature. Management of critically ill pregnant and puerperal women is complex, requiring close cooperation of obstetrician and anesthetist. Early improved strategies for management heamorrhage and hypertension may significantly reduce maternal morbidity.

**References:**

1. *Anaesthesia*(2008)63:1081-86;
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## 11AP4-11

### Interdisciplinary training for obstetrics emergencies - high fidelity simulation

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**Background and Goal of Study:** Obstetrics emergencies, though rare, are potentially devastating situations, requiring an immediate and coordinating interdisciplinary action. The availability of medical simulation in obstetric emergencies has provided a way to obstetricians, anesthesiologists and nurses train their skills and ability to work as a team.

The aim of our study was to assess the impact of the course in self perceived improvement in obstetric emergencies management and to evaluate satisfaction degree of the participants enrolled.

**Materials and methods:** An analysis of pre and post-course questionnaire, filled anonymously by the participants of obstetrics emergencies course, held in the last two years. We inquired about self-assessment capabilities, CRM topics and participants expectations. Statistical analysis with SPSS 20.0®(Kolmonorov-Smirnov, Wilcoxon and t student tests).

**Results and discussion:** Total of 54 participants (4 anesthesiologists, 16 anesthesiology residents; 3 obstetricians, 22 obstetric residents; 9 nurses). Overall in a 1 to 10 scale, there were statistical differences (paired samples *t* test) between pre and post-test in experience (3,7 vs 5,1;  $p=0,000$ ) and knowledge (4,9 vs 6;  $p=0,000$ ) in obstetric critical event. In a 5 items Likert scale the participants consider that the health care's education should focus non-technical skills (pre and post-course with a mean of 3,7 and 4,2, respectively). In cognitive aids, the mean pre and post-course was 1,7 and 2,1. The Wilcoxon test showed statistical differences in both situations ( $p=0,01$  and  $p=0,043$ ).

For the trainees, the course was above and according expectations, 52% and 44%, respectively. In 1 to 10 mean global satisfaction was 8,75 (±0,8; 7-10). All the participants felt comfortable with the debriefings.

98% of the participants agreed that they will change their clinical practice according to what they learned (81% totally agreed and 17% partially agreed).

**Conclusion:** Our study demonstrates a self-confidence improvement in the parameters of knowledge and experience dealing with obstetric critical event. The classical methodology of teaching and learning has been proved to be insufficient for modern medicine and current expectations. We believe that interdisciplinary high fidelity simulation can improve team actions in a real obstetric emergency

These results are very encouraging and inspire us to proceed with our program of team training in obstetric emergencies.

## 11AP5-1

### Heart rate, but not heart rate variability or pulse oximetry parameters of perfusion, predicts hypotension during spinal anesthesia for a cesarean section: a prospective observational study

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**Background and Goal of Study:** Spinal anesthesia for cesarean section induces hypotension which may exert severe adverse effects. Baseline peripheral vasomotor tone, volume status, and sympathetic activity are known to affect the degree of hypotension. Therefore, we hypothesized that the perfusion index (PI), pleth variability index (PVI), heart rate (HR), and parameters of heart rate variability (HRV) may predict hypotension.

The goal of our study was to determine whether hypotension after spinal anesthesia could be predicted by such measures as PI, PVI, HR, ratio of low frequency (LF) and high frequency (HF) (LF/HF) of HRV, and entropy of HRV.

**Methods:** PI, PVI, HR, LF/HF, and entropy were measured in women after 37 weeks of pregnancy undergoing elective cesarean section. These parameters were measured before induction of spinal anesthesia for 5 min. Epidural catheter was placed at the T12/L1 interspace, and spinal anesthesia was induced at the L3/4 or L4/5 interspace with 0.5% hyperbaric bupivacaine (10mg) and fentanyl (10mcg). Hypotension was defined as the systolic blood pressure below 80 mmHg, and was treated immediately with ephedrine 8mg. The predictive value of these parameters for detecting hypotension was assessed using logistic regression with Akaike's information criterion stepwise method. The predictive ability of the final model was examined by generating the receiver operating characteristic (ROC) curve. And the gray zone approach was used to minimize the risks of misclassification by showing the range of values where a prediction of hypotension was inconclusive. The gray zone was determined as the range between the points where sensitivity and specificity became 90% each (diagnostic tolerance of 10%).

**Results:** We enrolled 81 patients. Hypotension occurred in 51 of 81 patients (63%). Baseline HR was significantly higher in patients who developed hypotension ( $P=0,006$ ). The logistic regression revealed only HR as an independent factor to predict hypotension (odds ratio, 1.06; 95% confidence interval [CI], 1.01-1.13;  $P= 0,032$ ). Area under the ROC curve of HR was 0,686 (95%CI, 0,558-0,803). A gray zone of HR was shown within 71 to 89, and the numbers of parturients in the gray zone were 49 (60.5%).

**Conclusion:** Our results showed that the PI, PVI, and HRV did not predict hypotension, while preanesthetic HR of less than 71 bpm and more than 89 bpm was a prognostic factor for hypotension after spinal anesthesia in healthy women undergoing a cesarean section.

## 11AP5-2

### Size and number of uterine leiomyoma are significant risk factors for massive intraoperative haemorrhage in caesarean section

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**Background and Goal of Study:** Peripartum haemorrhage is one of the major causes of maternal mortality and morbidity. Although a study has shown that a presence of uterine leiomyoma increase the risk of massive haemorrhage in caesarean section, the criteria of uterine leiomyoma resulting the risk had been unclear. The goal of the study is to clarify the risk factors of leiomyoma resulting in the risk of massive bleeding during the surgery.

**Materials and methods:** After obtaining institutional review board approval, we collected the following data retrospectively from the patients with leiomyoma assessed using magnetic resonance image (MRI) who underwent caesarean section: maternal age, weight, height, and body mass index at delivery; gestational week; parity; neonatal weight; volume of uterine leiomyoma calculated using the equation of  $4\pi \times a \times b \times c / 3$  where a, b, and c are the length of three major axes of the leiomyoma in the MRI; number of the leiomyomas in the MRI; volume of intraoperative haemorrhage including amniotic fluid. Multivariate logistic regression analysis was applied to determine the significant risk factors of massive intraoperative haemorrhage. The criteria of massive haemorrhage was defined as 1000 (g) divided by the average maternal body weight of the present study. Possible dichotomous explanatory variables (predictors) included nullipara or multipara, maternal weight  $\geq 70$  or  $< 70$  kg, maximum volume of leiomyoma among all leiomyoma in each woman  $\geq x$  or  $< x$  cm<sup>3</sup> where x was determined using the cut-off value of the receiver operating characteristic (ROC) curves for the criteria of massive bleeding volume versus the maximum volume of leiomyoma, number of leiomyoma  $\geq z$  or  $< z$  where z is 2 or 3.

**Results and discussion:** Thirty eight pregnant women ( $35 \pm 4$  yr,  $63 \pm 8$  kg, 23 nullipara) with leiomyoma assessed using MRI examinations were obtained for the analysis. The ROC analysis with the criteria of massive bleeding volume, 16 g/kg, determined 175 cm<sup>3</sup> as the cut-off value of criteria. The multivariate logistic regression analysis finally determined volume of maximum leiomyoma  $\geq 175$  cm<sup>3</sup> (likelihood chi-square = 17.9,  $p < 0.001$ ) and number of leiomyoma  $\geq 3$  (likelihood chi-square = 6.0,  $p = 0.014$ ) as significant predictors for intraoperative haemorrhage.

**Conclusion:** Leiomyoma  $\geq 175$  cm<sup>3</sup> and number of leiomyoma  $\geq 3$  in women undergoing caesarean section found to be risk factors for massive intraoperative haemorrhage  $\geq 16$  g/kg maternal body weight.

## 11AP5-3

### Oxygen desaturation after cesarean section. Is sleep disordered breathing the culprit?

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**Background and Goal of Study:** Hypoxic events are often observed after surgery and anesthesia. However, postoperative SpO<sub>2</sub> is not usually monitored in cesarean patients. There has been only one study that focused on oxygen saturation after cesarean section. Abouleish et al. reported in 1991 that the incidence of desaturation (SpO<sub>2</sub> < 85%) after administration of 0.2 mg intrathecal morphine for postcesarean analgesia was 8/856 (0.9%) and that 8 women were all obese<sup>1</sup>. Recently, there is increasing concern for undiagnosed sleep disordered breathing in general population and its synergic effects on postoperative hypoxia. We therefore investigated the incidence of postoperative hypoxia and sleep disordered breathing in women who underwent cesarean section.

**Materials and methods:** Our study was approved by the IRB. Subjects were women who underwent cesarean section under spinal anesthesia with bupivacaine, fentanyl and 0.15 mg morphine, from Oct 2012 to Nov 2013. Transversus abdominis plane block was administered at the end of surgery to patients who desired it. When a patient complained of pain postoperatively, she was given NSAIDs and/or 15 mg intramuscular pentazocine. SpO<sub>2</sub> was monitored

continuously for 24 hours after introduction of spinal anesthesia. The data was recorded every 1 second and stored in the pulse oximeter for off line analysis. A desaturation episode was defined as SpO<sub>2</sub> < 90% lasting for more than 30 seconds. The Berlin Questionnaire (BQ) was completed before cesarean section.

**Results and discussion:** 213 women were included for the data analysis. 19 out of 213 (8.9%) patients had one or more desaturation episodes. The incidence is higher than that in the previous report<sup>1</sup>. The ratio of women with a positive BQ was 18%. Out of 19 women with desaturation episode(s), 7 were positive for BQ. There was a significant correlation between desaturation episode(s) and BQ-positive ( $p=0.04$ , odd ratio: 2.85), but a positive BQ did not explain all desaturation episodes. Possible related factors of hypoxia include preeclampsia, tocolytic agents and intrathecal morphine.

**Conclusion(s):** The incidence of postoperative desaturation episodes(s) after cesarean section was 9%. The ratio of a positive BQ was 18%. Sleep disordered breathing significantly increased the incidence of postoperative desaturation. Further studies are needed to identify other causes of postoperative hypoxia after cesarean section.

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## 11AP5-4

### Effect of rapid sequence induction for caesarean section in general anaesthesia with rocuronium versus succinylcholine on neonatal outcome: prospective randomised interventional multicenter trial

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**Background and Goal of Study:** Rocuronium for Rapid Sequence Induction (RSI) for Caesarean Section (CS) in General Anaesthesia (GA) can be an alternative to succinylcholine as neuromuscular-blocking agent. The aim of this study was to examine whether there are any differences in neonatal outcome when comparing the above mentioned relaxants.

**Materials and methods:** With Ethical Committee approval we enrolled 237 parturients who underwent CS in GA in the period 12/2012-11/2013. RSI for GA was performed with propofol 2 mg kg<sup>-1</sup> and rocuronium 1 mg kg<sup>-1</sup> in ROC group or succinylcholine 1 mg kg<sup>-1</sup> in SUC group after stratified randomization. Until umbilical cord was clamped, we used up to 50% concentration of nitrous oxide and sevoflurane up to 1 MAC for anaesthesia maintenance. We recorded maternal and newborn characteristics data, neonatal outcome parameters (pH, pCO<sub>2</sub>, pO<sub>2</sub> and BE in arterial umbilical blood, APGAR score) and transparency of amniotic fluid. Both groups were reported descriptively (mean, median, standard deviation); all differences were tested using Mann-Whitney test at the 5% significance level (SPSS 21).

**Results and discussion:** During the study period we enrolled 117 parturients and 128 newborns into ROC group and 120 parturients and 127 newborns into SUC group. We didn't reported statistically significant differences in monitored parameters between both groups, except the lower weight of the newborns (ROC 2852, 2990,  $\pm 828.9$  g; SUC 3082, 3125,  $\pm 740.8$  g,  $p = 0.049$ ) what can explain significantly lower APGAR score in 1<sup>st</sup> (ROC 7.8, 9,  $\pm 2.5$ ; SUC 8.5, 9,  $\pm 1.7$ ;  $p = 0.049$ ), 5<sup>th</sup> (ROC 8.6, 9,  $\pm 1.8$ ; SUC 9.2, 10,  $\pm 1.3$ ;  $p = 0.012$ ) and 10<sup>th</sup> minute (ROC 9.1, 10,  $\pm 1.5$ ; SUC 9.6, 10,  $\pm 1.1$ ;  $p = 0.004$ ) in ROC group which is however not clinically significant APGAR in 10<sup>th</sup> minute 7 and more (ROC 94.5%; SUC 99.2%;  $p = 0.066$ ). We neither recorded any significant difference in values of pH (ROC 7.3, 7.3,  $\pm 0.1$ ; SUC 7.3, 7.3,  $\pm 0.1$ ;  $p = 0.428$ ), pCO<sub>2</sub> (ROC 6.9, 6.9,  $\pm 1.1$ ; SUC 6.7, 6.8,  $\pm 1.0$ ;  $p = 0.077$ ), pO<sub>2</sub> (ROC 4.0, 3.5,  $\pm 2.5$ ; SUC 3.8, 3.4,  $\pm 2.1$ ;  $p = 0.803$ ) and BE (ROC -3.4, -3.0,  $\pm 3.3$ ; SUC -3.7, -3.4,  $\pm 2.7$ ;  $p = 0.505$ ).

**Conclusion:** We conclude no clinical difference between both groups. This is supported with no difference and good clinical values in acid base balance of arterial umbilical blood.

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**11AP5-5****Prevention of maternal hypotension during elective caesarean section under spinal anaesthesia with an intermittent pneumatic compression system in lower extremities: preliminary study**

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**Background and Goal of Study:** Hypotension after regional anaesthesia for caesarean section (CS) remains a common clinical problem. The aim of this study was to evaluate the effectiveness of intermittent pneumatic compression system (IPCS) in lower extremities for preventing maternal hypotension after spinal anaesthesia (SA).

**Materials and methods:** During 3 months patients scheduled for elective CS were randomised to have an IPCS on their legs before SA (G2) or not (G1: control). Exclusion criteria: age < 18 ys, non-elective CS, BMI > 40, gravidity hypertension, high-risk patients, sepsis, insulin-dependent diabetes mellitus, spinal block level > T5, ongoing epidural anaesthesia and multiple gravidities. Crystalloid cohydration with 500 ml saline solution IV was given. SA was performed with a 25G needle in the interspace L2/L3 in left side decubitus with hyperbaric bupivacaine 0.5% adjusted to height. Hypotension was defined as 30% decrease from initial systolic arterial pressure (SAP) or SAP lower than 90 mmHg. A prophylactic variable rate regimen of phenylephrine (P) infusion was titrated and rescue boluses were administered for maintenance of SAP using algorithms. Predelivery we recorded: demographics, oxygen saturation (SpO<sub>2</sub>), heart rate and basal blood pressure values and post-SA (systolic, mean and diastolic arterial pressure) every 2 min, umbilical cord blood gas values (UCBGV), APGAR scores after 1 min/5 min, P total doses, P boluses needed and final haemoglobin values. Data are presented as percentages, mean values ± standard deviation.

**Results:** A total of 26 patients were included (G1: 16, G2:10). Demographics, heart rates, UCBGV, APGAR scores, neonatal outcomes and haemoglobin values were not different among groups. Total phenylephrine consumption was  $0.451 \pm 1.77 \mu\text{g}/\text{kg}/\text{min}$  in G1 and  $0.370 \pm 0.10 \mu\text{g}/\text{kg}/\text{min}$  in G2 ( $p=0.241$ ). 43.8% of the patients in G1 needed P rescue boluses versus 40% in G2 ( $p=0.588$ ). The mean arterial pressure after SA was  $85.8 \pm 13.89 \text{ mmHg}$  in G1 versus  $90.6 \pm 13.64 \text{ mmHg}$  in G2 ( $p=0.404$ ). IPCS was well tolerated.

**Conclusion(s):** An intermittent pneumatic compression system on legs is an easy, noninvasive and nonpharmacological effective prophylactic method for preventing maternal hypotension after spinal anaesthesia for elective caesarean section. Our preliminary results point out a trend towards a reduction of vasoconstrictor requirements without side-effects. A bigger sample size will probably show a statistical significance among groups.

**11AP5-6****Beside ultrasound fluid volume assessment in the recovery room after gynecological and obstetric invasive procedures - prospective study**

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**Background and Goal of Study:** Sonography has become one of the most versatile modalities for diagnosing and supporting treatment of critically ill patients, it is also beneficial in assessing fluid volume in every patient. Until now multiple methods of evaluating patients' hydration status have been encountered in clinical use - all of them having their own limitations. Ultrasound evaluation of IVC/BSA diameter, IVC collapsibility and new parameter IVC/Ao index is an easy and fully non-invasive method, which gives prompt information about patient's hydration status. The aim of my study was to determine that this method is useful not only in pediatric population, but also in the gynecologic and obstetric patients in the recovery room.

**Materials and methods:** Sixty three ASA 1-3, age 27-74 gynecological and obstetric patients were involved in the study. The measurements were carried out up to 6 hours after the surgery (3 of them after 24 hours). The examination consisted of lungs ultrasound and calculations of: IVC/BSA diameter, IVC collapsibility and IVC/Ao index. The IVC diameter was recorded 1-2 cm before the right atrium, IVC collapsibility was measured after a maximum exhalation (in cooperating patients) and Ao diameter was taken 5 -10 mm above the

celiac trunk. The reference for IVC/Ao index was adopted as  $1,2 \pm 2\text{SD}$  and for IVC/BSA diameter as  $8 - 11,5 \text{ mm}/\text{m}^2$ . All ultrasound examinations were taken with Philips Sparq.

**Results and discussion:** 6% of all patients in the recovery room reached IVC/Ao index > 1,5, with the highest IVC/BSA diameter  $13,6 \text{ mm}/\text{m}^2$  (one interstitial pulmonary oedema was found in this group of patients). In 30% of patients IVC/Ao index was < 1. 5 patients had IVC/Ao index less than 0,5 with IVC collapsibility of 100% and IVC/BSA diameter less than  $7 \text{ mm}/\text{m}^2$  (three of them after surgical bleeding while waiting for blood transfusion, one assessed 24 hours after surgery and one with advanced cancer). In 4 cases interstitial oedema was reported (B3 pattern in both lungs), what was associated with decreased SpO<sub>2</sub> 92-95%.

**Conclusion(s):** Sonographic fluid status assessment suggest to play an important role in diagnosing patients with dehydration and fluid overload in the recovery room, what can be supportive in postoperative fluid therapy. IVC/Ao index is the most convenient parameter, which is not limited by BSA counting. Fluid overload isn't the only cause of interstitial pulmonary oedema in postsurgical patients.

**11AP5-7****A randomised trial of the analgesic efficacy of wound infiltration with tramadol after caesarean section under general anaesthesia**

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**Background and Goal of Study:** Local anesthetic injection into the wound is a simple way to enhance postoperative analgesia and to the decreased opioid consumption. The limitation of the efficacy of local anesthetic infiltration is the potential of systemic toxicity. The aim of the present study was to investigate whether tramadol wound infiltration decreases postoperative pain and analgesic need following caesarean section (CS) under general anaesthesia.

**Materials and methods:** Following the Ethics Committee approval, 60 ASA I-II term parturients undergoing CS were enrolled. Parturients with pre-eclampsia, cardiovascular problems, chronic preoperative pain, allergy to any of the study medications, or regular analgesic use were excluded. Participants were randomised to two groups: placebo group (group P; n=30) received 20 ml of local wound infiltration with 0.9% saline; and tramadol group (group T; n=30) 20 ml local wound infiltration with tramadol  $2 \text{ mgml}^{-1}$  within saline. Blood tramadol levels were assessed just before and 1 h after tramadol infiltration. Anaesthesia was standardized in all patients. After the closure of the uterine incision and rectus fascia, previously prepared solution was infiltrated subcutaneously. Postoperative analgesia was provided with iv morphine patient-controlled analgesia (PCA) (1 mg bolus, lock-out time: 10 min). 1 g of paracetamol was administered intravenously every 6 hours. If NRS was  $\geq 3$  patients were treated with incremental iv morphine doses up to  $0.05 \text{ mg kg}^{-1}$ . The primary outcome measure in this study was postoperative pain. Secondary outcome was cumulative morphine consumption. A previous study showed that morphine consumption after CS is  $38 \pm 14 \text{ mg}$ . To detect a 30% decrease in postoperative morphine consumption total 60 patients was required ( $\alpha=0.05$  and power 80%),  $p < 0.05$  was considered statistically significant.

**Results and discussion:** Demographic data were similar among the groups. NRS values were lower in group T than group P only at 15 mins after the operation ( $p < 0.05$ ). Patients in group T consumed significantly less morphine compared to group P at all measurement times. There was no difference among groups regarding the need for rescue analgesic and side effects.

**Conclusion(s):** Wound infiltration with tramadol reduced postoperative morphine consumption after CS compared to placebo.



**11AP5-8****Quality of anaesthesia for caesarean sections at Muhimbili National Hospital, Dar es Salaam, Tanzania**

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**Background:** Maternal mortality in Tanzania is high. Estimates vary between 620 and 1300 per 100,000 live births. The Muhimbili Karolinska Anaesthesia & Intensive Care Collaboration (MKaIC) was started in 2008. It aims to improve the care given to patients in Muhimbili and to develop cross-cultural understanding and partnership. Training courses, staff exchanges, longer clinical placements and equipment supply are all planned within the collaboration.

The quality of obstetric anaesthesia in Tanzania is unknown. Approximately 800 children are delivered and 400 caesarean sections are performed each month at Muhimbili. Ten of these mothers die in the hospitals each month and newborn mortality is close to 10%. The department of anaesthesia at Muhimbili is severely over-stretched, with only six specialist doctors.

This study aims to audit the current state of the quality of anaesthesia for caesarean section, to provide a needs-assessment and be a background for further work looking at how care can be improved in appropriate ways.

**Materials and methods:** The study is an observational audit looking at the quality of anaesthesia for caesarean section using a newly developed assessment instrument. 50 caesarean sections were observed in Nov 2011. Two researchers (JE/EL) from Karolinska collected observational and outcome data.

**Results and discussion:** The median age was 28.5 years. Essential drugs and equipment were present in most cases.

Airway were almost never evaluated. Spread of spinal were evaluated in about 30% of the cases. All patients had an i.v. line, and pulse oximeter. Wedge pillows were not used. Anaesthetic chart was always filled in. Anaesthetic personnel were not always present in the theatres during the entire operation.

The babies mean APGAR were 8.54. Seven required ventilation. Four babies were stillborn. All mothers were alive two days post surgery, two of those were treated at the ICU.

**Conclusion(s):** We strongly believe that there is a potential to improve the standards of obstetric anaesthesia with a structured approach to anaesthetic routines and education for the anaesthetic staff. MKaIC is planning several quality improvement interventions and will assess their success with follow-up audits. With our personal experiences, the results from our audit and with help from the personnel at Muhimbili, we designed a basic anaesthetic checklist to be used when performing caesarean sections. This checklist has recently been implemented at Muhimbili.

**11AP5-9****A randomized, controlled, double blind trial on the incidence of nausea and vomiting with prophylactic subhypnotic propofol vs metoclopramide and in combination therapy in cesarean section with subarachnoid anesthesia**

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**Background and Goal of Study:** Currently, there is little evidence that treatment combinations are better than single agents for nausea and vomiting/retching (NVR) (1). The aim of this study was to compare the incidence of NVR in parturients after caesarean section (CS) under subarachnoid anesthesia after single or a double pharmacologic prophylaxis.

**Materials and methods:** With IRB approval, patients received prophylaxis for NVR risk factors: fluid load (15ml/kg crystalloid+500ml Colloid)+anticholinergic antagonism (atropine 0.5mg)+nasal oxygen 3l/min+intramuscular injection of uterotonic agents. Surgery included uterine exteriorization.

At umbilical cord resection random allocation to 4 groups was:

C- Control

P- Propofol 1 mg/kg/h

M- Metoclopramide 10mg

PM- Propofol+Metoclopramide

Primary objective was the proportion of parturients with N or VR from delivery to end of surgery.

Sample size for a proportion difference of 0.4 with a power of 0.8 and a level of significance of 0.05 was 24 patients per group. Results were compared with Chi/Fisher tests and Cramer's V for effect size.

**Results and discussion:** Twenty-four patients were included in each group. The proportion of women reporting N in the post-delivery period of CS was as

follows ( $p = 0.06$ ): C (57%) > P (47%) > M (38%) > PM (20%).

The proportion of women reporting vomiting/retching was as follows ( $p = 0.006$ , Cramer's V 0.31 - large effect): C (35%) > M (22%), > P (7%) > PM (3%). Post-hoc analysis revealed that group C had a greater proportion of events than expected, and made the largest relative contribution to the Fisher's statistic. The observed frequency of other groups did not significantly deviate from the expected value.

**Conclusion(s):** In this study where a risk factor preventing strategy for NVR was followed, there was a trend towards reduced proportions of patients with nausea in groups with pharmacologic prophylaxis but this was not statistically significant compared to controls. The difference for VR between controls and other groups was large but there was no difference between single or double pharmacologic prophylaxis.

In conclusion, pharmacologic prophylaxis may reduce VR episodes with no difference between single treatment (propofol or metoclopramide) and combination treatment (propofol and metoclopramide).

**References:**

Griffiths JD, et al. Interventions for preventing nausea and vomiting in women undergoing regional anaesthesia for caesarean section. *Cochrane Database Syst Rev.* 2012;29:CD007579.

**11AP5-10****Enhanced recovery in obstetric surgery (Kings-EROS): early results from one of the UKs first programmes**

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**Background:** Enhanced recovery programs (ERP) have been successfully applied to many specialties throughout the world, positively impacting on surgical outcome, patient satisfaction and length of stay. We established the UKs first Obstetric ERP (Kings-EROS) in 2012. Over eight months we initiated and established an ERP for women undergoing elective caesarean sections.

**Methods:** An elective caesarean ERP was introduced in June 2012 as a protocol driven pathway and has undergone continuous auditing and changes since. We carried out a two-month audit comparing pre and post initiation of the program, collating patient demographics, anaesthetic and surgical details, and follow up data as follows: urinary catheter removal times, time to first mobilization after regional anaesthetic, re-catheterization rate, length of hospital stay (LOS), day one and seven post-discharge follow up, and readmission rates.

**Results and discussion:** We included 60 consecutive patients in each comparison group. From Jan-March 2013 60 patients had elective caesarean sections. 45(75%) patients followed the Kings EROS pathway. Patient demographics, anaesthetic technique and surgical techniques were comparable between the two groups. 59(98.3%) patients were able to eat and drink in the recovery unit. There were statistically significant differences in LOS and time to early mobilization. The mean LOS following all elective caesarean sections was reduced from 3.3 to 2.1 days (EROS patients 1.7 days). All patients were followed up on day 1 and 7 and 90% "agreed" that pain control was adequate to undertake routine tasks. There were no reported problems with mobilization, voiding urine, or general practitioner visits. The 7-day readmission rate was reduced from 8.3% to 3.3%. 97.8% women who followed the ERP would recommend this program to a friend and would be happy to undergo the same program for any future surgery.

**Conclusion:** Our results reflect a successful ERP in Obstetrics. Clear pathways are required to improve the experience of women undergoing an elective caesarean section. We have seen significant reductions in LOS together with very high patient satisfaction scores. Future areas of focus will include identifying the optimum time to urinary catheter removal and measures to minimize re-catheterization rates. In the future, we hope to extend the ERP to low risk patients undergoing emergency obstetric operations.

## 11AP6-1

### The relationship between body mass index and post-dural puncture headache after obstetric accidental dural puncture

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**Background and Goal of Study:** The obese pregnant population is more likely to experience difficult epidural insertion and accidental dural puncture, but low level evidence suggests that the subsequent risk of post-dural puncture headache (PDPH) declines as body mass index increases (1,2). We examined this postulate.

**Materials and methods:** With approval, a prospectively collected database on obstetric epidural and combined spinal epidural insertion was interrogated to identify 131 cases of accidental dural puncture with a 16 gauge Tuohy needle that occurred from 2007 to 2012 (incidence 0.7%). The database and patient medical record were examined to determine patient body mass index, headache characteristics and response to therapeutic epidural blood patch. Women were classified into groups of body mass index <30, ≥30 or ≥40 for categorical analysis using LogXact statistical software in Cytel Studio 8.

**Results and discussion:** Compared to Group < 30 (n=70), women in Group ≥ 30 (n=61) did not significantly differ in the incidence of PDPH (83% vs 80%, P = 0.71) or its intensity (severe 18% vs 30%, P = 0.23). Epidural blood patch was performed for 55% of both groups (P = 0.65). A sub-group analysis comparing those with BMI ≥ 40 (n=15) with those with BMI < 30 showed no statistically significant differences.

**Conclusions:** This retrospective study found no evidence that women of higher body mass index are less predisposed to develop a post-dural puncture headache after an accidental dural puncture, or that the characteristics of the headache and response to epidural blood patch were different.

#### References:

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## 11AP6-2

### The transversus abdominis block after caesarean delivery allows an effective analgesia without the use of morphine

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**Background and Goal of the Study:** The transversus abdominis plane (TAP) block is an effective method providing postoperative analgesia in patients undergoing lower abdominal surgery.

We evaluated the analgesia efficacy of the ultrasound (US)-guided TAP block in patient undergoing caesarean delivery inside a multimodal therapy with non-steroidal anti-inflammatory.

**Materials and methods:** Forty women undergoing elective cesarean delivery were studied, received US guide TAP block with bupivacaine 0.25% 15ml each side. All participants received spinal anesthetics with bupivacaine 9mg and fentanyl 15ug, followed by postoperative acetaminophen and metamizol. If any of the patients were in pain a first rescue with dexketoprofen was carried on and if they continued being in pain a second rescue with morphine iv was indicated.

We compare the results with our protocol in force for caesarean delivery (spinal anesthesia with bupivacaine 12mg followed by postoperative with dexketoprofen and morphine). Each patient was assessed during the first 24hs after delivery for morphine usage, average pain score, nausea, vomiting, the recovery of the spinal block with the Bromage score and the hours after surgery mobility began. A satisfaction survey was completed (v.satisfactory - S - unsatisfying)

**Results and discussion:** The forty participants completed the study. Only 26 of the patients demanded for an analgesic rescue (65%) and this was related with getting up, none of the participants required a second rescue with morphine. The participants reported improved satisfaction with their pain relief measured by visual analogue scale and compared with the patients of our protocol in force (p < 0.02), the results were similar to the pain on movement as well as mobility. Fewer incidence of nausea and vomiting (p < 0.03) and

sedation was reduced. The results with respect to the spinal block 2hs after spinal anesthesia were: 34 participants (85%) had a grade 1 of Bromage score. Patient's mobility began about 6-8 hours after surgery with an average of 4 in the visual analogue scale. Satisfaction survey were 75% very satisfactory and 22,5% satisfactory.

**Conclusions:** The TAP block, as a component of a multimodal analgesic regimen permits an adequate pain control for caesarean delivery with improved satisfaction and without the use of morphine. We consider that a multimodal analgesic like this allows an early mobility and improve the relation between the mother and the baby.

## 11AP6-3

### The effect of oxytocin infusion on neural blockade by bupivacaine

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**Background and Goal of Study:** Oxytocin is often infused for labor induction or augmentation. When parturients are under labor epidural analgesia, we anesthesiologists would like to know the interaction between oxytocin and local anesthetics. Therefore, we tested the hypothesis that intravenously administered oxytocin modifies the duration and intense of neural blockade by bupivacaine.

**Materials and methods:** The study was approved by the Ethics Committee on Animal Research of our institute. In 21 male Wister rats, the right jugular vein was catheterized under isoflurane anesthesia. The catheter was fixed in the subcutaneous tissue on their backs with plastic cover, and rats were allowed to recover from anesthesia.

On the next day, both sides of the ischiatic nerve were exteriorized under isoflurane anesthesia. A small paper disc soaked with bupivacaine 0.5mg was placed on the left ischiatic nerve, while saline-soaked disc was put on the left nerve. After disc placement, either oxytocin (1 U/ml) or saline was infused at 1ml/hr through the jugular vein catheter. Meanwhile the rat was recovered from anesthesia. A technician blinded to infused solution measured the threshold of thermal withdrawal response (TTWR) of both sides of the paw every 15min from 30min to 120min after the disc placement. The thresholds in two groups were compared using a repeated ANOVA. A p < 0.05 was defined as statistically significant difference.

**Results and discussion:** The values of % maximum possible effect (100%; complete blockade, 0%; full recovery) calculated from the TTWR of both sides of the paw were similar between two groups for 1 hr after injection of bupivacaine. However, The value in the oxytocin group was significantly lower than that in the saline group at 75min (100 +/- 0 % vs. 56 +/- 52 %). This suggests that the neural blockade with local anesthetic may be worn off early during oxytocin infusion for labor induction or augmentation. Our results are not consistent with the fact that oxytocin has a protective effect against hypersensitivity from peripheral nerve injury (1). The mechanism of the observation in this study remains determined by further experiments.

**Conclusion(s):** When a high dose of oxytocin was infused, the neural blockade with bupivacaine was worn off early.

#### References:

- Gutierrez S, Liu B, Hayashida K, et al. *Anesthesiology* 2013; 118: 152-9.

## 11AP6-4

### Study of impact of use of HemoCue as an alternative to laboratory haemoglobin estimation in pregnant women undergoing elective caesarean section

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**Background and Goal of Study:** Duration of hospital stay after elective caesarean section (CS) is determined by factors such as maternal and foetal well-being. However, maternal satisfaction is found to be high with home births as it allows mothers to return to their familiar circumstances early. Hospital discharge following elective operations can be delayed by unnecessary investigations.

We investigated the use of bedside testing of haemoglobin (HemoCue) as a means to improve efficiency and reduce in patient hospital stay.

**Materials and methods:** Ethical approval was sought. Data was collected prospectively in 84 elective CS. All patients had their haemoglobin estimated using lab and HemoCue methods perioperatively.

**Results and discussion:** All numbers mean (standard deviation).

Estimated Blood Loss (EBL) <500ml (n=49)						
Lab Hb pre-op	Hemocue pre-op	EBL/ml	Lab Hb post-op	Hemocue post-op	Lab Hb Day 1	Number transfused
12.3 (1.33)	12.4 (1.42)	424 (83.6)	11.0 (1.16)	10.8 (1.29)	11.1 (1.35)	1
Estimated Blood Loss >500ml (n=35)						
Lab Hb pre-op	Hemocue pre-op	EBL/ml	Lab Hb post-op	Hemocue post-op	Lab Hb Day 1	Number transfused
11.6 (1.26)	11.8 (1.73)	844 (308.4)	9.7 (1.22)	9.8 (1.04)	9.7 (1.14)	2

[Results]

**Conclusion(s):** In our institution there are approximately 750 elective CS per year. National statistics state that in 2010-11, 67000 planned CS were performed in the UK. In uncomplicated elective CS, with minimal postoperative blood loss, a further full blood count (FBC) taken on the first post operative day could be omitted with little clinical significance.

In our study, there was no significant difference between the haemoglobins measured immediately in recovery and on day 1 post CS. HemoCue reflected the variations in haemoglobin values predictably compared with formal laboratory values. Each laboratory FBC costs approximately £2.78 [1] without the costs of hospital stay and manpower included. Omission of this extra test could save a significant amount of time and expenses involved in this part of care. Cost of a HemoCue cuvette is only £0.95. Reduced cost may not be the only benefit. Delayed discharge while awaiting laboratory blood tests and time taken for phlebotomy, analysis and review could also be reduced; potentially reducing postnatal workload. This would potentially have an impact on maternal satisfaction with the possibility of earlier hospital discharge.

**References:**

1. www.nice.org.uk

## 11AP6-5

### Team training reduces the decision-to-delivery-interval (DDI) in acute grade 2 cesarean sections (AG2CS)

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**Background and Goal of Study:** The DDI is the time from the decision of a cesarean section (CS) to the time of the delivery. In AG2CS the DDI has to be < 30 minutes, according to Danish national guidelines.

In May and June 2013 an obstetrical full scale simulation team training program was held at Herlev University Hospital, Denmark. Participants were obstetricians, anaesthesiologists, midwives, anaesthesia- and scrub nurses. The background for the team training was poor results in the 2012 annual report from "Danish Quality Database for Births"[1]. In the report only 47.1% of AG2CS at Herlev Hospital were carried out within the recommended time limit. The goal is 95%. The hypothesis was that team training could increase the quality and efficiency of the teamwork in AG2CS and thereby reduce the DDI.

**Material and methods:** An interventional study, comparing the DDI before and after the team training. A total of 100 AG2CS patients were included from April 1<sup>st</sup> 2013 and back in time (before group) and compared with 100 AG2CS patients included from July 1<sup>st</sup> 2013 and forward in time (after group). We identified all acute CS in the electronic booking system, and investigated the charts to see grade, time of decision and time of delivery.

**Results and discussion:** By December 6<sup>th</sup> 2013 84 patients were included from July 1<sup>st</sup> 2013 and forward, and a preliminary analysis was made. Four patients had been excluded in total; three before April 1<sup>st</sup> 2013 because of conversion to either grade 1 or 3, and one after July 1<sup>st</sup> 2013 because the surgeons feared a rupture of the uterus in a patient where the fetus had died, but then slowed down when the uterus was intact.

The DDI could not be calculated for four patients in the before group and four patients in the after group, because time of decision was missing. The groups are comparable according to BMI, age, ASA score and previous CS.

	Before training (n=96)	After training (n=80)	Difference	P-value	Statistical test
DDI (min)	27.3 ± 7.375*	25.1 ± 5.732*	2.2 (0.200-4.191) <sup>‡</sup>	0.031	Two sample t-test
Births with DDI < 30 min	66 (69%) <sup>¶</sup>	64 (80%) <sup>¶</sup>		0.091	X <sup>2</sup> -test

[Table 1]

Legend: \*Mean ± SD. <sup>‡</sup>Mean difference and 95% CI. <sup>¶</sup>Number (percent).

**Conclusion:** The mean DDI in AG2CS was significantly reduced after the staff had participated in team training. The percentage of births with DDI < 30 minutes showed an increasing tendency, but this was not statistically significant, and larger groups need to be investigated to clarify this.

**References:**

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## 11AP6-6

### Spinal epidural haematoma after spinal anaesthesia - an unusual presentation

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**Background:** In the last few decades there has been a widespread of the use of central neuraxial blockages (CNB) in obstetric patients. The complications from the CNB range from the bothersome to the crippling and life-threatening [1]. Spinal Epidural Haematoma (SEH) is one of such severe complications, although rare.

**Case report:** A 29-year-old woman at term, ASA I, was proposed for a caesarean section after inadequate progression of labour. Spinal anaesthesia was administered with the patient in the seated position, L3-L4 interspace, with a 27G spinal needle. The first puncture was bloody, but after reposition clear liquor was obtained. Surgery was uneventful. The patient recovered from the motor blockage a few hours after surgery. The next morning (12h after the procedure) the patient complained of paresthesia over the lower limbs that progressed to paraplegia. An urgent MRI revealed a dorsally located SEH extending from D7 to D9. The patient was transferred and an emergency laminectomy was conducted.

**Discussion:** Vascular changes in pregnancy may predispose to SEH; in fact there are some reports of spontaneous SEH during pregnancy [2]. Structural changes in the vascular walls associated with the hemodynamic changes that occur during pregnancy can play a role in the development of SEH. Another possible explanation is the presence of arteriovenous malformations or occult pathology; none of which was confirmed in our patient. To our knowledge there is only another case similar to ours in which the SEH developed far from the level where the SA was performed and symptoms appeared many hours after motor recovery from the blockage was observed [3].

**References:**

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**Learning points:** Although SEH is a very rare event it can occur even in the healthy pregnant woman without known risks factors. A high suspicion should be maintained and new neurological symptoms should be prompt investigated with a spine MRI.

A whole spine MRI is preferred since the haematoma can develop far from the level where the CNB was conducted.

## 11AP6-7

### Use of rocuronium and active reversal of neuromuscular blockade with sugammadex in anaesthesia for caesarean section led to reduction of myalgia incidence in early postoperative period: prospective randomised interventional multicentric trial

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**Background and Goal of Study:** Use of a combination of rocuronium and sugammadex (ROCSUG) for Caesarean Section (CS) in General Anaesthesia (GA) can be an alternative to suxamethonium for neuromuscular blockade during GA induction. Our objective was to demonstrate that ROCSUG leads



to lower rate of subjective complaints in 24 hour period after CS compared to a combination of suxamethonium, rocuronium and neostigmine (SUCNEO).

**Materials and methods:** With Ethical Committee approval we enrolled 237 parturients in the period 12/2012-11/2013 who underwent CS in GA. In the interventional group (ROCSUG, N=117), muscle relaxation was induced with rocuronium 1 mg kg<sup>-1</sup> and at the end, active reversal was achieved with sugammadex 2-4 mg kg<sup>-1</sup>. In the control group (SUCNEO, N=120), suxamethonium 1 mg kg<sup>-1</sup> was used for induction, rocuronium 0.3 mg kg<sup>-1</sup> for maintaining and neostigmine 0.03 mg kg<sup>-1</sup> with atropine 0.01 mg kg<sup>-1</sup> for reversal of neuromuscular blockade. Data were recorded to Case Report Form. Depth of muscle relaxation was monitored with TOF Watch SX (Organon, NL).

One day after the CS, each parturient was interviewed by anaesthesiologist and the evaluation questionnaire of subjective complaints was completed (sore throat, vigilance during anaesthesia, myalgia, diplopia, weakness, inability to cough, shortness of breath (yes/no), VAS of postoperative pain (score recorded) and other complaints). Differences in categorical variables were assessed using Fisher exact and Pearson chi-square tests.

**Results and discussion:** We could demonstrate no statistically significant differences in rate of complaints, except higher incidence of myalgia in SUCNEO group (ROCSUG 0.0%; SUCNEO 6.7%; p=0.007). Use of rocuronium and sugammadex decreased the total amount of subjective complaints compared to use of suxamethonium (ROCSUG 21.4%; SUCNEO 37.5%; p=0.007). There were no difference in level of postoperative pain (median VAS; ROCSUG 3; SUCNEO 3; p=0.423).

**Conclusion(s):** Use of a combination of rocuronium and sugammadex for neuromuscular blockade and its reversal in patients who underwent General Anaesthesia for Caesarean Section led to the reduction of myalgia and total amount of subjective complaints in early postoperative period.

**Acknowledgements:** Financial support: Czech Ministry of Health: Internal Grant Agency (ID: NT 13906-4/2012). ClinicalTrials.gov ID: NCT01718236

## 11AP6-8

### Validation of a new protocol for prophylaxis of uterine atony during cesarean delivery

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**Background and Goal of Study:** Oxytocin is commonly employed for prophylaxis of uterine atony during Cesarean Delivery (CD), although it may provoke hemodynamic instability, among other complications. Recently we changed our protocol for oxytocin's administration in order to reduce dosage. We tested this protocol for efficacy and safety.

**Materials and methods:** A sample of 100 women scheduled for CD (group New) was treated with a 3 UI-bolus of oxytocin followed by an infusion of the same drug at 5 UI/h, using a syringe-pump; rate could be increased according to surgeons' indication and additional 1 UI-boluses were allowed. Data were then matched with a sample of 100 women submitted to elective CD during the first part of 2012 (Group Old). In that period protocol consisted in an infusion of 20 UI of oxytocin diluted in 500 ml of saline; further doses of 10 UI, prepared in the same way, were allowed. First outcome was mean intraoperative (IO) bleeding; IO or postoperative (PO) use of additional uterotonics, the incidence of total complications and PACU length of stay (PACU-LOS) were analyzed as well.

**Results:** Groups were homogenous for demographic data and preoperative assessment. Mean IO oxytocin dose was 21,5±4,4 vs. 6,8±2,1 in Old vs. New, while mean IO bleeding, using Stafford's Formula<sup>1</sup>, was 589,9±872 vs. 716,8±766 ml (p=0,278). There was no significant difference in IO or PO use of rescue uterotonics, as show in Table 1. IO antiemetic treatment was more prevalent in Old group (18 vs. 8 patients; p=0,003). No IO or PO transfusion was needed in groups. PACU-LOS was significantly longer in Old group (8±4 vs. 5,4±3,6 hours, p< 0,0001).

	Patients (Old vs. New)	p (Chi2)
IO Methylergometrine	7 vs. 10	0,613
IO Misoprostol	2 vs. 5	0,445
PO Oxytocin	20 vs. 11	0,117

[Table 1: Additional IO and PO uterotonics]

**Conclusion(s):** According to our data, the new protocol allowed reducing the total dose of oxytocin without increasing IO bleeding or maternal complications. Reduction in use of antiemetic drugs in New group could be related to better hemodynamic stability, while shorter PACU-LOS could be related to a general improvement in multidisciplinary treatment.

#### References:

1- Stafford I, Dildy GA, Clark SI, Belfort MA. Visually Estimated and Calculated Blood Loss in Vaginal and Cesarean Delivery. Am J Obstet Gynecol. 2008;199(5):519.e1-7

## 11AP6-9

### Remifentanyl infusion and subarachnoid block for external cephalic version

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**Background and Goal of Study:** External cephalic version (ECV) is a method to avoid cesarean section for breech fetal presentations. Neuraxial analgesia improves both patient satisfaction and technical difficulty<sup>1,2</sup>, but alternatives are scarce in case of rejection or contraindication. IV remifentanyl could be an alternative as it has never been associated adverse effects<sup>3</sup>. However, experience is scarce.

This study aims to describe neuraxial and remifentanyl techniques to provide analgesia for ECV.

**Materials and Methods:** We designed a prospective observational pilot study including adult ASA-II women undergoing ECV using any of the two techniques:

- Subarachnoid block (SB), 2mg bupivacaine and 25µg fentanyl 5min prior to start.
- Remifentanyl IV infusion (RI), base 0.05µg/Kg/ up to 0.25µg/Kg/min.

**Results and Discussion:** The study is currently in the data collection stage, with 10 patients gathered until now (3 SB and 7 RI), given the low incidence of ECV. Mean age is 29 years (SD 5.095) and gestational age 36.90 weeks (SD 0.316).

So far, both techniques succeed in providing good analgesia. They showed similar success rates, attempts and difficulty, but a lower time to discharge with RI.

Incidence of nausea was higher with RI, whereas pruritus was more frequent with SB. There are no records of vomiting, stiffness, hypotension or desaturations below 93%. However, we found a 100% incidence of postpunctional headache (PPH) with SB (27G Quincke). Fetal registry was normal in all cases.

	SB (n = 3)	RI (n=3)	p value
VAS score (mean)	3.00 (SD 2.000)	4.71 (SD 2.690)	0.383 (Mann-Whitney U test)
Success rate (%)	66.70	28.60	0.26 (Pearson Chi squared test)
Time to discharge (min)	135.00 (SD 15.000)	78.57 (SD 13.138)	0.017 (Mann-Whitney U test)
Pruritus incidence (%)	100.00	28.60	0.038 (Pearson Chi squared test)
Postpunctional headache (%)	100.00	0.00	0.002 (Pearson Chi squared test)
Fetal adverse effects (%)	0.00	0.00	-

[Summary of most relevant data]

**Conclusions:** Thus far, RI was a safe and useful alternative to SB for providing analgesia. It allowed an earlier discharge, despite a higher incidence of nausea.

Further collection of data within the next few months will probably offer more information and will clarify those already obtained.

#### References:

1. Weiniger et al. Br J Anaesth. 2010;104(5):613-8.  
2. Suen et al. J Matern Fetal Neonatal Med. 2012;25(6):719-22.  
3. Muñoz et al. The International Journal of Anaesthesia. 2001.

## Intensive Care Medicine

### 12AP1-1

#### Singapore SPICE: a prospective observational longitudinal cohort study of Sedation Practices in Intensive Care units in Singapore

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**Background and Goal of Study:** Delirium is a common complication in critically-ill intubated and sedated patients in the intensive care unit (ICU). Delirium leads to increased mortality, poorer patient outcomes and greater resource utilisation.

ICUs in 4 major public hospitals in Singapore agreed to implement sedation targets, sedation monitoring and delirium monitoring as standard of care. The investigators in the study spearheaded an educational programme to train ICU nurses to use standard monitoring scales, namely the Richmond Agitation Sedation Scale (RASS) for sedation monitoring, and the Confusion Assessment Method for the Intensive care Unit (CAM-ICU) for delirium monitoring.

To complement this initiative, we proposed an observational, longitudinal cohort study to investigate sedation practices and delirium incidence in our ICU population.

**Materials and methods:** All sedated intubated and mechanically ventilated adult ICU patients who were expected to remain intubated for another day were eligible for study. Exclusive criteria included age less than 18, a primary brain process that would impair cognition, burns patients and palliative care patients with a treatment limitation order. The following data was collected: demographics, hospitalization details, sedation and pain assessment, treatment details and outcome data. The daily RASS and CAM-ICU scores were recorded. Patients were followed up till extubation, ICU discharge or Day 28 of study. Sample size analysis required 300 patients to be observed.

**Results and discussion:** We present our local institution data. The average age of patients was 68.7. Average APACHE scores were 23. All patients had a RASS score prescribed for their ICU stay. Most patients had a combination of a analgesia-sedative for their sedation regime. The average RASS score was -1 to -2. CAM-ICU was positive in about 61% of this population. Delirium was treated with antipsychotic medications in 23% of this population.

**Conclusion(s):** Routine monitoring of sedation and detection of delirium in the ICU setting is feasible. In line with the most recent clinical practice guidelines for the management of pain, agitation and delirium in adult patients in the intensive care, RASS is the most valid sedation assessment tool, and the CAM-ICU is the most reliable method of monitoring delirium.

#### References:

Shapiro BA et al. Practice Parameters for intravenous analgesia and sedation for adult patients in the ICU. *CCM* 1995;23:1596-600

### 12AP1-2

#### Length of stay in neurocritical care after brain tumor surgery

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**Objectives:** Greater demand and limited resources for patients with brain tumor (BT) have changed patterns of length of stay (LOS) and the necessity for an intensive care monitoring. This study evaluates: a) the preoperative and perioperative predictive variables of extended need for LOS > 1 day; and b) patient's morbidity and mortality during the Intensive Care Unit (ICU) course and determinants of prolonged LOS.

**Design:** Retrospective chart review.

**Setting:** A neurocritical care unit (NCU) of a university teaching hospital, an independent ethics committee approved the study.

**Patients:** Patients were 316 consecutive postoperative BT resection cases admitted to a NCU within a 3-year period (2010-2012).

**Interventions:** Record review.

**Measurement and main results:** Sixty eight (21.5%) of 316 patients remained in the NCU for > 1 day (Group L), compared with 248 (78.5%) patients admitted for < 1 day (Group S). Univariate association of pre/perioperative risk factors with LOS in the ICU were evaluated. The chi-square or Fisher's exact test was used for categorical data and the Student's t-test for continuous data. Variables with  $p < 0.05$  and those with potential clinical interest were studied.

There were no differences in no demographic data, general health status, nor in tumor pathological features nor radiographic severity index tumor and LOS between groups.

Two (0.8%) patients of Group S needed tracheal intubation (TI) and 29 (42.6%) from Group L needed TI. Postoperative respiratory support and TI were the only perioperative factors that had a statistically significant correlation with LOS > 1 day stay in the ICU.

**Conclusions:** A fraction of patients required LOS > 1 day after craniotomy for tumour resection. An extended tracheal intubation and/or respiratory support postoperatively requirements are risk factors for a LOS > 1 day in the ICU. A patient's risk of prolonged stay can be well predicted by certain clinical findings such as long surgical times, and the decision to keep the patient intubated at the end of surgery based on the need for airway protection due to decreased mental status. A new postoperative hemiparesis requires > 1 day of ICU care secondary to cerebral edema or intracerebral haemorrhage. No other predictors for increased LOS were identified in this study.

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### 12AP1-3

#### Hyperglycemia is a predictor of prognosis in traumatic brain injury: tertiary intensive care unit study

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**Background and Goal of Study:** In the management of critically ill intensive care patients with mechanical ventilation, various assessment parameters are being used in order to predict patient outcome and mortality with efficient treatment. Multiple scoring systems, including Glasgow Coma Scale (GCS) and acute physiology and chronic health examination (APACHE)-II scores, and several biochemical parameters have been developed for the early prediction of severity of patients with traumatic injury to facilitate early treatment in an intensive care unit. We aimed to study the predictive roles and relationship between glucose values, GCS and APACHE II and clinical outcomes during ICU stay of mechanically ventilated patients with traumatic brain injury.

**Materials and methods:** Total of 112 patients with craniocerebral trauma, who hospitalized in ICU between January 2011 and December 2012 were included in the study. Mortality rate and length of ICU stay of patients were evaluated by their range of glucose, GCS and APACHE-II scores.

**Results and discussion:** The majority of the patients were male (66.1%) and the mean age of entire population was  $52.08 \pm 23.47$  years. Survivors had longer ICU length of stay than did nonsurvivors. Initial, last and mean glucose values were significantly higher for non-survivors than for survivors. Maximum glucose values at initial and last measurements were also significantly higher in nonsurvivor group than that of survivors. The highest survival rate, 69.2%, occurred among patients with mean glucose values between 110-149 mg/dL. Survival rate decreased with further increases in mean glucose values, with the lowest survival rate (26.7%) noted among patients with mean glucose values exceeding 180 mg/dL. APACHE II, GCS scores and mean glucose value were found to be associated with mortality ( $p=0.002$ ; coefficient= 72.1%). The odds ratio for APACHE-II score of 25 and higher was 14.37 (%95 CI: 1.64-132.73); 5.49 for mean glucose value between 150-179 (%95 CI: 1.28-23.53); 5.99 for mean glucose value higher than 180 (%95 CI: 1.08-33.39). Regression analysis revealed that APACHE II score was significantly associated with ICU length of stay ( $p=0.009$ ).

**Conclusion(s):** Increasing admission glucose, mean glucose and maximum glucose values are associated with increasing mortality rates in mechanically ventilated ICU patients with traumatic brain injury. The mortality predictive power of APACHE II score is higher than glucose values and GCS scores.

## 12AP1-4

### Delirium in ICU is associated with negative financial balance after elective cardiac surgery

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**Background and Goal of Study:** Delirium occurs frequently after cardiovascular surgery and affects cognitive outcomes especially in elderly patients. Delirium prolongs ICU stay and increases treatment costs. Longer length of stay and increased nursing workload indices may trigger higher revenues from the health payer, but the costs are unbeknownst to most institutions. Measures to prevent and treat ICU-delirium, though, are cost-intensive. Goals of this study were to assess (1) the effect of delirium on financial balances and (2) if delirium is reflected by standard workload indices.

**Materials and methods:** Hospital revenues, determined by 'diagnosis related groups' (DRG) were retrieved from the hospital patient data management system. Costs, revenues and workload indices of 215 elective ICU patients in cardiac surgery, who were prospectively screened for risk factors of delirium from October through December 2009 were available.

Costs were assessed with a calculation tool provided by the German Society of Anaesthesiology and Intensive Care.

Workload had been determined with daily 'ICU activity score points', consisting of a limited set of TISS-28 items (TISS-10) and items of the SAPS-II score (without GCS-scale). The ICU activity score points may contribute substantially to hospital funding from the healthpayers.

**Results and discussion:** Among 215 patients, 32.1% (N=69) had delirium during their ICU-stay. Patients with delirium produced median negative balances were (-2018 € (-3121 to -57) €) in patients with delirium vs. positive balances in patients free from delirium (709 €; -650 to 1009 €,  $P < 0.001$ ). Delirium was not associated with higher ICU activity scores.

**Conclusion(s):** Delirium was associated with negative financial balances, patients without delirium in ICU had positive balances. Higher workload associated with delirium was not reflected by ICU activity score points. Hence, further investigation should yield ICU workload scores that reflect workload associated with delirium in order to provide resources and staff for measures to cost-effectively prevent and treat delirium.

#### References:

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## 12AP1-5

### Thiopental and pseudohyponatremia

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**Background:** Status epilepticus(SE) is a neurologic life threatening emergency. Barbiturates are usually used for treatment of refractory status epilepticus. These drugs act by increasing GABA<sub>A</sub> mediating cell inhibition leading to a decrease of the cerebral metabolic rate. Thiopental is one of the most frequently used.<sup>1</sup>

The authors present two cases of SE treated with thiopental in which high serum sodium levels were observed from the central laboratory assay, not coincident with arterial bedside analysis. It as been described a dose dependent interference of thiopental with a sodium assay device, Dimension Vista, Siemens.<sup>2</sup> This device was also used in the author's hospital center.

**Case report:** A 40 year old woman was admitted to Intensive Care Unit (ICU) due to drug poisoning, with loss of consciousness. She developed a SE and a barbiturate coma was induced with thiopental at a maximum dose of 5mg/Kg/h. Two days later, hypernatremia was observed in the central laboratory assay (sodium maximum 162mmol/L) with concomitant sodium levels in the arterial bedside analysis below 143mmol/L. Main causes of hypernatremia were excluded and sodium levels normalized four days after thiopental infusion was discontinued.

The other case is a 20 year old male admitted to ICU with SE of unknown cause. From the first day, he was treated with thiopental at a maximum dose of 7mg/Kg/h. As in the first case, high hypernatremia was reported in the central laboratory assay (sodium maximum 169mmol/L) and was resolved four days after stopping barbiturates. Sodium levels in the arterial bedside analysis were always normal.

**Discussion:** During treatment with thiopental, the authors observed a pseudohyponatremia identified by Dimension Vista system with a marked discrepancy between central laboratory assay and arterial bedside analysis reaching 22mmol/L of difference. Therapeutic management of these elevated sodium levels may lead to erroneous administration of hypotonic fluids that can be harmful for patients.

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**Learning points:** The authors present these cases because of the impact of this artifact association that can lead to dangerous therapeutic decisions.

## 12AP1-8

### Haloperidol suppresses murine dendritic cell maturation and priming of T helper type 1 immune response

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**Background:** While administration of haloperidol and other anti-psychotics has been reported to suppress Th type 1 immune response in schizophrenic patients, the immunological basis for this suppression is not well understood. Since dendritic cells (DCs) are potent antigen-presenting cells that strongly affect immune-response polarity, we studied the effect of haloperidol on DCs and immune-response mediated DCs.

**Methods:** Evaluating surface molecules (CD80, CD83, CD86, and major histocompatibility complex class II) and interleukin-12 (IL-12) secretions, and analyzing the effect of haloperidol on the DC-mediated activation of lymphocytes in mixed-cell-culture assays with DCs and lymphocytes, we examined the effect of haloperidol on the activation of murine bone-marrow-derived DCs. Using a contact hypersensitivity model, we assessed the effects of haloperidol on *in vivo* Th type 1 immune response.

**Results:** Surface-molecule and IL-12 results indicated that haloperidol inhibits the activation of DCs. At the whole-animal level, mixed cell cultures and Th type 1 immune response results showed that haloperidol suppresses lymphocyte activation mediated by DCs. Furthermore, results using specific ligands for dopamine receptors suggested that these effects might be mediated by effects on dopamine D2-like receptors on DCs.

**Conclusion:** Our findings suggest that haloperidol suppresses the initiation of Th type 1 immune response through effects on DCs. This suppression can seriously compromise host defense against *Mycobacteria*, *Listeria*, and other pathogens that require a powerful Th type 1 immune response.

## 12AP1-9

### Central venous oxygen saturation following blood transfusion in neuro intensive care unit patients

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**Background and Goal of Study:** The 2,3 - diphospho glycerate, essential for oxygen release, is depleted in stored blood and gets replenished within 24 hours of transfusion. In this observational study, we looked at ScvO<sub>2</sub> changes for 24 hours following blood transfusion in patients admitted to neuro intensive care unit (NICU).

**Materials and methods:** Institutional review board approved the study. Adult patients with central venous catheter (CVC) in situ and requiring transfusion were recruited. Patients with unstable haemodynamics or requiring FIO<sub>2</sub> >0.8 were excluded. Blood was transfused at haemoglobin (Hb) < 9-10 gm/dL. Before transfusion, blood was taken from the CVC for analysing ScvO<sub>2</sub> and Hb. The same was repeated at the end of transfusion and 6,12,18 and 24 hours after the transfusion. At these time periods, heart rate (HR), mean blood pressure (MBP) and central venous pressure (CVP) were noted.

We hypothesized that a single unit of pRBC would increase ScvO<sub>2</sub> by 5%. 47 patients were required for 80% power. Assuming a dropout of 25%, we planned for 70 patients. Changes in Hb and ScvO<sub>2</sub> and the effect of HR, CVP, MBP and age of RBC on ScvO<sub>2</sub> were analysed by repeated measures ANOVA. Correlation between Hb, age of RBC and ScvO<sub>2</sub> changes were studied by Spearman's correlation.



**Results and discussion:** 86% received up to 2 units of pRBCs and the remaining received more than 2 units. Negative correlation was seen between ScvO<sub>2</sub> changes and pre transfusion Hb (p=0.02). Pre transfusion CVP, HR and CVP changes over study period influenced the ScvO<sub>2</sub> change (p=0.049, 0.04, & 0.002 respectively).

Practice of low Hb transfusion trigger in brain injury patients is controversial as anaemia can lead to brain ischemia. In the current study, ScvO<sub>2</sub> did not increase significantly over the 24 hour period. Higher pre transfusion Hb decreased the ScvO<sub>2</sub> changes. Of all the variables involved in the oxygen delivery-consumption process, only the HR and CVP influenced the ScvO<sub>2</sub> changes. This could be because of the associated cardiac output (CO) changes. Direct CO monitoring was not done to prove this speculation.

**Conclusion(s):** Our current trigger for blood transfusion did not increase the ScvO<sub>2</sub> during the 24 hour study period implying no improvement in systemic oxygen delivery. Future studies utilising brain tissue oxygen monitoring will help us to understand the changes in regional brain oxygen delivery following transfusion.

## 12AP1-10

### Length of hospital stay, mortality and use of oral antithrombotic agents in haemorrhagic neurocritical patients

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**Background and Goal of Study:** The major risk factors for intracranial hemorrhage include chronic arterial hypertension and oral anticoagulation. Spontaneous Haemorrhagic Neurocritical Patients (HNP) tend to have bad prognosis, more resources consumption and greater length of stay (LOS). The aim of this study was to analyze the LOS and the mortality in HNP and their association between the use of oral antithrombotic agents (OAT). The second goal was to compare the LOS and mortality of neurocritical patients (NP) during their stay at the intensive care unit of a university teaching hospital.

**Material and methods:** It was performed a retrospective analysis of prospectively collected data recorded in Neurologic Anaesthesia database between 2010 and 2012. Baseline demographics data, comorbidities, coagulation parameters, type of OAT consumed (nonsteroidal anti-inflammatory agents, low molecular weight heparin and acenocumarol) surgical management, and clinical course were assessed.

**Results:** A total of 2012 patients admitted, of which 895 were HNP. A total 96 HNP from these NP were recorded and divided into three different groups: 1) Intraventricular haemorrhage (IVH), n= 17 (17.7%); 2) Subdural haemorrhage (SDH) n= 25 (26%) and 3) Intracerebral Haemorrhagic stroke (IHS), n=54 (56.3%). LOS and mortality variables from HNP were analysed, comparing with NP average. In NP mean LOS was 3,1 days ±6,3. In HNP mean LOS was 6,54 ± 8,0 days. Death occurred in 55 NP (6,2%) and in 27 of HNP (28,1%). Death cases in HNP subgroups were distributed as follows: 4 IVH (23,5%); 1 SDH (4%) and in 22 IHS patients (40,7%). Mortality cases in HNP subgroup represents 49,1% of NP deaths. OAT use occurred in 50 HNP cases (52.1%) and in 46 HNP (47.1%) no OAT use was recorded before the haemorrhagic stroke.

**Conclusion:** HNP tend to have higher rates of mortality and greater LOS than other NP IHS subgroup has worse outcomes than IVH or SDH subgroups. The use of preinjury OAT does not seem to increase significantly the risk of mortality in HNP

## 12AP1-11

### Mortality of spontaneous cerebral haemorrhage according to the level of consciousness and ventricular extension

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**Background and Goal of Study:** To analyze mortality of patients with spontaneous cerebral haemorrhage according to the level of consciousness and the presence of intraventricular haemorrhage.

**Methods:** prospective cohort study. Patients with spontaneous intracerebral haemorrhage and/or non-traumatic subarachnoid haemorrhage between 2003-2008. We analyzed age, sex, type of haemorrhage, Glasgow on admission, APACHE-III, intraventricular haemorrhage, and ICU and hospital mortality. The statistical study was done with the Student, X<sup>2</sup> and logistic regression.

**Results:** 203 patients. Age 55.65±14.69 years, APACHE-III 51.48±33.02, GCS on admission 9.66±4.73. Hospital mortality 43.3%. GCS on admission: 12.30±3.80 in survivors versus 6.22±3.43 in those who died. In 30 patients the best GCS score was 4 points and their mortality was 90%. Intraventricular haemorrhage was present in 92 patients (mortality 66.3%) and absent in 104 patients (mortality 21.2%); p< 0.001.

We analyzed mortality according to the level of consciousness on admission and the presence of HIV. The GCS on admission was: GCS>8 (N=90) and GCS< 8 (N=108). Three of 73 patients without HIV and GCS>8 died (mortality 4.1%), and 19 of 29 patients without HIV and GCS≤8 died (mortality: 65.5%), (p< 0.001). Fourteen of 33 patients with HIV and GCS>8 died (mortality: 42.4%), and 45 of 56 patients with HIV and GCS≤8 died (mortality: 80.4%), (p< 0.001). Mortality was higher in the patients with HIV and a better level of consciousness on admission in comparison to those without HIV. This increased mortality associated with the presence of HIV was also seen in those who had a low level of consciousness, though much less markedly than in those with GCS>8.

The multivariate analysis detected a relation between hospital mortality and GCS on admission: OR 0.75 (0.68-0.82), type of haemorrhage: OR 2.4 (1.04-5.54), and the presence of HIV: OR 5.85 (2.58-13.28). Analysis of the interaction between level of consciousness on admission and the presence of HIV showed an interaction with HIV: OR for HIV plus GCS≤8 of 2.72 (0.94-7.83) and for HIV plus GCS>8 of 16.55 (4.25-64.49).

**Conclusion:** The presence of HIV and spontaneous cerebral haemorrhage is associated with an increased mortality, independently of the type of haemorrhage. This increase in mortality is much greater in patients with a better level of consciousness on admission to the ICU than in those with a low level of consciousness on admission.

## 12AP2-1

### A good predictor of infection in cardiac surgery patients: procalcitonin plus white blood cells

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**Background and Goal of Study:** The occurrence of sepsis after cardiac surgery increases mortality risk (1). Sepsis may be mistaken by the cardiac surgery-associated Systemic Inflammatory Response Syndrome (SIRS) (2). The identification of a marker able to predict sepsis in cardiac surgery patients and to differentiate SIRS from infectious and non-infectious origin would be very useful

**Materials and methods:** A prospective, observational study was carried out to compare procalcitonin (PCT), C-reactive protein (CRP) and White Blood Cells (WBCs) during the first 10 postoperative days after cardiac surgery with cardiopulmonary bypass (CPB) between 122 patients with infection (Infection group) and 301 without (Control group) to identify predictors of infection.

**Results and discussion:** WBC and PCT median values were significantly (p< 0.05) higher in infected than control patients, during 10 and on the third and fourth post-operative day, respectively, showing both variables a peak at 3 days in infected patients. The number of times that the WBC count overpassed its second postoperative median value (13000 cells/mm<sup>3</sup>) during the first 3 postoperative days plus the number of times that PCT overpassed its (1.7 ng/mL), was a parameter (ranging 1-6) with three categories (R1= overpassed 0-1 time; R2= 2-3 times; R3= 4-6 times) significantly associated to risk of infection, which increased with increasing number of times (R2: OR=2.48 [1.32-4.65] and R3: OR=7.06 [3.17-15.71]).

**Conclusion(s):** White blood cells and procalcitonin in combination, help to predict infection in patients after a cardiac surgery

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## 12AP2-2

### Risk of acute kidney injury in single kidney patients after cardiac surgery

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**Background and Goal of Study:** Acute kidney injury (AKI) is common after cardiac surgery (CS). Single kidney (SK) patients develop compensatory hyperfiltration, and their renal functional reserve (RFR) is lost or attenuated. This fact may put them at risk of AKI after insults like CS. The aim of this study was to determine if SK patients are at increased risk of AKI during the first week after CS.

**Material and methods:** By searching records in our prospectively collected Cardiac Anesthesia database (3783 mayor CS between 2002-2012), we identified 43 SK patients operated of mayor CS with cardiopulmonary bypass (CPB). Three patients were discarded due to lack of data. We tried to match each SK patient with one or more non SK cases for variables related to baseline renal function and known risk factors for AKI. Diagnosis of AKI was made with RIFLE and AKIN criteria. Odds ratio (OR) for AKI in SK patients was calculated with an ordered logistic regression model in which cases were clustered with their matched pairs. A p value < 0,05 was considered significant.

**Results and discussion:** 35 patients with SK were matched with 170 non SK cases for baseline creatinine, weight, age and CPB time. Each SK patient was matched with 1 to 5 non SK cases. Groups were well balanced for other AKI risk factors like left ventricle ejection fraction, diabetes mellitus, ischemia time or complex surgery. Female gender was mismatched between groups (54,3% in SK vs 31,8% in non SK; p=0,011). In the SK group 8 (22,8%), and 24 (68,6%) patients developed AKI by RIFLE and AKIN criteria respectively. No statistical significant differences were found with the non SK group (18,8% for RIFLE and 54,7% for AKIN, p=0,58 and p=0,08 respectively). OR (95% confidence interval) for AKI development of any category in the SK group were 1,04 (0,9-1,02) for RIFLE definition and 1,14 for AKIN criteria (0,96-1,36).

**Conclusion:** Despite hyperfiltration, SK patients were not at increased risk of developing AKI during the first week after CS in our sample. The limited number of cases precludes further statements. The results of this study warrant an assessment of the effect of reduced RFR in the setting of CS.

**Acknowledgements:** We appreciate the continuous efforts of the ICU staff in maintaining the Cardiac Anesthesia Database.

## 12AP2-3

### The value of the measurement of procalcitonin serum level as a marker of postoperative complications but not infection after CABG

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**Background and Goal of Study:** Cardiac surgeries are the most common operations performed worldwide and as any surgical intervention, apart from indisputable advantages, lead to variable complications. An increase in procalcitonin (PCT) level after cardiac surgery is still difficult to interpret. The aim of this study was to analyse the clinical value of the measurement of serum PCT level early in the post-operative period in order to recognize its clinical applications.

**Materials and methods:** In 173 patients undergoing CABG with CPB serum PCT and C-reactive protein (CRP) were collected prior to the procedure until postoperative day 3. The dynamics of change of PCT and CRP concentration in the postoperative period was performed by a comparison between the group with non-infective complications (n=63) and without complications (n=98). A comparison was also made between the group with infection (n=12) and with non-infective complications.

**Results and discussion:** The mean PCT values was significantly higher in the group with non-infective complications on consecutive post-operative days as compared with the values in the uncomplicated group (POD1  $2.36 \pm 2.64$  vs  $0.95 \pm 1.31$  ng/ml; POD2  $1.71 \pm 1.93$  vs  $0.72 \pm 1.10$  ng/ml; POD3  $1.24 \pm 1.38$  vs  $0.62 \pm 0.90$ ;  $P < 0.001$ ). Serum CRP values demonstrated a significant increase in both group from POD1 until POD3. The mean values, however, showed no significance difference between group (POD1 p=0.923; POD2 p=0.985; POD3 p=0.773).

A comparison of the group with infections (n=12) to the group with other complications using the Mann-Whitney test, despite higher values in the

group with infection, showed no statistical significance on the first postoperative day POD1 ( $7.45 \pm 12.06$  vs  $2.36 \pm 2.64$ ; p=0.834). The PCT values on POD2 and 3 were increasing in infected patients, but still did not differ significantly in comparison to group with non-infective complications (p=0.298 and p=0.095). The CRP value in the group with infection, but not in non-infective complications group, showed an increase, to reach significant result on day 3 (p=0.013).

**Conclusion(s):** The PCT level increased significantly in the group with post-operative complications, posing difficulties with the diagnosis of an early infection. Only repeatedly increasing values of PCT can serve as a marker for diagnosing infections. The CRP levels were very high in all groups, thus CRP seems to be a marker with no usability in diagnosing early infection.

## 12AP2-4

### New promising marker - copeptin in perioperative time in CABG patients

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**The Goal of Study:** Was to examine the values of copeptin in patients undergoing CABG procedure. The role in detection of myocardial ischaemia, comparability with troponin, correlation with heart haemodynamic parameters, connection with complications.

**Patients and Methods:** The study encompassed 98 patients undergoing isolated CABG surgery. The mean age of test subjects was  $63.5 \pm 8.59$  years. The values of copeptin and troponin T were measured preoperatively, postoperatively immediately after EKC and 8 hours after in ICY. In the same time period the hemodynamic parameters of heart function were estimated. We correlated copeptin with hemodynamic parameters.

We have selected the patients with complication (n=9) and examined the relationship with copeptin and other risk factors. We used Spearman's correlations. Hotelling T-test were used for multivariate data analysis. Multiple variance analysis of the relation between observed variables and occurrence of complication has been analysed with the use of Jrip algorithm within the Weka analytical system.

**Results:** The mean preoperative value of serum determined copeptin was  $0.91 \pm 0.42$  ng/mL, postoperatively increased  $1.45 \pm 0.64$  ng/ml, in JIL  $0.49 \pm 0.34$ . Troponin T value preoperative was  $0.05 \pm 0.13$  ng/mL, postoperatively  $0.64 \pm 1.19$  ng/mL, in JIL increased  $1.18 \pm 1.24$  ng/mL.

There was no correlation with hemodynamic parameters. JRip classifier divided patients with complications in 3 subclasses: Class 1 (n = 5) were patients with EURO SCORE less than 3.32, LWSVI eight hours postoperatively less than 28.2 g/m and the duration of cardiopulmonary bypass more than 93 minutes. Class 2 (n = 2), were patients with RWSVI postoperatively less than 2.7 g/m and with diagnosis of diabetes. Class 3 (n = 2), were patients with copeptin in JIL less than 0.17 ng/mL and troponin T preoperatively greater than 0.06 ng/mL. Patients with complication had a statistically significant value of RWSVI lesser than 5.7gm/m squared (p< 0.04), troponin 2.1 ng/ml (p< 0.01) duration of mechanical ventilation was 20.7 hours, (p< 0.02), ICU stay 5.2 days 8 (p< 0.01). Also copeptin in ICU was lesser o.17.

**Conclusion:** Copeptin may be useful in detecting myocardial ischaemia immediately after occurrence, while troponin not yet grown. No correlation with haemodynamic parameters which means that the copeptin is independent factor. Predicting complication and outcome can be only together with other factors.

## 12AP2-7

### Does restrictive volume infusion in lung resection surgery increase the risk of postoperative acute kidney injury?

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**Background:** The perioperative intravenous fluid overload has been linked to acute lung injury in lung resection surgery (LRS). This belief, has led to the adoption of a restriction of colloid and crystalloid infusion in the perioperative period. However, other authors consider that this restrictive fluids management could increase postoperative acute kidney injury (AKI) and have proposed a goal-directed hemodynamic therapy.

The aim of our study was to retrospectively evaluate if a severe restriction of intraoperative fluids infusion increases AKI incidence during the first three postoperative days comparing it with other data recently published.

**Materials and methods:** We designed a retrospective study including the last 150 patients who underwent LRS in which a protocolized perioperative restrictive fluid management was applied (crystalloid administration under  $3\text{ml}\cdot\text{kg}^{-1}\cdot\text{h}^{-1}$ . One liter of crystalloids and free water oral intake was delivered during the first 24 hours of the postoperative period). Renal replacement therapy was considered as exclusion criteria. Hypotension event was treated with boluses of vasopressors. Hemodynamic data from a Flow-trac monitor and intraoperative ventilation data were collected. Arterial blood gases were performed. Kidney damage was defined by AKIN classification. The incidence of any degree of AKI was analyzed and the preoperative characteristics and intraoperative management of these patients were compared.

**Results:** The incidence of AKI was 6%, 5% belonged to stage I of the AKIN classification and 1% to stage II. Patients who developed AKI in the postoperative period were older and had worse preoperative respiratory tests than patients who did not develop AKI. No intraoperative hemodynamic parameter or the use of vasoconstrictors to optimize intraoperative management was associated with the presence of postoperative AKI. There was no relationship with the type of preoperative medication (non steroidal antiinflammatory drugs, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers). The development of postoperative AKI prolonged hospital stay 1.5 times.

**Discussion:** In this study by using severe fluid restriction, we have observed similar AKI incidence as in recent studies where the amount of fluid used was higher. We think that the use of restrictive fluid therapy must be associated with prompt intraoperative interventions to treat hypotension events in order to protect kidney function.

## 12AP2-8

### Rapid detection of acute kidney injury by urinary neutrophil gelatinase-associated lipocalin in patients undergoing cardiopulmonary bypass surgery

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**Background and Goal of Study:** Acute kidney injury is common following cardiopulmonary bypass. The aim of this study is to determine the accuracy of urinary Neutrophil Gelatinase-Associated Lipocalin levels following cardiac surgery to establish the severity of renal impairment as compared to serum creatinine levels.

**Materials and methods:** Following the approval of our University Ethics Committee, a total number of 28 patients undergoing elective cardiopulmonary bypass were included. Diagnostic criteria of acute kidney injury was established in case of a percentage increase in the serum creatinine concentration of >50%. Serum creatinine levels were recorded in the preoperative period before induction and postoperative period in 24, 48 and 72. hours. Urinary Neutrophil Gelatinase-Associated Lipocalin measurement was performed before induction and in the 4th postoperative hour. The duration of cardiopulmonary bypass surgery, hospital stay and cross-clamp time were recorded.

**Results and discussion:** Based on acute kidney injury criteria, subjects were grouped into acute kidney injury (n=11) and no acute kidney injury (n=19). Postoperative urinary Neutrophil Gelatinase-Associated Lipocalin levels were found significantly higher in group with acute kidney injury ( $11.8\text{ ng mL}^{-1}$  vs  $104.0\text{ ng mL}^{-1}$ ,  $p=0.003$ ). In acute kidney injury Group, cardiopulmonary bypass time bypass ( $111.9\text{ min}$  vs  $82.7\text{ min}$ ) and cross-clamp time ( $76.9\text{ min}$  vs  $59.1\text{ min}$ ) were significantly higher. A cutoff of  $25.5\text{ ng mL}^{-1}$  yielded sensitivity of 81.82% and specificity of 94.12% at postoperative 4th hour with AUC of 0.947 for predication of acute kidney injury.

**Conclusion(s):** Urine Neutrophil Gelatinase-Associated Lipocalin rised significantly much earlier as compared to serum creatinine levels in the early postoperative period. Although larger case series are needed, we are in the opinion that urinary Neutrophil Gelatinase-Associated Lipocalin measurement may be used as an early clinical marker of acute kidney injury following cardiopulmonary bypass.

## 12AP2-9

### Hemodynamic changes during therapeutic hypothermia after cardiac arrest: endovascular compared to surface cooling techniques

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**Background:** One of the landmark trials on therapeutic hypothermia (TH) after cardiac arrest (CA) suggested that hypothermia, induced by surface cooling (ice packing) increased systemic vascular resistance (SVR). Current cooling technology offers the choice between endovascular cooling (EVC) or surface cooling (SFC). As far as today, no comparative data are available on the influence of the cooling technique on haemodynamic parameters, such as mean arterial blood pressure (MAP), cardiac output (CO) and systemic vascular resistance (SVR).

We compared MAP, CO and SVR in post-CA patients (pts), treated with TH using SFC or EVC.

**Materials and methods:** After IRB approval, data from post-CA pts were prospectively collected. Cold saline ( $4^{\circ}\text{C}$ ,  $30\text{ ml/kg}$ ) was administered at hospital arrival. TH ( $33^{\circ}\text{C}$ ) was induced by EVC or SFC and maintained for 24 hours. Active rewarming was performed at  $0.3^{\circ}\text{C/h}$ . All pts were monitored with a Swan-Ganz catheter. Mann Whitney U test was used to compare data between two groups. Changes in haemodynamic measurements over time were compared using one-sample Wilcoxon Signed Rank test. Data are presented at median ( $\pm$ IQR).

**Results:** Pts were selected from a prospective database in order to guarantee comparable temperature characteristics between EVC and SFC group. We selected 40 pts, 17 pts with SFC and 23 pts with EVC. Temperature at CCU-admission was not different between the two groups (EVC:  $34.9^{\circ}\text{C}$  (0.7); SFC:  $34.6^{\circ}\text{C}$  (1.8)  $p=0.764$ ). Also, time to target temperature was not different between the two groups (EVC:  $129.5\text{ min}$  (257); SFC:  $140.5\text{ min}$  (100)  $p=0.977$ ). MAP started at  $84\text{ mmHg}$  (24) and  $89\text{ mmHg}$  (21) in EVC and SFC group respectively ( $p=0.506$ ). CO started at  $3.7\text{ l/min}$  (1.5) for the EVC group and at  $4.2\text{ l/min}$  (0.3) for the SFC group, with no significant difference ( $p=0.245$ ). There was no significant difference in MAP or CO throughout the hypothermia or rewarming phase between the two groups. Although there was a significant increase in SVR in the first 6 hrs after start TH in the SFC group (from  $1311$  (765) dynes/cm<sup>5</sup> to  $2187$  (894) dynes/cm<sup>5</sup>  $p=0.03$ ), there were no significant differences in SVR between the SFC and EVC group.

**Conclusion(s):** Comparing similar induction rates of TH, we found that the method of cooling (surface or endovascular), used to induce TH to  $33^{\circ}$  for 24 hours, did not result in different hemodynamic profiles, however the first 6hrs of TH-induction with surface cooling did result in a significant increase in SVR.

## 12AP2-10

### Temperature characteristics of endovascular compared to surface cooling techniques used for therapeutic hypothermia after cardiac arrest

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**Background and Goal of Study:** Therapeutic hypothermia (TH) after cardiac arrest (CA) can be induced by endovascular (Coolgard®) or surface (Arctic Sun) cooling technology. Few comparative data are available, especially concerning maintenance of TH at  $33^{\circ}\text{C}$ . Therefore, we compared temperature characteristics during TH in post-CA patients cooled with endovascular cooling (EVC) or surface cooling (SFC).

**Materials and methods:** After IRB approval, data from post-CA pts were prospectively collected. Cold saline ( $4^{\circ}\text{C}$ ,  $30\text{ ml/kg}$ ) was administered at hospital arrival. TH ( $33^{\circ}\text{C}$ ) was induced by EVC or SFC and maintained for 24 hours. Active rewarming was performed at  $0.3^{\circ}\text{C/h}$ . In all pts, oesophageal temperature was continuously monitored. Mann Whitney U test was used to compare data between two groups. Data are presented at mean ( $\pm$ SD).

**Results and discussion:** Pts were selected from a prospective database in order to guarantee comparable groups concerning age, gender, weight and outcome. We selected 50 patients, 25 patients treated with EVC and 25 patients treated with SFC. Temperature at CCU admission was not different



between EVC vs SFC (34.9°C (0.8) vs 35.1°C (1.0)  $p=0.961$ ). Duration of cooling time to 33.1°C was significantly lower for EVC vs SFC (100min (85.1) vs 168min (109)  $p=0.005$ ) resulting in a significantly higher cooling rate for EVC (1.74°C/h (1.03) vs 0.81°C/h (0.39)  $p=0.001$ ). Mean temperature during TH maintenance phase was significantly lower in SFC vs EVC (33°C (0.08) vs 33.1°C (0.09)  $p=0.001$ ). In this maintenance phase, 99.6% of all temperatures in the EVC group and 99.9% in the SFC group ( $p=0.068$ ) were between 32°C and 34°C. Analyzing a more narrow range, 92.9% of all temperatures in the EVC group and 76.3% in the SFC group ( $p=0.001$ ) were between 32.7°C and 33.3°C. Rewarming rate (to 36.6°C) was not different between both groups (EVC : 0.32°C/h (0.09); SFC : 0.29°C/h (0.03)  $p=0.010$ ).

**Conclusion(s):** Comparing endovascular (or invasive) to surface (or non-invasive) cooling techniques, applied for use of TH, invasive cooling resulted in a significantly higher cooling rate, but non-invasive cooling resulted in comparable rewarming rate and in acceptable maintenance conditions of TH, with 76.3% of all temperatures within a narrow range of 32.7 to 33.3°C and 99.9% of all temperatures between 32°C and 34°C.

## 12AP2-11

### Inotropes and mortality in adults. A meta-analysis of ranfomizad trials

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**Background:** Inotropes and vasopressors are frequently used in the critically ill patient to improve cardiovascular function and to correct hemodynamic derangements. However, some studies have suggested a possible association between administration of inotropes and increased mortality. We therefore performed a meta-analysis of all the randomized clinical trials performed in the last 20 years to investigate the effect of inotropes and vasopressors on mortality.

**Materials and methods:** BioMedCentral, PubMed, Embase and the Cochrane Central Register were independently searched (range 1993-2013) by independent investigators. Inclusion criteria were: adult patients, random allocation to treatment with at least one group receiving an inotrope or vasopressor and one group receiving placebo or a non-inotropic/vasopressor control or standard treatment. The primary endpoint was mortality at the longest follow-up available.

**Results and discussion:** A total of 31,134 patients from 172 trials were included in the analysis. Overall, pooled estimates showed no difference in mortality between the group receiving inotropes or vasopressors and the control group (4,895/16,134 [30%] versus 4,546/15,000 [30%] risk ratio [RR], 1.00; 95% confidence interval [CI], 0.97 to 1.02;  $P=0.7$ ). A trend towards increased survival associated with inotropes/vasopressors administration was seen in the clinical setting of sepsis (64/138 [46%] versus 57/96 [59%] RR, 0.82; 95% CI, 0.66 to 1.01;  $P=0.07$ , with 7 studies included). No difference was found in the settings of cardiac surgery (46/1,634 [2.8%] versus 54/1,638 [3.3%] RR, 0.9; 95% CI, 0.63 to 1.28;  $P=0.55$ , with 66 studies included), acute heart failure (308/1,978 [16%] versus 227/1,538 [15%] RR, 0.93; 95% CI, 0.80 to 1.09;  $P=0.39$ , with 18 studies included), and chronic heart failure (2,062/8,219 [25%] versus 1773/6846 [26%] RR, 1.00; 95% CI 0.89 to 1.12;  $P=0.97$ , with 27 studies included).

**Conclusions:** Administration of inotropes and vasopressors according to published randomized evidence is not associated to an improved survival nor to an increased mortality in the overall adult population and in the majority of subsettings. The only exception seems to be sepsis, with a trend toward a beneficial effect of vasoconstrictors/inotropic agents on survival.

## 12AP3-1

### The relation of oxidative stress markers in patients with different stages of acute respiratory distress syndrome according to the Berlin definition

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**Background and Goal of Study:** Important role in acute respiratory distress syndrome (ARDS) pathophysiology may play an imbalance between oxidant and antioxidant species<sup>1</sup>.

The main goal of the study was to investigate the relation of oxidative stress markers in ARDS patients.

**Materials and methods:** The study was conducted in Pauls Stradins Clinical University Hospital ICU during 6 months in 2013. There were included ARDS patients according to the Berlin definition<sup>2</sup> with mechanical lung ventilation (MLV) over 24 hours. Lipid peroxidation (LPO) products as malondialdehyde (MDA), 4-hydroxynonenal (HNE) and thiobarbituric acid reactive substances (TBARS) were taken at the 1st, 4th and 7th day from the time of inclusion. Data were analyzed using SPSS 21.0 version.

**Results and discussion:** There were included 15 ARDS patients with acute severe pneumonia ( $n=5$ ; 33.3%), sepsis ( $n=4$ ; 26.7%), acute severe pancreatitis ( $n=4$ ; 26.7%) and severe bleeding ( $n=2$ ; 13.3%). Two of patients died. Increased plasma levels of MDA+HNE correlates with the  $\text{PaO}_2/\text{FiO}_2$  ratio ( $r=0.69$ ;  $p=0.026$ ) at the 1<sup>st</sup> day after inclusion. The same marker shows statistically significant negative correlation with the stage of ARDS ( $r=-0.64$ ;  $p=0.048$ ). The other marker is TBARS, which correlates with the poor outcome ( $r=-0.8$ ;  $p=0.006$ ). At the 4th day TBARS shows negative relation with the  $\text{PaO}_2/\text{FiO}_2$  ratio ( $r=-0.66$ ;  $p=0.05$ ), oxidation index ( $R=0.68$ ;  $p=0.042$ ) and PEEP levels in ARDS patients ( $r=0.73$ ;  $p=0.025$ ).

Our finding confirms the results of previous studies demonstrating elevated levels of oxidative stress markers in ARDS patients<sup>3</sup>.

**Conclusion:** The changes of oxidative markers are related to the level of hypoxemia of ARDS patients.

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## 12AP3-2

### Flecainide acetate attenuates endotoxin-induced acute lung injury by neutrophils mediated inflammatory process and pulmonary edema in a rat model

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**Background and Goal of Study:** Although flecainide acetate is a sodium channel blocker and an anti-arrhythmic agent, many results suggest that modulating in anti-inflammatory responses and alveolar fluid clearance (AFC) are mediated, in part, by sodium channel activity. So, we hypothesized that the spectrum of activity of flecainide acetate was extend to include novel role of anti-inflammatory effects and decreasing pulmonary edema. The experiment was performed to evaluate the effects of flecainide acetate on endotoxin-induced acute lung injury (ALI) in a rat model.

**Materials and methods:** Subcutaneously continuous infusion of saline or flecainide acetate was started 3 hours before and continued until 24 hours after injection of saline or endotoxin. And we measured the effects of flecainide acetate on severity of pulmonary neutrophil accumulation, level of proinflammatory cytokine in bronchoalveolar lavages fluid (BALF), degree of pulmonary edema and mortality rate.

**Results and discussion:** In present study, the main findings are that animals treated by flecainide acetate were protected from endotoxin-induced ALI, as determined by severity of neutrophils mediated inflammatory process, degree of pulmonary edema and mortality.

**Conclusion(s):** it was extended the activities of neutrophil function and AFC in which flecainide acetate has a role by demonstrating that flecainide acetate is capable of attenuating endotoxin-induced ALI under in vivo conditions.

## 12AP3-3

### The role of melanocortin receptor agonist BMS-470539 on lipopolysaccharide-induced neutrophil activation and acute lung injury

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**Background and Goal of Study:** Despite advances in the management of sepsis and acute respiratory distress syndrome, the mortality rate remains high. Over-activation of inflammatory cells involving neutrophils are associated with multiple organ failure under those conditions. Thus, nontoxic molecules that regulate inflammatory cells may provide a novel therapeutic strategy. This study was performed to evaluate the effects of melanocortin-1

receptor (MC-1R) agonist BMS-470539 on LPS-induced neutrophil activation and acute lung injury.

**Materials and methods:** To assess the anti-inflammatory effect of BMS-470539 on LPS induced inflammatory cells activation, Neutrophils from mouse bone marrow were incubated with various concentrations of BMS-470539 (0, 1, 10 and 100 nM) and LPS (100 ng/ml). The protein levels for MIP-2 and TNF- $\alpha$  were measured using ELISA 4 hr after incubation period. To elucidate the intracellular signaling pathway, we measured the levels of phosphorylation of MAPKs (p38, ERK1/2, JNK) with western blot analysis and NF- $\kappa$ B with EMSA 0.5 hr after incubation period. We also examined the effect of BMS-470539 (20mg/kg, IP) on acute lung injury and mortality of mouse treated with LPS(20 mg/kg, IP) to determine whether these effects of BMS-470539 also have in vivo significance.

**Results and discussion:** BMS-470539 inhibited the production of TNF- $\alpha$  and attenuated phosphorylation levels of ERK1/2 and p38 but not JNK in neutrophils stimulated with LPS. BMS-470539 also attenuated the production of TNF- $\alpha$  and the phosphorylation of ERK1/2 in the lungs of mice administered LPS. BMS-470539 reduced the wet/dry weight ratio, histological severity, and neutrophil accumulation in the lungs and improved mortality after LPS treatment.

**Conclusion(s):** BMS-470539 attenuated LPS-induced lung injury by suppressing TNF- $\alpha$  production as well as ERK1/2 and p38 activation in neutrophils stimulated with LPS.

## 12AP3-5

### Two cases of acute exacerbation of interstitial pneumonia treating with recombinant thrombomodulin

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**Background:** Acute exacerbation of interstitial pneumonia is episode of acute respiratory worsening without identifiable etiology and causes high mortality. The presence of disordered coagulation and fibrinolysis and the clinical similarities of ARDS support a pivotal role of it. We will report two cases with acute exacerbation of interstitial pneumonia treating with recombinant thrombomodulin (rTM).

#### Case report:

Case 1: A 53-year-old man was admitted because of 6-month history of cough and progressive dyspnea. PaO<sub>2</sub>/F<sub>i</sub>O<sub>2</sub> (P/F) was 87. Computer tomography showed pulmonary interstitial fibrosis and with ground-glass opacities. The patient was diagnosed with acute exacerbation of interstitial pneumonia and moved to intensive-care unit (ICU) and treated with prednisolone pulse therapy, direct hemoperfusion with polymyxinB-immobilized fiber column, and rTM. P/F improved within six days, he moved to general ward and discharged hospital about two months after being admitted.

Case2: A 67-year-old woman was admitted because of dyspnea. She had a history of asthma and interstitial pneumonia. Prednisolone pulse and immunosuppressant therapy, direct hemoperfusion with polymyxinB-immobilized fiber column, and rTM were performed. P/F improved, weaning from mechanical ventilation and extubation were performed within 11 days. She died on the 24th hospital day due to recurrence.

**Discussion:** It is known that anticoagulant therapy may improve P/F and the survival of patients with rapidly progressive interstitial pneumonia. Recent study shows that HMGB1 (high mobility group protein B1) which plays a crucial role of ARDS increases in the alveolar fluid after the onset of acute exacerbation, and that expression of thrombomodulin which has antiinflammatory effects not only via activated protein but also via sequestration of HMGB1 decreases.

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**Learning points:** rTM is considered to resist hyper coagulability and inflammatory response and expected to be a new therapy of interstitial pneumonia.

## 12AP3-6

### Effects of glutamine on healing of traumatic oral mucosal lesions

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**Background and Goal of Study:** Glutamine (GLN) has an important function in regulation of acid-base balance, protein turnover, ammonia metabolism, catabolic situations and enhancing immune system. GLN has significant role in wound healing and is the most abundant amino acid in blood while not available at sufficient amount in enteral or parenteral nutrition (1). Prevention, treatment and care of the oral mucosa lesions are very important for causing too many kinds of clinical and economic problem in patients.

**Materials and methods:** This study performed on 21 Wistar Albino rats with weight range 250-300 gr and 4 groups provided. Mechanical traumatic oral mucositis (OM) in the mouth was performed by punch biopsy (1 mm deep, 2 mm width, in + shape) to all rats after intraperitoneal administration of anesthesia. In the control group; no treatment was applied after trauma (n=3). In the study groups (n=6 for each groups); GLN treatment was applied by parenteral (total 0,4 mg/kg/day), enteral and topical (total 1 g/kg/day) in 5 days for 2 times a day. Healing of OM was observed in macroscopically and documented by digital photography. Rats were sacrificed at the end of 5 days of GLN administration and biopsy was taken for histopathological (epithelial proliferation, signs of acute inflammation, vascular proliferation and fibrosis parameters) and biochemical (SOD, GSH-Px, MDA ve HYP parameters) evaluation. Histopathological scoring was defined.

**Results:** In the histopathological examination; significant difference was observed between control and parenteral/topical (p< 0,05) in acute inflammation. Difference in epithelial proliferation between control and parenteral and difference in fibrosis between control and topical groups were significant (p< 0,05). The proliferation of vessels were similar in all groups. The only difference in biochemical evaluation was in MDA levels in between control and enteral groups (p< 0,02).

**Conclusion:** GLN supplementation was observed to have positive effect on treatment of OM. GLN administration by the parenteral route was found to give better results in comparison with topical and enteral route. GLN supplements administered via oral or enteral route was considered a better alternative in treatment of OM occurs in otherwise healthy individuals.

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- Ohtani M, Kawada S, Seki T, Okamoto Y. Aminoacid and vitamin supplementation improved health conditions in elderly participants. *J Clin Biochem Nutr.* 2012 Mar; 50(2):162-8.

## 12AP3-7

### Changes in initial distribution volume of glucose and extra vascular lung water index following whole lung lavage in patients with pulmonary alveolar proteinosis

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**Background:** Whole lung lavage (WLL) is still the gold-standard therapy for pulmonary alveolar proteinosis (PAP). WLL itself induces lung injury and necessitates respiratory care afterward. Initial distribution volume of glucose (IDVG) measures central extra-cellular fluid volume and has been reported as an indicator of cardiac preload (1). Extra-vascular lung water index (EV-LWI) has been demonstrated to detect acute lung injury (2). We investigated changes in IDVG and EVLWI before and after unilateral WLL (u-WLL) in patients with PAP.

**Methods:** After an approval by our ethical committee and obtaining informed consents from the patients with PAP between Aug. 2012 and Nov. 2013, we have measured intrathoracic blood volume index (ITBVI), pulmonary vasculature permeability index (PVPI), EVLWI, IDVG index and PaO<sub>2</sub>/F<sub>i</sub>O<sub>2</sub> (P/F) ratio before and just after u-WLL, and the next morning. The patient's trachea was intubated with a double lumen tube and u-WLL was performed with 10-12L warmed saline in ICU under general anesthesia. The patient remained intubated until the next morning to restore the lung function. We used PICCO® to measure those parameters. IDVG was measured with 5g glucose as described before. Data were mean  $\pm$  SD. Statistical analyses were performed

with RM-ANOVA followed by Dunnett's test and Pearson correlation test.  $P < 0.05$  was considered as significant.

**Results:** There were 3 PAP patients and they underwent plural WLL due to the repeated deterioration of lung function. Total numbers of u-WLL was 13 within the investigated period. Fluid balance just after u-WLL was  $588 \pm 713$  ml. EVLWI (Normal range  $< 10$  ml/kg) and IDVGI (normal range 110-130 ml/kg) significantly increased from  $20.8 \pm 2.5$  and  $117.0 \pm 14.3$  to  $29.1 \pm 4.9$  and  $134.0 \pm 16.5$ , respectively just after u-WLL and returned to the similar values to the initial ones until the next morning. ITBVI (ml/m<sup>2</sup>) did not show significant change just after u-WLL. P/F ratio significantly decreased from  $400.7 \pm 115.3$  to  $216.3 \pm 101.7$  and returned until the next morning. EVLWI was inversely correlated with P/F ratio ( $r = -0.561$ ,  $P = 0.0007$ ) and positively correlated with IDVGI ( $r = 0.624$ ,  $P = 0.0001$ ).

**Conclusion:** The value of EVLWI measured by PiCCO was overestimated in patients with PAP possibly due to the alveolar proteins. Even though, IDVGI and EVLWI, not ITBVI, can be an useful indicators to evaluate the residual effects of WLL on the lung.

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## 12AP3-8

### Long term cerebral outcome after ECMO för pandemic H1N1 respiratory failure

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**Background and Goal of Study:** Extracorporeal Membrane Oxygenation (ECMO) and arterial hypoxemia have been implicated to cause brain injury and/or cognitive impairment (1-3). Our aims were to study A) the cerebral status of long-term survivors ECMO-treated 2009 due to refractory respiratory failure caused by H1N1 (4), and B) whether cognitive impairment was correlated with hypoxemia during ECMO.

**Materials and methods:** Approval of the local ethical committee and written informed consent were obtained. The study was done 3 years after hospital discharge. The brain was examined by magnetic resonance imaging (MRI). Full scale intelligence quotient (FSIQ) and memory function index (MI) were calculated from Wechsler Adult Intelligence Scale, Rey Auditory Verbal Learning Test and Rey Complex Figure Test and Recognition Trial. Premorbid cognitive function could not be assessed. Peripheral SaO<sub>2</sub> during the first ten days of ECMO or the whole treatment and blood lactate concentrations were used to describe the degree of hypoxemia and/or hypoperfusion. ECMO oxygen transfer (VO<sub>2</sub> ECMO) and delivery (DO<sub>2</sub> ECMO) were calculated as described recently (4). All numbers are expressed as median. Normal values for FSIQ and MI are 90-110.

**Results and discussion:** 7 out of 11 survivors participated in the study (see table 1).

Patient	SaO <sub>2</sub> (%)	Lactate (mmol/l)	FSIQ	MI	ECMO treatment (days)	VO <sub>2</sub> ECMO	DO <sub>2</sub> ECMO
1	74	1	107	121	16	208	769
2	71	1.2	102	107	49	221	810
3	91	1.5	96	103	7	192	817
4	79	1.0	95	116	44	266	867
5, female	85	1.0	79	86	37	166	700
6	90	1.4	88	81	3	154	959
7, female	74	1.9	missing	108	23	212	741

[Table 1]

Despite SaO<sub>2</sub> was low, FSIQ and MI was in the normal range in 5 patients. In 2 patients (#5+ #6) with higher SaO<sub>2</sub> these variables were slightly reduced. 3 patients showed pathological findings in the MRI which could not be related to V-A ECMO (N=4). Tissue perfusion was not impaired.

**Conclusion(s):** In this small cohort of ECMO patients 1) the cerebral long-term function was good, and 2) low arterial oxygen saturation was not associ-

ated with bad cognitive outcome. These findings might be due to adequate DO<sub>2</sub> during ECMO. Due to the small number of patients studied general conclusions cannot be drawn.

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**Acknowledgements:** The Swedish Heart and Lung Foundation

## 12AP4-1

### Arginase activity and CD3-zeta chain expression after major surgery: a role for postoperative immunosuppression

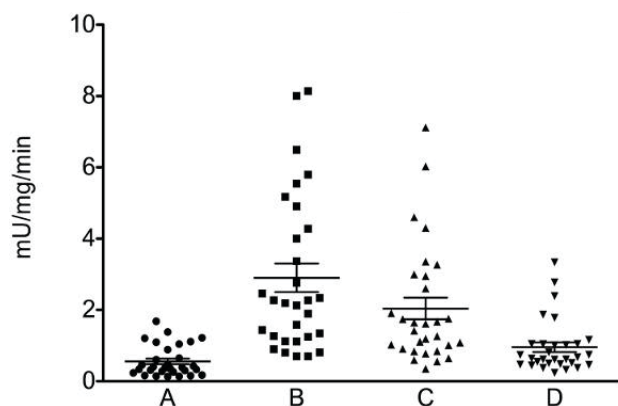
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**Background and Goal of Study:** A depression of cellular immunity after surgery appears to underlie an enhanced susceptibility to the development of septic complications and cancer metastases. Arginase I is induced after traumatic injury leading to distinct molecular changes in T cells. On these grounds we have measured the CD3-zeta expression and arginase I activity in patients undergoing major surgery, in order to determine their putative relationship.

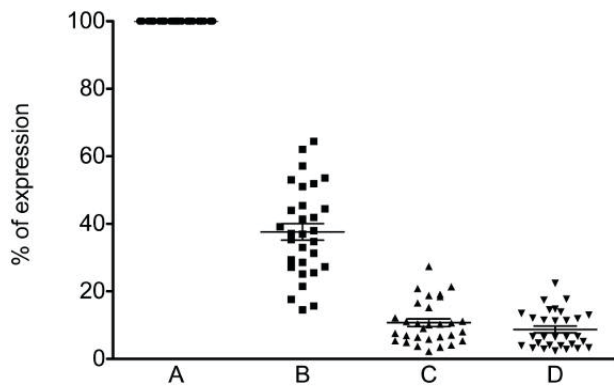
**Methods:** This study was a prospective, single-center observational study with 50 patients undergoing colorectal surgery. CD3-zeta expression, arginase activity, leucocytes, neutrophils, lymphocytes, platelets and fibrinogen were taken before surgery (d0), and the following mornings after surgery (d1), (d2), (d3). Pearson correlation coefficient was used to assess the linear correlation between neutrophils count /arginase and arginase / CD3-zeta.

**Results and discussion:** We found a statistically significant increase between preoperative arginase activity (d0) and 24h arginase activity (d1) ( $0.51 \pm 0.37$  mU/mg/min vs  $2.45 \pm 1.91$  mU/mg/min;  $p = 0.007$ ) (Fig 1); a statistically significant decrease between preoperative CD3-zeta expression (d0) and 24h CD3-zeta expression (d1) ( $100\%$  vs  $35.30 \pm 13.88\%$ ;  $p = 0.0001$ ) (Fig 2); and a statistically significant increase between preoperative neutrophil activity (d0) and 24h neutrophil activity (d1) ( $63.8 \pm 10\%$  vs  $84.5 \pm 5\%$ ;  $p = 0.0001$ ). We found a positive linear correlation between neutrophils increase and arginase activity in the first 24h ( $r = 0.842$ ;  $p = 0.0001$ ); a negative linear correlation between neutrophils increase and CD3 $\beta$  expression in the first 24h ( $r = -0.711$ ;  $p = 0.001$ ); and a negative linear correlation between arginase activity and CD3 $\beta$  expression in the first 24h ( $r = -0.796$ ;  $p = 0.003$ ).



[Fig 1. Arginase activity (mU/mg/min)]





[CD3-zeta expression (%)]

**Conclusion:** Our findings suggest that the decreased CD3-zeta expression found in T cells in our patients could be due to the increased production of arginase I 24 hours after surgery. This increased production of arginase I after surgery should be due to the activation of neutrophils after surgery. These findings could be the basis of the state of immunosuppression that occurs after surgery and could play an important role in the escape of the tumor and in the appearance of long term metastases after surgery.

#### References:

Munder, M., Mollinedo, F et al. Arginase I is constitutively expressed in human granulocytes and participates in fungicidal activity. *Blood* 2005;15:2549-56

## 12AP4-2

### Closure of the aortic valve and replacement of left ventricular assist device patient with severe aortic insufficiency and corynebacterium spp related infection device

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**Background:** Aortic insufficiency (AI) and after implantation of a left ventricular assist device (LVAD) can be majors problems for patients in destination therapy.

**Case report:** A 68 year old man with terminal cardiomyopathy underwent implantation of a LVAD as a destination therapy. Two years after implantation the patient developed a symptomatic cardiac insufficiency. Transthoracic echocardiography (TTE) revealed a mild AI. Medical management with diuretics and afterload reduction improved his symptoms. In the same time the patient developed infection with fever and no signs of driveline infection. Blood cultures were negative; TEE was not in favour of valve or canula endocarditis. Six weeks of antibiotic therapy improved his symptoms with no more fever. The sepsis reappeared after the end of antibiotic therapy. It was decided to do a Single Photon Emission Computed Tomography (SPECT) scan which showed a fixation on pump device. A minithoracotomy was realized to perform biological samples in the pump pocket but there were negative. It was decided to follow antibiotic therapy with high presumption of infection of pump device. Unfortunately the patient presented a stroke with right brachial deficit. The cerebral scan showed an aspect of mycotic aneurysm. After full recovery and following antibiotic therapy, it was decided to remove the pump and replace it by another one and in the same time to close aortic valve by placing a circular patch with a complete closure. Patient was discharged of hospital ten days after surgery and there has been no recurrence of AI on serial TTE and no history of fever or cardiac insufficiency symptoms. Finally bacteriological culture of the inside of the pump showed a *Corynebacterium* spp.

**Discussion:** The presence of AI creates a circulatory loop between the proximal ascending aorta and the inflow canula. It can lead to a poor systemic organ perfusion. Aortic valve replacement by a bioprosthetic valve is not recommended because the leaflets can fuse in a similar manner and prolonged the time of cross clamp and bypass times. A simple closure by a circular patch fixed with pledgeted prolene is simpler to realise especially when the replacement of infected pump is associated.

**Learning Points:** The SPECT scan appears an interest method of investigation for diagnosis of profound device infection. The best AI treatment in patient with LVAD is closure of aortic valve.

## 12AP4-3

### Profile bacteriological contamination of stethoscopes from intensivists physicians before and after decontamination with alcohol at 70%

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**Background and Goal of Study:** Stethoscope, since its inception, has been widely used in clinical practice. It is through the stethoscope, that health professionals do most of the physical examination. Most often, health professionals do not sanitize the stethoscope between query and another, enabling the spread of infection between patients and hospitals. This study aimed to analyze the bacteriological profile and effectiveness of microbial decontamination.

**Materials and methods:** 27 stethoscopes care physicians randomly selected from the on-duty in a general ICU of the city of Rio de Janeiro were analyzed. Was used to analyze the imprint of the diaphragm in the culture medium and swab the recesses of stethoscopes followed by direct seeding in the culture media: Agar - agar, Saboroud, Blood-agar Agar- mannitol. 2 samples were collected for each stethoscope: one before decontamination with 70% alcohol and the second after 2 minutes of decontamination and only after the stethoscope be completely dry. After seeding, the material was stored in an oven at 37.0 ° C for 48 hours. After the initial 48 hours, the colonies that formed were isolated and analyzed separately for bacterial identification, in addition to performing the antibiogram; except for fungi, where he waited seven days to verify colonic growth, identifying himself only if there was no growth or. Statistical analysis used the chi square test.

**Results and discussion:** Of all analyzed samples were 100% infected with fungi spp and 86% had any bacterial contamination which: 18.50% *S. aureus* MRSA (methicillin resistant *S. aureus*), 30% *O. aureus*, 25.5% *S. pneumoniae*, Enterococci 12% VRSA (Vancomycin -resistant Enterococcus spp.) After decontamination with 70% alcohol 1 stethoscope remained contaminated with fungus spp and 1 stethoscope remained contaminated with vancomycin-resistant enterococci to. P values were > 0.001 when comparing pre and post Stethoscopes decontamination

**Conclusion(s):** The most commonly found pathogenic bacterium was *S. aureus*, however, the rate of contamination with bacteria nosocomias was high. All stethoscopes were contaminated with some sort of fungus. It is known that most health professionals do not regularly performs disinfection. Awareness of all health professionals of the effectiveness of decontamination of stethoscope with alcohol 70% is required, which in this study was 93.6%.

## 12AP4-5

### Can we predict septic complications after urgent surgery?

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**Background:** Abdominal sepsis may lead to mortality in 50-70% cases.<sup>1,2</sup> Mortality predicting scales are very useful to determine the rate of death probability in septic patients.<sup>3,4</sup> But there are no such scales for predicting rate of sepsis occurrence in pts after surgery.

The aim to evaluate tumor necrosis factor (TNF $\alpha$ ) gene polymorphism as a predictor of septic complications in pts after urgent abdominal surgery.

**Methods:** After local ethic Committee approval and informed concern we studied 152 pts underwent urgent abdominal surgery. The frequency of septic complications after surgery and level of procalcitonin (PCT) were studied. All pts had genotype examination to reveal abnormalities of TNF $\alpha$  gene.

**Results:** 49 (32.2%) pts had septic complications after surgery (grp 1), 103 (37.8%) pts had no complications (grp 2). All pts had increased level of PCT: 4.17±0.4 ng/ml vs. 3.74±0.5 ng/ml (p>0.05). We have revealed pathological genotype AA of TNF $\alpha$  gene 68.6±6.62% in grp 1 and 9.9±3.36% in grp 2 (p<0.05). AG genotype was in 19.7±9.45% in grp 1 and 38.5±6.7% in grp 2 (p<0.05). Genotype GG have 13.5±9.05% of pts in grp 1 and 53.9±6.93% of pts in grp 2 (p<0.05).

**Discussion:** High PCT level in both groups of pts assumed all pts initially had SIRS. Prevalence of genotype AA of TNF $\alpha$  gene in pts with septic complications after surgery let us to suggest its role in development of septic complications after surgery. Genotype AA of TNF $\alpha$  gene can be settled as early prog-

nostic criteria of high risk for development of septic complications in surgical pts and may substantiate early aggressive prevention of septic complications in surgical patients to decrease mortality.

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## 12AP4-6

### The effects of wiping body nursing on the autonomic nervous function

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**Background and Goal of Study:** We seldom find reports which evaluates the nursing care effects on the autonomic nervous function. Because wiping body nursing has been a part of routine care in the ICU from now on it becomes necessary to reevaluate the effects on the autonomic nervous function. Therefore, we compared the influence of wiping body nursing on the autonomic nervous function before and after nursing utilizing an autonomic nervous system analyzer.

**Materials and methods:** 13 selected patients were hospitalized in our ICU. The exclusion cases were patients with arrhythmia and peacemaker and the ones who we had to change their medication. During wiping body nursing, we used warm towels which temperature was around 45-50 degrees, and we changed the position of the patients from dorsal to lateral.

The fractal features of heart rate and blood pressure variability were recorded using an autonomic nervous system analyzer (MemCalc/Tonam16C; Suwa Trust, Japan). The spectral bands were 0.04 to 0.15 Hz (low frequency: LF), 0.15 to 0.40 (high frequency: HF) and others. LF and HF were analyzed in heart rate (HR) and in systolic blood pressure (SBP). HR-HF component has been used as an indicator of parasympathetic balance. HR-LF/HF is reflected sympathetically. SBP-LF and CVSBP seem to be increased during sympathetic activation. We measured the HR, HR-HF, HR-LH/HF, SBP, DBP, BRS and SBP-LF. We compared them five minutes before and after wiping body nursing. The Wilcoxon signed-ranks test was used to compare the differences of this comparison. A p value of less than 0.05 was considered statistically significant.

**Results and discussion:** Although the HR-HF and HR-LF/HF were not significantly changed, the DBP, CVSBP, SBP-LF was substantially increased ( $p < 0.05$ ). In contrast, the BRS was notably decreased. Our result indicates that nursing cares like wiping body increase sympathetic nerve activity. According to previous reports, changing patient's position also increases sympathetic nerve activity, so we can not ignore the influence of changing patient's position. On the other hand there are reports that conclude that thermal stimulation like foot bath increases parasympathetic nerve activity, so we also need to analyze the influence of foot bath.

**Conclusion(s):** We investigated the influence of the autonomic nervous system before and after wiping body nursing in 13 patients in our ICU. The data indicates that wiping body nursing increases the sympathetic nerve function.

## 12AP4-7

### Immune responses in relation to the type and time of thermal injury: an experimental study

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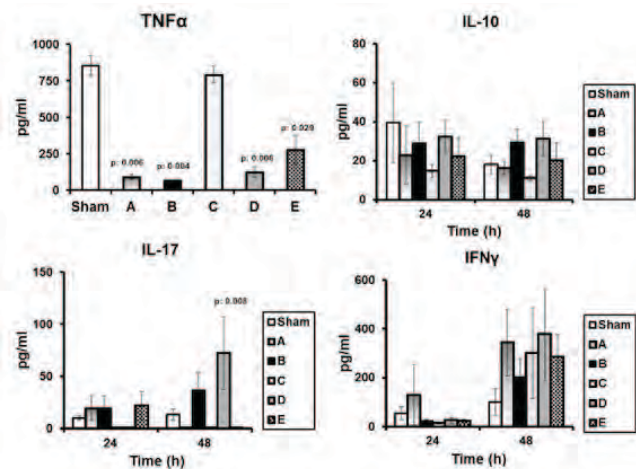
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**Background:** Thermal injury induces a complex immune reaction related to inflammation and suppression of cell-mediated immune responses [1-3]. Immune dysfunction increases patient's susceptibility to infection, systemic inflammatory response syndrome (SIRS) and multiple organ failure (MOF), thereby being responsible for the high morbidity and mortality following burn injury [4-7]. Pathophysiology is not well elucidated involving apoptosis, triggering receptor expression on myeloid cells (TREM)-1 and various cytokines

pathways (13). The aim of this experimental study was to determine the effects of thermal injury of varying intensity and exposure times, on immune response in a murine model.

**Methods:** After animal ethic committee approval, 120 C57BL/6 male mice were divided equally in 5 burn and 1 control group: Group Sham: no burn injury; Group A: burn for 60 seconds at 60°C; Group B: burn for 45 seconds at 60°C and then for 45 seconds at 4°C; Group C: burn for 15 seconds at 75°C; Group D: burn for 5 seconds at 90°C and Group E: burn for 45 seconds at 4°C and then for 45 seconds at 60°C. Ten mice per group were sacrificed 24 and 48 hours after burn injury and whole blood was collected; specimens of liver, lung, spleen, kidney and bowel were excised. Apoptosis and TREM-1 expression on circulating blood cells were measured. Cytokine production such as tumour necrosis factor-alpha (TNF $\alpha$ ), interleukin IL-10, IL-17 and interferon-gamma (IFN $\gamma$ ), was evaluated by isolated and stimulated splenocytes.

**Results:** Production of IL-17 from splenocytes of mice group D was enhanced. No effect was shown by burn injury on the production of IL-10 and of IFN $\gamma$ . Considerable effects were shown on the apoptosis of circulating lymphocytes and of spleen cells. The apoptotic rates varied between groups and also evolved after 24 and 48 hours. To examine the origin of this differential response, quantitative bacterial cultures of liver, lung and kidney were made but no differences were observed compared with sham-operated animals.



[Cytokine production by splenocytes]

**Conclusion:** There is a unique response for each type of injury depending on the temperature of the thermal source and the exposure time. IL-17 production is enhanced at high temperatures for short time. Adapted immunity is acquired by a mechanism unrelated to bacterial translocation in the setting of burn injury.

## 12AP4-8

### Diabetes mellitus as a risk factor for surgical site infection in colorectal surgery. Does preoperative and postoperative glycemic control matter?

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**Background and Goal of Study:** Diabetics are supposed to have a higher incidence of surgical site infection (SSI). It has not been established if poor perioperative metabolic control increases the risk for SSI. The primary aim of this study was to determine if diabetes is a risk factor for SSI in patients undergoing colorectal surgery. Secondly, we studied if there is an association between poor long-term preoperative glycemic control or perioperative glucose levels and SSI in diabetics.

**Materials and methods:** Observational prospective study of 150 patients who underwent colorectal surgery during 2012. Demographic and infection-related data were collected. Patients were divided in two groups: Diabetic patients group (DG) and non-diabetic patients group (nDG). A surgeon not involved in the study evaluated the patients for diagnosis of SSI (wound infection, anastomotic failure or intraabdominal abscess). Chi square test was used to compare SSI incidence in both groups. In the DG, preoperative HbA1c (as a marker of long-term glycemic control before surgery) and mean glucose levels during the first 48 hours after surgery were recorded. We subdivided the DG according to the diagnosis of SSI. Student's-T test was performed to

find differences in preoperative HbA1c levels and postoperative mean glucose levels at 24 and 48 hours between the group of diabetic patients with SSI (DG-SSI) and without SSI (DG-nSSI).

**Results and Discussion:** Of the 150 patients analyzed 21% were diabetic (32 patients). The incidence of SSI in the DG was 50% (16 patients) while in the nDG was 19% (22 patients) ( $p < 0.005$ ). No differences in demographic and infection-related data were found between the two groups. We divided the DG according to the diagnosis of SSI (DG-SSI  $n=16$ ) or no SSI (DG-nSSI  $n=16$ ). No differences were found both in preoperative Hb1Ac levels ( $7.11 \pm 1\%$  in the DG-SSI vs  $6.89 \pm 0.65\%$  in the DG-nSSI,  $p=0.5$ ) or in mean glucose levels during the first 24h ( $157 \pm 37$  mg/dL in the DG-SSI vs  $158 \pm 40$  mg/dL in the DM-nSSI,  $p=0.98$ ) and 48h ( $173 \pm 39$  mg/dL in the DG-SSI vs  $182 \pm 54$  mg/dL in the DM-nSSI,  $p=0.57$ ) between groups.

**Conclusion(s):** The incidence of SSI after colorectal surgery is higher in diabetic patients. Special attention has to be given to these patients to detect infectious complications earlier. Our results suggest that neither preoperative HbA1c levels nor postoperative glycemic control are related to the development of SSI.

## 12AP4-9

### Comparison of prophylactic effects of polyurethane cylindrical or tapered cuff and polyvinyl chloride cuff endotracheal tubes on ventilator-associated pneumonia

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**Background and Goal of Study:** Because microaspiration of contaminated supraglottic secretions past the endotracheal tube cuff is considered to be central in pathogenesis of pneumonia, improved design of endotracheal tubes with new cuff material and shape have reduced the size and number of folds, which together with the addition of suction ports above the cuff to drain pooled subglottic secretions leads to reduced aspiration of oropharyngeal secretions. So we conducted a study to compare the prophylactic effects of polyurethane- cylindrical or tapered cuff endotracheal tubes (ETT) on ventilator associated pneumonia.

**Materials and methods:** This randomized clinical trial was carried out in 12 bed surgical intensive care unit. 96 patients expected to require mechanical ventilation more than 96 hours were randomly allocated to one of three following groups: polyvinyl chloride cuff endotracheal tube, polyurethane cylindrical sealguard ETT and polyurethane taperguard ETT. Cuff pressure monitored every three hours 3 days in all patients. Mean cuff pressure did not have significant difference between three groups during 72 hours.

**Results and discussion:** Pneumonia was seen in 11 patients (34%) in group polyvinyl chloride, 8 (25%) in sealguard and 7 (21%) in taperguard group. Changes in mean cuff pressure between sealguard and polyvinyl chloride tubes and also between taperguard and polyvinyl chloride tubes did not show any significant difference. There was no significant difference in overinflation between three groups.

**Conclusion:** The use of ETT with polyurethane material results in reducing ventilator-associated pneumonia compared to ETT with associated pneumonia compared to sealguard tubes. polyvinyl chloride cuff. In polyurethane tubes taperguard has less incidence of ventilator associated pneumonia.

## 12AP4-10

### Effect of remote ischemic conditioning on systemic inflammatory response and survival rate in LPS-induced sepsis model

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**Background:** Remote ischemic preconditioning (RIPC) and postconditioning (RpostC) have protective effects on ischemia and reperfusion injury. The effects have been reported to activate HO-1 and attenuate NF- $\kappa$ B, and subsequently reduce systemic inflammation. NF- $\kappa$ B is a critical inflammatory mediator of sepsis and recently, up-regulation of HO-1 by chemical inducers has been reported to prevent LPS-induced acute hepatic injury. Therefore,

we investigated whether RIPC and RpostC could have protective effects on LPS-induced systemic inflammation.

**Materials and methods:** All experimental procedures involving animals were carried out in accordance with the NIH guide for the Care and Use of Laboratory Animals issued by the Korea University School of Medicine. The study was approved by the Ethical Committee on Animal Research of the Korea University College of Medicine. Six-week-old male BALB/c mice were randomly divided into two groups and intraperitoneally injected with LPS (20mg/kg) or saline. Remote ischemic conditioning was induced with three 10-min ischemia/10-min reperfusion cycles of the right hind limbs using tourniquet before LPS injection (RIPC) or after LPS injection (RpostC). The effects of RIPC and RpostC were examined for the survival rate, serum cytokines, NF- $\kappa$ B, HO-1 and liver pathology.

**Results:** Survival rate within 120 hours significantly increased in the LPS injected and remote ischemic conditioned mice than in LPS only injected mice (60-65% vs 5%, respectively,  $p < 0.01$ ). TNF- $\alpha$ , IL-1 $\beta$  and IL-6 increased markedly in the LPS only injected mice, however, remote ischemic conditioning suppressed the changes ( $p < 0.05$ ). IL-10 level was significantly higher in the LPS injected and RpostC treated mice than in the LPS only injected mice ( $p=0.014$ ). NF- $\kappa$ B activation was significantly attenuated ( $p < 0.05$ ) and HO-1 levels were substantially higher in the LPS injected and remote ischemic conditioned mice than in the LPS only injected mice. Neutrophil infiltration was significantly attenuated in the LPS injected and remote ischemic conditioned mice than in the only LPS injected mice ( $p < 0.05$ ).

**Conclusion(s):** RIPC and RpostC attenuated inflammatory responses and improved survival outcomes of mice with LPS-induced sepsis. The mechanism may be caused by modifying NF- $\kappa$ B mediated expression of cytokines.

## 12AP4-11

### Intermittent high-volume hemofiltration in patients with severe sepsis and intracranial hypertension

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**Background and Goal of Study:** It has been demonstrated by Pfister [1] that patients with sepsis had moderate elevations of intracranial pressure (ICP)  $> 15$  mmHg in 47% of cases. In turn, renal replacement therapy technique itself can have a direct impact on dynamic increase of intracranial pressure. Therefore, the aim of the study was to evaluate the risk factors that lead to further increase of intracranial pressure after intermittent high-volume hemofiltration in patients with severe sepsis and intracranial hypertension.

**Materials and methods:** The retrospective study in 268 patients with severe sepsis and intracranial hypertension measured by the pressure in the central retinal vein was performed. Intracranial hypertension was considered as ICP  $> 15$  mmHg. Patients were divided into two groups: with further growth of ICP (1 group) and with decrease of ICP (2 group) after HVHF. Statistical analysis was performed with SPSS statistical software, using Mann-Whitney U-test and ROC-curve analysis to determine optimal cut-off values.

**Results and discussion:** The two groups showed significant differences in ICP after HVHF: 21.0 (19.8-22.3) mmHg vs 14.5 (12.3-17.0) mmHg ( $p < 0.05$ ). In patients with elevated intracranial pressure after HVHF a significant decrease in cerebral perfusion pressure was identified: 68.0 (65.1 - 79.1)/63.5 (59.0-68.3) mmHg compared with patients group who presented decrease of ICP 71.7 (61.3-84.8)/80.0 (70.0-86.0) mmHg. The lactate levels also remained high compared to second group: 2.15 (1.9-2.3) vs 1.4 (1.2-1.6) mmol/l. Using ROC curve analysis it was estimated that  $\Delta pCO_2$  and Glasgow coma scale (GCS) score before HVHF were closely related with the increase of ICP after HVHF (AUROC = 0.93 and 0.91, respectively), with the "cut-off" for  $\Delta pCO_2 > 5.9$  mm Hg and for GCS score  $< 10$  points.

**Conclusion(s):** In view of the possible presence of brain edema, the influence of intracranial pressure (ICP) on cerebral perfusion pressure (CPP) must be considered. Thus, summarizing the above, it can be noted that in the case of initially elevated intracranial pressure intermittent high-volume hemofiltration in patients with severe sepsis is not recommended when  $\Delta pCO_2 > 5.9$  mm Hg and the GCS score  $< 10$  points.

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## 12AP5-2

## Phosphodiesterase-4-inhibition attenuates hepatocellular injury in systemic inflammation in vivo and in vitro

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**Background and Goal of Study:** Multi organ failure (MOF) caused by sepsis is associated with high mortality rates. It has been shown previously, that microcirculatory dysfunction, often associated with MOF (1), can be influenced by Phosphodiesterase-4-inhibition (PD-4-I) (2). Acute liver failure is a prognostic indicator of poor outcome in critically ill (3). In this study we evaluated the effect of PD-4-I on hepatic microcirculation and hepatocellular injury in vivo and in vitro.

**Materials and methods:** Upon animal care committee approval 16 rats were instrumented with central venous and arterial line, tracheostomy and continuous cardiac output monitoring. Animals were randomized into 3 groups: Control, Lipopolysaccharide (LPS) and LPS+PD-4-I. Hyperinflammation was induced by intravenous (i.v.) LPS and hepatic microcirculation was evaluated by intravital microscopy. LPS+PD-4-I animals were treated with Rolipram i.v. To establish MAP $\geq$ 60mmHg animals were fluid resuscitated with Sterofundin®Iso. Dead cells were visualized in vivo. Liver specimen were harvested and heme oxygenase 1 (HO-1) expression was quantified. HepG2 cells were exposed to different concentrations of LPS, TNF $\alpha$  and Rolipram and their cell viability was measured utilizing XTT testing. One way Anova (post-hoc Duncan), Kruskal-Wallis or student's t-test were performed for statistical analysis; p < 0.05; mean $\pm$ SEM.

**Results and discussion:** *In vivo:* Hepatic microcirculation in the LPS+PD-4-I group was maintained at control levels (Control: 16.1 $\pm$ 1.1pl/sec; LPS+PD-4-I: 16.8 $\pm$ 0.7pl/sec) and was significantly improved compared to the LPS group (LPS: 13 $\pm$ 0.6pl/sec). The functional sinusoidal density was significantly improved in the LPS+PD-4-I group. Hepatocellular injury was attenuated, but HO-1 expression remained unchanged. *In vitro:* HepG2 cell viability was reduced by incubation with LPS (82.9 $\pm$ 6%), but was significantly improved by coincubation with PD-4-I (e.g. 2.5 $\mu$ M: 144.4 $\pm$ 12%). PD-4-I also significantly improved viability of cells incubated with different concentrations of TNF $\alpha$ .

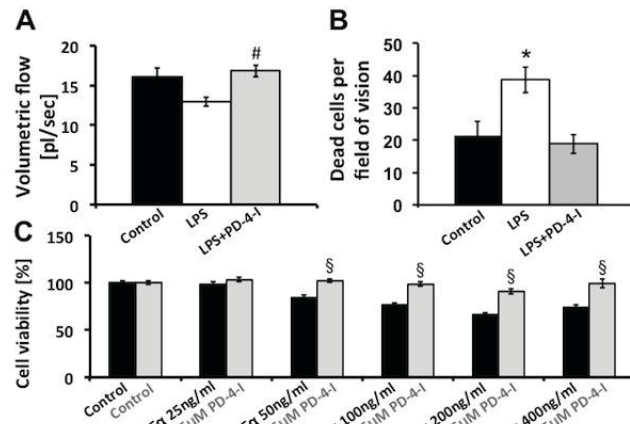


Figure 1. A: Hepatic microcirculation. B: Dead cells per field of view. C: HepG2 cell viability. \* p < 0.05 vs. Control; # vs. LPS; § vs. TNF $\alpha$ . Mean $\pm$ SEM.

[Graph 1]

**Conclusion:** PD-4-I treatment in hyperinflammation reduced hepatocellular injury and microcirculatory dysfunction in vivo. PD-4-I directly attenuates loss of cell viability in vitro. Meanwhile, the exact mechanisms of liver protection by PD-4-I therapy remains unclear and requires further research.

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## 12AP5-3

## MELD score 48 hours after liver transplantation: a significant predictor of 3-month recipient mortality

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**Background and Goal of Study:** Model for end-stage liver disease (MELD) is an accurate predictor of mortality in patients with cirrhosis, and it has been used on liver allocation priority. However, its impact on post-transplant mortality is still poorly characterized, specially in short-term survival, when patient is still in the Intensive Care Unit (ICU). This study is aimed at assessing the impact of implementation of the MELD system 48 hours after liver transplantation (LT) on mortality in the ICU.

**Materials and methods:** A retrospective study was carried out among 398 adult patients who underwent LT at our institution between January 2001 and December 2012. MELD values were calculated 48 hours after LT. A Cox regression analysis was made with those variables that resulted statistically significant in the univariate analysis.

**Results and discussion:** MELD scores 48 hours after LT correlated with 3-month survival. Mortality increased 7.7% with each additional point increase in MELD (HR 1.077; 95% CI 1.042-1.113; p < 0.001), in Cox-regression analysis. When categorized, MELD scores have the following 3-month cumulative survival:

<10 -- 93%  
10-19 96%  
20-29 81%  
30-39 78%  
>40 67%

When other factors were analyzed, five were identified as independent predictors of mortality following LT at three months: diabetes mellitus, length of surgery, primary graft failure, hepatic artery thrombosis and recipient age.

**Conclusion(s):** In our study, MELD score, calculated 48 hours after liver transplantation was an independent risk factor of 3-month mortality.

Other factors, such as diabetes mellitus, length of surgery, primary graft failure, recipient age and hepatic artery thrombosis had also significant influence on 3-month recipient survival after LT.

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## 12AP5-4

## Immunosuppressive therapy in orthotopic liver transplant: need of renal replacement therapy

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**Background and Goal of Study:** Kidney failure has a high incidence after orthotopic liver transplants (LT). When renal replacement therapies (RRT) are required, mortality rates increased. Changes in immunosuppressive protocols have been made within the past few years. The aim of this study was to evaluate the relationship between these changes and RRT used as an indicator of renal injury.

**Materials and methods:** Retrospective review and analysis was done over 398 patients who underwent orthotopic liver transplant between January 2002 and December 2012 at a single center. In 2010 immunosuppressive regimen changed in our center: calcineurin inhibitors (CI) were delayed until 72 hours after the transplant due to the early introduction of basiliximab, and we looked for lower CI plasmic levels. A multivariate logistic regression analysis was performed to evaluate the association between those changes and kidney injury defined by the need of renal replacement therapy (RRT). We carried out the multivariate analysis with those confounding variables that were found to have statistical association with hemodialysis in the univariate study.

**Results and discussion:** Patients requiring renal replacement therapy had a 90-day survival of 68% compared with 94% in patients not requiring RRT. RRT was needed in 29.2% of the patients before changes were made in immunosuppressive therapies, and only 1.7% of the patients required RRT after CI could be introduced 72 hours after the transplant. Association between those changes in the immunosuppressive therapies and the kidney injury,

defined as RRT needed first week after LT, was established: odds ratio 43.95; 95% (CI 5.32-362.66).

**Conclusion(s):** Less renal failure and less RRT is required when using basiliximab after a liver transplant probably because the introduction of calcineurin inhibitors such tacrolimus, can be delay until 72 hours after the surgery.

## 12AP5-6

### A descriptive study of the patients on an intensive care unit in Tanzania

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**Background and Goal of Study:** Tanzania is one of the poorest countries in the world. Scarcity of intensive care beds, trained staff and medical equipment together with delayed admission to hospital all contribute to high in-hospital mortality rates. There is currently little data on which patients that are cared for in Intensive Care Units (ICUs) in Tanzania or their outcomes. The aim of this study was to describe a patient cohort admitted to an ICU in Tanzania.

**Materials and methods:** We conducted a prospective single-centre cohort study at Muhimbili National Hospital, a tertiary referral hospital in Dar es Salaam, Tanzania. All patients admitted to the ICU in a three-month period (Dec 2012 to Feb 2013) were included. Data from patient observation charts were collected and analysed using descriptive statistics. Patient demographic data, reasons for admission, ICU length-of-stay (LOS) and mortality rates were studied. We measured illness severity on admission using two scores based on vital signs: a Modified Early Warning Score (MEWS) and presence of a priori defined danger signs.

**Results and discussion:** During the study period 73 patients were admitted to the ICU: 60 adults (>16 years), 9 children and 4 patients with missing age data. 47% were male and 53% female. Median age was 36 years (range 3 months to 80 years). Most common diagnoses among adult patients were postoperative care (54%) due to elective (32%) or acute (22%) surgery, followed by obstetric complications (18%), medical conditions (11%), infectious diseases (8%) and trauma (7%). On admission to the ICU, the adult patients had a median MEWS score of 6 (Inter-quartile range (ICQ) 5-8) and 47% had a critical MEWS score of  $\geq 5$ . 63% of the patients had  $\geq 1$  danger sign and 33% had at least two danger signs. Median LOS on the ICU was 1 day (ICQ 0.5-4 days). In-hospital mortality rate was 50%. Median LOS among the acutely admitted patients was 2.8 days and mortality 73% compared to a median LOS of 0.9 days and mortality rate of 5 % among elective admissions.

**Conclusion(s):** We have described a cohort of patients on an ICU in Tanzania. A large proportion of the patients are critically ill on admission and warrant urgent care. A mortality rate of 50% is extremely high. As the first study of its kind in Tanzania, the results can be used for comparison with other centres and as a baseline for future work and studies aiming to improve the quality of care and survival rates at Muhimbili.

## 12AP5-7

### Oxygen mask capnometry type <sup>R</sup> is useful device for continuous CO<sub>2</sub> monitoring during different breathing patterns in extubated post abdominal surgical patients: a prospective observational study

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**Background and Goal of Study:** Respiratory monitoring is standard and essential assessment after anaesthesia and surgery. Continuous end-tidal carbon dioxide concentration (EtCO<sub>2</sub>) monitoring with capnometry is used for the early detection of respiratory and haemodynamic changes during anaesthesia. However the accuracy of carbon dioxide (CO<sub>2</sub>) monitoring during spontaneous breathing without end tracheal tube has not been elucidated. This study compared EtCO<sub>2</sub> measured by capnometry using the oxygen mask with a carbon dioxide sampling port (Oxygen mask capnometry type <sup>R</sup>) and partial pressure of carbon dioxide (PaCO<sub>2</sub>) in extubated patients who performed ab-

dominal surgery. Further we investigated whether spontaneous deep breathing affect dissociation between PaCO<sub>2</sub> and EtCO<sub>2</sub>.

**Materials and methods:** Adult patients after abdominal surgery admitted to intensive care unit were enrolled. Oxygen was supplied at 6 liters min<sup>-1</sup> with Oxygen mask capnometry type <sup>R</sup> immediately after extubation. Blood gas analysis was collected after 30 min of oxygen supply, while EtCO<sub>2</sub> was measured under resting condition (EtCO<sub>2</sub> RE) and deep breathing (EtCO<sub>2</sub> DB). Correlation between PaCO<sub>2</sub> and EtCO<sub>2</sub> was analyzed both under resting and deep breathing. Bias, precision, and limits of agreement were calculated in Bland-Altman method in two different respiratory conditions.

**Results and discussion:** Twenty-seven patients, 17 male (63%), mean (inter-quartile range) age 61 (54-75) years and BMI 23 (21-25) kg m<sup>-2</sup>, were studied. Correlation between PaCO<sub>2</sub> and EtCO<sub>2</sub> under resting condition and deep breathing were  $r = 0.545$  and  $0.586$ , respectively. Compared with PaCO<sub>2</sub>, the bias and limits of agreement were  $-12.5$  ( $-20.2$  to  $-4.8$ ) for EtCO<sub>2</sub> RE and  $-9.1$  ( $-15.9$  to  $-2.4$ ) for EtCO<sub>2</sub> DB. In statistically, dissociation between PaCO<sub>2</sub> and EtCO<sub>2</sub> DB was significant smaller than those with EtCO<sub>2</sub> RE ( $p=0.001$ ). The change of dissociation might be derived from improving ventilation/perfusion mismatch due to physiological dead space decreased. Although it might be useful for continuous CO<sub>2</sub> monitoring with EtCO<sub>2</sub> DB, in clinical setting, it is difficult to predict precise value of PaCO<sub>2</sub> with using both of breathing pattern, because limits of agreement under two breathing pattern is similar and wide range.

**Conclusion(s):** In extubated patients after abdominal surgery, Oxygen mask capnometry type <sup>R</sup> is useful device for continuous CO<sub>2</sub> monitoring even breathing patterns is changed.

## 12AP5-8

### Serum ionized magnesium monitoring during living liver transplantation

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**Background:** Low concentration of serum ionized magnesium (iMg) causes various complications, like as sinus tachycardia in peri-operative period. It have been reported that massive bleeding and reperfusion after anhepatic phase is related to decrease in iMg, and the concentration of total magnesium in blood is not same as the concentration of iMg during living donor liver transplantation (LDLT). The monitoring and management of iMg are expected to contribute to the risk reduction of complications and the improvement of outcome. We investigated the transition of iMg concentration during LDLT, retrospectively.

**Methods:** This study was approved by center for clinical and translational research of Kyushu university hospital. Our study included 36 adults, 12 males and 25 females, who were taken LDLT from 1 / November / 2012 to 31 / October / 2013 at our hospital.

**Results:** The average concentration of iMg were kept in normal range at the beginning of operation (0.45 mmol/L), before anhepatic phase (0.47 mmol/L), right before reperfusion (0.44 mmol/L), right after reperfusion (0.44 mmol/L), 3 hours after reperfusion (0.48 mmol/L), the end of operation (0.50 mmol/L). There was no case that iMg was below 0.3 mmol/L, though it has been reported that arrhythmia more frequently happened below 0.3 mmol/L iMg. The patients, in whom total blood loss was below 5000 mL, were put into the low blood loss group (Group L) and the patients with large blood loss over 5000 mL were put into the high blood loss group (Group H). The amount of total blood loss was 2519 mL in the group L and 10924 mL in the group H. There were no differences of iMg concentration between both groups. No relationships were showed between the concentration of iMg and other minerals, like as ionized potassium and ionized calcium. The total dosages of magnesium sulfate were 15 mEq in the group L and 64 mEq in the group H and the proportional relationships were statistically showed between the amount of total blood loss and total dose of magnesium sulfate.

**Conclusions:** We are indicating that we could properly control the concentration of iMg during LDLT in the adults. Even in the cases of large amount of total blood loss, over 10000 mL, the measure of iMg contributed to the good control in the normal range of iMg concentration. We are still investigating that normal concentration of iMg reduces complications, and iMg monitoring is expected to contribute to improve the outcome of the patients after LDLT.

## 12AP5-9

### Application of APACHE II, SAPS II, SOFA and MODS scores in predicting outcome of severe acute pancreatitis (SAP)

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**Background and Goal of Study:** Acute pancreatitis represents a spectrum of disease ranging from a mild, self-limited course requiring only brief hospitalization to a rapidly progressive, fulminant illness resulting in the multiple organ dysfunction syndrome (MODS), with or without accompanying sepsis. The aim of this study was to compare Acute Physiological and Chronic Health Evaluation (APACHE II), Simplified Acute Physiology Score (SAPS II), Sequential Organ Failure Assessment (SOFA) score and Multiple Organ Dysfunction Score (MODS) for predicting hospital mortality in severe acute pancreatitis.

**Materials and methods:** Patients with predicted severe acute pancreatitis admitted to the ICU was calculated. Admission APACHE II (24h), SAPS II (24h), MODS and SOFA scores and maximum MODS and SOFA scores were calculated and compared regarding hospital mortality. The outcomes of the patient were classified as non survivors and survivors. The prognostic ability of these four scoring systems were assessed by the areas under the receiver operating characteristic curves (AUC).

**Results and discussion:** Forty-five patients were enrolled. There were 27 deaths (60%). The AUC of admission scores were  $0.76 \pm 0.05$  for APACHE II and  $0.78 \pm 0.04$  for SAPS II,  $0.79 \pm 0.05$  for MODS,  $0.86 \pm 0.04$  for SOFA in predicting hospital mortality. And the AUC of maximum scores were  $0.89 \pm 0.04$  for MODS and  $0.94 \pm 0.03$  for SOFA. All maximum scores had better ability in predicting hospital mortality than the admission scores respectively ( $P < 0.05$ ). In admission scores, SAPS II show better power than APACHE II to predict hospital mortality, while there were no significant difference among the MODS and SOFA. In maximum scores, SOFA show better power than MODS ( $P < 0.05$ ).

**Conclusion(s):** Organ dysfunction scores (MODS and SOFA) show better power than first day scoring systems (APACHE II and SAPS II) in predicting hospital mortality of the patients with SAP. And in organ dysfunction scores, the maximum scores show more ability than admission to predict outcome, especially the SOFA score.

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## 12AP5-10

### Procalcitonin after liver transplantation. Kinetics and correlation with postoperative complications

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**Background and Goal of Study:** Procalcitonin (PCT) is a peptide precursor of the hormone calcitonin produced by parafollicular cells of the thyroid and neuroendocrine cells of the lung and intestine. Its level rises in response to proinflammatory stimulus, especially in infections. High levels are associated with worse clinical status. It has been used as a diagnostic and prognostic marker. PCT Levels (PCTL) in the postoperative of Liver Transplantation (LT) has been poorly studied. It has been correlated with infection complications and rejection in this setting. The aim of our study was to investigate the relationship between PCTL after LT and infection complications.

**Materials and methods:** PCTL were analyzed immediately before LT, at the time of ICU admission, and at day 1, 2, 4 and 6 after LT. 29 patients transplanted between November of 2011 and September of 2012 were analyzed. Donor and recipient characteristics were collected. Anesthetic and intraoperative surgical variables, postoperative complications (including infections and rejection episodes), biochemical and hematological data and vital signs were recorded. We compared these data into 2 groups according PCTL ( $\geq 2$ ng/mL or  $< 2$ ng/mL), and then on 2 other groups with PCT cutoff level 10ng/mL. We also analyzed the relationship between PCTL and acute renal failure, defined by KDIGO classification.

**Results and discussion:** We found the peak PCTL on day 2 and, independently of the levels reached, then decreased. 75% of patients reached peak levels higher than 2 ng/mL and 35.7% higher than 10 ng/mL. We found no relationship between PCTL and infectious or PCTL and SIRS. No patient developed infection or rejection in the first week after LT. Patients that developed renal dysfunction after LT (all on day 2) had higher PCTL (all of them peak level higher than 2ng/mL). The analysis showed the relationship between the cause of donor death (anoxia), the clinical situation before surgery (higher MELD scores), and the presence of complications during surgery (reperfusion syndrome, length of surgery, vasoactive drugs required) and PCTL.

**Conclusion(s):** On our study, peak PCTL appeared on day 2 and decreased the following days. No correlation was found between PCTL and SIRS, infection or rejection. No patient developed infectious complications, so we can't describe the evolution of PCT after LT in these cases, although we assume that PCTL doesn't decrease with infectious complications, independently of its value.

## Resuscitation and Emergency Medicine

### 13AP1-1

#### Earlier start of advanced life support, and not basic life support, determines survival after out-of hospital cardiac arrest

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**Background and Goal of Study:** In a recent study, Goto et al. observed 4 important pre-hospital variables for predicting good neurological outcome 1 month after out-of hospital cardiac arrest (OHCA): shockable initial cardiac rhythm, age  $< 65$  yr, arrest witnessed by emergency medical personnel and call-to-hospital arrival  $< 24$  min.[1] In this small study, we examined the difference in response time of emergency medical teams and time between collapse, emergency call and start of BLS between survivors (S) and non-survivors (NS) of an OHCA.

**Materials and methods:** With IRB approval we prospectively collected time data of 51 OHCA patients between December 2011 and November 2013. CPR data were collected using the Utstein CPR data registration and the local emergency charts. S is defined as sustained spontaneous circulation more

than 20 minutes. Times collected are time between emergency call and start advanced life support (Tec-ALS), time emergency call and start BLS (Tec-BLS), time collapse and start ALS (Tc-ALS), time collapse and start BLS (Tc-BLS) and time between collapse and emergency call (Tc-ec). Mann-Whitney test and Pearson Chi-square was utilized for comparison of S and NS data.

**Results and discussion:** Of the 51 OHCA patients, 21 were S. Mean age was 70 yr ( $\pm 15$ ) and 69 yr ( $\pm 17$ ) ( $p = 0.916$ ) in respectively S and NS. BLS was performed in 17 S (81%) and 28 NS (93%) ( $p = 0.177$ ). In the group of S were 10 male patients and in the NS group 23 male patients ( $p = 0.033$ ). The OHCA as witnessed in 16 S and 15 NS ( $p = 0.059$ ). No significant differences was found in initial rhythm between both groups. Tec-ALS was 12 min (8-15) in the S and 14 min (12-17) in NS ( $p = 0.029$ ) with Tec-BLS 0 min (0-3) in S and NS ( $p = 0.916$ ). Time between collapse and emergency call was 1min (0-5) in S and 10 min (2-15) in NS ( $p = 0.037$ ) (6 missing data in S group and 11 missing data in NS group). BLS was performed during 10 min (6-14) in S and 14 min (10-17) in NS ( $p = 0.022$ ).

**Conclusion(s):** Despite the fact that there was no difference in time between start of BLS after collapse and/or emergency call, the response time (Tec-ALS) was significantly shorter in the survivor group. Larger studies need to be performed to confirm these findings.

#### References:

1. Y. Goto, T. Maeda, and Y. Nakatsu-Goto, "Neurological outcomes in patients transported to hospital without a prehospital return of spontaneous circulation after cardiac arrest," *Crit. Care Lond. Engl.*, vol. 17, no. 6, p. R274, Nov. 2013.



### 13AP1-2

#### Emulsified isoflurane postconditioning improves survival and neurological outcomes in a rat model of cardiac arrest

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**Background:** Ischemic brain injury, as one of the important complications after cardiac arrest (CA), directly causes serious disability and death. Emulsified isoflurane (Elso) is a lipid emulsion for intravenous administration and has been proved to have protective effect on ischemia/reperfusion (I/R) injury in heart, liver, and lung. Volatile anesthetics postconditioning have been clarified to have protection on brain I/R injuries. This study aimed to test the possibility whether Elso postconditioning could improve survival and neurological outcomes on a rat model of CA.

**Methods:** One hundred and seventy one adult Sprague-Dawley rats were randomly allocated to six groups. Cardiopulmonary resuscitation was processed after six minutes of asphyxia-induced CA. Resuscitated rats received Elso (2ml/kg), Elso (4ml/kg), isoflurane (1.3%), emulsion (4ml/kg), and placebo respectively for 30 min, the remaining animals underwent sham surgery but no asphyxia or drugs. One day and seven days after recovery of spontaneous circulation (ROSC), rats' survival condition were confirmed. Neurobehavioral evaluations and brain histopathology observation were also performed.

**Results:** Elso (4ml/kg) postconditioning could enhance one day survival rate (100% vs. 54.5% in CPR group) after ROSC. Behavioral tests shows Elso (4ml/kg) could enhance neural deficit score on one day and improve the memory function on seven days after ROSC. Additionally, histopathological results showed Elso (4ml/kg) postconditioning ameliorated hippocampal CA1 region cell death and apoptosis on seven days after ROSC.

**Conclusion:** Elso postconditioning improves one day survival rate, as applied in a CA paradigm which is highly clinically relevant. Compared with Elso (2ml/kg), more dosage of Elso (4ml/kg) display a better survival condition and neurological outcomes. Elso may provide a promising method for brain protection on clinical practice of resuscitation.

### 13AP1-3

#### Hyperfibrinolysis is a marker of tissue hypoperfusion in patients with out-of-hospital cardiac arrest

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**Background and Goal of Study:** We previously showed that hyperfibrinolysis in patients with out-of-hospital cardiopulmonary arrest (OHCA) and return of spontaneous circulation (ROSC) is particularly related to metabolic acidosis, suggesting an association between tissue perfusion and clot breakdown. Here we hypothesized that hyperfibrinolysis is more common in OHCA patients with disturbed cerebral tissue oxygenation as measure of tissue perfusion.

**Materials and Methods:** In 46 patients the level of fibrinolysis was determined upon emergency department admission using rotational thromboelastometry. Hyperfibrinolysis was defined as a lysis index > 15%. Cerebral tissue oxygenation was measured simultaneously using near-infrared spectroscopy, and tissue hypoperfusion was defined as a tissue oxygenation index (TOI) < 50%. Blood sample analysis included D-dimer concentration and plasma markers for hypoperfusion and coagulation.

**Results and Discussion:** OHCA was associated with a prolonged prothrombin time ( $1.60 \pm 0.88$  INR) and activated partial thromboplastin time ( $78 \pm 70$  sec). Seventeen out of 46 patients developed hyperfibrinolysis (37%) and showed higher D-dimer concentrations ( $12$  (4-35) vs.  $6$  (2-9) ng/ml;  $P=0.04$ ) compared to patients without hyperfibrinolysis.

Patients with hyperfibrinolysis had a more disturbed base excess ( $-16.0 \pm 6.1$  versus  $-7.7 \pm 5.9$  mmol/L;  $P < 0.001$ ) and higher lactate levels ( $11.7 \pm 4.1$  versus  $6.8 \pm 3.4$  mmol/L;  $P < 0.001$ ) than patients without hyperfibrinolysis. The lysis index was higher in patients with a TOI < 50% than in patients with normal tissue perfusion (92% (25-100) versus 6% (3-11);  $P < 0.001$ ).

There was a moderate association between the TOI and time to onset of hyperfibrinolysis in the FIBTEM test ( $r=0.49$ ;  $P=0.04$ ). Hyperfibrinolysis was associated with lower thrombin-antithrombin levels ( $20.2 \pm 16.1$  vs.  $31.7 \pm 11.0$  ng/ml), lower plasminogen levels ( $152 \pm 68$  vs.  $223 \pm 43$  microg/ml) and higher t-PA levels ( $20.2 \pm 4.8$  vs.  $6.8 \pm 3.6$  ng/ml) than in patients without

hyperfibrinolysis (all  $P < 0.02$ ). Twenty-four hour mortality was the highest in patients with hyperfibrinolysis (53% versus 6%;  $P < 0.001$ ).

**Conclusion:** Hyperfibrinolysis is a marker of tissue hypoperfusion and reduced tissue oxygenation in patients with return of spontaneous circulation after cardiopulmonary arrest, and may contribute to unfavorable outcome in these patients.

### 13AP1-4

#### Efficacy of lipid resuscitation in cardiac arrest induced by bupivacaine-glucose mixture in rats

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**Background and Goal of Study:** There have been reported that the infusion of lipid emulsion is effective to treat bupivacaine-induced cardiac arrest (1-3). As the postulated mechanism of action, the so-called "lipid sink" effect, may depend on the lipophilicity of local anesthetics. We examined the efficacy of lipid resuscitation when glucose is added to bupivacaine in awake rats.

**Materials and methods:** We divided SD rats into lipid emulsion group and control group. Twelve female SD rats anesthetized with sevoflurane underwent tracheostomy and cannulation through the right femoral artery and vein. Two hours after discontinuation of sevoflurane inhalation, the rats received hyperbaric 0.5% bupivacaine, containing 72.7 mg/mL glucose ( $n=6$ ) at a rate of 2 mg/kg/min. When pulse pressure decreased to zero, infusion of local anesthetic was stopped, and ventilation with 100% oxygen and chest compressions started immediately. Twenty % lipid emulsion (5 ml/kg bolus plus continuous infusion at 0.5 ml/kg/min) was intravenously infused in the lipid emulsion group, while the same volume of saline was infused in the control group. Chest compressions were continued until the native rate-pressure product increased by more than 20% of baseline. Electrocardiogram and arterial blood pressure were monitored continuously. Data were expressed as mean  $\pm$  SD. Statistical analysis were using Student-t test with Bonferroni correction, and  $P < 0.05$  was considered statistically significant.

**Results and discussion:** Baseline (before infusion of local anesthetics) arterial blood gas values, mean arterial blood pressure (MAP) and heart rate (HR) did not differ between groups. There were no significant differences between groups in MAP values at 2, 3, 4, 5 and 10 min after the start of resuscitation ( $10 \pm 7$  vs  $9 \pm 4$ ,  $15 \pm 9$  vs  $15 \pm 8$ ,  $19 \pm 10$  vs  $21 \pm 11$ ,  $25 \pm 15$  vs  $23 \pm 13$ ,  $113 \pm 64$  vs  $100 \pm 75$  mmHg, respectively) ( $P < 0.05$ ). Also, no significant differences were found between groups in HR values at 2, 3, 4, 5 and 10 min after the start of resuscitation ( $P < 0.05$ ).

**Conclusion(s):** Lipid therapy was not effective in resuscitation from cardiac arrest induced by bupivacaine-glucose mixture. Our finding suggests that glucose likely reduces the lipid sink effect.

#### References:

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2. Anesthesiology 108: 907-13, 2008.
3. Anesth Analg 109: 1323-6, 2009.

### 13AP1-5

#### Effects of helium pre- and postconditioning on caveolin-3 expression in a resuscitation model of the rat

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**Background and Goals:** Helium has cardioprotective effects, but the underlying mechanisms are still unknown (1). Recent studies have identified caveolin-3, a scaffolding protein responsible for regulating signaling molecules, as a possible mediator of this cardioprotection. We examined the expression of caveolin-3 after helium pre- and postconditioning in a resuscitation model of the rat.

**Material and methods:** After approval by the Animal Care Committee, 104 male Wistar rats underwent cardiac arrest induced by electrically evoked ventricular fibrillation. The intervention groups received 70% helium and 30% oxygen for 5 min before cardiac arrest and for 30 min after successful cardiopulmonary resuscitation. Control animals were ventilated with 70% nitrogen and 30% oxygen. After 2h, 4h or 7 days (d) the hearts were extracted and snap frozen in liquid nitrogen. In the 2h and 4h groups, arterial blood samples were taken before heart extraction.

Expression of caveolin-3 was measured by infrared western blot analysis in

different cell fractions of the heart homogenate as well as in serum. The cognitive function of the 7d group was detected at 4 time points using the tape removal test (1d before intervention, 1d post intervention (p.i.), 3d.p.i. 7d.p.i.). Helium and control groups of each time point were compared using the unpaired t-test. For the n=6 groups (2h and 4h groups) 2 independent experiments were performed. Differences were considered statistically significant with  $p < 0.05$ .

**Results and discussion:** In 36 of 54 treated rats and 36 of 50 control rats, restoration of spontaneous circulation was achieved.

The tape removal test demonstrated a global neurological deficit with initial recovery at day 7, with no significant difference between groups. After an initial decrease, caveolin-3 increased in the cytosolic and membranous fraction after 4h and 7d. No significant differences in caveolin-3 expression were detected in the serum.

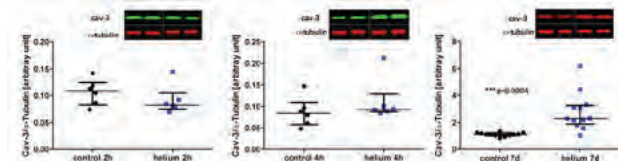


Figure 1: densitometric evaluation of cav-3/ $\alpha$ -tubulin expression in the cytosol (median with IQR)

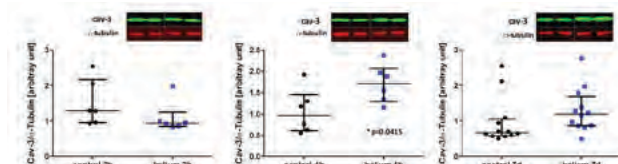


Figure 2: densitometric evaluation of cav-3/ $\alpha$ -tubulin expression in the membrane (median with IQR)

**Conclusion:** Helium pre- and postconditioning regulates caveolin-3 expression in a postreanimation model in rats.

#### Reference:

Oei et al. *Anesthesiology* 2010; 112: 1503-10

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### 13AP1-6

#### Cardiopulmonary resuscitation, chest compression only, and teamwork from the perspective of medical doctors, surgeons and anesthesiologists

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**Background and Goal of Study:** Resuscitation guidelines that were proposed by European resuscitation council in 2010 have introduced a new method of cardiopulmonary resuscitation (CPR) by chest compressions only for lay people and untrained professionals. An aim of the study was to evaluate differences between anaesthesiologists, surgeons and medical doctors towards critical points in CPR: call for help, chest-compression-only resuscitation, mouth-to-mouth ventilation and team work.

**Materials and methods:** We conducted a study using anonymous survey in 190 medical professionals: 93 medical doctors, 70 surgeons, and 27 anaesthesiologists in 2012 year. Statistical analysis was performed using Student's t-test and chi-square test.

**Results:** The mean age of doctors was 41.9 years. The only difference between medical doctors, surgeons and anaesthesiologists was observed regarding the male vs. female ratio, with more male surgeons (45, 55, and 11,  $p < 0.01$ ). All doctors considered CPR as important for their profession. Despite this, only anaesthesiologists knew how often guidelines in CPR do change and have performed resuscitations personally. This importance was not supported by education in CPR. Approximately 45% of medical doctors, 48% of surgeons and 77% of anaesthesiologists reported that they have renew their knowledge in CPR within last five years, 22%, 25 and 7% did it within last 10 years, whereas 34%, 25% and 22% medical doctors, surgeons and anaesthesiologists have not renew their knowledge in the CPR after they have completed their medical study ( $p=0.01$  between surgeons anaesthesiologists). More female respondents have never underwent education in

resuscitation (36% female vs. 28% male,  $p=0.06$ ). Chest-compression-only is recognized by 25.8% medical doctors, 14.3% surgeons and 59.3% anaesthesiologists as valuable CPR technique ( $p < 0.001$ ). Anaesthesiologists have estimated high risk of infection transmission (62%) and were more likely to refuse mouth-to-mouth ventilation vs. surgeons (25% vs.10%,  $p=0.01$ ). Anaesthesiologists are most commonly being called to help by their colleagues (55%), whereas 38% medical doctors and only 10% of surgeons call their departmental colleagues ( $p=0.0001$ ). Only rarely medical doctors and surgeons call departmental nurses to help in CPR.

**Conclusion:** Team education in all groups, involving doctors and nurses may improve familiarity with CPR and patient's outcome.

#### References:

Nolan JP et al. *Resuscitation*. 2010;81:1219-76.

### 13AP2-1

#### Out-of-hospital tracheal intubation under visual direction of emergency physicians with video-laryngoscope and real-time image transmission system

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**Introduction:** Difficulties related to out-of-hospital tracheal intubation (TI) have been well documented. To achieve successful out-of-hospital TI performed by paramedics while avoiding life-threatening complications, we developed a real-time visual assistance system employing a video-laryngoscope and image transmission system.

**Methods:** This study was approved by our IRB. All ambulances of the Hiroshima City Fire Department have been equipped with a specially designed transmission device (RVT-SD200, SONY) that transmits high resolution visual images and patient vital data using video cameras, a bio-monitor, and a video-laryngoscope. Data are transmitted in real time to medical directors at emergency medical centers in Hiroshima City via mobile phone networks and the Internet, allowing them to advise paramedics for performing evaluations and procedures while supervising live video images of the patient (Fig A). We also developed a visual assistance system for TI using a video-laryngoscope (PENTAX-AWS, HOYA) (Fig B) in pre-hospital settings and examined its effectiveness.

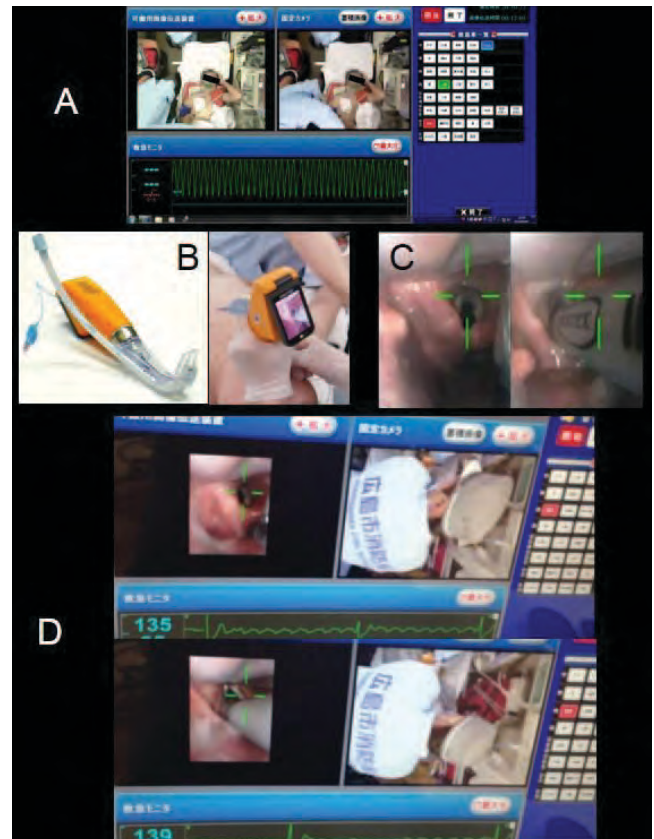


Figure 3



**Results:** From November 2012 through November 2013, 30 TI procedures were attempted using a video-laryngoscope, of which 20 employed the visual assistance system (VA group). The success rate for all 30 cases was 87% (VA group: 85%, non-VA group: 90%), with no instances of esophageal intubation noted. In the VA group, clear real-time pharyngo-laryngeal images were transmitted from the scene to the designated hospitals in all attempts, except for 2 because of a loose plug connection (Fig C, D), and the median time to intubation was 26 seconds (interquartile range, 19-57 seconds). Advice was most frequently provided when paramedics encountered difficulties in identifying the glottis or advancing the tube into the trachea in the VA group.

**Conclusions:** Transmitted images have been found to be quite useful for real-time medical supervision of out-of-hospital TI by EMS personnel. In addition, saved data can be used for post-incident analysis, education, and emergency care quality assurance. This real-time transmission system is expected to contribute to improve the quality of out-of-hospital TI.

### 13AP2-2

#### Potential utility of mean initial cerebral saturation during advanced life support in out-of hospital cardiac arrest patients as predictor of survival?

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**Background and Goal of Study:** Currently it is impossible to predict return of spontaneous circulation (ROSC) during CPR. Using near infra-red spectroscopy (NIRS), cerebral saturation (rSO<sub>2</sub>) can be measured during cardiac arrest. Parnia et al. investigated the feasibility of cerebral NIRS during CPR. (1) We measured rSO<sub>2</sub> during CPR in out-of-hospital cardiac arrest (OHCA) patients and compared the difference between mean rSO<sub>2</sub> of the first minute of advanced life support (ALS) in patients achieving ROSC compared to patients without ROSC.

**Materials and methods:** With IRB approval, cerebral saturation was measured during ALS in 52 OHCA patients with no obvious traumatic cause of cardiac arrest. One sensor of the Equanox® Advance was applied at the right side of the patients' forehead when the medical emergency team arrived. The measurement was discontinued if the patient died or at arrival at the intensive care unit. ROSC is defined as ROSC more than 20 minutes. CPR data were collected using the Utstein CPR data registration. Mann-Whitney test was used to compare survivor and non-survivor data. Non-parametric testing was used according to the underlying data distribution and expressed as median (25<sup>th</sup> - 75<sup>th</sup> percentile). Categorical features were given in terms of percentages. Mann-Whitney-U tests were performed to compare the initial rSO<sub>2</sub> values.

**Results and discussion:** Of the 52 patients, 22 patients achieved ROSC. Mean age in ROSC and no-ROSC group was respectively 72 yr (55-83) and 73 yr (61-79, p = 0.874). In the group of patients with ROSC 11 patients were male compared with 23 in the no-ROSC group (p = 0.046). Cardiac arrest was witnessed in 15 patients in the no-ROSC group and in 17 patients in the ROSC group (p = 0.046). A significant difference in duration between emergency call and start ALS is observed between ROSC and no-ROSC group, respectively 12 min (8-15) and 14 min (12-17; p = 0.031). The mean initial rSO<sub>2</sub> was 27% (14-33) and 36% (14-52) respectively in the no-ROSC and ROSC group (p = 0.046).

**Conclusion(s):** A significant difference is observed in mean initial rSO<sub>2</sub> values of the first minute of ALS between patients with ROSC and no-ROSC in OHCA patients. Further research is necessary to confirm these observations.

#### References:

1. Parnia S, Nasir A, Shah C, Patel R, Mani A, Richman P.A feasibility study evaluating the role of cerebral oximetry in predicting return of spontaneous circulation in cardiac arrest. *Resuscitation*. 2012;83(8):982-985

### 13AP2-3

#### OSCE - based resuscitation skills assessment during the Israeli national board examination - 10 years psychometric evaluation

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**Background and Goal of Study:** In order to improve anesthesiology residents' assessment, simulation-based OSCE was adapted as part of the board examination in anesthesiology in Israel. However, the limited numbers of participants in each examination period and changes in the scenarios over periods prevented thorough psychometric evaluation. The goal of the present study was to overcome these limitations and to perform psychometric evaluation by identifying identical items over the individual scenario.

**Materials and Methods:** Following ethics committee approval 28 scenarios used for the assessment of resuscitation skills over 10 years period were evaluated. Based on experts opinion 51 identical parameters over an individual scenario were defined. For each parameter - sample size, percent of correct performance, changes in performance over the years and inter-rater reliability were calculated. Correlation between parameters and internal reliability were calculated.

**Results and discussion:** The sample size for each of the 51 parameter varied between 12 to 265 (total number of examinees 310). In parameters related to initial patient (manikin) assessment gaps in performance were found (e.g. 64% checked jugular veins, 72% asked about chest pain). In parameters related to actual resuscitation (e.g. 89% performed chest compressions at the correct rate and depth), medical treatment for acute coronary syndrome (e.g. 94% administered nitroglycerine); and treatment of arrhythmias (e.g. 96% treated asystole properly) tasks were carried out correctly by most participants. The incidence of correct performance of tasks did not change over time. These results may indicate limitations of using manikins for the evaluation of initial patient assessment, and raises the optional solution of using a hybrid model for this purpose.

The inter rater reliability between examiners was 97% allowing the examination committee to reduce the number of examiners from two to one, thereby considerably reducing costs. Correlations found between different parameters in patient assessment, CPR performance and treatment of chest pain requires the unification of evaluation metrics. The differences between scenarios and limited sample size for each parameter prevented the calculation of internal reliability.

**Conclusion:** "over the scenario" psychometric evaluation using 10 years database offers unique information with possible impact on the structure and format of the examination.

### 13AP2-4

#### Fatal anaphylaxis with neuromuscular blocking agent agents: a risk factor and management analysis

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**Background and Goal of Study:** Anaphylactic reactions to neuromuscular blocking agents (NMBAs) can be severe and even fatal. Our aim was to evaluate mortality rate in France from anaphylactic reactions to NMBAs, to identify risk factors for a fatal outcome, and to describe management of the cases that proved fatal.

**Materials and methods:** The French national Pharmacovigilance Database was queried for reports of NMBA anaphylaxis that occurred between January 2000 and December 2011. A questionnaire was sent to regional pharmacovigilance centers to obtain further information on the management of cases with a fatal outcome. Deaths were classified into two subgroups:

- (1) "early deaths", i.e. an immediate fatal outcome (refractory cardiac arrest despite resuscitation) or fatal outcome following emergency cardiopulmonary bypass,



(2) "delayed deaths", i.e. patients who recovered from cardiac arrest but died from secondary organ failure. Multivariate logistic regression was used to determine risk factors associated with a fatal outcome.

**Results and discussion:** Overall, 2022 cases of NMBA hypersensitivity were retrieved of which 84 were fatal (mean mortality rate, 4.1%). Among the 1247 cases of severe NMBA anaphylaxis (grade 3 and 4), independent risk factors associated with a fatal outcome were reported in table 1.

	Odds Ratio	95% Confidence intervals	p
Female gender	0.4	0.2-0.7	0.0004
Emergency setting	2.6	1.5-4.6	0.0007
Obesity	2.4	1.1-5.3	0.0376
History of hypertension	2.5	1.5-4.4	0.0010
History of other cardiovascular disease	4.4	2.4-8.1	<0.0001
Ongoing Beta-blocker	4.2	1.8-9.8	0.0011

[Table 1. Risk factors for a fatal outcome]

The most commonly incriminated NMBA was suxamethonium (n=815, 65.4%) followed by atracurium (n= 181, 14.5%), rocuronium (n=105, 8.4%), cisatracurium (n=94, 7.5%), and vecuronium (n=23, 1.8%). Details on cardiac arrest management were obtained in 31 patients. They were all resuscitated according to international guidelines, receiving epinephrine in a median delay of 3.4 minutes after onset of the first symptom of anaphylaxis.

**Conclusion(s):** Male gender, obesity, a history of cardiovascular disease, ongoing betablocker treatment and surgery in an emergency setting were independent risk factors of a fatal outcome after NMBA-induced anaphylaxis. Epinephrine-resistant cases helped account for the high mortality rate of 4.1%. New therapeutic approaches need to be developed to treat these cases.

## 13AP2-5

### Intubation success rates of video-laryngoscopes under extreme daylight conditions: a manikin study on a Swiss glacier

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**Background and Goal of Study:** The role of Video-laryngoscopes (VLS) in out-of-hospital environment remains unclear because of the questionable performance of these devices under daylight conditions. We tested the performance of 6 VLS, the Macintosh laryngoscope and the Bonfils fiberoptic on a glacier in 3450meters above sea level (masl) in bright sunlight.

**Materials and methods:** Twenty anesthesiologists intubated a manikin (HAL, Gaumard, Miami) with an extrication collar reducing mouth opening to 3.5 cm. In random order, we evaluated eight assigned devices (Macintosh standard blade, Bonfils®, Glidescope®, C-MAC®, A.P.Advance®, McGrath®, KingVision®, Airtraq®) under five different conditions, including: indoors at 450masl (1) and at 3450masl indoors (2); outdoors in bright sunlight on the glacier in the snow without wearing sunglasses (3); outdoors wearing sunglasses in the snow (4); outdoors, manikin and study participant covered with a dark blanket to block the sunlight (5). The primary outcome parameter was intubation success rate within 60 seconds. Secondary parameters included anesthesiologists' SaO<sub>2</sub> (effect of height on participants), subjective rating of device. SPSS v.21.0.0 (Friedman's test and Cochran's Q) was used for analysis.

**Results and discussion:** Irrespective of the devices, first attempt success rate was almost identical indoors at 450masl and 3450 masl, and outdoors covered with a blanket: 95-100% (p>0.05). In general, VLS with a small screen performed worse in sunlight (dark screen). Wearing sunglasses improved the performance of McGrath and KingVision, but not of C-MAC. Covering with a blanket reversed all detrimental sun effects completely. Success rates were closely reflected by time necessary until successful intubation, being shortest indoors and covered with a blanket. SaO<sub>2</sub> were lower at 3450masl (90±3 vs. 99±2, p< 0.01). C-MAC and McGrath VLS were favored among anesthesiologists indoors and covered with a blanket; but the Macintosh blade and the Bonfils were preferred for sunlight conditions.

**Conclusion(s):** Video-laryngoscopes are unsuitable for intubation in these extreme daylight conditions because of the dark screen. If difficult airway

mandates the use of VLS, a simple blanket optimizes intubation conditions. Otherwise, the standard Macintosh blade remains a fast and reliable option in extreme daylight conditions.

## 13AP2-6

### A three-day course can increase knowledge and interest in disaster medicine for medical students

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**Introduction:** In Denmark there is no formal pre- or post graduate training in disaster medicine and anesthesiologists often play a major role in disaster preparedness. Despite this, there is no course in disaster medicine in the specialist training of anesthesiologists in Denmark.

The use of simulation training is well known in anesthesiology and is increasingly used in pre graduate medical training.

**Objective:** To investigate if a three-day course can increase knowledge and interest in disaster medicine for Danish medical students and if simulation training can be used in this context.

**Methods:** 62 medical students from Denmark, all members of the "Students' Society for Anesthesia and Traumatology" (SATS) and four from a sister organisation in Norway, participated in a three-day course.

The course included: Five workshops where selected skills were trained, five lectures related to the following scenarios and five lectures on other aspects of disaster management. Three full-scale simulations held in a military training area: A plane crash, a capsizing accident and a gas explosion. Figurants, sound effects and scenery were used together with medical devices like ambulances and fire trucks.

After each simulation the students underwent a debriefing and questionnaires were handed out ongoing for evaluation. The responses were made on a 5-point Lickert scale ranging from 1 - Strongly agree, to 5 - Strongly disagree.

**Results:** 65.2% (43/66) found that the teaching of the course was "very relevant" or "relevant" to the topic Disaster Medicine and 89.4 % (59/66) "strongly agreed" or "agreed" that Trauma Days 2013 have increased their knowledge of disaster medicine. Figure 1 shows the percentage of medical students who "agree" or "strongly agree" in statements about Trauma Days 2013 and the topic Disaster Medicine.

**Discussion:** In a world where the incidence of disasters increases, the need for physicians with an interest in disaster medicine is essential. Early introduction and education is likely to recruit physicians with those interests. With an early introduction of disaster medicine, skills can be trained repeatedly, and thus familiarity with these skills can be achieved.

**Conclusion:** A three-day course can increase knowledge and interest in disaster medicine for medical students, and simulation training is a method of teaching that the students welcome.

## 13AP2-7

### Quality of compression-only vs. standard bystander CPR in out-of-hospital cardiac arrest: take the breath away?

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**Background and Goal of Study:** Early recognition of out-of-hospital cardiac arrest (OHCA) and initiation of high quality cardiopulmonary resuscitation (CPR) by laypersons before emergency medical services (EMS) arrive are key determinants of OHCA survival. Emergency medical dispatcher driven telephone-CPR (T-CPR) can increase initiation and quality of bystander CPR. It remains unclear, whether compression-only or standard CPR is recommended for T-CPR. The aim of this prospective, randomized study was to evaluate both principles of T-CPR with respect to compliance with actual guidelines.

**Materials and methods:** After approval of the local ethics committee and obtained informed consent n=58 medical laypersons between 18 and 65 years were asked to treat a unconscious and pulseless person represented by a Manikin (AmbuMan W) while having the possibility to make an emergency call with a given mobile phone. By randomisation the participants were divided into three groups: no T-CPR (group 1, G1), compression-only T-CPR (group 2, G2) and standard T-CPR (group 3, G3) according to a standardized protocol. Using video surveillance and Ambu CPR Software V 3.0.6 we collected parameters to define the quality of bystander CPR over a period of eight minutes.

**Results and discussion:** To assess the quality of CPR we compared initial (i.e. before termination of the dispatchers comments) and over-all no-flow-time (NFT), compression depth and frequency as well as ventilation parameters. The initial NFT was lower in G2 (12,1 +/-5,4 %) compared with G3 (20,7 +/- 8,1 %). Over-all NFT was lowest in G1 (21,3 +/- 14,4), followed by G3 (49,1 +/- 8,5 %) and by G1 (57,6 +/- 16,4 %). The mean compression depth was similar in all three groups: 40,6 +/- 13,0 mm (G1), 41,0 +/- 12,2 mm (G2) and 38,8 +/- 15,8 mm (G3). The average compression frequencies were 75,8 +/- 37,6 1/min (G1), 86,1 +/- 24,2 1/min (G2) and 94,6 +/- 23,5 1/min (G3). As a parameter of ventilation quality the mean minute volumes were 2,2 +/- 2,5 l/min (G1) and 1,2 +/- 1,7 l/min (G3).

**Conclusion(s):** As compression rate was similar in all three groups, just the compression frequency was superior in the standard T-CPR group. Compared with its poor NFT, best quality of layperson CPR was achieved by compression-only T-CPR based on the shortest NFT. Further prospective studies have to be conducted to give a definitive recommendation for compression-only T-CPR for bystander CPR.

## 13AP2-8

### NIRS may be a reliable marker of CPR-quality because it correlates with systemic haemodynamics and reflects cerebral oxygenation

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**Background and Goal of Study:** Patients with severe accidental hypothermia often undergo prolonged periods of cardiopulmonary resuscitation (CPR). Consequently, CPR-quality is a decisive factor of outcome in particular in victims with concomitant asphyxia. End-tidal CO<sub>2</sub> (etCO<sub>2</sub>), mean arterial pressure (MAP) and mixed venous oxygen saturation (S<sub>mv</sub>O<sub>2</sub>) are accepted parameters to monitor the efficacy of external chest compression during prolonged CPR. Near-infrared-spectroscopy (NIRS) is a non-invasive measure of cerebral perfusion and may be a marker of CPR-quality. So far it has not been evaluated sufficiently what NIRS values really reflect and best correlate with. We therefore assessed if NIRS correlates with etCO<sub>2</sub>, MAP and S<sub>mv</sub>O<sub>2</sub>, as well as with parameters reflecting cerebral oxygen balance, e.g. partial pressure of brain tissue oxygen (P<sub>bt</sub>O<sub>2</sub>) and cerebral venous oxygen saturation (S<sub>cv</sub>O<sub>2</sub>). **Materials and methods:** Fourteen 30-40kg pigs were surface cooled to a core temperature of 28°C. Hypoxia and hypercapnia were induced to simulate an asphyxial state. After 2min of ventricular fibrillation (VF) mechanical chest compressions (LUCAS2, Physio-Control, Redmond, WA) were started for 15min, followed by 2min of VF and another 15min of mechanical chest compressions. Then the animals received epinephrine (45µg/kg) and additional 15min of LUCAS2 CPR.

**Results and discussion:** Preliminary statistical data show that NIRS correlates with MAP (r 0.669, p < 0.0001), S<sub>mv</sub>O<sub>2</sub> (r 0.785, p < 0.0001), P<sub>bt</sub>O<sub>2</sub> (r 0.447, p 0.032) and S<sub>cv</sub>O<sub>2</sub> (r 0.527, p 0.01). In contrast, MAP correlates with S<sub>mv</sub>O<sub>2</sub> (r 0.583, p 0.003) and S<sub>cv</sub>O<sub>2</sub> (r 0.622, p 0.001) but not with P<sub>bt</sub>O<sub>2</sub> (r 0.035, p 0.871), whereas etCO<sub>2</sub> does not correlate with any of the parameters of cerebral oxygen balance.

**Conclusion(s):** In this pig model of hypothermic asphyxial CPR, NIRS correlated with systemic haemodynamic parameters, e.g. MAP and S<sub>mv</sub>O<sub>2</sub> as well as with parameters reflecting cerebral oxygen supply and consumption, e.g. P<sub>bt</sub>O<sub>2</sub> and S<sub>cv</sub>O<sub>2</sub>. Thus, in deep hypothermia NIRS does not only inform on brain tissue oxygenation, but also monitor correctly the quality of CPR efforts.

## Acute and Chronic Pain Management

### 14AP1-1

#### Analysis of the efficacy of the lidocaine patch 5% in the treatment of neuropathic pain: "our feedback"

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**Background and Goal of Study:** The objective of this study was to evaluate the efficacy of the lidocaine patch 5% in different types of neuropathic pain.

**Materials and methods:** A prospective, longitudinal, observational study on a sample of 16 patients who consulted for neuropathic pain. A lidocaine patch 5% was applied to the painful area and as primary endpoint, the severity of the pain was studied using the Verbal Numeric Rating Scale (VNRS). Secondary quality of life-related endpoints were sleep during the night, mood and patient global impression of the treatment.

**Results:** Demographic data: 62.5% female and 37.5% male; mean age 55.31 ± 13.9 years; time since onset of the pain 8.4 months; and classified into 4 diagnosis groups: post-herpetic neuralgia 18.8%; complex regional pain syndrome 25%; surgical wound 50%; and others 6.3%. There was a reduction of more than 2 points in pain on the VNRS (median 6.5 to 3.5; p = 0.001), an improvement in sleep during the night, mood and relief (p < 0.05), less use of analgesics, no complications and over 30% of subjects reported improvement of over 50%.

**Conclusion(s):** The lidocaine patch 5% could be a useful tool for the control of neuropathic pain, not only for post-herpetic neuralgia, and it has a good safety and tolerability profile<sup>1,2</sup>. It would be interesting to investigate whether the patch's effect at the level of the mechanoreceptors in the skin could act

as inhibitory in pain transmission based on the Gate Theory<sup>3</sup> and to study the possible effect of long-term tolerance of the patch relate with tachyphylaxis.

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### 14AP1-2

#### Comparison between the combination of gabapentin, ketamine, lornoxicam and local ropivacaine and each of these drugs alone for pain after laparoscopic cholecystectomy: a randomized trial

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**Background and Goal of Study:** The main purpose of the study was to test if the combination of gabapentin (600mg 4h before surgery, 600mg after 24h), ketamine (0.3mg/kg before anesthesia), lornoxicam (8mg before anesthesia and 8mg/12h) and local ropivacaine (5ml 7.5% at insertion sites) provides

superior analgesia to each of these drugs alone in the first 24 hours after laparoscopic cholecystectomy. The secondary purpose was to examine if this combination has less opioid-related side effects.

**Materials and methods:** This was a two center randomized placebo-controlled trial. 148 Patients 18-70 years old were randomly assigned to 6 groups (28 in each group) with the use of computer software:

- A (gabapentin / ketamine / lornoxicam / ropivacaine),
- B (gabapentin / placebo / placebo / placebo),
- C (placebo / ketamine / placebo / placebo),
- D (placebo / placebo / lornoxicam / placebo),
- E (placebo / placebo / placebo / ropivacaine)
- F (placebo / placebo / placebo / placebo).

The primary outcome of the study was the 24hour morphine consumption. Secondary outcomes were frequency of opioid-related side effects.

**Results and discussion:** Only groups A (6.4mg), B (9.46mg) and D (9.36mg) had lower morphine consumption than control group (20.29mg) ( $p < 0.001$ ,  $p=0.01$  and  $p=0.008$  respectively). Group A was not different from B and D ( $p=0.92$ ,  $p=0.93$ ). There was difference only in episodes of nausea and only between groups A ( $n=5$ ) and the control group ( $n=12$ ) ( $p=0.018$ ). The patients receiving combinatorial therapy did not have statistically significant lower morphine consumption than those receiving treatment with only gabapentin or lornoxicam. Only the combination group experienced less episodes of nausea than the control group, potentially reflecting the lower morphine consumption. and does not affect other opioid-related side effects; however, larger trials are required to obtain safer conclusions.

**Conclusion(s):** The combination of gabapentin, ketamine, lornoxicam and local ropivacaine does not have better analgesic action than treatment with gabapentin or lornoxicam alone after laparoscopic cholecystectomy. The selected combination therapy only reduces the frequency of postoperative nausea.

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## 14AP1-4

### Efficacy of duloxetine versus placebo in patients with chronic low back pain and a neuropathic component

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**Background and Goal of Study:** Chronic low back pain (CLBP) with a neuropathic component is an extremely common condition as up to 37% of all patients suffering from low back pain display predominantly neuropathic symptoms. To date no pharmacological treatment has proven effective in neuropathic CLBP. The efficacy of duloxetine in diabetic and post herpetic neuralgia has been shown.

The aim of the current study was to evaluate the possible benefit of duloxetine in this condition.

**Materials and methods:** A total of 42 patients with chronic low back pain and an average visual analogue scale (VAS) score  $\geq 5$  were included in this randomized, prospective, double-blind, placebo-controlled cross-over trial. All patients were required to have a neuropathic component in their low back pain, as diagnosed by the painDETECT questionnaire. Each treatment phase lasted 4 weeks and was separated by a 2 week wash-out period. Treatment phases consisted of either duloxetine titrated up to a daily dose of 120mg or placebo. Patients kept a daily diary of their VAS score in the morning and evening. They were also required to record their daily use of rescue-medication. Primary endpoints were average VAS score and use of rescue medication during the last treatment week. Secondary outcome measures were quality of life (SF-36) and neuropathic component of low back pain as determined by painDETECT questionnaire. Statistical analysis was carried out in the intention to treat collective.

**Results and discussion:** VAS score was significantly lower in the duloxetine phase ( $3.7 \pm 2.9$ ) compared to placebo ( $5.7 \pm 2.6$ ;  $p=0.0013$ ). Of note painDETECT score was significantly reduced in the duloxetine phase ( $17.7 \pm 5.0$  versus  $21.3 \pm 3.4$ ;  $p=0.0023$ ). Quality of life (assessed by SF-36) improved during the intake of duloxetine compared to placebo ( $35.5 \pm 10$  and  $31.9 \pm 9.1$  respectively;  $p=0.007$ ).

However, duloxetine had no effect on the use of rescue medication compared to placebo ( $p > 0.05$ ).

**Conclusion(s):** Duloxetine significantly reduces VAS score in patients with chronic low back pain and a neuropathic component, when compared to placebo. Duloxetine could be an effective co-analgetic in this particular group of patients.

## 14AP1-5

### Reflex analgesia in treatment of chronic tension headaches

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**Background and Goal of Study:** To estimate the effectiveness of the classical corporal acupuncture (CCA) in complex treatment of chronic tension headache[1,2].

**Materials and methods:** 126 patients were examined (97 (77%) female and 29 (23%) men) aged from 18 to 72 years. Disease duration ranged from 3 month to 9 years. All the patients were divided into two groups: study and control (by 63 people). Patients of the control group received conventional therapy with central muscle relaxants and antidepressants. Patients of the study group, in addition to the described treatment, received CCA 3 times per week, a course of 14 sessions every 2 months. The following investigation methods were used: neuroorthopedic examination, algologic testing using Visual Analogue Scale (VAS) and McGill pain questionnaire (MGPQ). Evaluation of treatment results was carried out at the initial visit, after 1, 3 and 6 months of treatment.

**Results and discussion:** At the neuroorthopedic examination 52 (83%) patients of the study and 54 (86%) people of the control group had marked and moderate myofascial disorders of the cervicocranial zone. The intensity of headaches before the study was  $3.7 \pm 1.2$  points by VAS among the patients in the control group and  $4.1 \pm 1.6$  points in the study group. In accordance with the MGPQ before treatment in the control group the sensory rank pain index (RPI) was  $5.64 \pm 1.73$  points, affective RPI  $-3.14 \pm 0.62$  points, the total RPI  $-6.95 \pm 2.17$  points, while the corresponding figures in the study group amounted to  $6.10 \pm 1.84$ ;  $2.89 \pm 0.58$ , and  $7.21 \pm 1.79$  points, respectively. One month after the start of treatment the intensity of pain in the control group was  $4.17 \pm 0.61$ , 3 months later  $3.5 \pm 0.4$ , 6 months later  $2.1 \pm 0.6$  points, in the study group was  $3.1 \pm 0.9$ ,  $2.3 \pm 0.4$ ,  $1.2 \pm 0.3$  points. Against the background of the treatment, the patients in the study group reported a significant regression of painful sensations by descriptors of the MGPQ. Patients of the control group also showed a similar positive trend, but to a lesser extent.

**Conclusion(s):** The use of the CCA in complex treatment of chronic tension headaches is an effective and safe method of impact at all stages of treatment.

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## 14AP1-6

### Treatment of neuropathic pain with capsaicin 8% - a single-center experience

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**Background and Goal of Study:** Neuropathic pain (NP) management comprises different drugs, with partial efficacy, low tolerability and complex therapeutic schedule. Capsaicin 8% dermal patch (Qutenza®) has long been used in NP treatment with reports of pain reduction persisting for 12 weeks after a single application. Our aim was to describe NP treatment with Qutenza® in a chronic pain clinic.

**Materials and methods:** Retrospective study of patients with NP treated with Qutenza®, from November 2010 to March 2013. Data were collected from patient medical records and nurse notes. The pain intensity numerical rating scale (PI-NRS) was used to evaluate pain at baseline and during follow-up at weeks 2, 4, 8 and 12. A 30% reduction from baseline PI-NRS was considered clinically important.

**Results and discussion:** The study analysed 43 patients (37% males, mean age  $61 \pm 16$  years, pain duration  $3 \pm 3$  years, PI-NRS baseline  $6 \pm 2$ ). The majority (83,6%) of patients used concomitant neuropathic pain medications.



The main pain syndromes were post-traumatic/post-surgical NP (49%) and postherpetic neuralgia (33%). The most common pain characteristics were numbness (61%) and pins and needles (61%).

Pretreatment analgesia was used in 93% of patients. All patients tolerated the procedure. A third of patients reported transient application-site reactions: pain (18.6%), burning (13.9%) and erythema (4.6%).

Four weeks after the treatment 61.5% of patients experienced a decrease in baseline PI-NRS, which was clinically important in 38.4%.

**Conclusions:** In our clinic every patient tolerated treatment with Qutenza®. Although there were frequent adverse events, these were all minor application-site reactions.

At four weeks after treatment there was a clinically important relief of pain in over a third of patients.

## 14AP1-7

### Postoperative chronic pain after breast surgery with or without cancer: follow up 6 months

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**Background and Goal of Study:** This study's primary aim was to determine the incidence of chronic postoperative pain after sort of breast surgery. The secondary aim was to examine factors associated with chronic postoperative pain.

**Materials and methods:** The prevalence of the postoperative chronic pain and its clinical characteristics were assessed in a group of patients who had undergone surgery for diagnostic, reconstructive and breast cancer at the department of surgery, Tepecik Teaching Hospital, within the period of December 2010-January 2012. The prospective study included 240 female patients. Data were collected on: verbal rating scale (VAS) pain scores in the Post Anesthesia Care Unit (PACU) at 1st month and at 3rd-6th months postoperative and age, BMI, preoperative pain, radiotherapy, chemotherapy, postoperative acute pain, length of hospital stay were taken into account. Severe postoperative pain was defined as VAS>3. Data were analyzed using chi square, Fisher's exact test, Spearman's correlation test, with  $\alpha > 0.05$ .

**Results and discussion:** Chronic postoperative pain was experienced by 39.2% of patients at 3rd month and 18.3% of patients at 6th month. There was correlation in body mass index and age between postoperative chronic pain ( $p < 0.05$ ). PACU pain and the incidence of severe PACU pain increased with surgical complexity ( $p < 0.05$ ). PACU pain scores averaged  $4.68 \pm 0.45$  and 6.3% of subjects experienced mild pain (VAS < 3). None of the patients without severe acute postoperative pain was detected to have chronic pain. Whereas chronic pain was detected in 41.8% of patients who had severe acute postoperative pain. Preoperative presence of pain, surgical type of operation, postoperative acute severe pain, chemotherapy and radiotherapy, length of hospital stay and development of complications played a role in postoperative pain but the preexisting operations were found not effective in chronic pain.

**Conclusions:** Chronic pain developed in 39.2% of patients having breast surgery and in this group, 35% of patients with cancer post mastectomy pain syndrome has developed. Also if axillary lymph node dissection was performed with mastectomy, this ratio was found to be 64%. The demographic characteristics, preoperative and severe acute postoperative pain, the type of surgery, the length of hospital stay, development of complications, chemotherapy and radiotherapy treatment have been shown to be the risk factors in chronic postoperative pain after breast surgery.

## 14AP1-8

### Chronic post-surgical pain and its impact on quality of life and recovery after amputation

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**Background and Goal of Study:** Chronic post-surgical pain (CPSP) develops after surgery and persists for at least 2 months, excluding other causes. The aim of this study was to evaluate the incidence of CPSP and its impact in quality of life (QoL) and quality of recovery (QoR) after amputation surgery.

**Materials and methods:** After study approval by the institutional ethics committee, a prospective study was conducted in 13 patients scheduled for elective surgery admitted in the Post-Anesthesia Care Unit (PACU) from June to August 2013. CPSP was assessed with the Brief Pain Inventory (BPI), QoL

was evaluated with the EuroQol five-dimension questionnaire (EQ-5D) and QoR with the 15-item Quality of Recovery score (QoR-15). QoL and BPI evaluations were performed preoperatively (T0) and 3 months after surgery (T3). Inclusion criteria: patients undergoing vascular amputation surgery. Exclusion criteria: patients unable to give informed consent and cognitive impairment (Mini-mental State Examination < 24). The primary end point was CPSP. Descriptive analyses of variables were used to summarize data and non-parametric tests were performed for comparisons.

**Results and discussion:** Four patients had CPSP 90 days after surgery (31%). Three months after surgery patients with CPSP reported significantly more problems in one dimension of EQ-5D: pain/discomfort ( $p=0.002$ ). Regarding QoR-15 scores at T24, CPSP patients have median lower scores for "moderate pain" (2.5 vs. 6.5,  $p=0.048$ ).

**Conclusion:** CPSP is an important outcome after amputation surgery because its incidence in our patients was considerable and these patients had more problems in EQ-5D pain/discomfort dimension. Twenty-four hours after surgery CPSP patients had lower scores for QoR domains regarding pain evaluation.

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## 14AP1-9

### Chronic post-surgical pain: an underestimated syndrome

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**Background:** Chronic post-surgical pain (CPSP) is a pain syndrome that develops postoperatively and lasts for at least 2 months in the absence of other causes for pain. It occurs in 10% to 50% of individuals after common surgeries<sup>1</sup>, such as mastectomy, amputation, thoracotomy, inguinal hernia repair, hip/ knee arthroplasty and hysterectomy. Genetic predisposition, female gender, young age, preoperative anxiety, obesity, pre-existing pain and an inflammatory state are risk factors to CPSP.

**Materials and methods:** Retrospective study. We reviewed data from adults with non-oncologic chronic post-surgical pain, followed in Pedro Hispano Hospital Chronic Pain Unit (CPU), during 2012. The patients undergoing spine surgery were excluded.

**Results and discussion:** Of the 432 patients referred to the CPU during 2012, 6.25% ( $n=27$ ) present with nonmalignant CPSP. The most are female (74.1%) and the mean of age is  $58.15 \pm 16.29$  years. The specialties of origin are mainly of the surgical area, with a predominance of Orthopaedics (25.9%), General Surgery (25.9%) and Obstetrics/Gynecology (22.2%). The more often involved surgical procedures are surgical correction of abdominal wall hernia (25.9%), abdominal hysterectomy (11.1%) and hip arthroplasty/revision (11.1%). In 63% ( $n=17$ ) of cases, the time elapsed until the referral was less than 1 year and 92.6% of the patients obtained a consultation within 6 months after referral.

Our results were consistent with those existent in the literature, but we believe that the prevalence of the CPSP in our CPU can underestimated and only patients with high to moderated functional limitations are referred.

**Conclusions:** CPSP prevention is a critical concern for the anesthetist because, once established, it can be a disabling condition and difficult to treat, like many other chronic pain conditions. It has a multifactorial aetiology, in which the deregulated postinjury hyperalgesia is included. Techniques that avoid trauma to nerves, with reduced inflammatory stimuli, should be chosen and an aggressive multimodal analgesia is mandatory.

Because only a fraction of surgical patients develop CPSP, it is important to detect these patients before surgery. Kalkman score can be very useful for identification of patients who appear to have a major risk to developing CPSP. CPSP can be an important cause of morbidity. Studies like this help us to understand the importance of preventive strategies and the needing of an early diagnosis and treatment.

## 14AP1-10

### Is minocycline an effective treatment for subacute radicular pain in humans?

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**Background and Goal of Study:** Current drug therapy for neuropathic pain falls short due to lack in effectiveness and to side-effects. Minocycline showed promising results in rodent models of neuropathic pain but was never studied in humans with regard to the treatment of neuropathic pain.

**Materials and methods:** The Ethics Committee of the Ziekenhuis Oost-Limburg approved the study. In this randomized, double-blind, placebo-controlled trial, patients with subacute lumbar radicular pain received either oral placebo or minocycline 100mg once daily (n= 20 per group) for 14 days. Primary outcome measure was the mean daily pain intensity as measured with a visual analogue scale (VAS) on day 7 and 14. Secondary outcome measures were reduction of neuropathic pain symptoms as determined with the DN4 questionnaire, consumption of rescue medication (tramadol 50mg up to 3 times daily) and adverse events on day 7 and 14. A mixed-model repeated-measures analysis with Bonferroni *post-hoc* test and model terms for study drug, time and drug-time interaction was used to assess changes in VAS and DN4 scores and consumption of rescue medication between the study groups. A repeated-measures ANOVA with Tukey's *post hoc* test was used to compare data within one group at different time points. Data are presented as means  $\pm$  SEM.

**Results and discussion:** Of the 40 randomized patients, 34 were included in a modified intention-to-treat analysis (n=17 per group, duration of pain in the placebo and minocycline group:  $2.8 \pm 0.4$  months and  $2.5 \pm 0.3$  months, respectively). Baseline VAS values in the placebo and minocycline group were  $7.3 \pm 0.3$  and  $6.7 \pm 0.4$  respectively. After 14 days, patients in the minocycline group reported a significant reduction in mean daily pain intensity compared to the placebo group ( $4.9 \pm 0.7$  vs.  $7.0 \pm 0.5$ ;  $P < 0.05$ ). The number needed to treat for moderate ( $\geq 30\%$ ) and substantial ( $\geq 50\%$ ) clinically important improvements in VAS score was 3 and 6, respectively. 'Within group' analysis showed a reduction of neuropathic pain symptoms in the minocycline group on day 14 compared to baseline ( $3.9 \pm 0.5$  vs.  $5.1 \pm 0.3$ ,  $P < 0.05$ ). There were no differences in consumption of rescue medication between the two groups. There were no adverse events in either group.

**Conclusion(s):** Our study suggests that minocycline may be an effective treatment for subacute lumbar radicular neuropathic pain. More studies are needed to examine long-term outcome and effectiveness in other etiologies of neuropathic pain.

## 14AP2-1

### Ultrasound-guided infraorbital nerve block to treat trigeminal neuralgia using a high concentration of tetracaine dissolved in bupivacaine

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**Background:** Nerve blocks using a high concentration of tetracaine dissolved in bupivacaine are effective in treating Trigeminal neuralgia (TN) (1). Ultrasound (US) imaging is useful for localizing foramina when performing superficial trigeminal nerve blocks (2). We performed real time US guidance for infraorbital nerve blocks in TN patients.

**Materials and methods:** Six patients with TN in the V2 area were enrolled. Written informed consent as permitted by the ethics committee of the Ehime University Hospital was obtained from all patients.

An US system with a 6-13MHz linear probe (Sonosite, Bothell, WA USA) was used with a sterile cover. The probe was put on the cheek just beside the nose and was slid in the cranial direction to find the dimple of the infraorbital foramen. The needle was inserted using out-of-plane approach. A test dose of lidocaine (2%, 0.5ml) was injected. Anaesthesia of the skin innervated by the infraorbital nerve was confirmed and a solution of tetracaine (20mg) dissolved in bupivacaine (0.5%, 0.5ml) was injected. During each injection, the spread of the agent around the nerve was confirmed using US images.

**Results and discussion:** Ten blocks were performed for six patients. Immediately after the procedure, seven blocks relieved the pain. Within these seven blocks, pain recurred after three months in two blocks, pain recurred after more than six months in two blocks, and pain relief continued in three blocks. In the three blocks not yet described, analgesia was produced in the infraor-

bita nerve region; however, pain was observed in a new trigger point outside of the infraorbital nerve region.

In conventional infraorbital nerve block methods, we sometimes observe that although the effect of a test block is complete, the effect of the neurolytic block is incomplete. In these cases, we speculate that the needle tip is moved from the foramen after the test block. In conventional methods, paresthesia helps confirm the needle tip in the foramen. Therefore, it is difficult to identify the needle position after local anaesthesia has been applied via a test block. By using US guidance, needle position can be identified and adjusted after a test block. Therefore, US guidance may increase the success rate of infraorbital nerve blocks.

**Conclusion:** The US-guided infraorbital nerve block is a useful method for the treatment of TN in the V2 area.

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## 14AP2-2

### Pulsed radiofrequency on chronic shoulder pain: preliminary results

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**Background and Goal of Study:** Painful shoulder it's a frequent syndrome that includes, as possible causes, supraspinatus tendinitis, rupture of the rotators' cuff, arthrosis and posttraumatic cases. The traditional treatment for these syndromes it's based on rehabilitation, analgesics, infiltrations and even surgical options.

In our hypothesis we believe that the pain it's maintained and delivered by the suprascapular nerve, and pulsed radiofrequency of this nerve could improve the pain.

**Materials and methods:** Patients with painful shoulder that didn't respond to rehabilitation and analgesic treatment were recruited over a 6 months period. All had MRI or ultrasonography prior to the procedure in order to get a diagnostic imaging. After obtaining the informed consent, we proceeded to the application of percutaneous pulsed radiofrequency (42°C, 120 seconds) of the suprascapular nerve in the scapular notch using neurostimulation to locate it. We obtained the base VAS (Visual Analogue Scale) and, after 3 months, the percentage of subjective improvement with the procedure. Anova and Chi-squared test was used.

**Results and discussion:** A total of 24 patients were evaluated. Most of the patients were women (70.8%), with an average age of  $67.7 \pm 14.2$  years, a weight of  $68.8 \pm 15.1$  Kg, a height of  $162 \pm 7$  cm. 13 procedures were bilateral, 6 were on the right shoulder and 5 were on the left shoulder. The diagnostic imaging showed that 43.5% of the patients had supraspinatus tendinitis, 26.2% posttraumatic or degenerative arthrosis, 13% rupture or tendinitis of the rotators' cuff, 8.7% arthrosis with rupture or tendinitis of the rotators' cuff, 4.3% osteomyelitis and 4.3% supraspinatus calcic tendinitis. The previous VAS were  $7.24 \pm 1.3$ , that changed to  $4.2 \pm 3.1$  at a 3 months interval ( $p = 0.036$ ). The difference between the before and after VAS was statistically significant on the patients with supraspinatus tendinitis ( $4.5 \pm 1.8$ ), rupture of the rotators' cuff ( $5.0 \pm 1.7$ ) and rupture of the rotators' cuff with arthrosis ( $3.5 \pm 2.1$ ), much more than the patients with posttraumatic or degenerative arthrosis ( $0.8 \pm 1.3$ ).

**Conclusion(s):** The pulsed radiofrequency of the suprascapular nerve seems like a fast effective treatment for the painful shoulder of tendinous etiology, but not when the cause of the pain is arthrosis.

## 14AP2-3

### Infection on the site of insertion of a spinal cord stimulation device, an uncommon reported yet interesting complication

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**Background:** Spinal cord stimulation (SCS) is a choice for the treatment of severe and refractory pain, and its use is increasing because of its efficacy. However, the implantation in the epidural space is not without complications, even if it is made under strict sterile circumstances and the technique is correct. A case about a patient who developed local infection after the insertion of a SCS device is presented.

**Case report:** A 43 years old male diagnosed with failed back surgery syndrome was scheduled for the test phase of spinal cord stimulation.

Patient's medical history did not include any relevant data and his laboratory tests were normal.

The procedure was performed in an operating room (OR), with cefazolin (2g) as antibiotic prophylaxis, sedation and local anesthesia, using a fluoroscope to guide the intervention and under aseptic conditions. There were no complications.

During the test phase the patient reported a good area coverage and an improvement of >50% of his pain. After a satisfactory trial phase the definitive system was implanted, the procedure was made under the same conditions and it was uneventful.

A day after the procedure, the patient presented at the emergency department with 38.0°C fever and headache; an area of redness and serosanguineous fluid drainage was seen on the implantation site, with C reactive protein and fibrinogen elevation on the laboratory results. The patient was admitted to hospital with an IV vancomycin + cefepime antibiotic regimen. A surgical wound culture showed an oxacillin sensitive *S. aureus*, after which a directed antibiotic scheme was given during 14 days. A thoracolumbar medullary MR showed a subcutaneous abscess at L1 level, connected with a posterior epidural abscess in D12-L1; surgical treatment of the abscess was dismissed by neurosurgery. The device was removed. The infection disappeared within the two weeks of oxacillin regimen, with resolution of the symptoms and normalization of laboratory parameters. The patient was discharged without further complications.

**Discussion:** SCS is increasingly used, so it is important to remember it's an invasive technique that has to be done under rigorous both aseptic and technical circumstances, and even with the ideal scenario, complications and mistakes can take place.

**Learning Points:** Although the complication resolved, the cost was leaving the patient without an effective treatment for his pain after a good result with the neurostimulator.

#### 14AP2-4

##### Retrospective analysis of long-term results after spinal endoscopic adhesiolysis for the treatment of failed BSS

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**Background and Goal of Study:** Epidural fibrosis is responsible for as much as 35 % of all cases of failed back surgery syndrome (FBSS). Spinal endoscopic adhesiolysis (SEA) in these selected patients showed promising short-term results, but literature evaluating long-term results is sparse. Therefore, we performed a retrospective long-term outcome analysis of the patients who underwent SEA in our pain clinic.

**Materials and methods:** The study was approved by the ethics committee of the Ziekenhuis Oost-Limburg. We performed a retrospective chart review of all the patients who underwent SEA in our pain clinic. Patients with a global perceived effect (GPE) of 50 improvement, 6 months after SEA were included in this study. These patients were recontacted and asked about their GPE at that moment in time. The mean time elapsed between SEA and recontact was calculated. Data are presented as percentage or mean +/-SEM.

**Results and discussion:** Over a period of 46 months (april 2009 to february 2013), 41 patients underwent SEA.

Eleven patients had a GPE of more than 50 %, 6 months after the procedure and were included in the study. Seven patients (64%) had a GPE > 50 % improvement at the time of inquiry, while 1 patient (9%) had a GPE of 30 % improvement. Three patients experienced no effect what so ever of the SEA ( 27 % ). The elapsed time between the SEA procedure and patient contact was 34 +/- 4 months.

**Conclusion(s):** The majority of patients with a good short-term outcome after SEA (defined as GPE > 50 % at 6 months) still experienced a good effect after 34 months.

#### 14AP2-5

##### The effect of pulsed radiofrequency treatment for occipital neuralgia on brain-derived neurotrophic factor concentrations in blood

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**Background and Goal of Study:** Animal studies showed that brain-derived neurotrophic factor (BDNF) plays an important role in the generation of neuropathic pain. However, the role of BDNF in human neuropathic pain remains unclear. In a recent clinical trial, we discovered that 4 weeks treatment of chronic lumbar radicular neuropathic pain with dorsal column stimulation (DCS) resulted in increased serum concentrations BDNF. In this study we investigated the effect of pulsed radiofrequency treatment (PRF) for occipital neuralgia on plasma and serum BDNF concentrations.

**Materials and Methods:** The Ethics Committee of the Ziekenhuis Oost-Limburg approved the study. Patients fulfilling the International Headache Society criteria for occipital neuralgia underwent PRF of the culprit occipital nerves after a positive diagnostic block (> 50% reduction on a visual analogue scale-VAS). Target nerves were identified with the external landmarks described by Vital (1) and correct needle position was verified with electrical stimulation at 50 Hz (threshold < 0.5 V). PRF (20msec, 2Hz, 45V, 42°C) was performed during 4 min. Serum and plasma were sampled at baseline and 8 weeks after PRF. All samples were collected between 8 AM and 12 AM to minimize the effects of a circadian rhythm. BDNF concentrations in serum and plasma were determined by ELISA (R&D systems Europe, Abingdon, United Kingdom). Detection range: 20-4000 pg/ml. A paired Student t-test was used to compare data. Data are presented as mean±SEM.

**Results and Discussion:** Twenty patients were included in the study (14 female, age: 51±3years, duration of pain: 39±12 months). Baseline concentrations of plasma and serum BDNF concentrations were 3932±1143 pg/ml and 11037±2500 pg/ml, respectively. Eight weeks after PRF of the occipital nerves, there was no significant change in plasma and serum BDNF concentrations (3507±850 pg/ml; P=0.3 and 12945±2820 pg/ml; P=0.2, respectively)

**Conclusions:** Unlike DCS for radicular pain, PRF for occipital neuralgia does not increase serum concentrations of BDNF

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#### 14AP2-6

##### Transverse tripolar stimulation with combined percutaneous plate and cylindrical leads for the management of failed back surgery syndrome

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**Background:** low back pain management with spinal cord stimulation (SCS) presents some difficulties and this case shows a different strategy used to address the treatment.

**Case report:** the patient is a 36 year old female, diagnosed with Failed Back Surgery Syndrome (FBSS), suffering from persistent pain predominantly in the low back and irradiated to the left lower limb (LLL), treated with spinal cord stimulation. In a first phase a percutaneous epidural implantation of an octapolar plate lead and an octapolar cylindrical lead located on the left of the plate was made with fluoroscopic guide. Both leads were connected to an external pulse generator for the trial phase, which was regarded as positive by the patient due to a significant relief in the lower limbs, though no paresthesia could be achieved in the low back. In order to get lumbar stimulation another cylindrical lead on the right of the plate was implanted in order to make transverse tripolar stimulation possible. Two stimulation patterns were programmed to work simultaneously at a frequency of 52 Hz: stim-set one with transverse tripolar array and PW of 375 µs for the coverage of low back and RLL, and stim-set 2 with longitudinal polarity in the octapolar plate and 350 µs of PW for the LLL. The coverage of both stim-sets together was complete in the patient's painful area. Six months after implantation results were 50% VAS decrease (from 10 to 5 in the numerical pain scale) and 50% reduction of anticonvulsant drug intake.

**Discussion:** The difficulty in stimulating low back is a consequence of a number of anatomical and physiological characteristics resulting in a preferential recruitment of dorsal horn fibers over the dorsal column fibers. In this case,



dual stimulation using a medial plate and a lateral cylindrical lead did not achieve stimulation in the target area (low back), so an additional lateral lead was implanted for the programming of a transverse guarded cathode which achieved a higher penetration in the medial dorsal column.

**Learning points:** In this case, transverse tripolar stimulation was necessary to achieve adequate paresthesia coverage in the low back. The lack of a validated technique for the relief of low back pain has promoted the development of new devices with higher number of electric contacts (up to 16) in different geometric patterns, with the aim of achieving a better coverage of the painful area.

## 14AP2-7

### The effect of dorsal column stimulation on $\gamma$ -aminobutyric acid concentrations in the cerebrospinal fluid

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**Background and Goal of Study:** Dorsal column stimulation (DCS) is an effective treatment for neuropathic pain. Animal research showed that spinal  $\gamma$ -aminobutyric acid (GABA) plays an important role in the effect of DCS. We investigated the effect of DCS on GABA concentrations in the cerebrospinal fluid (CSF) of humans suffering from neuropathic.

**Materials and methods:** The study was approved by the Ethics Committee of the Ziekenhuis Oost-Limburg. GABA concentrations were determined by ELISA (Immunodiagnostik AG, Bensheim, Germany; detection range: 0.05-2  $\mu$ mol/l) in CSF of patients suffering from failed back surgery syndrome with predominant radicular pain before and after 4 weeks of treatment with DCS. All CSF samples were collected between 8 and 12 AM to minimize effects of a circadian rhythm. The neuropathic nature of the pain was confirmed with a DN4 questionnaire (cut-off  $\geq 4$ ). Pain intensity was measured with a visual analogue scale (VAS). Patients received epidural lead implantation under local anesthesia with light sedation. In short, a percutaneous quadri- or octapolar epidural lead was introduced epidurally in the T12-L1 interspace and advanced until full coverage of the painful dermatomes with paresthesia was attained with trial stimulation. Next, the epidural lead was tunneled subcutaneously towards the lateral side and connected to an external trialling neurostimulator for 4 weeks. A Wilcoxon matched-pairs signed rank test was used to compare data between before and after DCS treatment. Data are presented as mean  $\pm$  SEM.

**Results and discussion:** Over a 3-year period 20 patients (45% male, age  $52 \pm 3$  years) were included.

Four weeks treatment with DCS resulted in a clear reduction of VAS pain scores ( $85.6 \pm 2.3$  vs.  $37.8 \pm 5.4$ ,  $P \leq 0.0005$ ). However, the CSF concentration of GABA did not change significantly over these 4 weeks ( $668.4 \pm 252.3$  nmol/l vs.  $497.1 \pm 161.7$  nmol/l;  $P = 0.50$ ).

**Conclusion(s):** DCS effectively reduces radicular neuropathic pain in patients suffering from failed back surgery syndrome. However, this is not accompanied by changes in GABA concentrations in the CSF. No statements can be made concerning intracellular spinal GABA concentrations in these patients.

## 14AP2-8

### Ultrasound-guided sural nerve pulsed radiofrequency for the treatment of ankle neuropathic pain

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**Background:** The sural nerve subserves a purely sensory function in the lateral surface of the foot and ankle territory. Sural neuropathy is an uncommon condition, being trauma the most frequent cause. Pulsed radiofrequency (PRF) has been successfully used in the treatment of multiple chronic pain syndromes. However, there is only limited data on an ultrasound-guided technique concerning peripheral nerve injury pain relief. This report describes the successful treatment of a patient with sural neuropathy using ultrasound-guided PRF.

**Case report:** A 28-year-old female had developed chronic pain and allodynia in the sural nerve distribution after a percutaneous Achilles tendinoplasty unresponsive to conventional treatment. After a positive diagnostic sural block,

the patient was proposed for ultrasound-guided PRF Sural nerve was identified in the external malleolus and pulsed during 180 seconds at 45 volts, never exceeding the temperature of 42°C. After 3 applications, the patient reported complete symptom relief. No pain recurrence was reported 1 year after the procedure.

**Discussion:** The exact mechanism of the PRF antinociceptive effect remains unknown. Changes in molecular structure, early gene expression, stimulation of descending inhibitory pathways and transient inhibition of excitatory transmission may play a role. PRF is a minimally invasive percutaneous technique that may provide long-term pain relief in cases of sural nerve injury<sup>1</sup>. Neuro-modulation of the sural nerve under real time ultrasound guidance is easy to perform and increases technique efficacy.

#### References:

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**Learning points:** PRF should be considered in the therapeutic approach of sural nerve neuropathy, especially in cases unresponsive to pharmacological treatment, but also in the initial management of these patients. Ultrasound-guided technique has the potential to enhance its success.

## 14AP2-9

### Diabetic amyotrophy post percutaneous splanchnic nerve radiofrequency ablation for a patient with chronic pancreatitis

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**Background:** Percutaneous splanchnic nerve radiofrequency ablation (RFA) has been an alternative in the management of patients with chronic pancreatitis[1]. But, RFA has its own risks. Diabetic amyotrophy is a form of diabetic neuropathy characterized by an abrupt onset of pain and asymmetric proximal weakness and atrophy of the legs[2]. Here we present a diabetic patient with chronic pancreatitis diagnosed with diabetic amyotrophy after being treated with percutaneous splanchnic RFA for chronic abdominal pain.

**Case Report:** A 43-year-old diabetic male with chronic pancreatitis received T11-12 bilateral splanchnic nerve radiofrequency coagulation denervation therapy for chronic abdominal pain. He complained of right lower leg numbness, weakness, and pain the next day. Thoracic spine MRI and abdominal CT studies showed negative findings. Sensory examination revealed hypoesthesia on the medial aspect of thigh and calf. Nerve conduction studies showed reduced CMAPs at right common peroneal nerve and reduced SNAPs at right sural nerve, suggesting an axonal type sensorimotor polyneuropathy superimposed with right common peroneal neuropathy. EMG showed subacute neuropathic changes at the lower limb muscles. The findings were consistent with polyradiculoneuropathy. Gradual improvement is observed from the past 9 months of follow-up.

**Discussion:** Complications of neurologic deficits of RFA have been reported, with the majority of patients complaining weakness or numbness in the lower extremities due to lumbar root injury. Another potential mechanism may be due to vascular spasm of lumbar radicular arteries resulting in spinal cord ischemia. Our patient was first suspected to be a result of a RFA-related complication. However, diabetic amyotrophy was diagnosed after all. The presentation is an acute or subacute onset of severe, asymmetrical lower extremity pain and paresthesias involving the anterolateral thigh region[3]. The diagnosis relies mostly on clinical suspicion and electromyographic findings.

**Learning points:** Aside from careful manipulation in performing percutaneous splanchnic nerve RFA, we must keep in mind of other underlying diseases, especially diabetes. Diabetic amyotrophy should be considered in the differential diagnosis, with the help of NCV and EMG studies and radiological investigations such as MRI and CT.

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## 14AP2-10

### Trigeminal neuralgia and perfusion pump of intrathecal morphine, a case report

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**Background:** Trigeminal neuralgia (TN) is a painful disorder characterized by brief, electric-shock-like pains, is limited to the distribution of one or more divisions of the trigeminal nerve, sometimes if medical treatment is not successful or results in marked deterioration in activities of daily living, surgical or invasive techniques should be considered[1]. This case is about of TN for treatment surgical of sphenoid tumor with unsatisfactory analgesia and surgical or percutaneous techniques[2] in gasserian ganglion not possible for dissemination, we decided to place an intrathecal morphine perfusion.

**Case report:** AC is a 68-year-old female, she has been operated for resection of sphenoid fibromyxosarcoma in 2010. She was evaluated for pain management in our hospital in 2012, Medications at the time of consult included long-acting carbamazepine 200 mg 4 times a day, Cymbalta 30 mg day, Rivotril 0.5 mg night, Lyrica varying doses, without success. Interventional treatment for the TN included multiple nerve blocks in three divisions of which were helpful only temporarily.

In October 2013, we did two test events (1 ug morphine) with pain relief for 6 hours, with rapid decrease and finally. We placed the pump (20 ml. Morphine 1% (0.1mg/ml.) and catheter were examined under fluoroscopy, the IT catheter tip at T12 and advance the catheter until C1-C2, confirming with contrast sub-arachnoid distribution.

Morphine dose and concentration was 100 ug/d and timely dose was 50 ug during one hour. At the postprocedure follow-up, the patient reported satisfaction with the procedure, without headache after lumbar puncture, although with the increase of dose, she has had a vasovagal syncope, no others effects and today she continues talking notably relief from the TN.

**Discussion:** This is a case about analgesic response to intrathecal morphine in perfusion, for chronic trigeminal neuropathic pain without response to medical treatment and multiple nerve blocks with pain relief for this patient.

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1. International association for the study of pain, global year against, orofacial pain, October 2013.
2. Gronseth G, Cruccu G, Alksne J, et al. Practice parameter: the diagnostic evaluation and treatment of trigeminal neuralgia (an evidence-based review). *Neurology*. 2008;71:1183-1190.

**Learning points:** This technical would be applied in those patients without response in conventional treatment or without possibilities of surgical procedures or percutaneous techniques.

## 14AP2-11

### Refractory back pain treated by caudal epidural pulsed radiofrequency. Case report

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**Background:** Central sensitization is a chronic clinical condition difficult to diagnose and treat (1). Long lasting, refractory lower back pain is one of the reasons for the condition. Pulsed radiofrequency (PRF) is successfully used for treatment of neuropathic and nociceptive pain (2).

**Case report:** A 77 year old woman with two years long lower back pain due to spinal spondilosis, spondiloarthrosis and spinal stenosis L4-L5 presented to pain clinic; pain level 8 NRS; on physical exam she presented central sensitization syndrome with tenderness over *processi spinosi* of thoracic and lumbar vertebrae. As conservative medication regimens and epidural steroid injections showed no significant pain relief was treated with PRF at 42° Celsius, 50V, 5Hz, 5 ms for 7min in caudal epidural space. Before applying the PRF fluoroscopic conformation of electrode position was performed in AP and LL projections with an injected 1ml of contrast medium. Pain level was assessed by NRS; adapted Oswestry disability questionnaire was used to estimate the level of disability in daily living. Patient reported 50% (from 8 to 4 NRS) pain relief 2 days after PRF treatment that lasted till the one month follow up. The disability index (DI) was 28 (max 60) points before the PRF. Following PFN, she reported an increased ability to complete activities of daily living presenting the DI of 14/60 points. The highlight of disability evaluation was the complete extinction of previous sleep disturbances.

**Discussion:** Epidural space is richly parasympathetic innervated region that contacts with vagus nerve. We suggest that the positive effect of caudal PRF could be associated with the activation of parasympathetic nervous system. Goehler LE et.al. (3) have described vagal immunosensory communication to brain. Previous successful epidural caudal PRF has been described by Atim for coccygodynia patients in 2011.

#### References:

1. Clifford J Woolf, Central sensitization: Implications for the diagnosis and treatment of pain. *Pain*, 2011, V152, S2-S15
2. Rohof OJ, Radiofrequency treatment of peripheral nerves. *Pain Pract*. 2002 Sep;2(3):257-60.
3. Goehler LE et al. Vagal immune-to-brain communication: a visceral chemosensory pathway. *Autonomic Neuroscience*, 2000, 85, 49-59

**Learning points:** Caudal epidural PRF may be alternative minimally invasive and safe treatment for refractory back pain. Further studies should be made to ascertain the role of parasympathetic nervous system in chronic pain with central sensitization syndrome.

## 14AP3-1

### Catechol-O-methyltransferase (COMT) and opioid $\mu$ -1 receptor (OPRM1) gene single nucleotide polymorphisms (SNP) and postoperative opioid analgesia

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**Background and Goal of Study:** COMT 1947G>A (rs4680) and OPRM1 118A>G (rs1799971) gene SNPs are actively investigated in various populations and diseases; but the results remain controversial! Objective of this study is to evaluate the prevalence of SNPs in Crimean (Ukrainian) population and their possible association with postoperative opioid analgesia.

**Materials and methods:** 81 consecutive patients scheduled for a major urologic surgery were enrolled in this study. COMT 1947G>A and OPRM1 118A>G gene SNPs were detected via real-time PCR. For basic analgesia all patients received 100 mg of  $\mu$ -agonist trimeperidine on the first postoperative day (POD1), additional analgesia was provided using dexketoprofen. The severity of postoperative pain and side effects of opioids have been analyzed on POD1. Statistical analysis was performed using median and Pearson's  $\chi^2$  tests with data presented as Me (Q<sub>1</sub>-Q<sub>3</sub>).

**Results and Discussion:** Possible variations of COMT SNP 1947G>A were identified: AA - 15 (18.5%) patients, AG - 44 (54.3%) patients, GG - 22 (27.2%) patients. Maximum pain level on POD1 for AA group was 5 (5-6) points, 7 (5-8) points in AG group and 8 (5-9) points in GG group (p=0.024). The incidence of pruritus was lower in group AA+AG than in GG group - 3.3% vs. 22.7%, respectively (p=0.021). Data for OPRM1 SNP 118A>G genotypes were as follows: AA - 57 (70.3%) patients, AG - 16 (19.7%) patients, GG - 8 (9.9%) patients. There were no statistically significant differences in maximum pain level between groups on POD1: AA patients - 7 (5-8) points, AG patients - 6.5 (5-9) points, GG patients - 6 (4-9) points (p=0.97). Nevertheless, patients from AA group more rarely reported about additional analgesic requirements than patients in AG+GG group - 17.5% vs. 41.7%, respectively (p=0.044). There were no differences in the incidence of nausea, vomiting and respiratory depression between groups of both SNPs. Thus, SNPs COMT 1947G>A and OPRM1 118A>G might be associated with efficacy of postoperative analgesia and the incidence of pruritus.

**Conclusion(s):** COMT 1947G>A and OPRM1 118A>G gene SNPs might affect the postoperative opioid analgesia. For the clinical implication of this data further research is required.

#### References:

1. Mura E., Govony S., Racchi M. et al. Consequences of the 118A>G polymorphism in the OPRM1 gene: translation from bench to bedside? *J Pain Research* 2013; 6:331-53.

## 14AP3-2

### Choice of anesthesia affects post-operative pain after ankle fracture surgery

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**Background and Goal of Study:** Multiple anaesthesia techniques are used for ankle fracture surgery. The post-operative effects of anaesthesia choice have not been described sufficiently in the literature.

With this study we aimed to investigate the impact of anaesthetic technique on postoperative pain and related parameters in ankle fracture patients.

**Materials and methods:** We constructed a database consisting of data collected from the histories of 622 patients (ages 9-99) undergoing reconstructive ankle fracture surgery at Herlev University Hospital, Copenhagen, Denmark. The database focus on data relating to anaesthesia and perioperative pain management. The Patients were divided into four anaesthesia groups: 1. General Anaesthesia (GA), 2. GA + Peripheral Nerve Block (PNB), 3. Spinal Anaesthesia (SA), and 4. SA + PNB. The primary outcome was difference in consumption of opioid pain medication in the first 24 hours postoperatively. Secondary outcomes were Post Anaesthetic Care Unit (PACU) pain score, treatment for Post-Operative Nausea and Vomiting (PONV), time in the PACU and length of stay (LOS). Outcomes were corrected for a number of demographic and anamnestic parameters, eg: ASA-score, pretraumatic use of pain medication and fracture type.

**Results and discussion:** We discovered the following differences in opioid consumption between the groups:

Anesthesia Group	Mean consumption [mg]	Difference in consumption.	P-value
1. GA	21.87	Reference	-
2. GA+PNB	16.31	-4.9 (-8.6;-1.3)	0.008
3. SA	17.08	-4.5 (-8.1;-0.9)	0.01
4. SA+PNB	14.55	-6.9 (-10.4;-3.3)	0.0002

[Difference in opioid consumption over 24-hours post-op, converted to equipotent dose IV-morphine [mg], (range). A difference of -3.33 is equivalent to one less 10 mg morphine tablet. Difference was statistically corrected for demographic and anamnestic factors.]

The PACU pain scores were significantly higher in the GA group than in any other group, while the other secondary outcomes yielded no significant differences.

Our results show that the choice of anaesthesia technique have an impact on postoperative opioid consumption, and although a reduction equal to two morphine tablets (-6.9 mg iv-equivalents) may not seem to be of substantial clinical importance it could represent a reduction of pain by up to 33%.

These findings along with the database will provide a solid foundation for further research in this group of patients.

**Conclusion(s):** Use of regional anaesthesia improves the management of pain in the first 24 hours after reconstructive ankle surgery.

### 14AP3-3

#### Differences in mRNA expression profile in patients with Crohn's disease with high and low postoperative morphine consumption?

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**Background and Goal of Study:** Crohn's disease (CD) is a painful inflammatory bowel disease with a heterogeneous clinical appearance. CD patients undergoing major abdominal surgery require notably higher postoperative opioid amount compared to non CD patients.<sup>1</sup> The quantity of morphin consumption serves as a surrogate marker for sensation of pain. To investigate if there are specific molecular differences between CD patients with high or low postoperative morphin consumption we analyzed whole genome mRNA expression in inflamed and non-inflamed small intestine.

**Materials and methods:** After approval of the local ethics committee and written informed consent we enrolled 103 CD patients undergoing open ileocecal resection. For postoperative pain management patients received continuous infusion of metamizol and a patient controlled analgesia using morphine. Patients with high (mean + 1 standard deviation) and low (mean - 1 standard deviation) morphin consumption were compared. mRNA was extracted from cryosections of inflamed and non-inflamed small intestine tissue of 3 CD patients with high and 3 patients with low postsurgical opioid requirement. Expression profiling of all 12 tissues was performed using Affymetrix U133 Plus2.0 microarrays. Transcripts with significantly altered expression in high versus low consumers (fold change of >2; p-value < 0.05), were further investigated using quantitative real-time PCR and original mRNA as well as (for selected genes) a second set of mRNAs extracted from different regions of the original biopsies.

**Results and discussion:** CD patients with high postoperative morphine consumption showed significantly altered expression profiles in three genes, with

higher levels of IRS2 and TCF21 and significantly lower levels of SPIB, respectively.

**Conclusion(s):** We found significant differences of the mRNA expression in the small intestine between CD patients with high and low postoperative morphine consumption. The relevance of these genes for pain sensation and the underlying physiological mechanisms need further investigation.

#### References:

1. Huehne K et al. Eur J Pain 2009; 13(10):1036-42

### 14AP3-4

#### Epigenetic regulation of chronic postsurgical pain - role of P300/CBP associated factor (PCAF)

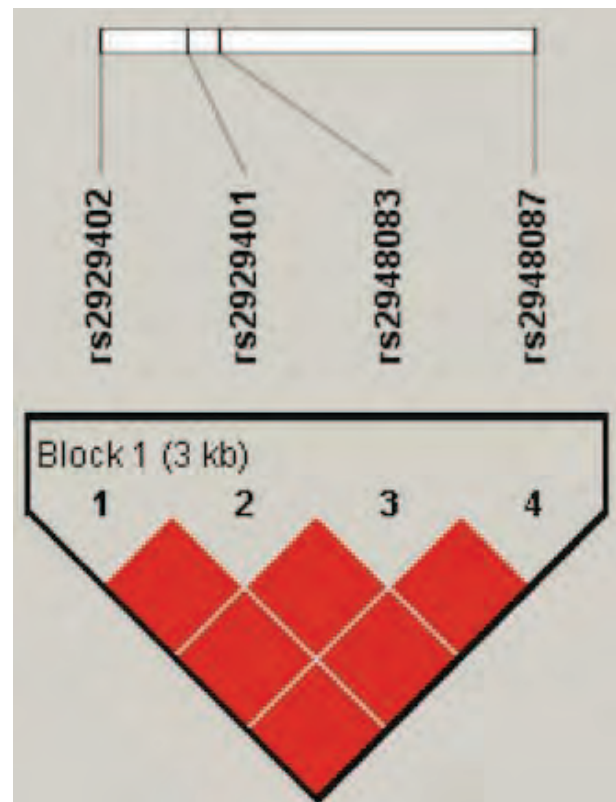
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**Background and Goal of Study:** Previous data suggested that P300/CBP-associated factor (PCAF) is a transcriptional coactivator of cyclooxygenase-2 expression and may modulate the development of chronic pain (1, 2). In this study, we determined the association between variants of PCAF gene and risk of chronic postsurgical pain.

**Materials and methods:** The study was approved by the Clinical Research Ethics Committee. Informed consent was obtained from 1,140 consecutive patients scheduled for major surgery. They were contacted 3 months after surgery and rated their wound pain using the modified Brief Pain Inventory. Venous blood samples had been collected before surgery for genotyping of 49 candidate single nucleotide polymorphisms (SNPs) in PCAF gene, with minor allele frequency > 5%, identified in the Hapmap project. Associations between genetic data and chronic postsurgical pain were analyzed using PLINK software (version 1.07). The interaction between alleles were tested using Haploview (version 4.2).

**Results and discussion:** Chronic postsurgical pain was reported by 246 patients (21.6%), with 58 (5.1%) reporting pain scores > 5 (out of 10). Patients carrying variant alleles in SNPs *rs2948087* and *rs2948083* reported higher rates of chronic postsurgical pain compared with wild-type patients. The adjusted odds ratios (95%CI) for chronic postsurgical pain, in SNP *rs2948087* and *rs2948083* were 11.6 (3.0-45.2)  $p < 0.001$  and 9.0 (2.4-33.3),  $p = 0.002$ , respectively. The haplotype GAGG (constructed with 4 SNPs, Figure 1) in PCAF gene was associated with higher risk of severe chronic postsurgical [odds ratio (95%CI): = 11.29 (2.9-43.9),  $p < 0.001$ ].



[Figure. A haplotype in PCAF gene]



**Conclusions:** Variants in PCAF gene increased the risk of chronic postsurgical pain. Further studies are required to define the molecular mechanisms of PCAF in regulating the development of chronic pain.

**References:**

1. Deng WG, Zhu Y, Wu KK. *Blood*. 2004;103(6):2135-42.
2. Zhu XY, Huang CS, Li Q, et al. *Molecular Pain*. 2012;8:84.

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### 14AP3-6

#### CHEOPS score in tonsillectomy: a good tool to achieve good postoperative pain management in children: preliminary results of observational prospective study

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**Background and Goal of Study:** Postoperative pain is the most frequent algic process in children. It should be adequately assessed in order to achieve effective pain control. Inability to do so, may lead to postoperative complications like nausea, vomiting and acute bleeding. The goal of this study is to make use of the CHEOPS score to predict poor postoperative pain control in patients undergoing tonsillectomy before leaving PACU, in order to achieve good analgesic management.

**Materials and methods:** 30 patients, ages 3-6 years old, who underwent a tonsillectomy were enrolled in our observational study. All patients were induced with sevoflourane, fentanyl and rocuronium and maintained with sevoflurane and a O2/Air (50:50) mixture. Monopolar electrocautery surgical technique was used. Age, CHEOPS score before PACU discharge, VAS score at rest and at mobilization in 24 hours, adverse reactions and incidence of post tonsillectomy bleeding complications were assessed in both groups. For statistical analysis, Pearson's r between VAS and CHEOPS was used; differences in proportions were evaluated by using  $\chi^2$  test. A value of  $p < 0.05$  was considered to indicate a significant difference.

**Results and discussion:** There was a moderate correlation between CHEOPS score obtained in PACU and VAS scores at 24h. In the same way, there were more postoperative complications ( $p < 0.05$ ) in high CHEOPS scores ( $\geq 7$ ). There was no significant difference among high or low CHEOPS scores related to postoperative bleeding complications.

**Conclusions:** CHEOPS score is a good choice to assess early postoperative pain to optimize postoperative pain control in ward, in order to reduce postoperative complications and improve patient's satisfaction.

### 14AP3-9

#### Scoliosis surgery: influence of intraoperative opioid on postoperative morphine consumption

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**Background and Goal of Study:** Postoperative (PO) pain management for scoliosis surgery (SS) is a challenge: pain is severe, it is predominantly a pediatric population and it is difficult to apply locoregional techniques. It has been shown in previous studies (1,2) that continuous intraoperative infusion of remifentanyl increases PO morphine consumption. The aim of this study was to evaluate the PO intravenous (IV) morphine consumption by patient controlled analgesia (PCA) in patients anesthetized with sufentanil (S), remifentanyl (R) or fentanyl (F).

**Materials and methods:** Retrospective study approved by the hospital's ethics committee. We analyzed the electronic medical record of patients submitted to SS (last 4 years) at our hospital and whose PO pain was controlled with IV morphine PCA associated with non-opioid analgesics. Groups according with intraoperative opioid. Demographics (age, weight, gender and ASA status), surgery-related details (surgical approach, vertebral levels exposed and levels of thoracoplasty) and total postoperative morphine consumption (mg) were analyzed. Statistical analysis was performed using: Chi-Square test and One-Way ANOVA. Statistical significance  $p < 0.05$ . Results presented as mean  $\pm$  standard deviation.

**Results and discussion:** 176 patients were analyzed; 26 excluded due to lack of records: S-114, R-21, F-15. The groups were similar with respect to age, weight, gender, ASA status, surgical approach (anterior x posterior), levels

of thoracoplasty and PCA time duration. There was a statistically significant difference in the number of exposed vertebrae ( $S=10,6\pm 3,4$ ,  $R=8,2\pm 3,8$ ,  $F=7,7\pm 4,2$ ;  $p=0,001$ ). There was no statistically significant difference in PO morphine consumption between groups ( $S=83,5\pm 48,4$ ,  $R=62,1\pm 41,8$ ,  $F=81,4\pm 54,8$ ;  $p=0,179$ ).

**Conclusion:** In this study, the intraoperative use of remifentanyl does not cause a statistically significant difference in total morphine consumption when comparing with sufentanil or fentanyl. The greater extent of exposed vertebrae in the S group may justify similar morphine consumption in this group comparing to the others. The difference in sample sizes is a limitation of the study. Prospective studies are required to clarify the results.

**References:**

1. Crawford MW, Hickey C, Zaarour C, et al. *Anesth. Analg.* 2006;102:1662-7
2. Guignard B, Bossard A E, Coste C, et al. *Anesthesiology* 2000;93:409-17

### 14AP3-10

#### The influence of sexes on postoperative pain

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**Background and Goal of Study:** The influence of gender and sexes is a key issue of today's research. However, current literature in the field of perioperative medicine rarely focuses on this question.

Our aim was to analyze a large population to find differences in postoperative pain perception in females and males.

**Material and Methods:** This study was designed as an open, observational, prospective trial. Patients were interviewed 24 hours postoperatively based on a specially designed questionnaire. This incorporated details about surgery and anesthesia (this part was filled by the attending anesthetist) and questions about the patient's wellbeing and postoperative pain.

**Results and Discussion:** During a 50-month interval 10200 patient were interviewed (42.12% male, 57.88% female). When analysing data for influences of sexes on postoperative pain, no significant differences could be found. However, after stratifying data for the different kind of surgeries, sexes showed significantly different results. Male were prone to experience a greater number of moderate pain after major vascular and orthopaedic surgery  $p < 0.05$ , females reported higher pain ratings after diagnostic procedures as well as (e.g. biopsies)  $p < 0.05$ .

**Conclusion:** The gender differences on pain perception are still heavily disputed, both in experimental and clinical field. Our data do not definitely clarify this issue; however, based on our findings it can be presumed that the type (and severity) of surgery may play a pivotal role, as females express higher pain scores after minor procedures, whereas males are more affected after major surgery.

### 14AP3-11

#### Predisposing factors for persistent postoperative pain

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**Background and Goal of Study:** Persistent Postoperative Pain (PPP) is a silent epidemic that is in urgent need for better understanding of the pathophysiology. The International Association of the Study of Pain defines it as persistent pain after surgery of 3 months' duration. The goal of study was to identify predisposing factors for PPP

**Materials and methods:** Observational prospective study conducted in adults scheduled for elective surgery. We applied the short-form Brief Pain Inventory (SF-BPI) preoperatively (T0), one day after surgery (T1) and 3 months later (T3). At T3, the first question asked was "Do you still have any pain that you could relate to the surgical procedure?" This is an adaptation of the SF-BPI first question on pain prospection. If the patient answered "yes", then they were considered as having PPP and we applied the short-form McGill Pain Questionnaire (SF-MPQ). Non-parametric and parametric tests were performed for comparisons between numerical variables, and Chi-Square test for categorical variables.

**Results and discussion:** 175 patients completed the study and the incidence of PPP was 28%. Relatively to surgical groups, cholecystectomies were less associated with PPP (8.3% vs 31.1%,  $p=0.021$ ) and arthroplasties were more associated with PPP (50.0% vs 25.5%). PPP was higher in patients with preoperative pain in the related area (51.4% vs 21.5%,  $p < 0.001$ ), even when we

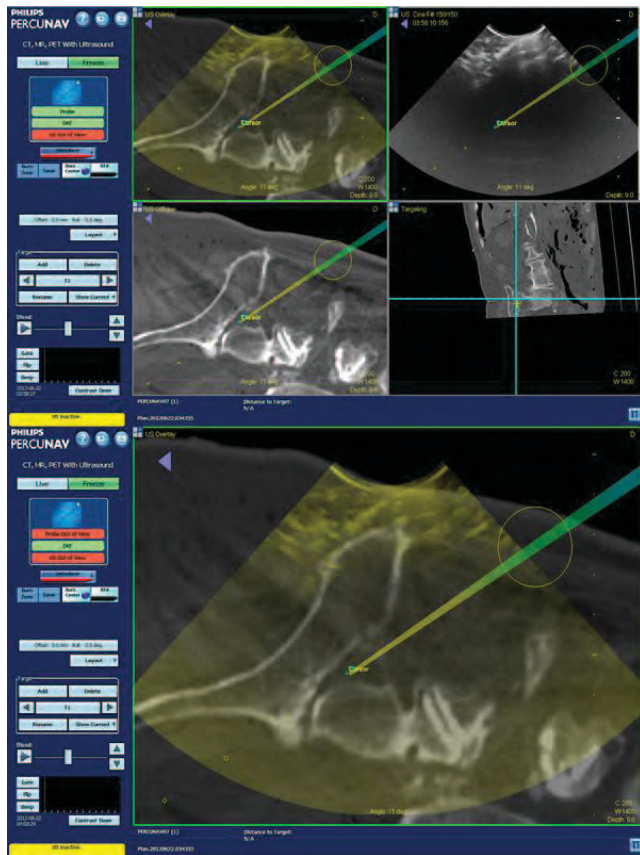
exclude patients with presence of acute postoperative pain (55.5% vs 10.1,  $p=0.002$ ). PPP was higher in patients with presence of acute postoperative pain (37.0% vs 18.5%,  $p<0.021$ ), even when we exclude patients with preoperative pain (32.2% vs 11.1%,  $p=0.011$ ). Patients with history of prior surgery in the related area had higher incidence of PPP (50.0% vs 24.5%,  $p=0.01$ ). PPP was positively associated with preoperative current treatment on benzodiazepines (42.9% vs 23.5%,  $p=0.015$ ) or antidepressants (61.3% vs 21.3%,  $p<0.001$ ). PPP patients presented more problems related to anxiety and depression (54.1% vs 20.6%,  $p<0.001$ ), that were associated with higher scores for BPI Severity and Interference, and Pain Rating Indexes. We were unable to detect differences for genre, age, body mass index, diabetes and statin medication prior to surgery.

**Conclusions:** Acute postoperative pain, preoperative pain and history of prior surgery in the related area were associated with PPP. Anxiety and depressive disorders were associated with higher incidence of PPP and higher pain scores.

**14AP4-1**  
**Ultrasound-based imaging fusion for sacroiliac joint (SIJ) injection: a cadaver preliminary study**

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**Background:** SIJ injection either to diagnose or treat pain associated with SIJ dysfunction is usually fluoroscopy or CT-guided. The Ultrasound (US) Fusion (F) Imaging (UFI) involves the co-registered display of live US with a reference series from another modality such as CT in this case. As the US exam is performed, the F system continuously generates reformatted planes from the reference series, displayed either as an overlay or a side-by-side with the live US [Fig.1]. The UFI potential transposition to Pain Clinic and Spine Medicine was tested in this cadaver preliminary study.

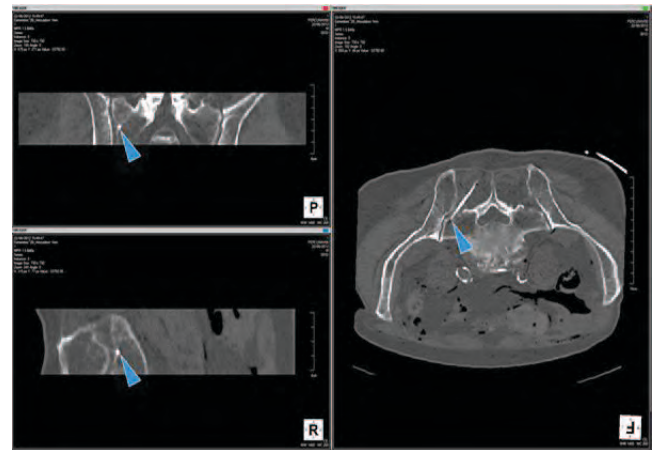


[Fusion based Left SIJ]

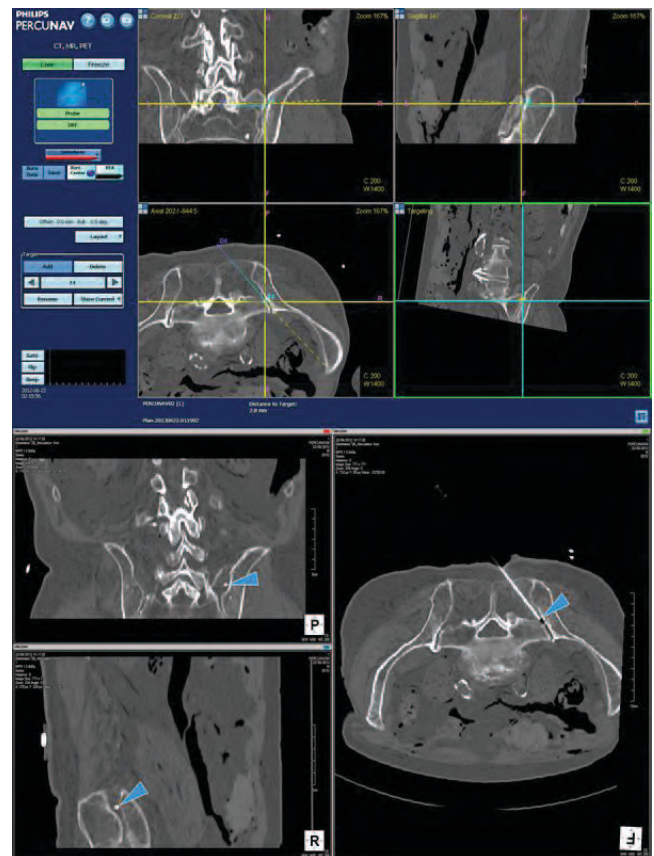
**Case report:** In a 66yo male fresh frozen cadaver (prone position), the UFI-guided SIJ needle insertion was performed bilaterally using the Philips™ Percunav™ system. With 3 active fiducials RegPatch™ (in total 6 electromagnetic trackers) attached peripherally to the region of interest (ROI) to the patient's

back skin, a T8 to sacrum CT (Siemens™ Somatom™) was acquired first. The magnetic field generator was placed at 40cm to the skin, lateral to the ROI. About co-registration, we used 5 bones landmarks: postero-superior iliac spines (PSIS) and the L2, L3, L5 spinous process tips. When matching was optimal, the first SIJ needle insertion attempt was performed on the left side. First the US and CT side-by-side view was used before to work with the overlay [Fig.1]. With the convex 1-5MHz 60mm wide transducer, we scan just medially to the left PSIS to expose the postero-superior SIJ opening [Fig.1] under transversal, short axis view. The transducer left in the good place using an autostatic Vygon™ probe holder, a slightly cephalad to caudad and medial to lateral needle insertion pathway was planned following an in-plane approach [Fig.1]. The skin entry (E) and the target (T) points were fixed while the path length was measured. Then, an 16G 15cm long tracked needle was inserted. During the navigation, the tip was followed using a color code until to be considered as in place, matching for the T. Then a control CT was taken to check the needle placement [Fig.2].

On the right side, the same guidance procedure was used but preferentially based on the specific CT view [Fig.3]. A second control CT was taken always for the needle placement check [Fig.3].



[CTscan control Left SIJ]



[Fusion based vs CTscan control Right SIJ]



**Discussion:** On both side, after only one attempt, the needle was successfully inserted with less than 1mm of spatial shift [Fig 2 & 3]. These promising results are in favor of this Xray free technology and have to encourage us to pursue.

## 14AP4-2

### Patients' preoperative preference and postoperative implementation for four pain scales

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**Background and Goal of Study:** The most commonly used scales for measuring pain intensity after surgery are visual analogue scale(VAS), numerical rating scale(NRS), faces pain scale-revised(FPS-R) and verbal rating scale(VRS). It is generally believed that the different comprehension and preference of patients for these scales may affect the accuracy of the pain assessment after surgery. Our objective was to study patient preference for four pain intensity scales and evaluate the implementation of the scales in the assessment of postoperative pain.

**Materials and methods:** 404 patients who were to receive selected surgery with general anesthesia and ASA class $\leq$ 3 during April–May,2013 in this hospital were included in the study. On the day before surgery, we introduced the methods of VAS,NRS,VRS and FPS-R for the patients and inquired which scale was more reasonable and the preference in the assessment of postoperative pain. After surgery, the patients were asked to assess their pain intensity with the four pain scales.

**Results and discussion:** Preoperative survey showed that 45.1% of the patients preferred the NRS, followed by the FPS-R (18.3%),the VAS (2.2%). Significant differences were found in terms of age, gender and educational level for scale preference. Postoperative pain scores showed that 324 patients completed the assessment of postoperative pain and among them there were 16.7% of the patients to refuse to use the VAS, 7.4% to refuse the FPS-R, 4.0% to refuse the NRS, and no one to refuse the VRS. The results reminded that nearly half of the participants preferred the VRS, and there was a negative correlation between the order of the preference of four pain scales and the size of the rejection rate. A study of 173 Chinese patients showed that nearly half of the participants (48.1%) preferred the FPS-R, followed by the NRS (24.4%), the VRS (23.1%), and the VAS (4.4%). Maybe, both of these two studies indicated that most patients in China did not prefer the VAS, although the VAS was widely used in pain assessment.

**Conclusion(s):** The VRS is the most patients' preference in the assessment of postoperative pain and there is a higher rejection rate for the VAS.

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## 14AP4-3

### Influence factors of the rejection rate of visual analogue scale in pain evaluation after surgery

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**Background and Goal of Study:** The VAS was widely used for its sensitivity and the ability to detect differences in pain intensity due to treatment or over time. However, the VAS was difficult to understand and use for several patients. And some patients refused to use the VAS for postoperative pain evaluation. The objective of our study was to research the influence factors of the rejection rate of visual analogue scale(VAS) in pain evaluation after surgery.

**Materials and methods:** 324 patients who were to receive selected general surgery with general anesthesia and American Society of Anesthesiologists (ASA) class $\leq$  2 were included in this study. We introduced the methods of VAS for the patients on the day before surgery and asked them to assess their pain intensity using the pain scales when they were awake after surgery. Meanwhile patients' heart rate and blood pressure were recorded.

**Results and discussion:** There were 54 patients who refused to use VAS to evaluate their pain intensity.

- (1) The rejection rate of patients with less than high school education was higher than that of patients with more than high school education.
- (2) The rejection rate was significantly lower in patients who were treated by

laparoscopy than by laparotomy.

(3) The rejection rate was significantly higher in patients with tumorous diseases than without.

(4) There was no difference in the rejection rate between genders.

(5) The mean age for the patients who completed the VAS was significantly lower than that of the patients who did not complete ( $54.2 \pm 14.45$  vs  $59.4 \pm 13.38$ ). When the patients were elder or had lower education level or were diagnosed with neoplastic disease as well as were treated by laparotomy, their postoperative recovery was slower and they would like to refuse to use the VAS.

**Conclusion(s):** Gender,educational level,the type of surgery and diagnosis of tumorous disease before operation were the influence factors for the rejection rate of the VAS in the pain evaluation after surgery.

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## 14AP4-4

### Pain prevalence is higher than the four traditional vital signs: investigation in a China teaching hospital

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**Background and Goal of Study:** A descriptive, cross-sectional study to identify the prevalence of pain and four traditional vital signs as well as the strengths and weaknesses of pain management in a China university teaching hospital.

**Materials and methods:** Structured interviews were conducted by independent researchers. The prevalence of pain and the four vital signs were recorded during the whole hospitalization. The catalogue, severity, causes, duration of pain, pain medications for patients and the knowledge of pain medications of medical staffs were interviewed.

**Results and discussion:** A total of 3248 patients who were contacted participated in the study, with 63.36% of which experienced pain during the hospitalization, which was

1. 8~2.8 times higher than the abnormality of the traditional four vital signs.
2. Seventy-six of the patients had moderate pain and 21.98% of them reported severe pain at worst.
3. Pain intensity differed among patients' diseases, rather than other demographic factors.
4. Acute and chronic pain was recorded in 68% and 26% of patients, respectively. Sixteen percent of the patients suffered from neuropathic pain.
5. Over half of patients with pain refused to receive pain medication, the addiction problem of opioids and the side effect of the analgesics are their main concerns.
6. The majority of the medical staffs grasped the three ladder analgesics appropriately.

In summary, this survey revealed a high prevalence of pain than the abnormality of other four traditional vital signs in a China teaching hospital. Pain should be assessed systematically to identify the exact amount of analgesics required and to evaluate outcome. Meanwhile, our survey also indicated that the knowledge and the attitudes of health professionals towards the management and treatment of patients in pain have been greatly improved which lead to a high satisfaction of the hospitalized patients, while the educational intervention is required to improve the knowledge and attitudes of the patients towards the approach and handling of pain.

**Conclusion(s):** It is necessary to recognize and check the level of pain as the fifth vital sign due to the high prevalence of pain. The knowledge and the attitudes of health professionals towards the management of patients with pain have been improved. However, patients need more educational intervention of pain management.



## 14AP4-5

### The effect of intraperitoneal local anesthetic administration on abdominal pain after laparoscopic cholecystectomy: a meta-analysis and systematic review

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**Background and Goal of Study:** Intraperitoneal local anesthetic administration (IPLA) has been used to reduce the pain after laparoscopic cholecystectomy (LC). Although a number of studies have investigated about the effect of IPLA on pain after LC, the results were controversy. This systematic review was performed to determine the effect of IPLA on abdominal pain after LC.

**Materials and methods:** We searched the database of Medline and EMBASE between 1966 and July 2013. Of a total of 60 potentially relevant RCTs were identified, thirty RCTs were included in the systematic review. Data were analyzed with Review Manager 5.2.

**Results and discussion:** There was a significant reduction in pain scores among IPLA and control groups at all of time points after LC favoring pain control for IPLA groups: 2 h (SMD = -0.91, 95% CI = -1.33, -0.49, I<sup>2</sup> = 92%), 4 h (SMD = -0.96, 95% CI = -1.30, -0.61, I<sup>2</sup> = 90%), 8 h (SMD = -0.95, 95% CI = -1.28, -0.62, I<sup>2</sup> = 90%), and 24 h (SMD = -0.31, 95% CI = -0.55, -0.07, I<sup>2</sup> = 84%). IPLA administration before gallbladder dissection showed significant reduction in pain at only 8 h after LC (SMD = -0.66, 95% CI = -1.23, -0.10, I<sup>2</sup> = 85%), whereas IPLA administration after dissection did at all of time points except at 24 h. Of the types of local anesthetics, bupivacaine is most effective in pain reduction: 2 h (SMD = -0.93, 95% CI = -1.47, -0.38, I<sup>2</sup> = 92%), 4 h (SMD = -1.33, 95% CI = -1.92, -0.74, I<sup>2</sup> = 92%), 8 h (SMD = -0.92, 95% CI = -1.36, -0.48, I<sup>2</sup> = 89%), and 24 h (SMD = -0.41, 95% CI = -0.77, -0.05, I<sup>2</sup> = 86%). There was a significant reduction in visceral pain scores with the use of IPLA at 2 and 8 h after surgery. Overall, visceral pain scores showed a significant reduction in IPLA groups compared with control groups (overall SMD = -1.72, 95% CI = -2.67, -0.77, I<sup>2</sup> = 95%). There was a significant reduction in parietal pain scores with the use of IPLA at 4 h (SMD = -0.70, 95% CI = -1.38, -0.03, I<sup>2</sup> = 69%) and 8 h (SMD = -0.65, 95% CI = -1.02, -0.28, I<sup>2</sup> = 0%) postoperatively, and a pain reduction in totality was significant in IPLA groups compared with control groups (overall SMD = -0.77, 95% CI = -1.38, -0.17, I<sup>2</sup> = 91%).

**Conclusion(s):** We conclude that the use of IPLA results in a statistically significant reduction in pain after LC, there was little evidence with regard to benefit of preemptive analgesia with IPLA, and administration of intraperitoneal bupivacaine is most effective in abdominal pain relief.

## 14AP4-6

### Intra-operative fentanyl gives superior pain relief for patients undergoing laparoscopic bariatric surgery when compared to morphine

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**Background and Goal of Study:** Bariatric surgery has recently transformed from open to laparoscopic. Bariatric patients suffer from multiple co-morbidities, e.g. obstructive sleep apnoea and hypertension[1]. It is therefore important to prevent inadequate pain relief or avoid opioid side effects. Effective pain relief also ensures early patient mobility, cardiovascular stability, and a lower incidence of pneumonia[2]. The aim of this study is to promote effective pain management and develop recommendations for patients undergoing laparoscopic bariatric procedures.

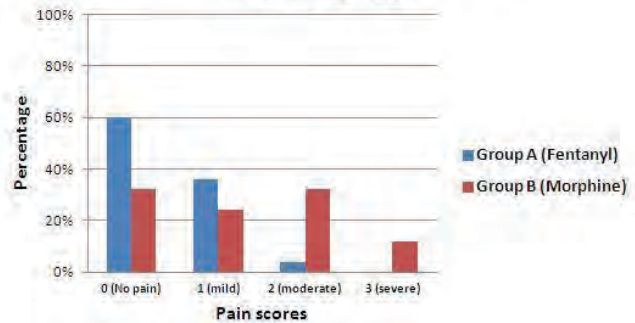
**Methodology:** We conducted a retrospective observational study. We selected 50 patients who underwent laparoscopic Roux-en-Y surgery over 3 months and divided them into 2 equal groups of 25: Group A received 300 mcg of i.v fentanyl and Group B received 10 mg of i.v Morphine intra-operatively. The mean BMIs for Group A and B were 47.9 and 48.2 respectively (range 45-50). All the patients received intra-operative i.v Paracetamol 2g, i.v Parecoxib 40mg and Local anaesthetic infiltration (30ml of 0.5% L-Bupivacaine). We compared pain scores for each group after 1 hour in the post anaesthetic care unit (PACU).

**Results and discussion:** Group B had remarkably worse pain scores than Group A (figure.1). 12% of the morphine group reported severe pain in PACU, whereas no patients in the Fentanyl group reported severe pain. In fact, 60% of the Fentanyl group were pain free. Multi-modal analgesic regimes should

be adopted for these patients and recent evidence has shown that they have little pain with adequate local anaesthetic infiltration. Intra-operative Fentanyl in a dose range of 200-300 mcg appears to provide optimal analgesia during the operation and in PACU.

**Conclusion:** Fentanyl appears to be superior to Morphine as an analgesic in laparoscopic bariatric patients. It is advisable to avoid morphine as it is less effective and can have dangerous side effects.

Pain scores for patients undergoing laparoscopic Roux-en-Y (n=50)



[Figure 1]

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## 14AP4-7

### Evaluation of a smartphone application connected to a web-based system for remote monitoring of post-operative pain in ambulatory surgery: a randomised controlled trial

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**Background and Goal of Study:** Good connection to patients following ambulatory surgery is an essential factor to its success. Problems increase in large areas with deficient land communications, aged populations, poor economical status, few scholar studies and adverse climatic conditions. Our aim is to evaluate in those settings the usefulness of a system (N. Pombo et al.) developed for remote pain monitoring and analysis.

**Materials and methods:** Our system is an application for smartphone, developed to record pain scores several times a day (from 0 to 10) and to provide informations about medication, using a web record to receive, manage and deliver the collected data to health care professionals.

Patients enrolled: after ethical committee approval, 62 adults submitted to ambulatory surgery, aged 18 to 75 years, ASA I or II, that gave written informed consent.

Exclusion criteria are illiteracy and physical or mental inability to use a smartphone.

Patients were randomly assigned in group I (31 patients, monitored with our novel system) or group II (31, control).

Primary outcome was pain intensity scores during initial five post-operative (PO) days. Additionally, we evaluated adherence to the apps and studied factors that influenced success rates.

**Results and discussion:** Groups were not different in age (t-Student, p=ns) and sex (Chi-square, p=ns). One patient of group I did not adhere to the apps, meaning 97% of full compliance. PO1 pain scores (mean ± SD) were 1.2 ± 1.4 in Group I and 1.2 ± 1.3 in Group II (Mann-Whitney, p=ns). Respective values at PO5 were 0.9 ± 1.4 and 0.2 ± 0.5.

Group I patients, 18 male and 13 female aged 44.1 ± 13.5 years, previously used mobile phones (97%) while it was scarce the usage for professional purposes (15%) and Internet access (23%). Concerning the suitability of the application to improve pain management, Spearman correlation reveals a rs=0.679, p< 0.01 with the suitability to provide medical information and the recommendation of the application by the users (rs=0.603, p< 0.01).

**Conclusion:** Our study proved the feasibility and user-friendliness of the system. We were unable to prove improvements in the quality of pain manage-

ment, but this can be explained by the low pain scores registered in both groups. Studies with a high number of patients, including major ambulatory surgery or chronic pain, are necessary to evaluate this goal.

**Reference:**

Pombo N. et al. *Lecture Notes in Engineering and Computer Science* 2012; 1: 589-92.

#### 14AP4-8

##### Anesthesiologists may underestimate postoperative pain scores compared to corresponding patients postoperative pain scores following major surgery operations

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**Background and Goal of Study:** In the management of postoperative pain, estimation of pain intensity plays an important role. The aim of this study was to compare the postoperative pain levels reported by patients with those documented by anesthesiologists in order to evaluate potential causes of under-treatment and to determine the effectiveness of the intervention.

**Materials and methods:** 212 patients ASA I-III, who underwent major urologic, orthopedic, vascular or general surgery operations, were studied. Analgesia technique was chosen from predetermined protocols of the Anesthesia Department. Epidural analgesia technique included the use of local anesthetic alone or in combination with morphine. Intravenous analgesia techniques included the use of opioids alone or in combination with ketamine. Continuous infusion of the chosen regimen was designed to provide 24h postoperative pain relief in each patient. In all studied patients, pain intensity was assessed at rest and during movement (deep breath or cough) using the Numerical Rating Scale (NRS 0-10) by asking the patient (P) and the observing anesthesiologist (A) at 6h and 24h postoperatively. If patients NRS scores were higher than 3, additional analgesics were provided. Statistical analysis was performed with a two-tailed Student's *t* test. Statistical significance was set at  $p < 0.05$ .

**Results and discussion:** At 6h postoperatively assessment the average pain level reported by patients (P) was significantly higher compared to the corresponding reported by the observing anesthesiologist (A) (rest P:  $1.1 \pm 1.5$  vs. A:  $0.8 \pm 1.1$ ;  $p < 0.05$ , movement P:  $1.7 \pm 1.9$  vs. A:  $1.2 \pm 1.6$ ;  $p < 0.05$ ). Average pain levels, at rest and during movement, remained lower when reported by the observing anesthesiologist, 24h postoperatively, compared to that reported by patients with no statistical significance (NS) (rest P:  $0.6 \pm 0.9$  vs. A:  $0.5 \pm 0.8$ ; NS, movement P:  $1.1 \pm 1.4$  vs. A:  $0.8 \pm 1.2$ ; NS). The percentage of patients receiving additional analgesics, based on patients data was 37.5%.

**Conclusion(s):** The study showed a discrepancy in pain scoring assessment between patients and anesthesiologists, indicating the need for more accurate pain assessment, since the patient experiences pain and doctors determine the treatment.

#### 14AP4-9

##### Modeling the trajectory of intravenous patient-controlled analgesic demands over time after surgery for colorectal cancer using the latent curve analysis

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**Background and Goal of Study:** Intravenous patient-controlled analgesia (IVPCA) is often used to relieve pain after colorectal surgery. Although studies have investigated factors related to IVPCA demand, few inspected how they interact over time. This study aimed to model the trajectory of analgesic demand over time after colorectal cancer surgery and explore potentially relevant influential factors using latent curve analysis, focusing on laparoscopic-assisted surgery and renal function.

**Materials and methods:** In this retrospective study (with Institutional Review Board approval) of patients who had undergone colorectal surgery with postoperative IVPCA, archived data was retrieved from the IVPCA pumps. Patients were randomly divided into two equal parts to enable model construction and cross validation. The data set included: patient demographics, IVPCA demands during 12 hour periods for 48 hours, serum creatinine, and whether

laparoscopic-assisted or fully open surgery. Latent curve modelling with two latent variables, intercept and slope, which reflected the trajectory baseline and deviation, respectively, were used to analyse the IVPCA demand over time. Effects of potentially influential factors on the two latent variables were also estimated to evaluate their interactions with time on analgesic demand. Goodness of fit indices were used to assess the model fit to both the model construction and validation datasets.

**Results and discussion:** Data were collected from 834 patients, of whom 112 had laparoscopic-assisted surgery. Latent curve analysis of the model construction dataset revealed that body weight had a positive effect, whereas increasing age, female gender, poor renal function and laparoscopic-assisted surgery exerted negative effects on the baseline trajectory of analgesic demand over time. By contrast, only age and weight exerted significant effects on the slope parameter to modify the trajectory of IVPCA demand. There was good cross validation, as the parameter estimates derived from the model construction dataset fitted well to the validation dataset (comparative fit index: 0.97; root mean square error of approximation: 0.05).

**Conclusion(s):** Laparoscopic-assisted surgery and renal function affected the baseline trajectory of IVPCA demand over time, but had no significant effect on its slope. Latent curve analysis provided an insight into the dynamic relationships between the trajectory of IVPCA demand over time and its influential factors.

#### 14AP4-10

##### Effect of two different circumcision techniques on postoperative pain: a prospective randomized double blind study

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**Background and Goal of Study:** The number of outpatients minor surgeries due to various indications is increasing. The most common outpatient surgeries in children are minor surgeries such as circumcision. The aim of this prospective randomized double blind study is to compare the effect of two surgical techniques used in circumcision for postoperative pain.

**Materials and methods:** The local ethic committee consent was taken. After power analysis two groups were formed each consisting of 30 patients. Between January to July 2013, 30 patients were randomly allocated to dorsal slit incision technique (Group1) and the other 30 was included to double incision circumcision(Group 2). After the operation the same surgent applied dorsal penil block with 0.5 ml/kg, 0.5 % bupivacaine (Marcaine® 5 mg ml<sup>-1</sup> Abbott Laboratories Elverum, Norway) for postoperative analgesia to all patients. In order to evaluate pain modified objective pain scale was used, we also recorded first analgesic requirement time and frequency of analgesic use. In order to evaluate agitation during recovery, Ramsey sedation scale was used. The patients and their families, and the anesthesiologist were blinded to surgical techniques and the surgents were blinded to evaluation of pain.

**Results and discussion:** The patients demographic variables were similar. In the first postoperative 8 hours patients in Group 2 had fewer pain and agitation ( $p < 0.05$ ). In the postoperative 24 hours 12 patients (%40) in Group 1 and 23 patients (%76.6) in Group 2 did not receive analgesics ( $p < 0.05$ ). There were no complications in any group.

**Conclusion(s):** Double incision technique in circumcision which is more respective to the anatomical structures and tissues has a better postoperative pain control.

#### 14AP5-1

##### IV, paravertebral or epidural anesthesia to treat pain after hybrid atrial fibrillation (AF) ablation surgery?

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**Background and Goal of Study:** Both thoracic and diaphragmatic nerve endings may be sensitized after hybrid (bilateral thoracoscopic and endovascular) AF ablation surgery. Hence, optimal pain therapy is here a matter of concern. We compared the efficacy of thoracic epidural anaesthesia (PCEA), intravenous patient controlled analgesia (PCIA) and bilateral paravertebral blocks (PVB).

**Materials and methods:** After Hospital Ethical Committee study approval, patients with AF scheduled for hybrid AF ablation surgery were prospectively included. Depending on their coagulation status, they were given as option for postoperative pain treatment: PCEA (ropivacaine and sufentanil), bilateral PVB (ropivacaine, clonidine and hydrocortisone) or PCIA (piritramide with dydrobenzperidol). Preoperative anxiety scores, VAS scores (at rest, when moving or coughing), respiratory rate, respiratory muscle use (diaphragmatic, intercostal, accessory), patient's comments on pain, sleep, sedation, PONV, block extent, transit time, length of stay, and presence of allodynia-hyperalgesia at 1 and 3 months were recorded. Stats included ANOVA and Chi-Square analysis when necessary. P-values < 0.05 were considered significant

**Results and discussion:** Twenty four patients were recruited (PCEA: 10; PCIA:9; PVB: 5). One patient in the PCIA group was converted to PVB 24h after surgery for intractable pain. VAS scores were globally better for the PCEA group. The VAS scores of the PVB group were comparable for the first 24h but were worse on day 2 and day 3. Surprisingly, the IV-PCIA group had more VAS variability with reasonable to unsatisfactory pain VAS scores or pain complaints for the first 48h. After 72h, VAS scores lowered in all groups. Albeit not always optimal, quality and duration of sleep was best after PCEA (range: [30min-6h] day 1 to 3) and intravenous (IV) morphine supplements were sometimes necessary (6/10). Unsatisfactory pain relief was more frequently observed in the PCIA or PVB (after day 1) groups. Constipation tended to be more observed in the PCIA group ( $p = 0.23$ ), but did not affect first meal onset time [day 1-day4]. Duration of hospital time was equal (average 6-7d) ( $p=0.80$ ). Remarkably, patients did not complain of hyperalgesia or allodynia 3 months after their surgery.

**Conclusion(s):** Combining PCEA with IV sedation when deemed necessary seems to be the most convenient situation for pain relief for hybrid AF ablation surgery

## 14AP5-2

### Effect of different doses of dexamethasone on the duration of single shot interscalene blocks with ropivacaine

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**Background and Goal of Study:** Interscalene brachial plexus block provides excellent analgesia, but has limited duration. Dexamethasone added to local anesthetic prolongs the duration of a single-shot interscalene block (SSIB). However, dose of dexamethasone as an adjuvant for the SSIB is not established. We aimed to evaluate an effect of different doses of dexamethasone on the duration of SSIB with 0.5% ropivacaine.

**Materials and methods:** In a double-blinded trial utilizing SSIB, 79 patients scheduled for elective arthroscopic shoulder surgery were randomized to one of four groups: Total 12 ml of 0.5% ropivacaine mixed with normal saline (Group I, control group,  $n=19$ ), dexamethasone 2.5mg (Group II,  $n=20$ ), dexamethasone 5mg (Group III,  $n=20$ ), dexamethasone 7.5mg (Group IV,  $n=20$ ). All patients underwent SSIB and followed by general anesthesia using sevoflurane. The primary outcome was the time to first analgesic request after performing SSIB. The Kaplan-Meier survival density estimation was used to compare groups. The pain score and possible complications were observed for postoperative 48 hours.

**Results and discussion:** The time to first analgesic request was prolonged significantly in Group III and IV [median (IQR) 1380 (950-1260), 1150 (1040-1395)] compared with Group I [720 (505-1060)] (log-rank test  $P < 0.05$ ). There was not a significant difference of the time to first analgesic request between Group III and IV. The pain score during for postoperative 48 hours were not different significantly. There were no significant differences of adverse events between four groups.

**Conclusion(s):** Dexamethasone 5mg and 7.5mg prolong analgesia from SSIB using 0.5% ropivacaine compared to normal saline and dexamethasone 2.5mg. However, there were no significant differences between using dexamethasone 5mg and 7.5mg. We recommend a use of dexamethasone 5mg as an adjuvant for SSIB.

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## 14AP5-3

### Bone marrow aspiration performed using multimodal local infiltration anaesthesia: a randomized double blind controlled study

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**Background and Goal of Study:** Bone marrow aspiration/biopsy (BMA) is an essential procedure for diagnosing haematological disorders. Local infiltration anaesthetics (LIA) are most often used to relieve potential procedural pain during BMA. The aim of this prospective, randomized, double blind study was to compare two different local infiltration anaesthetics; lidocaine LIA and multimodal LIA regarding patients' experience of pain during BMA.

**Materials and methods:** Fifty adult patients undergoing BMA were randomized to receive either 15 ml lidocaine (150 mg) LIA (25 patients) or 15 ml multimodal LIA (ropivacaine 30 mg, ketorolac 6 mg and epinephrine 0.1 mg) (25 patients). Questions on occurrence (yes/no) and intensity of pain on VAS (0-100mm) were used to assess patients' pain before, 10 minutes after and 1-7 days after BMA. Differences between the two groups were calculated using Mann-Whitney u-test or the chi-square test.

**Results and discussion:** More than half (62%) of the patients experienced pain during BMA with no statistically significant difference between the two groups at any of the measurement occasions. Eight patients (32%) in the multimodal LIA group and five (20%) in the lidocaine LIA group reported moderate-to-severe pain (VAS>54) ( $p=.001$ ) during BMA. More than half (60%) of the patients experienced pain during insertion of local anaesthesia. At 10 minutes after BMA seven patients (14%) reported pain, four (16%) in the multimodal LIA group and three (12%) in the lidocaine LIA group (NS). At subsequent follow-ups 1, 3 and seven days post BMA pain was present in 26 (52%), 16 (12%) and 4 (8%) patients, respectively. The current findings indicate that the use of a multimodal LIA analgesic combination of ropivacaine, ketorolac and epinephrine does not provide better pain relief than lidocaine during and after BMA. More than half the patients reported pain during BMA and several experienced moderate-to-severe pain regardless of the type of local analgesic. More studies to establish effective pain treatment during BMA are needed.

**Conclusion(s):** Experienced pain intensity during BMA did not differ between multimodal LIA and lidocaine LIA.

## 14AP5-4

### Effect of preoperative versus intraoperative administration of nefopam on acute postoperative pain after renal surgery

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**Background and Goal of Study:** This prospective randomized, double-blind trial was designed to investigate if there is any benefit of preoperative administration of a single intravenous dose of nefopam comparing to its intraoperative use, in terms of analgesia effectiveness, side-effects and patient satisfaction, during first 24h following renal surgery.

**Materials and Methods:** After IEB approval and written informed consent, 53 patients, aged 31-75 years (ASA I-III), scheduled for renal surgery, have been randomly divided into two groups. Group A patients ( $n=26$ ) have received intravenously 20 mg nefopam, 1h before skin incision, respectively a placebo, 1h before skin closure. According to the same protocol, in group B ( $n=27$ ) we have administered placebo preoperatively and nefopam intraoperatively. Standard general anesthesia and acute postoperative analgesia consisting of PCA with morphine (1.5 mg bolus, 10 min lockout) have been used in both groups. We have evaluated the intensity of acute postoperative pain at rest and on cough, measured by visual analog scale at 1h, 2h, 4h, 6h, 8h, 10h, 12h, 24h post-procedure. Time to first request for analgesia, total morphine consumption, the incidence of adverse events, as well as patient satisfaction during first 24h postoperatively have been recorded, too. Statistical analysis has been performed by means of U-test and chi square-test ( $p < 0.05$ ).

**Results and Discussion:** The two groups are similar concerning demographics and duration of surgery. VAS scores have been significantly lower in group A for resting pain, during study period ( $p < 0.001$ ), respectively until 8h postoperatively for pain on cough ( $p < 0.05$ ). For the following intervals, pain scores on cough have indicated similar values, although a discrete ad-



vantage of group A should be noted. Time to first demand for analgesia has been statistically prolonged in group A ( $p < 0.05$ ). Total morphine consumption has been significantly less ( $p < 0.001$ ) and, consequently the incidence of adverse events has registered statistically lower values ( $p < 0.05$ ) in group A. Significantly more patients in group A have rated their postoperative pain management as excellent ( $p < 0.006$ ).

**Conclusion(s):** Our study suggests that a single dose of 20 mg nefopam appears to be more effective in preemptive than in intraoperative usage, since it significantly improves the quality of acute postoperative analgesia and patient satisfaction with pain therapy after renal surgery.

## 14AP5-6

### Analgesia after bariatric surgery: relationship between preoperative psychological characteristics and pain variables

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**Background and Goal of Study:** Previous studies have revealed that psychological factors may affect patients' response to postoperative pain (1). The aim of this study was to investigate the extent to which psychological variables may influence postoperative pain intensity and need of analgesics using patient-controlled analgesia (PCA) in patients undergoing bariatric surgery.

**Materials and methods:** 50 patients, aged 18 to 70 years, with an ASA physical status I-II, undergoing bariatric surgery were enrolled. Binge scale questionnaire (BES) and anxiety and depression Hamilton scales were used -on the day before surgery- to assess patients' psychologic status. General anesthesia was induced with propofol 2.5 mg/Kg IBW; fentanyl 3 mcg/Kg IBW and rocuronium 1.2 mg/Kg IBW. For the maintenance, sevoflurane concentration was titrated so as to maintain Bispectral Index  $< 60$ .

Additional fentanyl boluses were administered (maximum dose = 10 mcg/Kg IBW). Intraoperative analgesia was then assured by remifentanyl, at infusion rates ranging from 0.1 to 0.3 mcg/kg (IBW)/min. Paracetamol (1000 mg) was administered 30 minutes before the end of surgery. In the recovery room, a PCA electronic device containing tramadol 5 mg/mL and programmed to deliver an intravenous bolus of 4 mL (lockout interval = 7 minutes; dose limit over 8 hours = 150 mg) was immediately made available for a 36-hour postoperative analgesia Visual analog scale at rest (VASr) and after coughing (VASi), number of effective and total (effective + ineffective) PCA requests and time to rescue were registered. Rescue analgesia was performed by ketorolac 30 mg (maximum dose = 90 mg/die). Pearson's correlation and linear regression were used for statistical analysis.

**Results and discussion:** Pearson's  $r$  showed positive correlations between BES, anxiety, depression, and pain indicators (VASr, VASi and effective PCA requests) ( $p < 0.01$ ). Anxiety was the only psychological factor which also correlated with the number of total PCA requests ( $p < 0.05$ ). Linear regression revealed that number of effective ( $p < 0.001$ ) and total ( $p < 0.05$ ) PCA requests was predicted by anxiety.

**Conclusion(s):** Pain perception intensity and analgesic requests were correlated with BES, anxiety and depression. Patients with high anxiety levels were more prone to use PCA more often, likely because the chance of pushing an "analgesic" button could have represented a way to alleviate anxiety in those patients.

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## 14AP5-7

### Perioperative infusion of lidocaine vs. dexmedetomidine; effect on reduction of postoperative analgesics consumption after laparoscopic cholecystectomy

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**Background and Goal of Study:** Postoperative pain is the most common complaints of patients undergoing laparoscopic cholecystectomy (LC). Intravenous lidocaine has analgesic, anti-hyperalgesic, and anti-inflammatory effects and dexmedetomidine has anti-nociceptive and analgesic sparing effects. We evaluate the effects of perioperative infusion of lidocaine and dexmedetomidine intravenously on postoperative pain control and analgesics consumption after LC.

**Materials and methods:** Eighty-four patients, aged 20-60 years, and who were undergoing elective LC were assigned randomly to 3 groups ( $n = 28$ , re-

spectively). The patients in group L received an intravenous lidocaine bolus of 1.5 mg/kg and then continuous infusion of 2 mg/kg/hr. The group D received an intravenous dexmedetomidine bolus 1 mcg/kg, followed by continuous infusion of 0.4 mcg/kg/hr. The group N received saline by same method as group L. Bolus doses were given during 10 minutes before the induction of anesthesia, followed by continuous infusion until end of the surgery. Visual analogue scale (VAS) score and postoperative analgesics consumption were evaluated during 24 hours after the surgery.

**Results and discussion:** No significant difference was observed in VAS score among group L, group D and group N during the first 24 hours after LC. The amount of fentanyl consumption in PACU was significantly less in both group L and group D compared to group N.

**Conclusion:** Both perioperative intravenous infusion of dexmedetomidine and lidocaine reduce postoperative requirements of fentanyl in early postoperative period after LC. On the other hand, there was no significant difference between dexmedetomidine and lidocaine in analgesic sparing effect.

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## 14AP5-8

### Prediction of postoperative nausea and vomiting during patient-controlled analgesia by intravenous fentanyl in the sitting position before the induction of anesthesia

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**Background and Goal of Study:** Patient-controlled analgesia (PCA) is commonly used for postoperative pain management. However, postoperative nausea and vomiting (PONV) is the most common adverse effect associated with opioids. If the sensitivity of the patient to opioids is known before surgery, PCA settings can be adjusted accordingly. We measured the patient's response to intravenous fentanyl in the sitting position before the induction of anesthesia, and examined whether the response was a risk factor for PONV when receiving PCA.

**Materials and methods:** After obtaining approval from the institutional ethics committee, 379 patients undergoing multilevel cervical laminoplasty were enrolled in this study.

All patients were aged between 20 and 80 years and were of the ASA physical status I or II. Before the induction of anesthesia, 1 mcg/kg of fentanyl was administered intravenously, and 2 min later, the patient response was elicited in the sitting position. The patients reporting nausea, dizziness and light-headedness after intravenous fentanyl administration in this position were categorized as responders. After this measurement, general anesthesia was induced with propofol and fentanyl. Anesthesia was maintained with nitrous oxide in oxygen with sevoflurane or propofol and remifentanyl. On completion of surgery, the patients were connected to a PCA device that was set for a fixed bolus dose of 0.15-0.40 mcg/kg fentanyl at a lockout interval of 10 min, with a background infusion of 0.35-0.75 mcg/kg/h. PCA was continued for at least 24 h. Nausea and vomiting was observed by regular nurses blinded to the study during early (from 0 to 6 h) and late postoperative hours (from 6 to 24 h).

**Results and discussion:** After excluding 2 patients, 377 patients were enrolled in this study. Two hundred six patients (54.6%) were categorized as responders. The incidence of nausea was 11.4% (early) and 43.0% (late), while the incidence of vomiting was 4.8% (early) and 26.8% (late). On multivariable analysis, responders were at the risk of PONV during late postoperative hours [nausea: odds ratio (OR) 2.99, 95% confidence interval (CI) 1.85-4.83, vomiting: OR 1.95, 95% CI 1.15-3.30]. The response to fentanyl in the sitting position may reflect PONV in ambulation.

**Conclusion(s):** The response to fentanyl in the sitting position before induction of anesthesia can predict occurrence of PONV in the late period related to ambulation during PCA.

**14AP5-9****Effects of thoracic paravertebral block on postoperative analgesia in patients undergoing modified radical mastectomy**

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**Background and Goal of Study:** Following mastectomy, 50% of patients have chronic postoperative pain. Paravertebral block is concluded in studies as an effective method of analgesia as well as anesthesia. The aim of this study is to compare postoperative pain scores and opioid consumption after a single dose of 150 mg levobupivacaine with thoracic paravertebral block in patients undergoing mastectomy.

**Materials and methods:** Following the Ethics Committee approval and patients written informed consents, forty patients between the ages of 20 to 65 and diagnosed with breast cancer, undergoing modified radical mastectomy and axillary dissection, enrolled in the study. Patients were randomized into two groups as the control group (group K, n = 20) and thoracic paravertebral group (Group T, n = 20). Postoperative pain scores were recorded at 0, 1, 6, 12 and 24. hours at rest, using a 0-10 mm Visual Analogue Scale (VAS). Additional quantities of postoperative tramadol (1.5 mg/kg, iv infusion) were recorded.

**Results and discussion:** Postoperatively at 0, 1, 6, 12 and 24. hours, patients in the control group had significantly higher VAS scores than the group treated with thoracic paravertebral block ( $p < 0.01$ ). According to the VAS scores at postoperative 0. h, there was a statistically significant decrease in VAS scores at 1, 6, 12 and 24 hours in both groups ( $p < 0.01$ ). Additional use of tramadol was significantly lower in group T ( $p < 0.01$ ).

**Conclusion(s):** Paravertebral block with a single dose of 150 mg levobupivacaine before general anesthesia in patients undergoing modified radical mastectomy and axillary lymph node dissection decreases the postoperative pain scores and the need for analgesics during the postoperative 24 hours.

**14AP5-10****Post thyroidectomy wound infiltration for postoperative pain relief**

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**Background:** Post-thyroidectomy acute pain should be controlled especially during the first post-operative day. Many surgeons are reluctant to use non steroidal anti-inflammatory drugs soon after this type of surgery because of fear of bleeding complications. Also, opioids are not a good choice as they may promote postoperative nausea and vomiting, which are already frequent after this type of surgery. Therefore, local wound infiltration (LWI) with local anesthetics (LA) is a simple and safe alternative approach for postoperative pain relief.

**Goal of Study:** Wound infiltration with local anesthetic for post-thyroidectomy pain provides a good quality of analgesia and prolonged duration. We aimed to assess local wound infiltration (LWI) after thyroid surgery with regard to postoperative analgesic efficacy.

**Materials and Methods:** This study was carried out on 58 adult patients of both sexes undergoing elective thyroid surgery. Only euthyroid patients with physical status of ASA-I or ASA-II were included in the study.

Patients were randomly categorized into two equal groups. In the first group no infiltration was performed (group-N), and the second group (group-B) the wound was infiltrated with 0.5% Bupivacaine at the end of surgery. Local infiltration of the wound was performed by the surgeon at the end of surgery just before wound closure. A 23-gauge needle was inserted along the incision line and 20 ml of 0.5% Bupivacaine were infiltrated in the subcutaneous layers. Postoperatively, all patients were transferred to the post-anesthetic care unit (PACU) where they stayed for at least 1 hr, and then they were transferred to the ward. Pain intensity was evaluated by the four-category verbal rating scale VRS (no pain (I), mild pain (II), moderate pain (III), and severe pain (IV) at the first hour after surgery, and then every 4 hours for the 24 hours postoperatively. Postoperative nausea, vomiting, analgesic requirements were fully recorded.

**Results and Discussion:** VRS mean scores were significantly lower in group (B) compared with the (N) group. The median postoperative values measured by VRS were 2 for group B versus 3 for no infiltration group, while the amount of IV analgesics is increased for 34.45% in no infiltration group.

**Conclusion:** For post-thyroidectomy pain management during the first post-operative 24 hours, wound infiltration at the end of surgery provides a better analgesia and effectively decreases postoperative intravenous analgesia consumption.

**14AP6-1****Morphine- but not piritramide-based postoperative analgesia negatively influences levels of circulating tumor cells and patients' survival following colorectal cancer surgery**

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**Background and Goal of Study:** The presence of circulating and/or residual tumor cells (CTCs) is an independent negative prognostic factor in stage I-III colorectal cancer (CRC) patients. Opioid analgesia was shown to affect cancer survival. The goal of our study was to investigate effect of two different opioid analgesics (morphine and piritramide) on CTCs and survival outcomes of CRC patients.

**Materials and methods:** Data from 121 stage I-III CRC patients who underwent radical surgery were prospectively tested for presence of CTCs in blood and bone marrow and retrospectively analyzed for potential effect of the opioids. 39/82 patients received morphine/piritramide-based analgesia (MA/PA). The use of MA and PA was correlated with CTCs levels tested using quantitative real time PCR method based on quantification of epithelial genes (CEA, CK20 and EGFR1), disease-free survival (DFS) and overall survival (OS). Effects of other perioperative factors (analgesia effectiveness, comorbidities, ASA status, age, body-mass index, gender, anesthetic data, type of surgery and its duration and transfusion requirements) were also evaluated. Levels of bone marrow, systemic and tumor draining blood CTCs were measured before, directly after and one month after surgery.

**Results and discussion:** MA was associated with higher CK20 levels in systemic blood ( $p < 0.045$ ) and bone marrow ( $p < 0.065$ ) one month after surgery. Moreover, MA led to significantly shorter DFS in subgroups of CEA, CK20 and EGFR negative patients. Similar trends were also observed in other subgroups. Apart from trend to shorter OS in a subgroup of CK20 bone marrow negative patients ( $p < 0.06$ ), no significant effects on OS were observed. This could be attributable to adjuvant and/or palliative therapy given to high risk and/or recurrent patients and to higher age in PA group ( $p < 0.004$ ).

**Conclusion(s):** Morphine- but not piritramide-based analgesia increases presence of CTCs and shortens DFS following radical surgery in stage I-III CRC patients.

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**14AP6-4****Antiallodynic effect of intrathecal nefopam in neuropathic pain rat model and reduced glial expression in the spinal cord**

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**Background and Goal of Study:** Though many medications are used to control the neuropathic pain, they do not exert satisfactory effect. Systemic nefopam has been used in various pain conditions and their analgesic effects are similar to some antidepressants. Intrathecal nefopam was tried in rat spinal nerve ligation model and their effects on the spinal cord level were probed.

**Materials and methods:** Spinal nerve ligation model was made with male Sprague-Dawley rats. For the those rats which expressed mechanical allodynia, intrathecal catheter was inserted to the L5 level. Intrathecal nefopam, either 10 or 100  $\mu\text{g}/\text{kg}$ , or normal saline were injected intrathecally every other day for 14 days. After drug administration, thresholds for the mechanical allodynia was measured by the Dynamic plantar aesthesiometer and compared. At the end of experiment, rats were sacrificed and immunohistochemistry for cluster of differentiation molecule 11b (CD11b) and glial fibrillary acidic protein (GFAP) was done on the spinal cord at the level of L5. The total amounts of extracellular signal-regulated kinase 1/2 (ERK 1/2) and cyclic AMP response element binding protein (CREB) were then assessed.

**Results and discussion:** Intrathecal nefopam improved mechanical allodynia dose dependently for hours. The expressions of CD11b and GFAP were reduced and ERK 1/2 and CREB expression was attenuated in nefopam treated group at the end of experiment.

**Conclusion(s):** Intrathecal nefopam may improve mechanical allodynia in rat spinal nerve ligation model. Nefopam might reduce the mechanical allodynia through the inhibition of microglial and astrocytic activation and suppression of the transcription factors mitogen-activated protein kinases.

**References:**

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## 14AP6-5

### Reduction of spinal glycine receptor-mediated miniature inhibitory postsynaptic currents in streptozotocin-induced diabetic neuropathic pain

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**Background and Goal of Study:** Patients with diabetes and neuropathy report a significantly decreased quality of life secondary to diabetic neuropathic pain (DNP), which is a major complication of diabetic neuropathy. Despite the high morbidity of DNP, mechanisms underlying the onset and progression of this complication are poorly understood. Pre- and post-synaptic inhibition mediated by glycine expressing inhibitory interneurons in the dorsal horn of the spinal cord plays a major role in the modulation and processing of nociceptive sensory information.

**Materials and methods:** Male Sprague-Dawley rats with or without streptozotocin (STZ) intraperitoneal (i.p.) injection were used. Tactile sensitivities were assessed by measuring paw withdrawal thresholds to von Frey filaments and withdrawal latencies to noxious heat for four weeks. The extent of glycine receptor-mediated inhibition controlling primary afferent-evoked excitation in dorsal horn neurons was examined by using the whole cell patch clamp recording technique in isolated adult rat spinal cord slices. The content of spinal dorsal horn glycine levels was measured by microdialysis. Intrathecal glycine agonist injection was used to test whether mimicking endogenous glycine-receptor mediated inhibition reduces DNP.

**Results and discussion:** Persistent hyperglycemia induced by i.p. administration of STZ caused a decrease in the paw withdrawal latency to mechanical stimuli. Miniature IPSC rise, decay kinetics and mean GlyR-mediated mIPSC amplitude were not affected in DNP. The mean frequency of GlyR-mediated mIPSCs of lamina I neurons from DNP rats was, however, significantly reduced when compared with neurons from control rats. Principal passive and active membrane properties and firing patterns of spinal lamina I neurons were not changed in DNP. Spinal microdialysis showed a significant decrease in glycine levels following STZ injection. Intrathecal administration of the glycine diminished tactile pain hypersensitivity in DNP rats.

**Conclusion(s):** These results indicate that long-lasting hyperglycemia induced by STZ injection leads to a reduced glycinergic inhibitory control of spinal lamina I neurons by a presynaptic mechanism.

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## 14AP6-6

### Antinociceptive effect of *Spirulina platensis* in streptozotocin-induced diabetic rats

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**Background and Goal of Study:** Hyperalgesia is one of the major symptoms of diabetic neuropathy in diabetic patients. Streptozotocin (STZ)-induced diabetic rats display exaggerated hyperalgesic behavior in response to noxious stimuli. To evaluate the analgesic effect of oral *Spirulina Platensis* extract on formalin-induced nociceptive responses (standard formalin test) in STZ induced diabetic rats

**Materials and methods:** Mature male albino rats weighing 175-225 g, were used and provided with standard laboratory diet and water. Sixty rats were randomly divided into six experimental groups each of 10 as following; 1<sup>st</sup> con-

trol non-diabetic group receiving 0.9% saline, 2nd *Spirulina Platensis* aqueous extract-treated non-diabetic control group, 3rd Sodium salicylate-treated rats used as a positive non-diabetic control group, 4th vehicle-treated diabetic group, 5th *Spirulina Platensis* aqueous extract treated-diabetic group and 6th Sodium salicylate-treated-diabetic rats used as a diabetic positive control group. All procedures involving animals were performed in accordance with the ethical guidelines for the use and care of laboratory animals which approved by the Departmental Committee on the use and care of laboratory animals, National Research Center, Dokki, Egypt. STZ-diabetic rats were orally given the aqueous extract of *Spirulina Platensis* in a dose of 500 mg kg<sup>-1</sup>/day for one month.

**Results and discussion:** Body weight and serum glucose level were measured before and at 4th week of the experiment. There was an increase in the pain scores in both phases of the test in the diabetic group. It was found out that treatment with *Spirulina Platensis* extract significantly reduced blood glucose in diabetic rats, P < 0.01 and *Spirulina Platensis* -treated diabetic rats exhibited a lower pain score for both phases of the test as compared to untreated-diabetic ones, P < 0.01. In contrast, sodium salicylate which acts as positive control only reduced pain scores in the second phase. There is an intensified nociceptive response in both phases of the formalin test in diabetic rats. It was demonstrated that oral administration of aqueous *Spirulina Platensis* extract at a dose of 500 mg/Kg for a period of one month could produce a significant antinociceptive effect in both phases of the formalin test in control and diabetic rats.

**Conclusion(s):** Oral intake of *Spirulina Platensis* for one month could be a therapeutic potential for treating painful diabetic neuropathy in rats.

## 14AP6-7

### Role of spinal 5-HT<sub>4</sub>, 5-HT<sub>6</sub> and 5-HT<sub>7</sub> receptors in a rat model of trigeminal neuropathic pain

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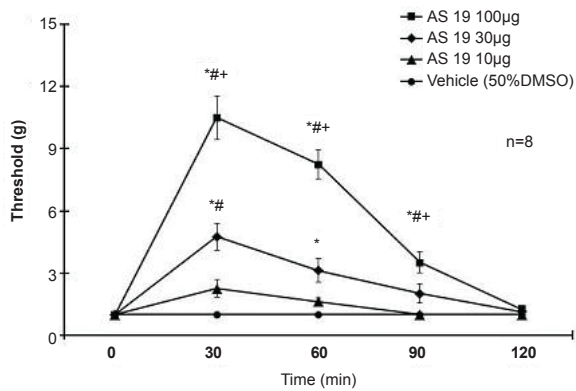
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**Background and Goal of Study:** The serotonin (5-HT) receptor has been recognized to be important in the spinal modulation of nociceptive transmission. Both pronociceptive and antinociceptive effects have been attributed to the 5-HT receptor subtypes. The involvement of 5-HT<sub>4</sub>, 5HT<sub>6</sub>, and 5-HT<sub>7</sub> receptors in nociception and pain, particularly neuropathic pain, has been poorly investigated. Chronic constriction injury to the infraorbital nerve (ION-CCI) has proven a useful model for trigeminal neuropathic pain. The present study evaluated the possible role of spinal 5-HT<sub>4</sub>, 5HT<sub>6</sub>, and 5-HT<sub>7</sub> receptors in ION-CCI rat model.

**Materials and methods:** Male Sprague Dawley rats underwent unilateral CCI to the right ION. Two nylon (5-0) ligatures were tied around the ION. Series of von Frey filaments were used to determine pain hypersensitivity to mechanical stimulation on day 14 after surgery. A polyethylene (PE-10) catheter was implanted for upper cervical spinal injection of drugs. The rats were allowed to recover for 7 days. The time course of the antiallodynic effects and the dose-response effects of intrathecally administered a 5-HT<sub>4</sub> receptor antagonist ML10302, a 5-HT<sub>4</sub> receptor antagonist SB 204070, a 5-HT<sub>6</sub> receptor antagonist WAY 208466, a 5-HT<sub>6</sub> receptor antagonist SB 399885, a 5-HT<sub>7</sub> receptor antagonist AS 19, and a 5-HT<sub>7</sub> receptor antagonist SB 258719 were examined. The time course data for the dose-response effects were analyzed by two-way analysis of variance and Tukey-Kramer multiple-comparison test.

**Results and discussion:** Intrathecal administration of ML10302, WAY 208466, and AS 19 increased mechanical thresholds in a dose dependent manner (P < 0.05) (figure 1). Intrathecal administration of SB 204070, SB 399885, and SB 258719 did not alter mechanical thresholds.





[Figure 1: Intrathecal administration of AS 19 (5-HT7 receptor agonist) produced dose-dependent antiallodynic effects. (n=8)]

\* P < 0.05 compared with vehicle (50% DMSO) group  
# P < 0.05 compared with 10 µg-treated group  
+ P < 0.05 compared with 30 µg-treated group

**Conclusion(s):** The results indicated that spinal 5-HT4, 5-HT6, and 5-HT7 receptors may play an important role in a rat model of trigeminal neuropathic pain.

## 14AP6-8

### Spinal ERK activation via ROS contributes to the development of mechanical allodynia in CPIP rats

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**Background and Goal of Study:** An emerging theme in the study of the pathophysiology of persistent pain is the role of reactive oxygen species (ROS) and their effects on intracellular signaling. Superoxide as well as nitric oxide (NO) mediate mechanical allodynia of ischemia/reperfusion injury (IRI)-induced neuropathic pain, and ROS scavengers administered during peri-reperfusion period have long-term analgesic effects.(1) The ROS increase phosphorylation of N-methyl-D-aspartate (NMDA) receptor subunit 1 (NR1). N-acetyl-L-cysteine, an antioxidant, has a long-term antiallodynic effect through the attenuation of NMDA receptor phosphorylation. Nociceptive stimuli, such as formalin, capsaicin or carageenan, activate extracellular signaling-regulated kinase (ERK) in the spinal cord. Inhibitor of ERK signaling reduces nociceptive behavior. To expand the previous finding of ROS mediated nociceptive process, in the present study, we investigated the changes of ERK in the development of IRI induced mechanical allodynia.

**Materials and Methods:** Chronic post-ischemia pain (CPIP), an animal model of CRPS-Type I, was produced by a Nitrite 70 Durometer O-ring for 3 hrs ischemia and subsequent reperfusion of left hind paw of SD rats.(2) To block the effects of superoxide or nitric oxide (NO), superoxide dismutase (SOD, 4000 U/kg), N-nitro-L-arginine methyl ester (L-NAME, 10 mg/kg), or SOD + L-NAME was treated (i.p.) for 3 days after reperfusion. The activations of ERK and NR1 in lumbar spinal cord at 3 days after reperfusion (the lowest withdrawal threshold on von Frey stimulation) were analyzed by the Western blot. To confirm the effects of superoxide and/or NO - mediated ERK activation, the peroxynitrite decomposition catalyst administered at doses of 1, 3 and 10 mg/kg (i.p.) 30 min prior to reperfusion. Data were expressed as the mean ± SEM. Statistical analysis was performed using analysis of variance, followed by a post hoc Student-Newman-Keuls test (p < 0.05).

**Results and Discussion:** SOD and/or L-NAME attenuated phosphorylations of ERK as well as NR1. FeTMPyP, peroxynitrite (product of interaction of superoxide and NO) decomposition catalyst, attenuated ERK phosphorylation in a dose dependent manner.

**Conclusion(s):** Activation of ERK in spinal cord by the ROS is closely related with the development of nociceptive process in neuropathic pain.

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## 14AP6-9

### Significant involvement of spinal alpha-2, 5-HT3 and 5-HT7 receptors in antinociceptive effect of intrathecal nefopam in formalin-evoked pain behavior of rat

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**Background and Goal of Study:** Nefopam, a non-opiate analgesic, has been known to inhibit the reuptake of monoamines including serotonin and catecholamine. Although spinal cord is an important site of action of monoamines and the binding of nefopam to 5-HT and alpha-adrenergic receptors was proved, the mechanisms of nefopam's antinociception at spinal level remain unclear. In addition, although alpha-adrenergic agents or antagonists of serotonin receptor are being widely used in perioperative period, the role of noradrenergic or serotonergic modulation in the analgesic effect of nefopam has not been fully addressed. This study compared the difference in the contribution of serotonergic and noradrenergic system to the antinociceptive effect of nefopam, and further examined the role of alpha-1, alpha-2, 5-HT3 and 5-HT7 receptor of spinal cord or rat.

**Materials and methods:** Effects of intrathecal (i.t.) nefopam on formalin-evoked flinching responses were examined in male Sprague-Dawley rats. Changes in the effect of nefopam were explored in animals pretreated with i.t. 5,7-dihydroxytryptamine (5,7-DHT) or 6-hydroxydopamine (6-OHDA) to deplete spinal serotonin or noradrenalin. In addition, antagonism to the effect of nefopam by prazosin, yohimbine, ondansetron and SB269970 was evaluated to further elucidate the antinociceptive mechanisms of i.t. nefopam.

**Results and discussion:** I.t. nefopam significantly reduced the flinching responses during both phases of formalin test with the maximum effect at a dose of 30 µg. A significant reduction of the flinching responses during phase 2 was observed in 5,7-DHT-pretreated rat, but no further antinociceptive effect was produced by i.t. nefopam in those rats. Pretreatment with i.t. 6-OHDA alone did not alter the responses in either phases, but it attenuated the antinociceptive effect of i.t. nefopam significantly during phase 1, but not phase 2. The antagonist of alpha-2 receptor, but not alpha-1 receptor, significantly reduced the antinociceptive effect of i.t. nefopam during phase 1, but not during phase 2. In contrast, blockade of 5-HT3 and 5-HT7 receptor significantly reversed the antinociceptive effect of nefopam in both phases.

**Conclusion:** Intrathecal nefopam has an antinociceptive effect against formalin-elicited pain, and its effect is more dependent on serotonergic modulation than noradrenergic and involves spinal alpha-2 and 5-HT3, 5-HT7 receptor, but not alpha 1 receptor.

## 14AP7-1

### Ultrasound-guided pulsed radiofrequency treatment for ilioinguinal neuralgia

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**Background and Goal of Study:** Iliac neuralgia (IN) is a disabling medical condition, frequently involving the ilioinguinal nerve (iiN) and often challenging to treat. A recent retrospective analysis of pulsed radiofrequency therapy (PRF) of the iiN by external landmark technique showed significant pain relief in 34.6% of IN patients. However, extensive anatomic variability might compromise the accuracy of both clinical diagnosis and landmark-guided treatment. Since ultrasound provides clear sight of soft tissue targets, an ultrasound-guided technique might improve patient selection and responder rate.

**Materials and methods:** After approval by the local ethics committee, we analyzed 11 cases presented to us over the past 15 months with IN. All patients underwent ultrasound-guided diagnostic block of the iiN with 2mL of lidocaine 2%. Only patients with more than 50% pain relief were scheduled for ultrasound-guided PRF on later date. The iiN was accessed about 2cm above the anterior superior iliac spine, perpendicular to its course, using a high-frequency linear probe. A 23-gauge cannula with thermocouple electrode was advanced until 50Hz sensory stimulation provoked paresthesia in the iiN dermatome at less than 0.50V to ensure correct position. PRF was performed during 240 seconds at 20ms pulse width and 45V, not exceeding 42°C at the needle tip. Global perceived effect (GPE) was evaluated 8 weeks after PRF, GPE >50% was considered significant pain relief.

**Results and discussion:** In 8 patients IN occurred after lower abdominal surgery (72.7%), 3 cases were labeled idiopathic (27.2%). Positive diagnostic

block confirmed neuralgia of the iIN in 7 cases (63.6% of 11 patients, i.e. 6 post-surgical and 1 idiopathic IN). Four patients, all post-surgery IN cases, reported significant pain relief 8 weeks after PRF (36.4% of 11 patients presenting with IN, i.e. 57.1% of 7 patients with iIN neuralgia selected by diagnostic block). No complications were noted during or after procedure.

**Conclusion:** The data suggest PRF of the iIN is a valuable treatment for IN. Ultrasound-guided diagnostic block of the iIN followed by ultrasound-guided PRF increases responder rate to 57.1%, compared to 34.6% by the conventional external landmark technique. These observations must be validated in larger studies, also analyzing long-term results. Other potential improvements of clinical success rate such as combined ultrasound-guided PRF of the iliohypogastric and iIN should be investigated.

## 14AP7-2

### Retrobulbar alcohol injection for orbital pain relief in blind: a case report

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**Background:** The enucleation or evisceration has traditionally been the definitive treatment of choice for the intractable painful, poorly visual and disfigured eye. Sometimes, retrobulbar block with neurolytic agents, such as alcohol, may be reasonable as the alternative of surgery for blind chronically painful eyes. We present a successful and efficient painful blind eye management using retrobulbar alcohol injection.

**Case report:** The patient had left phthisis bulbi and neovascular glaucoma presenting with painful blind eyes. He underwent left iridectomy and Ahmed valve implantation for control of pain and intraocular pressure, but still suffered the continuous ocular pain with an increasing severity. We planned to perform retrobulbar alcohol injection because he was resistant to other medical therapy, and obtained complete pain relief during 12 months after the procedure.

**Discussion:** The enucleation or evisceration may not be the answer if the patient is psychologically not ready to agree surgery, or has not cosmetically problems and blind eye. In this situation, we can perform the retrobulbar block with neurolytics as one of valuable alternatives. Especially, in patients with severe intractable pain in a blind or near-blind eye, primary focus of the management is the pain relief and globe preservation is secondary [1]. Neurolytics can be delivered very close the apex of the orbit behind the globe, where the exit of sensory nerves and entry of motor nerves are present, by the retrobulbar block. If the needle for retrobulbar block is successfully placed near the nerve, the pain relief may last for two years [2]. Furthermore, the recurrences of pain depend on the degree and extent of nerve destruction, which depends on the accuracy of injection technique [3].

#### References:

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3. Kumar CM, Dowd TC, Hawthorne M. Retrobulbar alcohol injection for orbital pain relief under difficult circumstances: a case report. *Ann Acad Med Singapore.* 2006;35:260-5.

**Learning Points:** We suggest that retrobulbar alcohol injection under fluoroscopy is efficient in patients who have the blind intractable painful eyes, which the medical and surgical treatments are refractory.

## 14AP7-3

### The effectiveness of amitriptyline in the treatment of subacute lumbar radicular pain

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**Background and Goal of Study:** Lumbar radicular pain is the most common etiology of neuropathic pain but is the least researched with regard to drug therapy. Moreover, efficacy of a drug for a particular type of neuropathic pain cannot be extrapolated to efficacy for radicular neuropathic pain. We investigated the effect of amitriptyline, a first-line drug for neuropathic pain treatment, on radicular neuropathic pain.

**Materials and Methods:** The Ethics Committee of the Ziekenhuis Oost-Limburg approved the study. In this randomized, double-blind, placebo-con-

trolled trial, patients with subacute lumbar radicular pain received oral placebo or amitriptyline 25mg once daily for 14 days. Primary outcome measure was pain intensity as measured with a visual analogue scale (VAS) on day 7 and 14. Secondary outcome measures were reduction of neuropathic pain symptoms as determined with the DN4 questionnaire, consumption of rescue medication (tramadol 50mg up to 3 times daily) and adverse events on day 7 and 14. A mixed-model repeated-measures analysis with Bonferroni *post-hoc* test and model terms for study drug, time and drug-time interaction was used to assess changes in VAS and DN4 scores and consumption of rescue medication between study groups. A repeated-measures ANOVA with Tukey's *post hoc* test was used to compare 'within group' data. Data are presented as means  $\pm$  SEM.

**Results and Discussion:** Of 40 randomized patients, 34 were included in a modified intention-to-treat analysis (n=17 per group, duration of pain in the placebo and amitriptyline group: 2.8 $\pm$ 0.4 months and 3.2 $\pm$ 0.6 months, respectively). Baseline VAS values in the placebo and amitriptyline group were 7.3 $\pm$ 0.3 and 6.6 $\pm$ 0.4 respectively. After 14 days, patients in the amitriptyline group reported a significant reduction in VAS scores compared to the placebo group (4.8 $\pm$ 0.6 vs. 7.0 $\pm$ 0.5;  $P < 0.05$ ). The number needed to treat for moderate ( $\geq 30\%$ ) and substantial ( $\geq 50\%$ ) improvement in VAS score were 3 and 4, respectively. 'Within group' analysis showed reduction of neuropathic pain symptoms in the amitriptyline group on day 7 and 14 compared to baseline (2.8 $\pm$ 0.4 vs. 4.1 $\pm$ 0.5;  $P < 0.01$  and 2.1 $\pm$ 0.3 vs. 4.1 $\pm$ 0.5;  $P < 0.001$ , respectively). There were no differences in consumption of rescue medication between groups. The rate of adverse events in the amitriptyline group was 10% vs. 0% in the placebo group.

**Conclusion:** Amitriptyline reduces subacute lumbar radicular pain.

## 14AP7-4

### Does pulsed radiofrequency treatment alleviate neuropathic pain symptoms in patients suffering from occipital neuralgia?

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**Background and Goal of Study:** According to the International Headache Society (IHS), occipital neuralgia is a non-throbbing neck pain spreading ipsilaterally to the occipito-temporo-frontal area and is relieved by injection of local anesthetics at the level of the greater and/or lesser occipital nerve. In an earlier study, we showed that pulsed radiofrequency therapy (PRF) of the occipital nerves provided long-term pain relief. In the present study we investigated if PRF not only alleviates pain intensity but also the neuropathic symptoms associated with occipital neuralgia.

**Materials and Methods:** The Ethics Committee of the Ziekenhuis Oost-Limburg approved the study. Patients fulfilling the IHS-criteria for occipital neuralgia underwent PRF of the culprit occipital nerves after a positive diagnostic block ( $> 50\%$  reduction on a visual analogue scale-VAS). Target nerves were identified with the external landmarks described by Vital (1) and correct needle position was verified with electrical stimulation at 50 Hz (threshold  $< 0.5$  V). PRF (20msec, 2Hz, 45 V, with 42°C) was performed during 4 min. Pain intensity and neuropathic symptoms were measured with a VAS and the DN4 questionnaire, respectively at baseline and 8 weeks after PRF. A paired Student *t*-test was used to compare data. Data are presented as mean $\pm$ SEM.

**Results and Discussion:** Twenty patients were included in the study (14 female, age: 51 $\pm$ 3years, duration of pain: 39 $\pm$ 12 months). Baseline VAS and DN4 scores were 7.6 $\pm$ 0.4 and 4.5 $\pm$ 0.4 respectively. Eight weeks after PRF, VAS and DN4 scores dropped to 4.5 $\pm$ 0.6 ( $P \leq 0.0005$ ) and 3.1 $\pm$ 0.5 ( $P \leq 0.005$ ), respectively. 45% and 30% of patients reported  $> 50\%$  improvement in VAS and DN4 score, respectively.

**Conclusions:** This study confirms our earlier results that PRF alleviates pain intensity in occipital neuralgia, and adds the fact that PRF also relieves neuropathic symptoms as measured with the DN4 questionnaire.

#### References:

1. Vital JM, et al.: *Surg Radiol Anat* 1989;11(3):205-10.

## 14AP7-5

### Pulsed radiofrequency treatment of the pterygopalatine (sphenopalatine) ganglion in cluster headache: a 10 year retrospective analysis

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**Background and Goal of Study:** The pterygopalatine ganglion (PPG) is one of the key structures in the expression of cranial autonomic symptoms and is involved in the pathophysiology of cluster headache (CH). Therefore it has been a strategic target for its treatment. When pharmacological therapy fails, radiofrequency (RF) of the PPG can be considered, but involves the risk of unintentional partial or complete lesion of the n. maxillaris. Pulsed radiofrequency (PRF) of the PPG has been suggested as a nonablative alternative. However, the efficacy of PRF may be lower compared to RF. In this study the long term effect of PRF in CH patients is evaluated.

**Materials and methods:** The study was approved by the ethics committee. A retrospective analysis (chart review and telephone interview) was performed of CH patients, refractory to pharmacological management, and treated with PRF of the PPG in our centre over the last ten years. PRF was applied for 4 minutes with a frequency of 2Hz and a pulse width of 20ms at 45 Volt, not exceeding a temperature of 42°C at the tip of the electrode. Diagnosis was made by an independent neurologist. An independent evaluator scored: global perceived effect (GPE, %), time to recurrence, consecutive RF or PRF treatment, and complications. A GPE of < 50%, >50%, >75% or 100% improvement was considered poor, good, very good or complete pain relief respectively. Data are presented as mean +/- standard error of mean.

**Results and discussion:** 11 patients (all men) were included with a mean follow-up period of 69.8 +/- 12.6 months. 8 had good to complete pain relief after PRF. 1 had no effect of PRF nor RF and 1 had good pain relief for 11 months but had no effect when PRF or RF was repeated. 1 only responded to RF. A total of 32 PRF were performed resulting in poor (28%), good (12.5%), very good (37.5%) and complete (21.9%) pain relief lasting 20.5 +/- 2.8 months. 8 times PRF was followed by RF. At the time of evaluation, 8 patients reported very good (1/8) to complete (7/8) ongoing pain relief lasting 29.2 +/- 7.1 months after PRF. 1 epistaxis and 1 transient paranasal-palatal numbness was reported.

**Conclusion(s):** PRF of the PPG can be an alternative to RF in the management of CH as 72.7% experienced long-term pain relief from this minimal invasive method. No major (neurological) complications were reported.

## 14AP7-6

### One step further on spinal cord stimulation therapy: introducing high-frequency, no paresthesia systems

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**Background and Goal of Study:** Failed Back Surgery Syndrome (FBSS) refers to chronic back and/or leg pain following lumbar spine surgery, due to radicular compression neurological symptoms.

New stimulation system "10 kHz High-Frequency Spinal Cord Stimulation therapy (HF10-SCS)", introduced by NEURO<sup>a</sup>, differs from previous systems in some main features; its generator is able to reach 10 kHz frequency, it avoids from causing paresthesia, so that the surgery time is decreased thanks to a lack of patients' collaboration during the procedure.

A retrospective descriptive study of the experience with HF10-SCS in Hospital Universitario Puerta de Hierro, Madrid, (HUPH) is presented. The aim of this study is to assess not only the effectiveness and patient satisfaction of HF10-SCS to treat FBSS but also the possibility of decreasing surgery time.

**Materials and methods:** A data collection of 18 patients (11 men and 7 women), with FBSS (only one patient was suffering from leg pain secondary to thalamic stroke) and treated with HF10-SCS, was performed by personal interview; pain was evaluated (with Visual Analogue Scale score VAS) after a system test period (one month before definitive implantation), and a week, one month, three, six and twelve months later. Time between lumbar spine surgery and definitive system implantation was a mean of 4.2 years ± 3.1 SD. Satisfaction of the treatment was evaluated after one year of definitive implantation.

**Results and discussion:** VAS scores before the HF10-SCS therapy was a mean of 8.4 ± 0.5 SD and decreased to VAS score 3.7 ± 1.9 SD after system

test period. VAS score values after implantation remained below 8.4, with a slight increase up to VAS score 4.8 ± 1.5 SD after one year of treatment. Global pain relief reached 60%.

All the patients were satisfied with the treatment and would choose it again, considering HF10-SCS the best treatment ever received.

System test surgery took a mean of 45 minutes ± 12.2 SD and definitive system implantation took a mean of 39 minutes ± 7.4 SD.

**Conclusion(s):** HF10-SCS therapy can reduce pain in patients with FBSS. When implant is carried out, it is not needed neither the paresthesia nor patient collaboration to check the correct position of the system, therefore a decreased surgery time is achieved.

## 14AP7-7

### Perioperative and late postoperative pain after breast cancer surgery: 1-year results in a Spanish University Hospital

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**Background and Goal of Study:** Breast cancer surgery is associated with late neuropathic postoperative pain (LNPOP) in up to 50% of the cases (1). The aim of this study was to evaluate the incidence of late neuropathic pain (NP) at 3 months after breast surgery, in a university hospital.

**Materials and methods:** Consecutive patients scheduled for breast cancer surgery were included in this prospective observational study over a 1-year period. Data were collected about demographic characteristics, preoperative conditions, anaesthetic and surgical management, and postoperative pain management. Three months after surgery, the presence of LNPOP was measured using the DN2 score. A DN2 ≥ 3 was considered positive. Parametric tests and chi-2 test or Fisher's exact were used to analyze quantitative and qualitative variables. p < 0,05 was considered significant.

**Results and discussion:** Fifty nine patients, were included in the study, mainly operated of total mastectomy (28,8%), total mastectomy with lymphadenectomy (32,2%) and total mastectomy with immediate reconstruction with expander (22,0%). 10(16,9%) presented preoperative pain. A central block (paravertebral block (PV): 22% and epidural block (EB): 37,3%) was combined with general anaesthesia in 59,3%, and was used for postoperative analgesia for 40,1 ± 24,8h. Patients who did not receive central block were treated postoperatively with minor analgesics (27,1%), or morphine PCA (15,3%). After three months, the incidence of NP was 28,8%. Its apparition was not influenced by age (p=0,25), preoperative pain (p=0,28), pre- and postoperative radiotherapy (p=0,09 and 0,275) and chemotherapy (p=0,25 and 0,58), the existence of metastasis (p=0,46) or bilateral tumor (p=0,50). The type of intervention (p=0,42) and the anaesthetic technique (p=0,48) did not either affect the incidence of NP. The intraoperative use of ketamine (p=0,37), N2O (p=0,27) did not protect patients, and remifentanyl (p=0,28) did not increase its incidence. The central blocks were associated with more intraoperative hypotension episodes (p=0,03) but no difference between PV and EB (p=0,25), and a 40% decrease of intraoperative fentanyl consumption (p < 0,001). No differences were found for hospital stay (p=0,65), DN2 score (p=0,85) and neuropathic pain (p=0,5).

**Conclusion(s):** In this study, we observed a lower incidence of LNPOP than described in the literature. The use of central block did not seem to affect the DN2 score.

#### Reference:

BJA 105 (6):842-52(2010)

## 14AP7-8

### Chronic post-surgical pain and its impact on quality of life and recovery after thyroidectomy

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**Background and Goal of Study:** Chronic post-surgical pain (CPSP) is an under-recognised and prevalent healthcare problem. In recent years, the focus of the investigation about risk factors for CPSP as type of surgery, has increased, but definitive data regarding the incidence of CPSP have not been obtained yet. The aim of this study was to evaluate the incidence of CPSP and its impact in quality of life (QoL) and quality of recovery (QoR) after thyroidectomy.

**Materials and methods:** After study approval by the institutional ethics committee, a prospective study was conducted in patients scheduled for elective surgery admitted in the PACU (from June to August 2013). Inclusion criteria:



patients undergoing thyroidectomy.

Patients who were unable to give informed consent and had cognitive impairment (Mini-mental State Examination <24) were excluded. CPSP was assessed, in 26 patients, with the Brief Pain Inventory (BPI), QoL was evaluated with the portuguese version of the EuroQol (EQ-5D) and QoR with the 15-item Quality of Recovery score (QoR-15). Quality of life and BPI evaluations were performed preoperatively (T0) and 3 months after surgery (T3). QoR was performed preoperatively (T0) and 24 hours after surgery (T24). The primary end point was CPSP. Ordinal and continuous data were tested for normal distribution, based on the Kolmogorov-Smirnov test. Descriptive analysis was performed and the Mann-Whitney U test, Fisher's exact test or Chi-square test were applied.

**Results and discussion:** Six patients (23%) had CPSP three months after surgery. At T3, patients with CPSP reported significantly more problems in two EQ-5D dimensions: usual activities ( $p=0.023$ ) and pain/discomfort ( $p=0.002$ ), reported lower median EuroQol Visual analogue scale (EQ-VAS) (55 vs. 80,  $p=0.003$ ) and had a lower EQ Index (79 vs. 95,  $p=0.001$ ). Regarding QoR-15 scores, CPSP patients have median lower scores at T24 for "been able to enjoy food" ( $p=0.015$ ), for "severe pain" ( $p=0.048$ ) and for a global QoR-15 global score (115 vs.130,  $p=0.039$ ).

**Conclusions:** The incidence of CPSP after thyroidectomy was 23%. These patients had worse QoL and present lower scores for pain scores in QoR-15 at T24.

### 14AP7-9

#### Chronic post-surgical pain and its impact on quality of life and recovery after laparoscopic cholecystectomy

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**Background and Goal of Study:** Chronic post-surgical pain (CPSP) develops after surgery and persists for at least 3 months, excluding other causes. Studies on CPSP after cholecystectomy report an incidence from 3% to more than 20%<sup>1</sup>. The aim of this study was to evaluate the incidence of CPSP and its impact in quality of life (QoL) and quality of recovery (QoR)<sup>2</sup> after laparoscopic cholecystectomy.

**Materials and methods:** After study approval by the institutional ethics committee, an observational prospective study was conducted in 24 patients scheduled for elective laparoscopic cholecystectomy admitted in the post anesthetic care unit (PACU), from June to August 2013. CPSP was assessed with the Brief Pain Inventory (BPI), QoL was evaluated with the EuroQol five-dimension questionnaire (EQ-5D) and QoR with the 15-item Quality of Recovery Score (QoR-15). Quality of life and BPI evaluations were performed preoperatively (T0) and 3 months after surgery (T3). QoR-15 was performed preoperatively (T0) and 24h after surgery (T24).

Inclusion criteria: patients undergoing elective laparoscopic cholecystectomy. Exclusion criteria: inability to give informed consent and cognitive impairment (Mini-mental State Examination < 24). The primary end point was CPSP. Ordinal and continuous data were tested for normal distribution, based on the Kolmogorov-Smirnov test. Normal distribution variables are presented as mean and standard deviation (SD). *Descriptive analysis was performed and parametric tests and Fisher's exact test or Chi-square test were applied for comparisons.*

**Results and discussion:** Two patients had CPSP 90 days after surgery (8%). Three months after surgery patients with CPSP reported significantly more problems in pain/discomfort ( $p < 0.001$ ) and anxiety/depression ( $p=0.002$ ) in EQ-5D. Regarding QoR-15 scores, CPSP patients presented with lower total mean scores at T0 at the parameter: "moderate pain" ( $5.0 \pm 1.8$  vs.  $9.3 \pm 1.8$ ,  $p=0.019$ ). At T24, CPSP patients have lower scores for "feeling rested" ( $7.0 \pm 1.4$  vs.  $9.0 \pm 1.2$ ,  $p=0.047$ ) and "have had a good sleep" ( $7.0 \pm 1.4$  vs.  $9.0 \pm 1.2$   $p=0.034$ ).

**Conclusion(s):** CPSP was an important outcome after laparoscopic cholecystectomy and these patients had more problems in EQ-5D pain/discomfort and anxiety/depression dimensions. Twenty-four hours after surgery CPSP patients had lower scores in QoR questions about moderate pain.

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### 14AP7-10

#### The timings in the first chronic pain consultation

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**Background and Goal of Study:** Medical consultation length has been studied, especially in General Practice<sup>1</sup>. While recognizing the importance of this subject and the lack of data in Chronic Pain consultations, we performed an evaluation of, not only the length of the *First* Consultations at our Chronic Pain Unit (CPU), but also other *timings* we considered relevant for the unit's organization and the patient's satisfaction.

**Materials and methods:** During three consecutive months we registered the following data relative to the First Consultations for Chronic Pain at our CPU: sex, age, time taken between arrival of patient at CPU and beginning of Nurse's Consultation (NC), length of NC, time taken between the end of NC and beginning of Medical Consultation (MC) and length of MC. The length of MC was also divided into the different types of consultation performed at our CPU, being each type performed by the same experienced doctor: length of MC for doctor A (Oncology Pain), doctor B (Neuropathic Pain), doctor C (Osteoarticular Pain) and doctor D (Musculoskeletal Pain).

**Results and discussion:** We gathered 145 records, being 4 excluded due to incomplete data. Of the remaining 141 records, 55.8% were female, 44.2% male and the average age was 66.5 years. Patients spent an average of 148.8 min in their First Pain Consultation at our CPU. The average time taken between arrival of patient at CPU and beginning of NC was 17.1 min, the average length of NC was 37.1 min. The average time taken between the end of NC and beginning MC was 46.3 min and the average length of MC was 48.3 min. Considering the different types of consultation, the average length was 67.3 min for doctor A (Oncology Pain Consultation), 37.1 min for doctor B (Neuropathic Pain Consultation), 39.0 for doctor C (Osteoarticular Pain) and 48.4 for doctor D (Musculoskeletal Pain).

**Conclusion(s):** The Oncology Pain Consultation was the longest, probably due to the emotional implications of the disease. Although we didn't find any similar data in literature to compare, time between the NC and MC stood out and was clearly too long. Overall we believe there's room for improvement, for the benefit of the patient and functioning of our CPU.

#### References:

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### 14AP8-1

#### Patients with epidural analgesia stay as long in hospital as patients with initial systemic pain therapy, but are dismissed with higher opioid doses: retrospective evaluation of 1555 patients

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**Background:** To assess the protocols of epidural analgesia vs systemic analgesia retrospectively in 1555 thoracotomies in our thoracic centre during 2011-2012.

**Methods:** Pain therapy is aggressive and standardized in our thoracic centre throughout the complete postoperative stay. Patients receive either standardized epidural analgesia with ropivacaine+sufentanil 4-8 mls/h (500 mls bag) and are bridged when the epidural bag is finished to a standardized controlled-release oxycodone protocol with non opioid every 6 hours (EDA Group), or patients receive immediately postoperative standardized oral analgesic protocol with controlled-released oxycodone and non opioid every 6 h (Oxy Group).

**Results:** Data of 1555 thoracotomies from 2011-2012 were analysed, 838 patients in the EDA Group and 717 patients in the Oxy Group. 7.5% of patients in the EDA Group and 13% in the Oxy Group had a preexisting pain therapy ( $p=0.001$ ). In the EDA Group epidural analgesia was performed for  $4.6 \pm 1.5$  days. Length of hospital stay was the same in both groups (EDA:  $9.9, 6 \pm 4.9$  vs Oxy:  $9.6 \pm 5.8$  days). 84.7% of patients in the EDA Group and 79.1% of

patients of the Oxy Group were dismissed with oral opioid ( $p < 0.004$ ). When patients were dismissed with opioid medication patients in the EDA Group were dismissed with higher oxycodone opioid doses than patients in the Oxy Group ( $29.5 \pm 15.2$  mg vs  $26.9 \pm 15.2$  mg,  $p = 0.01$ ). There was no difference with regard to dejection time between the two groups (EDA:  $3.8 \pm 2.2$  days vs Oxy:  $3.7 \pm 1.6$  days, n.s.).

**Discussion:** To our knowledge up to now no data are available with regard to a postoperative analgesic protocol for thoracotomies throughout their whole stay in hospital until dismissal. Our retrospective analysis presents data that patients with epidural analgesia stay longer in hospital and are dismissed with higher opioid doses compared to systemic analgesia after undergoing thoracotomy.

#### Literature:

Kampe S, Lohmer J, Weinreich G, Hahn M, Stamatis G, Welter S. Epidural analgesia is not superior to systemic postoperative analgesia with regard to preventing chronic or neuropathic pain after thoracotomies. *Journal Cardiothoracic Surgery* 2013;8:127-11. Kampe S, Lüttecke D, Wolter K, Cheufou D, Stamatis G. Minimal incidence of chronic and neuropathic postthoracotomy pain after anteroaxillary thoracotomy with consequent systemic pain therapy. *Eur J Anaesthesiol* 2013;30:1-4. (in press)

## 14AP8-2

### What anaesthetic and analgesic regimes affect postoperative Oxynorm consumption in patients undergoing primary hip and knee arthroplasty surgery?

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**Background:** In 2012 our Trust introduced a standardised enhanced recovery programme for primary hip and knee arthroplasty surgery. Patients receive standardised oral premedication. The standard anaesthetic technique is spinal (without opiate) and propofol sedation. If spinal is unsuitable, patients receive a general anaesthetic with fentanyl intraoperatively. All patients receive surgical local infiltration with 0.2% Ropivacaine; knee arthroplasties have an additional intra-articular infusion postoperatively. A standardised postoperative multimodal analgesic regime is prescribed (+/-NSAID if suitable) with Oxynorm for breakthrough pain. The aim of this study is to identify which anaesthetic and analgesic regimes impact on postoperative Oxynorm consumption.

**Methods:** All patients having primary hip/knee arthroplasty surgery are entered in the above programme. A single data analyst collected prospective data from anaesthetic and drug charts. All drugs given pre, intra and post-operatively were recorded. The results were presented and analysed in Excel 2010. A one-way ANOVA ( $P < 0.05$ ) was used to analyse significant differences between Oxynorm consumption following different regimes.

**Results:** From December 2012 to October 2013, 978 primary arthroplasties were performed, 545 (55.7%) were knees. Females accounted for 562 (57.5%).

Anaesthetic Technique	Average Oxynorm Consumption in Mg (SD)	Patient Count (%)
Spinal + Sedation	25.64 (26.80)	839 (85.9)
GA Alone	32.35 (29.59)	66 (6.8)
GA + Spinal	25.1 (25.24)	46 (4.7)
GA + Regional block	30.56 (22.97)	9 (0.9)
Spinal + Regional block	25.88 (23.99)	17 (1.7)
GA + Spinal + Regional block	15	1 (0.1)

[Table 1. Oxynorm consumption by anaesthetic type]

The lowest average consumption of Oxynorm was in patients having a combined GA/spinal, closely followed by the standard spinal/sedation technique (Table 1). The highest consumption was in patients receiving GA alone. These differences are not significant ( $F 0.86_{(5)}$ ,  $P 0.51$ ).

There is a trend towards decreased average Oxynorm consumption when all analgesic components are taken plus NSAID (with NSAID  $23.28\text{mg} \pm 25.54$ ; without NSAID  $31.88\text{mg} \pm 28.66$ ). However, there were no significant differences ( $F 28_{(1)}$ ,  $P 1.09$ ). Given the variation within the standard deviations a significant difference was unlikely.

**Conclusion:** Whilst not statistically significant, there is a trend towards decreased Oxynorm consumption both in patients receiving spinal anaesthesia and those who receive postoperative NSAID.

## 14AP8-3

### The efficacy of intrathecal morphine for the postoperative pain management in open nephrectomy

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**Background and Goal of Study:** Intrathecal morphine (ITM) injection has been used effectively for the postoperative pain management. The goal of this study was to evaluate the efficacy and safety of the ITM in patients undergoing open nephrectomy.

**Materials and methods:** Forty five patients scheduled for open nephrectomy were randomly allocated into the ITM group or the intravenous patient-controlled analgesia (IV-PCA) group. In the ITM group, postoperative pain was managed using preoperative ITM 300 mcg plus IV-PCA ( $n=22$ ). In IV-PCA group, postoperative pain was managed only by using only IV-PCA ( $n=23$ ). The numerical pain score (NPS), postoperative opioid requirements and, opioid-related complications including nausea, vomiting, dizziness, headache, back pain and pruritus were compared between the two groups.

**Results and discussion:** The NPS were significantly lower in the ITM group than the IV-PCA group up to postoperative 24 h both at rest and on coughing. The ITM group showed less cumulative morphine consumption for postoperative 72 h compared to the IV-PCA group (20 mg, IQR 9-33 vs. 30 mg, IQR 15-48,  $P < 0.05$ ). The opioid-related complications were similar between the two groups except pruritus (13% vs. 38%,  $P < 0.05$ ).

**Conclusion(s):** ITM combined with IV-PCA provided satisfactory analgesia and reduced morphine requirements during postoperative period. This study suggests that ITM combined with IV-PCA may be an effective and safe method for immediate postoperative pain management in open nephrectomy.

#### References:

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- Nicholson ML, Kaushik M, Lewis GR, et al. Randomized clinical trial of laparoscopic versus open donor nephrectomy. *The British journal of surgery* 2010; **97**: 21-8

## 14AP8-4

### Tourniquet use during ankle surgery leads to increased postoperative pain

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**Background and Goal of Study:** Ankle surgery is often done using a tourniquet. Tourniquet gives the surgeon a bloodless field and decreases blood loss, but it also leads to a number of challenges for the anaesthesiologist in the perioperative period. Ischaemia/reperfusion injury (I/R injury) caused by the use of tourniquet may increase postoperative pain.<sup>1,2</sup> The aim of our study was to compare the amount of opioids given to patients after undergoing ankle surgery with and without tourniquet. We regarded opioid consumption as a measure for pain.

**Material and methods:** We identified patients undergoing reconstructive ankle fracture surgery at Herlev University Hospital between January 2008 and December 2011 from hospital records. We used the following exclusion criteria: multiple fractures of the same extremity and/or major trauma, reoperations, arthrodesis of the ankle joint and missing data on tourniquet use. We extracted data on tourniquet time, postoperative opioid consumption, demographic and anamnestic information for analysis. We performed multiple linear regression in order to control for possible confounders.

**Results and discussion:** We included 603 patients in this study. Of these 358 patients underwent surgery with tourniquet (mean tourniquet time was 70,20min (SD 26,81)).

There was a significant correlation between tourniquet time and postoperative opioid consumption with a p-value of 0,001. The slope was 0,043 representing an increase in postoperative opioid consumption by 0,43 mg for every 10 minutes of tourniquet time.

The relation between postoperative opioid consumption and actual pain experience is unexplained. Using pain medication as a surrogate measure for pain has been shown to be valid.<sup>3</sup>

There may be a number of reasons for pain after tourniquet use including I/R injury, nerve and skin damage etc. all possibly adding to the pain experience.

Whether I/R injury is a major contributor to our results have not been investigated in this study, but other studies<sup>2</sup> support this theory.

**Conclusion:** We found an increase in postoperative opioid consumption after tourniquet use. Possible preventive measures with anti-oxidant treatment should be investigated.

**References:**

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2. Estebe J-P, Davies JM, Richebe P Eur J Anaesthesiol 2011; 28: 404-411
3. Snyder M, Shugars DA, White RP et al. J Oral Maxillofac Surg 2005; 63:1130-7

### 14AP8-5

#### Pregabalin for the treatment of acute postoperative pain - a systematic review and meta-analysis of randomized controlled trials

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**Introduction:** The objective of this systematic review and meta-analysis was to assess the effects of pregabalin on postoperative pain management.

**Methods:** We prospectively registered our systematic review (PROSPERO registration number CRD42012002078) and published an *a priori* peer-reviewed detailed protocol to which our research conduct has been adherent [1]. In July 2013, we completed the search as described in the published protocol [2].

Main analyses were directed towards the following surgical pain models- Model 1: surgery associated with neuropathic pain (eg. spine surgery and joint replacement etc.); Model 2: surgery not associated with neuropathic pain (eg. laparoscopic and minor surgery) and Model 3: unknown association of surgery with neuropathic pain [3].

**Results:** Our search strategies retrieved 1437 citations and PRISMA guidelines were followed [4]. After full text screening, 44 RCTs were included for both quantitative and qualitative analysis.

Patients receiving pregabalin had a significant reduction in pain scores for Model 1 (surgery associated with neuropathic pain). Pregabalin had a greater impact on decreasing pain on movement than rest pain. Sedation was observed in patients receiving pregabalin. Pregabalin caused a significant increase in blurred vision. Nausea and vomiting was reduced in patients receiving pregabalin.

Outcome	Measure	Model 1 No. of Trials, p n (Pregabalin/Control)	Model 2 No. of Trials n (Pregabalin/Control)	Model 3	Overall Effect	Test of interaction between subgroups
Pain Scores-at Rest	Mean Difference	-1.09 [-1.80, -0.37] 5 RCTs, p=0.003 135/ 138	-0.45 [-1.03, 0.13] 8 RCTs, p=0.13 263/ 263	Nil	-0.65 [-1.17, -0.14] P=0.001	P=0.17
Pain Scores-with Movement	Mean Difference	-0.94 [-1.23, -0.65] 5 RCTs, p<0.0001 141/ 142	-0.31 [-0.77, 0.15] 7 RCTs, p=0.19 228/ 222	Nil	-0.54 [-0.9, -0.19] P=0.002	P=0.02
Analgesic Consumption-Total Rescue Dose	Ratio of Means	0.08 [0.71, 0.90] 8 RCTs	0.86 [0.79, 0.94] 13 RCTs	0.85 [0.63, 1.14] 3 RCTs	0.84 [0.79, 0.91]	P=0.58

[Pregabalin SR- Pain Scores and Analgesic Consumpt]

**Conclusions:** We observed very prominent clinical and methodological heterogeneity for all meta-analyses. It appears that use of pregabalin in surgical procedures associated with neuropathic pain provides maximal benefit. Pregabalin also decreases nausea and vomiting but patients often experience blurred vision and sedation. Therefore the risk- benefit ratio for the perioperative use of pregabalin for acute pain favours careful selection of surgical procedures. We recommend that further clinical trials in surgical procedures not associated with neuropathic pain should be discouraged as it exposes patients to increased risk of adverse events.

**References:**

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### 14AP8-6

#### Combination of Nefopam and Ketoprofen for analgesia can minimize opioids use in the early period after cardiovascular surgery

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**Background and Goal of Study:** Adequate postoperative analgesia is of great importance in cardiovascular surgery patients. The aim of the study was to compare different analgesia protocols using nonsteroidal antiinflammatory drug Ketoprofen and nonopioid central analgesic Nefopam.

**Materials and methods:** Investigated four schemes of postoperative analgesia:

- 1) continuous infusion of Nefopam (120 mg/24 h) and PCA with Trimeperidine,
- 2) Ketoprofen (100 mg every 12 h) and the PCA with Trimeperidine,
- 3) combination of Nefopam and Ketoprofen in the above chart and PCA with Trimeperidine,
- 4) PCA of Trimeperidine as mono-therapy.

Non-opioid analgetic therapy in the first 3 groups was started before tracheal extubation. In all groups PCA started 2 hours after extubation of trachea to avoid respiratory depression caused by Trimeperidine. Each group consisted of 20 patients aged 40 to 70 years. The 5-level scale for pain assessment was used.

**Results and discussion:** Intensity of pain in the 1-3 groups during first 6 hours ranged from 0 to 1 point - no pain or slight pain during cough or deep breathing. In the 4th group at that time it ranged between 1 and 2 points - light pain at rest or serious pain during deep breathing. From the 12th to 24th hours there were no difference in pain intensity between the investigated groups. The combination of Nefopam and Ketoprofen led to the most pronounced analgesic and opioid-sparing effect, and in 11 (55%) patients not a single pressing the trigger of PCA device had been noted. The total Trimeperidine dose in 70% of the patients of this group was equal to the background dose of PCA infusion (7.4mg/24 h), and on average reached 14.7mg. It was 4.9 times less than the average dose consumed in the group of isolated PCA - 72.3 mg (p=0.001). Consumption of Trimeperidine in group 1 was 1.7 times (p=0.002), and in group 2 - 1.8 (p=0.001) times lower than in group 4. In general undesirable side effects were associated with the introduction of Trimeperidine and depended on it's dose.

**Conclusion:** Combination of Nefopam and Ketoprofen for postoperative analgesia in cardiovascular surgery patients provides good analgesic effect, gives the opportunity to minimize or avoid additional opioid use and diminish the frequency of opioid-related side effects.

### 14AP8-7

#### Intravenous patient-controlled analgesia - risk factor for postoperative delirium

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**Background and Goal of Study:** Delirium is a major concern during the perioperative period and has been reported to increase the rate of mortality. It has been reported various factors affecting occurrence of delirium. We guessed that the occurrence of delirium is more frequent in patients using patient-controlled intravenous analgesia (IVPCA) compared with those using patient-controlled epidural analgesia (PCEA).

We investigated the incidence of and risk factors affecting delirium in patients receiving PCA for postoperative pain.

**Materials and methods:** After obtaining institutional approval, we retrospectively investigated the records of patients who received PCA from 2009 to 2013. We routinely use morphine for IVPCA, and fentanyl and ropivacaine for PCEA. Delirium was defined as clouding of consciousness (visual and auditory hallucination), restlessness, or dangerous behavior while using PCA. We investigated patient background including age, sex, height, weight, coexisting diseases such as dementia, cerebrovascular disorder, respiratory disorder, diabetes mellitus, hypertension, liver dysfunction, renal dysfunction, and anemia, and surgical factors including operation time and blood loss amount. Statistical analysis with multivariable logistic regression was performed. The dependent variables examined were kind of PCA, and patient background and surgical factors, while the objective variable was delirium. A p-value < 0.05 was considered to indicate statistical significance.



**Results and discussion:** A total of 3365 patients (IVPCA: 1248, PCEA: 2117) were investigated. Delirium was noted in 130 patients (3.86%), 4.81% with IVPCA and 3.31% with PCEA. Risk factors found to be significantly associated with delirium were IVPCA ( $P=0.038$ , OR 1.53 95%CI 1.02-2.31), age (per 10-year increase,  $P<0.001$ , OR 2.37 95%CI 1.92-2.94), dementia ( $P<0.001$ , OR 8.12 95%CI 3.52-20.9), operation time (per 1-hour increase,  $P<0.01$ , OR 1.15 95%CI 1.05-1.26), and liver dysfunction ( $P<0.01$ , RO 2.2 95%CI 1.34-3.61).

**Conclusion(s):** Delirium was more frequent in patients who received IVPCA as compared to PCEA. We concluded that IVPCA should be considered as a risk factor for postoperative delirium.

## 14AP8-8

### Sleep Onset REM (SOREMs) after tramadol therapy for acute postoperative pain

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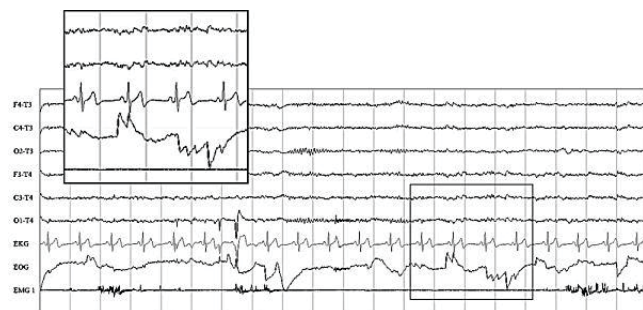
**Background:** Tramadol is widely used to treat moderate pain for its weaker respiratory depression. R enantiomer acts as a feeble  $\mu$  agonist and increases serotonin release, while S inhibits norepinephrine reuptake. These characteristics may be responsible for some side effects: troubled sleep and vivid and unpleasant dreams. After obtaining consent, 7 patients ASA I to III were treated with tramadol for the PO acute pain and then underwent a sleep latency test (SLT - 30 min long) to evaluate sleep disturbances.

**Case report:** A 42 years old caucasian male 80Kg BMI 26 ASA I candidate for a laparoscopic cholecystectomy with no other comorbidities underwent a GA: fentanyl 120 $\mu$ g, propofol 160mg, rocuronium 60mg; maintenance: remifentanyl, rocuronium, desflurane. At end of the surgical procedure he received tramadol 100mg and metoclopramide 10mg in bolo; then a 24h elastomer containing tramadol 200mg, metoclopramide 20mg, ranitidine 100mg and ketorolac 30mg. In the afternoon the patient experimented particularly vivid and unpleasant dreams. SLT showed short periods of SOREM. These dreams continued until the suspension of the infusion on the second postoperative day. In the anamnestic interview, the patient referred that he usually did not dream at all. Contacted 60 days after these episodes, he did not report more side-effects, returning to his previous sleeping habits.

**Discussion:** Tramadol may reduce the quality of sleep<sup>1</sup>. While the sleeping problems seem to be linked to its effect on the cited receptors (SNRIs are likely to decrease the deepest stages of sleep), no evidence of the mechanism of vivid dreams was ever reported.

#### References:

- Walder B, et al. The effects of two single doses of tramadol on sleep: a randomized, cross-over trial in healthy volunteers. *Eur J Anaesthesiol.* 2001 Jan;18(1):36-42



[SOREMs Polysomnographic Recording]

**Learning points:** Tramadol may be responsible for SOREMs in sensible patients. However, these episodes do not seem correlate to delirium or disorientation: the patient remained lucid for all his hospital staying and did not manifest any alteration of his cognitive performance, as indicated by the same MMSE score before and after surgery (both 29/30 - not corrected for age).

## 14AP8-10

### The effects of preoperative oral pregabalin and perioperative intravenous lidocaine infusion on postoperative morphine requirement in patients undergoing laparotomy

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**Background and Goal of Study:** The aim of our study was to evaluate and compare the effects of preoperative oral pregabalin and perioperative IV lidocaine infusion on postoperative morphine requirement, adverse effects, patients' satisfaction, mobilization, first defecation and discharge time in patients undergoing laparotomy.

**Materials and methods:** Following the Ethics Committee approval, 80 patients aged between 18-65 years, undergoing elective laparotomy were randomly divided into 4 groups (n=20). In Group C, patients had placebo capsules 12 hours prior to operation and at the morning of operation and normal saline was infused 6 cc/h during operation. In Group L, patients had also placebo capsules and lidocaine was infused 2mg/kg/hr perioperatively after 1mg/kg iv bolus dose. In Group P, patients had 150 mg oral pregabalin 12 h prior to operation and at the morning of operation and normal saline was infused during operation. In Group PL, patients had 150 mg oral pregabalin 12 h before operation and at the morning of operation and lidocaine was infused 2mg/kg/hr perioperatively after 1mg/kg iv bolus dose. Heart rate, mean arterial blood pressure, peripheral oxygen saturation and end-tidal carbon dioxide pressure were recorded with 30 min intervals during operation. Postoperatively morphine was administered until Visual Analogue Scale (VAS) scores < 30, and IV morphine patient controlled analgesia (PCA) was started. During 48 hours postoperatively, VAS scores, IV PCA consumption, additional analgesic requirement, side effects, mobilization time, first defecation time, discharge time and patients' satisfaction were recorded.

**Results and discussion:** VAS scores of Group L, Group P and Group PL were lower than control group ( $p<0.05$ ). Morphine consumption of Group P and Group PL were lower than control group ( $p<0.05$ ). Incidence of nausea in control group was higher than Group L and Group PL. Time of first defecation and mobilization were shorter in Group L and Group PL than control group ( $p<0.05$ ).

**Conclusion(s):** We concluded that preoperative oral pregabalin and perioperative IV lidocaine infusion decrease postoperative VAS scores, also preoperative oral pregabalin decreases morphine requirement and perioperative IV lidocaine infusion fastens gastrointestinal motility, mobilization and decreases the incidence of nausea in patients undergoing laparotomy.

## 14AP8-11

### Patient-controlled analgesia with intravenous morphine: predictors of higher consumption

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**Background and Goal of Study:** The knowledge of variables that are associated with higher consumption of intravenous (IV) morphine by patient-controlled analgesia (PCA) allows optimization of analgesia and improves outcomes. The aim of our study was to find predictors of higher morphine needs.

**Materials and methods:** Retrospective study, approved by the hospital's ethics committee.

Consultation of electronic medical records of patients (last 2 years) that had analgesia with IV morphine PCA. Collecting data: gender, age, weight, ASA status, type of pain, type of surgery. PCA related data and total morphine consumption (mg/Kg).

Statistical analysis with t-test, ANOVA, Pearson correlation coefficient and linear regression modelling. Statistical significance  $P<0.05$ . Data are presented in mean  $\pm$  standard deviation.

**Results and discussion:** 930 patients included: male 51%; mean age 50,7 $\pm$ 19,6 years; mean weight 69 $\pm$ 14,7Kg; ASA 2 46%; days with PCA 2,7 $\pm$ 2,5; background morphine infusion and bolus 4,2%; total morphine consumption 0,9 $\pm$ 2,1.

Regarding mean total morphine consumption: there was no statistically significant difference between gender,  $p=0,199$ ; ASA 3 patients had higher (1,5 $\pm$ 3,3) and ASA 4 had less consumption (0,6 $\pm$ 1,0),  $p<0,001$ ; there was statistically significant difference between type of pain - ischemic (6,5 $\pm$ 7,8), traumatic (3,2 $\pm$ 5,2), other (2,7 $\pm$ 1,9) and postoperative pain (0,9 $\pm$ 1,7),  $p<0,001$ . We also found statistically significant difference between type of sur-

gery - vascular lower limb (3,2±5,7), thoracic (1,9±1,8), scoliosis (1,5±0,9), abdomen (0,8±1,5), spinal (0,6±0,8), orthopedic lower limb (0,5±0,5), upper limb (0,4±0,4), head and neck surgery (0,3±0,3),  $p < 0,001$ .

A significant correlation ( $p < 0,01$ ) was found between morphine consumption and age ( $R = -0,104$ ), weight ( $R = -0,145$ ), type of pain ( $R = 0,222$ ), type of surgery ( $R = 0,302$ ), number of days with PCA ( $R = 0,837$ ) and continuous infusion ( $R = 0,457$ ).

Patient weight and type of surgery proved to be independent predictor factors for the total amount of morphine consumption.

**Conclusion(s):** We found that ischemic and traumatic pain was associated with highest morphine consumption.

Among the group of postoperative pain, vascular lower limb, thoracic and scoliosis surgery were associated with more needs of morphine.

Intravenous morphine requirements decrease as patient age/weight increases.

Patient weight and type of surgery showed to be independent predictors of morphine consumption.

## 14AP9-1

### Preoperative low-dose ketamine has no preemptive analgesic effect in patients undergoing colon surgery when standard-practice opioid infusions are used

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**Background and Goal of Study:** The analgesic properties of ketamine are related to its actions as a non-competitive N-methyl-D-aspartate receptors antagonist; these receptors present an excitatory function on pain transmission and this binding seems to prevent or reverse its central sensitization. In literature, the use of this anesthetic for preemptive analgesia in the management of postoperative pain is controversial; The objective of this study was to determine whether preoperative low-dose-ketamine reduces postoperative pain and morphine consumption in adults undergoing colon surgery.

**Materials and methods:** In a double-blind, randomized trial, 48 patients were studied. Patients in the ketamine group received 0.5 mg/kg ketamine iv before surgical incision while normal saline was given in the control group. The postoperative analgesia was performed with a continuous infusion of morphine at 0.015 mg•kg<sup>-1</sup>•h<sup>-1</sup> with the possibility of 0.02 mg/kg bolus every 10 min. Pain was assessed using the Visual Analog Scale (VAS), Verbal Rating Scale (VRS), morphine consumption and hemodynamic parameters at 0,1,2,4,8,12,16 and 24 hours postoperatively. We quantified times to rescue analgesic (Paracetamol), adverse effects and patient satisfaction. We compared the categorical variables between both groups with the Chi-square test. The numerical variables were compared between groups, after checking the assumption of normal distribution with the Kolmogorov-Smirnov test, with the Student's t-test or the Mann-Whitney U-test accordingly. We compared the variables in the different time points with the Friedman test for related groups. The level of significance was set at  $P < 0,05$ . Data were analyzed using SPSS statistical software (v.19.0).

**Results and Discussion:** There were no statistically significant differences in VAS and VRS scores between groups ( $P > 0,05$ ) nor differences in cumulative consumption of morphine at any time point ( $P > 0,05$ ). The time to first requested rescue analgesia was 70 ± 15.491 min in the ketamine group and 44 ± 19.494 min in the control group ( $P > 0,05$ ). There were no differences in hemodynamic parameters and patient satisfaction ( $P > 0,05$ ). The majority of patients evaluated their pain control as excellent.

**Conclusion(s):** Preoperative low-dose-ketamine didn't have a preemptive analgesic effect nor was effective as an adjuvant to decrease opioid requirement or postoperative pain in patients receiving intravenous analgesia with morphine after colon surgery.

## 14AP9-2

### Preoperative ketorolac administration has no preemptive analgesic effect for abdominal hysterectomy

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**Background:** Experimental models using noxious stimuli have led to the concept of preemptive analgesia. Reduction of afferent nociceptive input to the spinal cord using analgesics started before the initial painful stimulus reduces the development of spinal hyperexcitability in animal models and results in less pain. In addition to hyperexcitability at the level of the spinal cord, it is known that hyperexcitability also occurs in nerve endings at the site of tissue damage and is mediated in part by the release of prostaglandins. Drugs which inhibit their production such as non-steroidal anti-inflammatory drugs (NSAIDs) might therefore be expected to prevent or minimize the development of this peripheral and central hyperexcitability. Ketorolac, a NSAID, has been shown to have a postoperative narcotic sparing effect when given preoperatively and alternatively to not have this effect. This study was undertaken to determine whether a single intravenous dose of ketorolac would result in decreased postoperative pain and narcotic requirements.

**Methods:** In a double-blind, randomized trial, 48 women undergoing abdominal hysterectomy were studied. Patients in the ketorolac group received 30 mg of ketorolac trometamol iv 30 min before surgical incision while normal saline in the control group. The postoperative analgesia was performed with a continuous infusion of tramadol at 12 mg/h with the possibility of bolus of 10 mg every 10 min. Pain was assessed using the Visual Analog Scale (VAS), Verbal Rating Scale (VRS), tramadol consumption and hemodynamic parameters at 0,1,2,4,8,12,16 and 24 hours postoperatively. We quantified times to rescue analgesic (Morphine), adverse effects and patient satisfaction.

**Results:** There were no statistically significant differences in VAS and VRS scores between groups ( $P > 0,05$ ) nor differences in cumulative and incremental consumption of tramadol at any time point ( $P > 0,05$ ). The time to first requested rescue analgesia was 66.25 ± 38.61 min in the ketorolac group and 65 ± 28.86 min in the control group ( $P = 0,765$ ). There were no meaningful differences in hemodynamic parameters and patient satisfaction between groups ( $P > 0,05$ ). The majority of patients evaluated their pain control as very good.

**Conclusion:** Preoperative ketorolac didn't show a preemptive analgesic effect nor was effective as an adjuvant to decrease opioid requirement or postoperative pain in patients receiving intravenous analgesia with tramadol after abdominal hysterectomy.

## 14AP9-3

### The effects of preoperative dextrose loading on hyperalgesia induced by high-doses remifentanil in patients undergoing laparoscopy-assisted distal gastrectomy

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**Background and Goal of Study:** Perioperative dextrose loading has been shown conflicting results on postoperative pain. The aim of this study was investigate the effect of preoperative administration of glucose on hyperalgesia induced by high-doses remifentanil for laparoscopy assisted distal gastrectomy.

**Materials and methods:** Seventy, ASA I-II patients were randomly assigned to one of the following three groups, each of which received either 250 ml hartmann's solution (HS) or 5% dextrose in HS for 1 hour before anesthesia and intraoperative remifentanil infusion. Group LHS received HS and 0.05 µg/kg/min remifentanil; group HHS, HS and 0.3 µg/kg/min remifentanil, and group HHD, 5% dextrose in HS and 0.3 µg/kg/min remifentanil. The primary outcome was cumulative patient-controlled analgesia (PCA) volume containing morphine for 24 h after surgery. Secondary outcome measures were time to first postoperative analgesic requirement, ketorolac consumption during the first hour after surgery, pain intensity using visual analog scale (VAS) at immediately after postanesthesia care unit (PACU), 1, 6, 12 and 24 hours after surgery, postoperative nausea and antiemetic required. Perioperative blood glucose level were measured at baseline, 10 min after study fluid infusion, 30 min after operation starting, and 10 min after PACU arrival.

**Results and Discussion:** Cumulative PCA volume containing morphine for 24 h after surgery, analgesic consumption, and pain intensity for 12 hours after surgery were significantly greater in group HHS and group HHD than in group LHS. Time to first postoperative analgesic requirement was shorter in group HHS and group HHD than in group LHS. Glucose loading may lead to opioid induced hyperalgesia, because elevated plasma cholecystokinin caused by administration of dextrose is involved in modulating pain and altering acute tolerance to opiates. Hyperalgesia induced by opioid was defined as an increase in clinically relevant pain including cumulative PCA volume containing morphine for 24 h after surgery, analgesic consumption, time to first postoperative analgesic requirement or pain intensity). Clinically relevant pain was not significantly different between group HHS and group HHD.

**Conclusion(s):** High-doses remifentanyl resulted in clinically relevant pain implying hyperalgesia. Preoperative administration of dextrose in patients undergoing laparoscopy assisted distal gastrectomy didn't show any effects on hyperalgesia.

#### 14AP9-4

##### Rectus sheath catheters vs thoracic epidurals for post-operative analgesia following midline laparotomies. Work load implications for acute pain teams

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**Background:** Thoracic epidurals (TE) or rectus sheath catheters (RSC) are used as part of the armamentarium available for analgesia in the post-operative period. RSC have been successfully implemented in other centres<sup>1,2</sup>. The impact on nursing contact time was evaluated and information on complications or side effects associated with both techniques was collected. The hypothesis is that RSC can be as effective as TE but associated with a better side effect profile and lower risks to patients. Acute pain teams are a finite resource, changes in practice may have an impact on workload.

**Methods:** This is a retrospective observational study and as an audit of current practice no formal ethics approval was required. Information was collected using the acute pain team forms. Data was analysed from May to October 2013 (6 months). The descriptive analysis was performed by calculating means, medians and range where applicable. Problems or side effects were taken from notes by acute pain nurses on their daily rounds. Differences were assessed by using Chi-squared ( $p < 0.05$ ).

**Results:** A total of 100 patients were analysed (50 RCS, 50 TE). Mean age was 63.43 (range 20-89). Median number of visits to patients with RCS is 2 (range 1-6) while patients with TE are seen 3 times (range 1-9). The average time spent reviewing patients with RCS was 38 mins compared to 55 mins for patients with TE. Problems were more common in the TE group (27) compared to the RCS group (15), ( $p=0.038$ ). Most common problem in the RCS group is inadequate analgesia (4) mostly due to intermittent bolus not being given (4). The most common problem with TE is inadequate analgesia (16) followed by hypotension (3).

**Conclusion:** 2 groups undergoing midline laparotomies that received a different post-operative analgesic regime were compared. The RCS group required less visits and shorter contact time with the acute pain team. This group also suffers less adverse events or inadequate analgesia. Prospective data including numeric rating scales and total opioid load needs to be collected to produce a more informed opinion about efficacy.

##### References:

1. B.A. Parsons et al. The use of rectus sheath catheters as an analgesic technique for patients undergoing radical cystectomy. *British Journal of Medical and Surgical Urology* 2011;4:24-30
2. Finch L et al. An evaluation of the effects of a service change from epidurals to rectus sheath catheters on postoperative pain. *J Obstet Gynaecol.* 2013;33:502-4

#### 14AP9-5

##### Capnography for early postoperative analgesia

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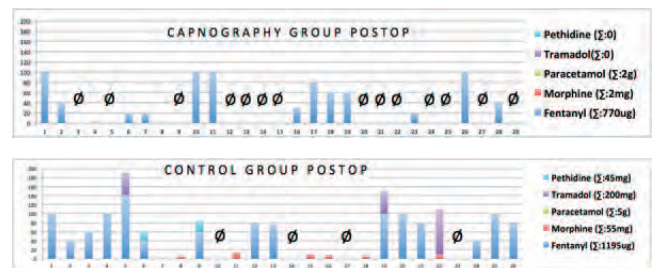
Opioids were titrated before extubation with help of Capnography to improve early postoperative analgesia.

Of 55 patients for donor-Nephrectomy for Renal transplant, 29 in tested group showed lower opioids consumption and better analgesia early postoperatively compared to 26 patients in the control group (Opioids in the control group were given traditionally, without titrating with Capnography):

	Zero Requirement of Analgesics	Maximal Pain in Recovery Room	Pain > 2 in Recovery Room	Max Pain by Patients	Pain > 2 evaluated by Patients	Drowsiness evaluated by Patients
	Number Of Patients	Average (Scale 1-10)	Number of Patients	Average (Scale 1-10)	Number of Patients	Average (Scale 1-3)
Capnography (29 Patients)	14 (48%)	1.4	7 (24%)	1.2	4 (14%)	2.1
Control (26 Patients)	4 (15%)	3.3	13 (50%)	2.9	14 (54%)	1.8

[Table 1: Analgesia and sedation in Capnography and Control groups]

The most dominant feature was extreme individual variability in opioids requirements during titrating of Opioids before extubation, as so as early postoperatively which confirms usefulness of Capnography:



[Figure 1: Variability and sums of analgesics requirement early postoperatively before start of Patient Controlled Analgesia (PCA). PCA was started when patient was pain free, calm and oriented. With "0" are marked patients with zero analgesics in the Recovery Room before PCA]

**Conclusion:** Capnography before extubation can be useful for titrating of early postoperative analgesia. Opioids requirements are extreme individual. Patients who received higher doses of Opioids were more sedated, regardless Capnography: Opioids are not less dangerous with Capnography but with it they can be better titrated. Combined strategy (LA infiltration, multiple kinds of analgesics, timing, etc..) should be an integral part of analgesia for extreme painful surgery.

#### 14AP9-7

##### Chronic post-surgical pain and its impact on quality of life and recovery after surgery

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**Background and Goal of Study:** Chronic post-surgical (CPSP) is a common complication after surgery that persists for at least 2 months, excluding others causes. The aim of this study was to evaluate the incidence of CPSP and its impact on quality of life (QoL) and quality of recovery (QoR).

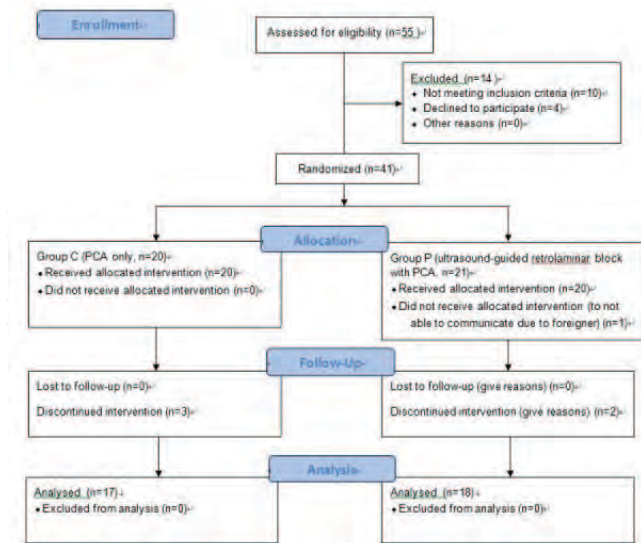
**Materials and methods:** After study approval by the institutional ethics committee, a prospective study was conducted in patients scheduled for elective surgery admitted at the PACU (from June to August 2013). CPSP was assessed with the Brief Pain Inventory (BPI), QoL was evaluated with the Euro-QoL 5-dimension questionnaire (EQ-5D) and QoR with the 15-item Quality of Score (QoR-15). Quality of life and BPI evaluations were performed preoperatively (T0) and 3 months after surgery (T3) in 173 patients. Inclusion criteria: patients undergoing orthopedic, vascular, gynecologic and general surgery.



Exclusion criteria: unable to give informed consent and cognitive impairment (Mini-mental State Examination < 24). The primary end point was CPSP. Ordinal and continuous data were tested for normal distribution. Descriptive analysis was performed and the Mann-Whitney U test, Fischer's exact test or Chi-square test were applied.

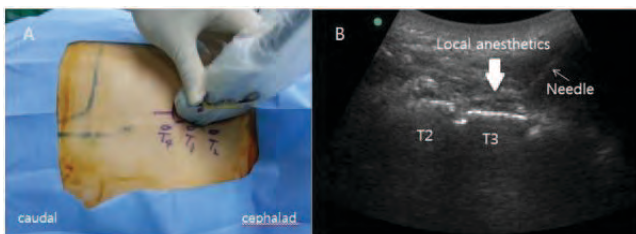
**Results and discussion:** Forty-seven patients had CPSP 90 days after surgery. Three months after surgery patients with CPSP reported significantly more problems in all EQ-5D dimensions: mobility ( $p=0.001$ ), self-care ( $p=0.002$ ), usual activities ( $p < 0.001$ ), pain/discomfort ( $p < 0.001$ ) and anxiety/depression ( $p=0.006$ ). Patients with CPSP reported lower median Euro-QoL Visual analogue scale (68 vs. 87,  $p < 0.001$ ) and had a lower EQ Index (91 vs. 64,  $p > 0.001$ ). Regarding QoR-15 scores, CPSP patients presented with lower total median scores at T0 at four items: "getting support from hospital doctors and nurses" ( $p=0.040$ ), "able to return to work or usual home activities" ( $p=0.035$ ), "moderate pain" ( $p < 0.001$ ), "severe pain" ( $p < 0.001$ ) and for a median global score (127 vs. 132,  $p=0.032$ ). At T24 CPSP patients had lower QoR median global score (103 vs. 121,  $p < 0.001$ ) and had lower scores for "been able to enjoy food" ( $p=0.030$ ), "feeling rested" ( $p=0.001$ ), "moderate pain" ( $p=0.003$ ) and "feeling sad or depressed" ( $p=0.017$ ).

**Conclusion(s):** CPSP is an important outcome after surgery because its incidence in our patient was considerable and the patients had a worst QoR and QoL. Twenty-four hours after surgery, CPSP patients had lower scores for pain evaluation at QoR.



[CONSORT flow diagram]

Ultrasound-guided paravertebral lamina block was performed at the level of T3 with 30ml of local anaesthetics mixture (0.75% ropivacaine 20ml + 2% lidocaine 10ml) under general anaesthesia.



[Photographic (A) and ultrasonographic (B) view]

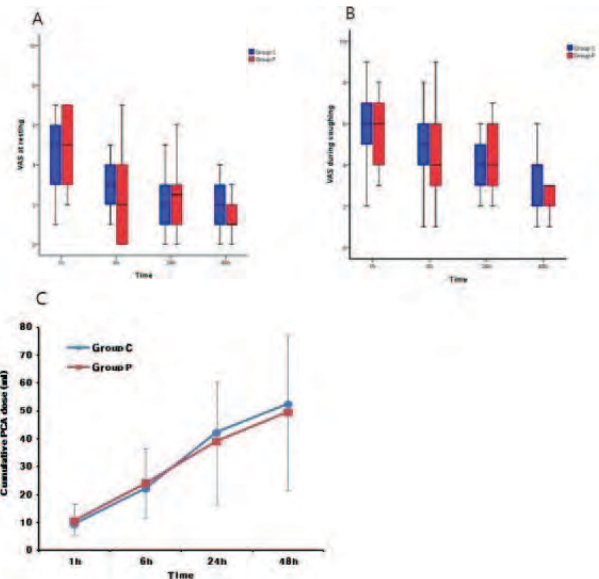
VAS at rest and during coughing, opioid consumption and nausea, vomiting were recorded during the 48 hours after surgery.

**Results and discussion:** There were no differences in demographics except the duration of anaesthesia and remifentanyl.

	Group C (n=17)	Group P (n=18)	P-value
Age (yr; mean ± SD)	51.2 ± 11.9	52.7 ± 8.0	0.678
BMI (kg/m <sup>2</sup> ; mean ± SD)	23.0 ± 2.6	22.7 ± 2.5	0.756
ASA status I/II (n)	10/7	12/6	0.631
Apfel score (median [inter-Quartile range])	2 [2-3]	2 [2-2.25]	0.572
Propofol consumption (mg; mean ± SD)	1127.8 ± 362.5	1076.2 ± 203.6	0.605
Remifentanyl consumption (mcg; mean ± SD)	815.4 ± 260.6	651.5 ± 156.5†	0.030
Duration of Anaesthesia (min; mean ± SD)	172.1 ± 31.9	192.5 ± 25.9†	0.044

[Patients characteristics]

Comparisons of total opioid consumption and pain between the groups in postoperative analgesia showed no differences.



[VAS and Opioid consumption]

There was no difference in incidence of nausea, vomiting.

**Conclusion:** Ultrasound-guided single-injection of retrolaminar paravertebral block does not reduce the opioid requirement and postoperative pain after breast surgery.

### 14AP9-9

#### Chronic post-surgical pain and its impact in quality of life and recovery after herniorrhaphy

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**Background and Goal of Study:** Chronic post-surgical pain (CPSP) develops after surgery and persists for at least 3 months, excluding other causes of pain. Chronic pain following inguinal hernia repair is quite common and may reduce quality of life. It is a potentially incapacitating complication and presents a diagnostic and therapeutic challenge to the clinician. The aim of this study was to evaluate the incidence of CPSP and its impact on quality of life (QoL) and quality of recovery (QoR) after inguinal hernia repair.

**Materials and methods:** After study approval by the institutional ethics committee, a prospective observational study was conducted in patients scheduled for elective inguinal hernia repair admitted at the PACU (Post Anesthetic Care Unit), from June to July 2013. CPSP was assessed with the Brief Pain Inventory (BPI), QoL was evaluated with the EQ-5D EuroQoL five-dimension questionnaire (EQ-5D) and QoR with the 15-item Quality of Recovery Score (QoR-15). EQ-5D and BPI evaluations were performed preoperatively (T0) and 3 months after surgery (T3) in 29 patients. QoR-15 was performed preoperatively (T0) and 24 hours after surgery (T24).

Inclusion criteria: patients undergoing herniorrhaphy.

Exclusion criteria: unable to give informed consent, pain prior to surgery and

cognitive impairment (Mini-mental State Examination < 24). The primary end point was CPSP: considered when pain was present at T3. Ordinal and continuous data were tested for normal distribution, based on the Kolmogorov-Smirnov test. Descriptive analysis was performed and the Mann-Whitney U test, Fisher's exact test or Chi-square test were applied.

**Results:** Eight patients developed CPSP (28%). At T3, patients with CPSP reported significantly more problems in four EQ-5D dimensions: self-care ( $p=0.013$ ), usual activities ( $p=0.005$ ), pain/discomfort ( $p < 0.001$ ) and anxiety/depression ( $p=0.041$ ) and a lower EQ index (59 vs 100,  $p < 0.001$ ). Regarding QoR-15 scores, CPSP patients presented with lower total mean scores at T0 for global score (113 vs 122,  $p=0.022$ ) and at two domains: "feeling comfortable and in control" ( $p=0.036$ ), "moderate pain" ( $p=0.026$ ). At T24, CPSP patients had lower scores for "moderate pain" ( $p=0.048$ ).

**Conclusions:** CPSP is an important outcome after surgery. Its incidence in our patients was considerable and these patients had lower QoL at T3. Twenty-four hours after surgery CPSP patients had lower scores for moderate pain scores in QOR-15.

## 14AP9-10

### Analgesic effect of intraarticular tramadol after arthroscopic knee surgery

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**Background and Goal of Study:** Post-operative pain is an acute pain. Opioid analgesics block transmission of the pain from the periphery to the brain. The aim of this study was investigated the analgesic effects of intraarticular tramadol given after arthroscopic knee surgery and effect when tramadol was administered in combination with a local anesthetic.

**Materials and methods:** In randomised prospective study, we investigated 45 patients who had received one of three injections after arthroscopic knee surgery. Patients in the first "T" group ( $n = 15$ ) were given 100 mg of tramadol with saline, patients in the second "TL" group ( $n = 20$ ) were given 100 mg tramadol and 18 ml Levobupivacaine 0.125% (22.5 mg) and patients in the third "N" group ( $n = 10$ ) were given 20ml of 0.9% NaCl. The volume of the Intraarticular injection was 20ml. We investigated following parameters: the time to the occurrence of pain, the severity of post-operative pain, the need for supplemental analgesic agents, vital parameters and any side effects. The severity of post-operative pain was assessed with a visual - analogue scale (VAS). The scores were obtained 2, 4, 6, 10 and 24 hours after the injections of the drug. All patients were given spinal anaesthesia (3 ml, Levobupivacaine 0.5%), level L3 - L4.

**Results and discussion:** The time to occurrence of pain, the severity of post-operative pain, the need for the supplemental analgesics agents was significantly lower in the "TL" group then in the "T" group. The differences were significant 6, 8 and 10 hours after the injection of the drug. VAS was  $3.6 \pm 1$ . Four patients in the "TL" group had VAS less than 3. The need for supplemental analgesic agents in the first 24 hours was significantly less in the "TL" group ( $65 \pm 12$  mg of diclofenac), "T" group ( $75 \pm 45$  mg of diclofenac and  $50 \text{ mg} \pm 30$  mg of tramadol i.v.). Two patients in the "TL" group did not need supplement-

tal analgesics agents in the first 24 hours. VAS was significantly higher in the "N" group than in "TL" group 2-4 hours after the injections of the drug as well as the need for the supplemental analgesics agents ( $98 \pm 35$  mg of diclofenac and  $78 \pm 32$  mg of tramadol i.v.).

**Conclusion(s):** Low doses of intraarticular opioid analgesics can significantly reduce pain after arthroscopic knee surgery. Maximum effect was obtained 6-8 hours after the injections of the drug. In combination with a low dose of the local anesthetic analgesic effect can be extended up to 24 hours.

## 14AP9-11

### Postoperative pain management after craniotomy

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**Background and Goal of Study:** Postoperative pain is common in the first 24 hours after brain surgery and is often undertreated for the fear of masking neurosurgical pathology or depressing ventilation (1). Our goal was to evaluate severity and treatment of postoperative pain after scalp nerve blockade, wound infiltration or systemic analgesia in patients who underwent major intracranial surgery.

**Materials and methods:** This prospective, double-blind, randomized observational study, included 75 adult patients (ASA status I-III) undergoing craniotomy for the removal of brain tumor under general anesthesia. Patients were randomly divided into three equal groups. Groups with scalp nerve blockade (B) and wound infiltration (I) received 0.25% bupivacaine + 1% lidocaine with 1:200.000 adrenaline (20 ml) and group with systemic analgesia (S) received paracetamol 1 g and ketoprofen 2 mg/kg intravenous (IV) after skin closure. Postoperative pain was assessed at 1, 3, 6 and 24 hours (h) using a visual analogue scale (0-100 mm). Ketorolac 30 mg IV, paracetamol 1 g IV and pethidine 50 mg im were administered as rescue analgesia. Duration for requirement of first rescue analgesia and the incidence of the adverse effects were recorded. Data were analyzed using Chi square test.

Results are presented as mean  $\pm$  standard deviation.  $P < 0.05$  was regarded as significant.

**Results:** There were no significant differences between the groups with demographic characteristics. Main pain scores were significantly lower after scalp nerve block up to 1h (B  $9.8 \pm 19.0$ , Median (Me)=0; I  $21.4 \pm 25.9$ , Me=8; S  $39.0 \pm 28.3$ , Me=40),  $p=0$ ; 6h (B  $13.0 \pm 18.6$ , Me=8; I  $21.9 \pm 21.6$ , Me=18; S  $29.8 \pm 28.2$ , Me=27),  $p=0.044$  and 24h (B  $15.3 \pm 24.8$ , Me=2.5; I  $26.8 \pm 30.2$ , Me=11, S  $39.7 \pm 32.5$ , Me=34),  $p=0.026$ . Administered doses of ketorolac were significantly lower in group B ( $20.4 \pm 25.6$  mg, Me=0) compared to groups I ( $24.6 \pm 24.8$  mg, Me=30) and S ( $39.6 \pm 26.5$  mg, Me=30),  $p=0.019$ . Duration for the requirement of first rescue analgesia was longer in group B compared to groups I and S (B  $185 \pm 104.1$  min; I  $180 \pm 116.4$  min; S  $75 \pm 17.1$  min),  $p=0.006$ .

**Conclusion:** This study demonstrates that scalp nerve block using solution of 0.25% bupivacaine combined with 1 % lidocaine decreases the incidence and severity of postoperative pain and doses of rescue analgesia in patients undergoing craniotomy.

#### References:

1. Bala I, et al. Anaesth Intensive Care. 2006; 34:224-7.

## Education, Research and Presentation

### 15AP1-1

#### A questionnaire survey to aid development of a new critical care course in Liberia, West Africa

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**Background:** Mothers of Africa (MOA) is a UK based medical educational charity that aims to reduce maternal deaths in sub-Saharan African countries including Liberia, by supporting the training of local healthcare professionals. Approximately 70% of emergency surgical workload in Liberia is obstetric and the maternal mortality ratio (MMR) is 770 per 100,000 live births [1]. MOA's experience and a previous study in the resource poor setting show that 80% of maternal deaths occur during the post-operative period [2]. The 3-day BASIC DHS course (Basic Assessment and Support of Seriously Ill Patients in Developing Healthcare Systems) has been developed to improve care of such patients and others who are critically ill. In 2013 2 pilot courses ran in Liberia.

**Goal of Study:** To aid development of the BASIC DHS course by assessing 1) The quality, usefulness and appropriateness of knowledge and skills delivered 2) The preferred teaching method 3) The effect on motivation to improve local services/care delivery 4) The effect on the confidence of healthcare providers in managing acutely unwell patients.

**Method:** Follow-up questionnaire from 12 former delegates (doctors and nurse anaesthetists).

**Results and discussion:** A 100% follow-up rate was achieved. 100% of participants reported changes to their clinical practice, with all giving examples of improved care. 83% reported positive changes within their departments and 58% reported developing new department protocols and guidelines as a result of the course. 100% felt more empowered in their workplace and 92% reported improvements in interactions with colleagues. The majority wanted a longer course with more time for skills stations and interactive discussions. The participant's average confidence rating in managing critically ill patients improved from 6.3 out of 10 pre-course to 9.25 out of 10 post-course.

**Conclusion:** This pilot of the BASIC DHS course in Liberia has been well received with subjective evidence of empowerment and improved ways of working. The Liberians themselves will drive forward improvements in the course supported by MOA. Further objective evidence is required to demonstrate impacts on patient outcomes but initial results from the pilots are promising.

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1. www.data.worldbank.org/indicator/SH.STA.MMRT.
2. Fenton P et al. Caesarean section in Malawi: prospective study of early maternal and perinatal mortality. *BMJ* 2003; 327:587.

### 15AP1-2

#### How do trainees rate their trainers? A survey of clinical and educational supervision in a major UK university teaching hospital anaesthetic department

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**Background and Goal of Study:** The General Medical Council (GMC) alongside the Academy of Medical Educators (AoME) has set out guidelines for clinicians involved in the supervision of postgraduate training. The aim of our study was to evaluate how a cohort of Anaesthetic trainees subjectively rated their trainers with respect to a range of indicators of educational and clinical supervision standards within our institution.

**Materials and methods:** A survey consisting of 7 statements created using an online software program was distributed to trainees of all grades undertaking a module of training within our institution between August and December 2013.

Q1-This person takes steps to address my specific learning needs.

Q2-This person allows me to take clinical responsibility appropriate to my experience.

Q3-This person is approachable for clinical advice.

Q4-This person gives me useful feedback.

Q5-This person is a positive role model for trainees.

Q6-I would be comfortable / confident to approach this person with a personal issue.

Q7-This person is an effective educator.

Responses were given on a 6-point scale-

5- Strongly Agree

4- Agree

3- Neither Agree nor Disagree

2- Disagree

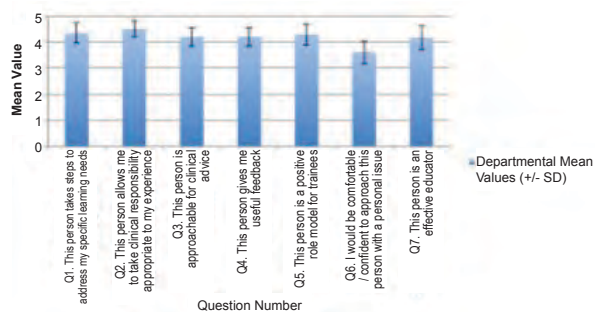
1- Strongly Disagree

0- Unable to Comment

Data was collected and analysed - responses were assigned numerical values for analysis (as above). Individual means, departmental means (+/- standard deviation) and trainer ranking within the department were calculated for each statement. Individual trainer 'performance' graphs were produced.

**Results and discussion:** The overall response was 39/55 (71%)

There was a positive response from trainees. Departmental mean scores being in the Agree / Strongly Agree range (i.e. >4) for all but one statement. The lowest departmental mean was for question 6 (3.62 +/- 0.44), which relates to more 'pastoral' aspects of trainee supervision.



[Departmental Mean +/- SD]

**Conclusion(s):** Standards of Educational and Clinical Supervision are subjectively rated highly by trainees within our establishment. This method of data collection is a valuable and reproducible source of feedback for trainers to continuously improve standards of Educational and Clinical supervision for trainees in Anaesthesia.

### 15AP1-3

#### Who are the trainees preparing the European diploma of anaesthesiology and intensive care: a 3-years evolution study in the Madrid training center

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**Background and Goal of Study:** The European Diploma of anaesthesiology and Intensive Care (EDAIC) has attracted a growing interest in Spain in the last few years. Young Spanish professionals are now encouraged by the Spanish society of anaesthesiology (SEDAR) to realize the EDAIC. Since 2008, a training program has guided future candidates to prepare the part 1 exam. This longitudinal study was realized among participants to the trainings between 2011 and 2013.

**Materials and methods:** In every course, an information meeting was organized. Future candidates were asked to answer an anonymous questionnaire consisting of 8 questions to assess their motivations, the way they were informed about the exam, and what were their expectations. Chi-2 tests were used to analyze data.  $p < 0,05$  was considered significant.

**Results and Discussion:** 137 trainees were assessed, 50 in 2011, 40 in 2012 and 47 in 2013, with a higher number of residents (60-90%) than staff anaesthesiologists (SA) (10-40%), mostly between the second and fourth year of residency (56-82,5%). More SA participated to the training in 2011 (40%) than the two following years (10 and 34%) ( $p=0,005$ ). Most of trainees worked in Madrid (78-97,5%), and came from university hospitals (93,6-98%) with no differences between years ( $p=0,08$  and  $0,47$  respectively). They heard of the training following recommendations from colleagues (46,2-66%) or their tutors (12,8-24%), but also through the SEDAR (6-10,6%) or after participating to previous trainings (4-15,4%). Colleagues' recommendation increased and tutors recommendation decreased through the years ( $p=0,004$ ). 12-27,5% anaesthesiologists repeated the training, and 0-6,4% more than once, to pres-



ent the part1 exam for the first time the same year (50-90%), with no changes between years ( $p=0,11$  and  $0,472$  respectively). In 2011, their main objective was to pass EDA-1, while in 2012 and 2013 they were more interested in testing their theoretical knowledge ( $p < 0,001$ ). Candidates aspired to a planification of revisions (38-65,6%), a training with mocks of the exam (17,8-22%) and an orientative study plan (8-15,6%). The interest for a planification of revisions and an orientative study plan increased through the years ( $p=0,001$ ).

**Conclusion(s):** This survey permitted to assess the changes of expectations of future candidates to the EDAIC, and to orientate future editions of the training program towards organizational outcomes for a better preparation of the exam.

## 15AP1-4

### Statistical knowledge amongst anaesthetists in a district general hospital

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**Background and Goal of Study:** Over the past decades, various reviews have highlighted the dearth in statistical knowledge amongst doctors (1). This may result in overreliance on misunderstood statistical concepts and poorly analysed data, which may have an impact on medical care (2).

**Materials and methods:** With hospital audit committee approval, anaesthetists were surveyed in our department of anaesthesia to determine their level of statistical knowledge. Questions were asked on the proficiency and training in descriptive and inferential statistics and the familiarity, derivation and interpretation of these concepts. As a guide, the statistical concepts rated 'four stars' and 'five stars' in a 'basic' medical textbook for statistics (3) were used (five star concepts: used in a majority of medical papers; four star concepts: used in at least a third of medical papers).

**Results and discussion:** 62 out of 87 anaesthetists within the department responded to the survey. 32 were trainees of various levels and 30 were senior anaesthetists. Only nine senior anaesthetists and nine trainees had some formal statistics teaching at medical school. Importantly, five senior and eight junior anaesthetists currently have had no statistics training (formal or informal). All trainees and senior anaesthetists could derive and interpret descriptive statistics (mean, mode, median). Less than half of the senior anaesthetists and trainees felt they had enough statistical knowledge to interpret a paper. All (but one) felt more emphasis on statistics should be placed in medical school. The ability of senior and junior anaesthetists to derive and interpret various inferential statistical concepts is illustrated in Figure 1. Much of the data presented in research papers may be difficult for doctors to analyse, resulting in an inability to truly assimilate the information without expert statistical help.

	Senior Anaesthetists (n=30)	Senior Anaesthetists (n=30)	Junior Anaesthetists (n=32)	Junior Anaesthetists (n=32)
Inferential Statistic:	Able to Derive	Able to Interpret	Able to Derive	Able to interpret
Incidence	27	28	14	24
Confidence Intervals	18	26	17	26
p- values	19	30	8	28
t -tests	17	20	8	10
Chi Square	12	18	7	14
Odds Ratio	12	17	10	12
ANOVA	13	14	4	6
Prevalence	17	24	14	22

[Figure 1: Knowledge of Inferential Statistics]

**Conclusion(s):** Despite the necessity, statistics is still not considered vital enough to warrant more formal education in medical school, or as formal sessions whilst in anaesthetic training. Further education in statistical techniques is needed.

#### References:

- Altman D et al: J R Statist Soc 1991; 154: 223-267
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## 15AP1-5

### Use of 'Google Forms' as a residents' evaluating tool in a tertiary referral hospital

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**Background and Goal:** Most of the international and national societies establish a minimum number of procedures and technics to be done by a resident during its training period, but it is difficult to design a system that allow us to find out if our residents are receiving the proper training in a quick look. As a hospital forming future anesthesiology physicians, we thought of a way of both evaluating the work of our residents and having a statistical database of the procedures made in our operating rooms.

**Materials and methods:** We built a form using 'Google Forms', a free web-based application. This form is linked to a 'Google Docs' Spreadsheet. This way, after one of our residents fills one of these forms, all the data is stored in the 'cloud'. This form asks about several items that allow us to know the kind of patient, surgical procedure, skills applied by the resident, complications and final state of the patient. This spreadsheet can be downloaded and imported into a database program in order to make complex researches. We also distributed a satisfaction survey among the users of this new system after 6 months.

**Results and discussion:** After six months, our system has recorded 1334 patients from both programmed and urgent procedures. At this time 539 laringoscopies, 572 locoregional technics, 140 central venous catheterization have been made by our residents among other technics. 72 problems during the anesthetic procedures were recorded, being the most usual difficult intubation (31) and difficult ventilation (16). 16% of the patients were admitted in our Intensive Care Units and no exitus was communicated.

The residents also felt very satisfied with the new system (average of 4'90 in a 1 to 5 scale), with an average time to fill the form for each patient of 2.3 minutes, being 'Very easy' to use (1 to 3 scale).

**Conclusions:** This kind of database record system, multiplatform, web-based and easy to build and use, has improved the knowledge of the residents' work in our hospital. We also have now a general view of the number of technics and complications we experience in our operating rooms. This way we can improve our formative programs, not only for all of the residents, but also paying attention to individual needs.

But it also has several limitations. As a statistical database we only record data from residents, and not always a resident is in each operating room. We also face the 'honesty factor', specially talking about complications.

## 15AP1-6

### Introducing the scholarly activity index as a tool to assess and motivate research in anaesthesia residents

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**Background and Goal of Study:** Scientific activity is crucial during the training of anaesthesia residents (AR). However evaluation methods are underdeveloped and to motivate residents remains a challenge. The aim of this study was to evaluate the scientific activity of AR using the scholarly activity index (SAI) as an evaluation tool and to propose a set point according to the year of training.

**Methods:** We performed an observational transversal study based on an anonymous questionnaire proposed to AR from 1<sup>st</sup> to 4<sup>th</sup> years of residence (AR1, AR2, AR3 and AR4). We assessed gender, nationality and calculated the SAI, which consists of summing points assigned to scientific works realized by the residents (active research project (30), abstract in international meetings as 1<sup>st</sup> author (50) and coauthor (25), abstract at local meetings (12), manuscripts in review period: 1<sup>st</sup> author (100) and coauthor (50), case reports: 1<sup>st</sup> author (75) and coauthor 25, letters to the editor (30), book chapters (37-100) and review articles (25-150) according to authorship). Results are presented as median[range]. We compared variables using Kruskal Wallis test for non-parametric samples,  $p < 0.05$  was considered significant.

**Results:** 42/42 distributed questionnaires were collected (10 AR1, 10 AR2, 12 AR3 and 10 AR4). Median SAI scores for year of training were: AR1: 0 [0-855], AR2 62.5 [0-475], AR3 173.8 [0-825], AR4: 75 [0-4665], ( $p=0,007$ ). Sex ratio was 1 to 2, with significant difference of SCA between male and female

( $p=0.59$ ). 19/42 were Spanish native and 23/42 foreign AR, with no score difference depending on origin ( $p=0.73$ ). As a whole, AR produce 11911 SAI points (126 abstracts, 14 book chapters, 15 manuscripts under review, 32 publications, 19 case reports, 9 letters to the editor and 44 active projects) in 2012.

**Discussion and conclusions:** The SAI gives higher scores for increased complexity of research activity and is a valid instrument for assessing objectively scientific activity. AR3 obtained higher scores than AR4, possibly due to the preparation of the European Diploma of Anaesthesia. The introduction of a minimal score per year could be useful to motivate residents to get involved in scientific activity. The requirement of 30 points for AR1, with a progressive increase up to 150 points for AR4 seems a reasonable endpoint for their training period.

## 15AP1-7

### Do anaesthesia residents present more burnout and depression than medicine and surgery residents?

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**Background:** Prevalence of Burnout Syndrome (BS) has been studied in anaesthesiologists, but less in anaesthesia residents (AR) and none in comparison with other specialties. The aim of this study was to evaluate the prevalence of BS and depression (DEP) among AR, medicine (MR) and surgery (SR) residents.

**Method:** We performed an observational transversal study based on an anonymous and voluntary questionnaire proposed to AR, MR and SR from the second year of training onwards. We also assessed: demographic parameters, toxic habits, knowledge on BS, working hours and work environment characteristics. We used Maslach Burnout Inventory to analyze BS's 3 components: emotional exhaustion, depersonalization and personal accomplishment; BS diagnosed if high values on the first two items or low on the third. Harvard National Depression Screening was used to detect depression. We compared variables using Chi2 and ANOVA;  $p < 0.05$  was considered significant.

**Results:** 97/97 distributed questionnaires were collected (32 AR, 35 MR, 30 SR). 96% were doing their desired specialty. 42% male and 58% female. 53% native Spanish AR and 47% foreigners (all from South America). Native AR had more BS (74% vs 43%  $p=0.002$ ). DEP was found in 14 residents, 2 AR, 6 MR and 6 SR ( $p=0.035$ ), and BS was related to higher DEP scores ( $p=0.001$ ). 49% were concerned about their stress level: 68% MR, 36% AR and 42% SR ( $p=0.042$ ). 12% felt burnout at present ( $p=0.55$ ) and 28% had felt burnout in the past 3 months, with differences between MR, 38%, SR 42% and AR 7% ( $p=0.011$ ).

Higher BS in MR 66% and SR 73% than AR 41% ( $p=0.021$ ), with higher emotional exhaustion ( $p=0.019$ ) and depersonalization ( $p=0.025$ ) but no differences on personal accomplishment ( $p=0.278$ ). BS had no relationship with the sensation of having BS at the present moment ( $p=0.55$ ), but was higher in residents who were concerned about their stress level ( $p=0.001$ ), and in those who thought to had BS in the past 3 months ( $p=0.030$ ), positive predictive value of 80% for this question alone.

**Discussion and conclusion:** BS and DEP were higher in MR and SR in comparison with AR. Although anaesthesia is rated as a stressful environment, and burnout in staff is high in several series, AR seem to be protected. In our health care system this might be related to higher supervision of AR compared to SR and MR, lower working loads and a different profile of motivation. BS among residents should be acknowledged and strategies should be planned to reduce it.

## 15AP1-8

### Training professionals: a novel approach to educational supervision and non clinical learning

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**Background:** The Training Professionals project was one of 9 winners selected nationally from over 200 applications to the Inspire Improvement competition and is receiving funding from Health Education England as part of the Better Training Better Care initiative. We believe it could represent a future model for non-clinical teaching and educational supervision for trainees. Making the Trainee the centre of their own training and responsible for their

own successes will better prepare them for the roles and responsibilities of a modern Consultant.

#### Methods:

There are three main aspects to our project:

1. Trainee produced goals and delivery plan

We have split the non-clinical aspects of training into four perspectives - Knowledge & Education, Audit, Research and Corporate & Management. At the start of each training block trainees will develop goals within each perspective. The goals will be described as having a tiered level of success - basic requirement and aspirational. Trainees then produce a delivery plan for the achievement of those goals, detailing the necessary steps involved and the time frame within which they will meet each step.

2. Trainer Facilitation

To support and supervise trainees as they achieve their goals Educational Supervisors will have a more regular role in overseeing their trainees. The Trainee will update their goals and delivery plan onto a 'cloud' based document. The Trainee and Educational Supervisor will interact remotely on a weekly basis via this document. For Educational Supervisors the tool provides evidence of the fulfilment of their responsibilities for appraisal and revalidation.

3. Trainee Resource and Time Ownership

The tool developed allows trainees to demonstrate success in their professional development and effective use of time allocated such that they should be given greater control over their non-clinical teaching time.

**Conclusion:** We believe teaching time should be of measurable benefit to the trainees and there should be high-quality, demonstrable, weekly interactions with supervisors. Training professionals can deliver this. Once Training Professionals produces evidence that both Trainees and Educational Supervisors find it of benefit and that it demonstrates real improvements to the Trainee's career progression we hope that it will be incorporated into training program curricula and either work alongside or within the e-portfolios that Trainees use.

## 15AP1-9

### Comparison of evidence evaluation skills of anaesthesiologists and medical students - a web-based consensus study

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**Background and Goal of Study:** Evidence-based Medicine (EBM) is a new approach to medicine. The 2010 "1<sup>st</sup> International Consensus Conference in Milan" has identified 10 non-surgical interventions that has been shown to improve or worsen the life expectancy of patients undergoing cardiac surgery. The aim of this study was to assess the differences between the opinions and the evidence evaluation skills of anaesthesiologists and V. and VI. grade medical students.

**Materials and methods:** 34 articles have been selected for web-based voting about 10 non-surgical interventions published in the last 2 years, which met the selection criteria. The voting process was based on the 6 stages of the evidence-based classification system of the GRADE Working Group. Literature search was performed via the internet (PubMed; Embase, OvidSP, Cochrane Library). Major selection criterion was the relationship between cardiac surgery and mortality. Two independent experts agreed on the most acceptable grade for each questions, and the answers were analyzed regarding under- and overgrading. For statistical analysis Mann-Whitney U-test and paired T-test was used.

**Results and discussion:** The number of respondents were 91 anaesthesiologist and 87 medical school students. Differences observed between the two groups regarding overall overgrading (38% vs. 30%  $p=0.001$  for anaesthesiologists and students, respectively), undergrading (42% vs. 51%  $p<0.001$  for anaesthesiologists and students, respectively) and mean difference in undergrading (means:  $-1.75 \pm 0.82$  vs.  $-1.94 \pm 0.88$ ,  $p=0.009$  for anaesthesiologists and students, respectively). Agreement of rating was observed in the following topics: IABP usage ( $p=0.69$ ), quality considerations of hospitals performing more surgeries ( $p=0.67$ ) and risk of using old blood transfusions ( $p=0.86$ ).

**Conclusion(s):** Significant differences have been observed between the opinion of anaesthesiologists and medical students. Reasons of these discrepancies could be the lack of personal experience of the students affecting the assessment of the level of evidence and the bias of specialists, especially in the case of cardiac anaesthesiologists.

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## 15AP2-1

### Feedback corresponding to simulated errors or trainees' errors: the effect on skill retention of basic life support in medical students

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**Background:** In basic life support (BLS) training, a pre-test could identify trainees' errors and corresponding feedback could facilitate followed training. However, the time spent in pre-test for a group of trainees was enormous. Moreover, to show a trainee's errors in a group during feedback might take a risk of conflict of confidentiality. We hypothesize feedback corresponding to simulated errors might have the same beneficial effect on skill retention of BLS as feedback corresponding to trainees' own errors in pre-test, but avoids its drawbacks. Simulated errors (both common and rare) were shown through pictures and videos in that an actor performed BLS deliberately in wrong ways.

**Materials and methods:** Forty eight 3<sup>rd</sup>-year medical students were randomly enrolled into 3 groups: the control group (C group), the trainee's errors group (TE group) and the simulated errors group (SE group).

BLS skills were tested in three groups before training (pre-test). And then, the C group had a 45-minute training. In TE group, by showing students' errors in pre-test, corresponding feedback was given in fifteen minutes and followed by a 30-minute training. In SE group, by showing simulated errors, corresponding feedback was given in fifteen minutes and followed by a 30-minute training. BLS skills were tested in three groups after training (post-test) and one month later (retention-test). BLS skills were compared among three groups using ONE WAY ANOVA test, and a  $P < 0.05$  was considered as statistically significant.

**Results and discussion:** There were no skill differences among three groups at pre-test. Better BLS skills were observed in TE group and SE group at post-test and retention-test, compared with C group ( $P < 0.05$ , respectively). In either post-test or retention-test, no inter-group skill difference was observed between TE group and SE group. By showing simulated errors, corresponding feedback in SE group had the same beneficial effect on skill learning as feedback corresponding to trainees' errors in pre-test in TE group. Therefore, the pre-test to identify trainees' errors in SE group could be unnecessary and the time spent in it could be saved. Showing simulated errors during feedback in SE group avoided the risk of conflict of confidentiality as well.

**Conclusion(s):** As feedback corresponding to trainees' own errors in the pre-test, feedback corresponding to simulated errors had the same beneficial effect on improving skill retention of BLS in medical students.

## 15AP2-2

### Evaluating the impact of scenario-based high fidelity patient simulation for anaesthetic residents in the intensive care setting

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**Background and Goal of Study:** High Fidelity medical simulation has been used as an effective educational tool for training residents. The aim of using simulation is to improve the quality of healthcare through teaching teamwork and clinical decision making. Simulation provides an enhanced environment for experiential learning and reflective practice. Patient safety outcomes may be enhanced if resident training in acute areas eg. operating theatres (OT) and intensive care unit (ICU) is first developed using simulation training.

**Materials and methods:** All residents posted to Tan Tock Seng Hospital Anaesthesiology Department completed a questionnaire assessing their baseline knowledge of critical care medicine. Results of the questionnaire were kept confidential and residents were given an opportunity to seek clarification on areas of doubt.

Residents were divided into groups of 2 residents, partnered with groups of 4 nurses trained in critical care areas. All groups underwent high-fidelity simulation training on 3 real-life based case scenarios, namely:

1. Resuscitation of the patient with massive haemorrhage
2. Resuscitation of a patient in septic shock
3. Management of a malignant cardiac arrhythmia

During the simulation training, 2 independent assessors rated the residents performance on task-specific technical skills, medications used and behaviour displayed, using direct observed procedural skills (DOPS) assessment.

After completion of the simulation, all residents completed an evaluation questionnaire which included learner satisfaction scores.

**Results and discussion:** All residents indicated that simulation training was useful in teaching management of critically ill patients. Most residents indicated that they were more confident in the management of the critically ill patients seen in an emergency setting. They also indicated a better understanding of team work and the importance of communication with the rest of the team, including nurses.

**Conclusion(s):** High-fidelity simulation training is an effective and useful educational technique for training anaesthetic residents in common but critical clinical scenarios.

We should strive to make simulation of crises scenarios an important and necessary module in training future anaesthetic residents. This would allow team work and assessment of competency of these residents in a controlled and safe environment.

#### References:

1. Schroder et al. Simulation-based anaesthesia crisis resource management. *Anaes* 2009 Oct;58(10)

## 15AP2-3

### Computer screen-based simulation software as a valid tool for assessment in anaesthesia training

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**Background and Goal of Study:** As the use of full-scale mannequin-based simulators for anaesthesia training still remains limited because of their high cost, less expensive computer screen-based simulators may partially replace them for teaching nontechnical skills. However, their value as a valid and reliable assessment tool is not fully investigated. The goal of this study was to determine the validity and reliability of computer screen-based simulator Anesthesia Simulator 5 by Anesoft Corporation for assessment in anaesthesia training.

**Materials and methods:** After institutional research board approval 17 anaesthesia residents in their 2<sup>nd</sup> year of training and 15 attending anaesthetists with at least 5 years of experience were enrolled in this prospective study. Before the simulation an orientation session was held for all participants using a simulation scenario which was not used in the study process later. All participants performed the same 33 scenarios from various domains of anaesthesia containing different critical incidents and were assigned an evaluation score by computer. The consultant function of software was not available during sessions. Two expert examiners well familiar with the simulator were blinded to training level of participants and independently evaluated their performance using a global rating scale (GRS). To facilitate the evaluation process during sessions the computer screen was projected on wall screen. The software construct validity was established by its ability to distinguish between varying levels of training and correlation of its score with GRS. Independent samples t-test was used to check the statistical difference between two groups. Interrater reliability was assessed by kappa statistics.

**Results and discussion:** The performance of attending anaesthetists was significantly better than that of residents according to the assessment by both examiners using GRS ( $P=0.002$ ) and computer generated score (mean±SE=82±4.6 and 36±5.2, respectively,  $p < 0.001$ ). There was significant correlation between computer scores and GRS ( $r=0.78$ ,  $p < 0.001$ ). The overall interrater reliability for GRS was near-perfect ( $k=0.86$ ,  $p < 0.001$ ). Feedback from participants was positive regarding the ease and practicality of the simulator use.

**Conclusion:** The investigated simulator is valid and reliable as it reliably discriminated between different levels of training and can be adopted for formative assessment of nontechnical skills in anaesthesia training.



## 15AP2-4

### A time based or competency-based basic life support refresh course before clerkship: the effect on skill retention in medical students

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**Background and Goal of Study:** Medical students might participate resuscitation for patients with cardiac arrest during their clerkship. For patients' safety, generally a basic life support (BLS) refresh course would be organized for medical students before their clerkship. However, a traditional time-based BLS refresh course might contribute to the poor skill retention of BLS in medical students, which might result in the low rate of survival after cardiac arrest. In medical education, competency-based learning has been proven to be effective for improving long-term skill retention. We hypothesize that a competency-based BLS refresh course might improve skill retention in medical students, compared with a time-based refresh course.

**Materials and methods:** Forty 5<sup>th</sup>-year medical students preparing to entry clerkship were randomly enrolled into 2 groups: the traditional time-based (T group, the control) or the competency-based (CB group) group, each of 20. Before the refresh course, BLS skills were tested in two groups (pre-test). In the T group, an one-hour traditional BLS refresh course was conducted and individualized skills were tested thereafter (post-test). In the CB group, a 30-minute brief training was followed by individualized skills assessment. Specific feedback was given to each individual based on his/her performance and those who did not achieve the competency level were required to do more practice. The process of practice, individualized assessment (the last one was regarded as post-test) and giving feedback was repeated until everyone in the CB group achieved the competency level. BLS skills were tested one year later (retention-test) in both groups. Skill competency rate was compared between the two groups at post-test and retention-test (Chi-square test), and a  $P < 0.05$  was regarded as statistically significant.

**Results and discussion:** There was no skill difference between the two groups at pre-test. Higher BLS skill competency rate were observed in the CB group at post-test (100% vs. 56.1%) and retention-test (34.3% vs. 5.85%), compared with the T group ( $P < 0.05$  respectively). In contrast to a time-based course, a competency-based course addresses learning outcomes and de-emphasizes time. Deliberate practice, rigorous assessment and specific feedback in a competency-based course could facilitate students' learning.

**Conclusion(s):** A competency-based BLS refresh course improved skills retention of BLS in medical students during their clerkship.

## 15AP2-5

### Education affects medical students' attitudes toward defibrillation

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**Background and Goal of Study:** Graduating medical students often feel insecure towards cardiopulmonary resuscitation and defibrillation (CPR-D). The purpose of this cohort study was to examine medical students' beliefs and attitudes toward CPR-D and current practice guidelines in two different universities and assess the possible changes in attitudes towards resuscitation practices after an educational intervention (1).

**Materials and methods:** A questionnaire concerning beliefs and attitudes toward cardiopulmonary resuscitation was distributed to first year students during their first days in the University of Helsinki, to 4<sup>th</sup> year medical students at University of Helsinki and University of Turku just prior to an ALS introduction lecture, and again six months after the education for the same groups. The questions were answered using Likert scale (1 = totally disagree, 7 = totally agree). Factor loading of the questionnaire was made using maximum likelihood analysis and varimax rotation. Four scales were constructed (Hesitant, Anxiety, Leader). Cronbach's alpha were adequate (0,912-9,843. Statistics: Student's t-test, ANOVA, Pearson Correlation).

**Results and discussion:** The questionnaire was answered by 657 students in the Universities of Helsinki and Turku, participation in each course was over 55%. The first year students were significantly more Hesitant towards defibrillation than the 4<sup>th</sup> year students before the educational intervention (scale mean 5.24 vs. 3.25)( $p < 0.01$ ), felt more Anxiety about resuscitation (scale mean 3.46 vs. 2.97)( $p < 0.05$ ) and more insecure as leaders (scale mean 2.87

vs. 4.22)( $p < 0.01$ ). Education had a statistically significant impact in scales Hesitant ( $p < 0.001$ ) and Leader ( $p < 0.01$ ) in both Universities, but not on Anxiety. Scale Hesitant had statistically significant negative correlation to scale Leader ( $p < 0.01$ ). In comparison with Turku, students in Helsinki were significantly less Hesitation (scale mean 2.32 vs. 4.62)( $p < 0.01$ ), and felt more competent Leaders (scale mean 5.11 vs. 3.36)( $p < 0.001$ ), in scale Anxiety there was no statistically significant difference.

**Conclusion:** The results indicate, that hesitation towards defibrillation can be reduced and self-security in working as a member or a leader of a team can be facilitated by an educational intervention. New educational approach is needed in order to diminish general anxiety towards CPR-D.

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## 15AP2-6

### Simulated crisis training and anaesthetic non technical skills

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**Background:** Simulation-based training for anaesthesia critical events is appropriate and feasible; however, measures of outcome improvements have been scarcely assessed. The primary purpose of this study was to determine whether simulated anaesthesia crisis training for anaesthesia teams improves nontechnical skills.

**Methods:** A crisis resource management course was developed for anaesthesia teams. Prior to the simulation sessions, a 30 minutes orientation was held for all participants with the aim to explain them the principles of anaesthesia crisis resource management (1) and elements of Anaesthetist's Non-Technical Skills assessment (ANTS) (2). Later, each team performed six different simulation scenarios using a high-fidelity patient simulator. The scenarios were videotaped. After each scenario a trained instructor guided a debriefing session focused on technical and nontechnical skills performance. Two independent assessors assessed participant's nontechnical skills using ANTS. Finally, a survey was done two months later with the aim to collect self-perceived changes in their critical events' management.

**Results:** The participants agreed that the scenarios were consistent with the objectives, the debriefings were adequately and the scenarios were realistic. There was no improvement in the mean total category ANTS score of participants between their first and last scenario. At the element level, there were no differences in the mean scores between their first and last scenario.

Eighty percent of the participants answered the administered survey two months later. All of them agreed that the course was relevant for their clinical practice and that it improved their ability to manage anesthetic emergencies. 69% of the participants were involved in critical events since having taken the course. They reported an improvement in several aspects, such as leadership, delegating tasks, communication and resource's management.

**Conclusions:** Exposure to six simulated anaesthesia crises does not improve participants' nontechnical skills, despite a high perception of improvement in their clinical practice.

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## 15AP2-7

### The teaching of pediatric emergency procedures to medical students - a pilot study

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**Background and Goal of Study:** Junior doctors are often first on scene in the emergency department. It is therefore crucial that they are capable of performing life-saving procedures. In general, pediatricians or anesthesiologists handle pediatric emergencies. However, depending on hospital location, local structure and resources junior doctors can be compelled to perform these life-saving procedures.

Many junior doctors will not learn additional pediatric skills after the end of the assigned curriculum in medical school, even though they can be expected to handle acutely ill children. We designed a four-hour workshop-based course to introduce Danish medical students to clinical skills, needed to manage pediatric emergencies.

**Materials and methods:** 12 medical students all in their fourth-sixth year of medical school participated in a four-hour course in pediatric procedures. Students were divided into groups of four.

The course included three workshops with theory and practical training in:

1. Intraosseous access practiced on a phantom and foreign body airway obstruction practiced with two real size manikins
2. Neonatal resuscitation
3. Umbilical vein catheterization

Prior to the workshops the students were presented with a multiple-choice questionnaire (MCQ). The MCQ was repeated at the end of the course.

At the end of the training sessions an OSCE was performed and the students were assessed using a standardized checklist.

Data from the MCQ pre and post test were analyzed using the Wilcoxon Signed Rank test and a p-value < 0,01 was considered significant.

**Results and discussion:** A total of 12 medical students performed the pre and post MCQ test and the four practical tests.

Table 1 shows the percentage of correct answers for the pre and post MCQ.

Question	Correct Pre-test	Correct Post-test
Which technic in the FBAO algorithm is not used for children under the age of 1?	50% (6)	67% (8)
The most common insertion place for intraosseous access in children?	58% (7)	92% (11)
What does the needle size chosen for intraosseous access depend on?	25% (3)	75% (9)
What is NOT a contraindication for intraosseous access in children?	42% (5)	42% (5)
Which of the following is a contraindication for umbilical vein catheterization?	58% (7)	100% (12)
How long is the maximum duration of use of an umbilical vein catheter?	17% (2)	75% (9)
How long after birth is the umbilical vein viable for cannulation?	0% (0)	58% (7)
What is the most frequent cause of cardiac arrest in children?	75% (9)	92% (11)
How high should heart rate be if no interventions are needed after birth?	58% (7)	83% (10)

[Table 1. MCQ]

A Wilcoxon signed-rank test shows a significant improvement in the post-test ( $W = 78$   $Z = 3,04$ ,  $p < 0.005$ ).

The OSCE scores can be seen in table 2.

OSCE						
Umbilical Vein Catheter performance checklist						
	0point	1point	2point	3point	Score	Maximum score
Identify the umbilical vessels (vein and arteries)	1	11	11		22	24
Obtain an umbilical vascular catheter and flush with saline	1	11			11	12
Attach the catheter to a 3-way stopcock	1	11			11	12
Measure and mark 5 cm from the tip of the catheter	1	11			11	12
Insert the end of a smooth forceps into the lumen and dilate it	1		11		22	24
The student is asked how long should the catheter be inserted	2	5	5		16	24
					80% (92)	106
Foreign Body Airway Obstruction performance checklist						
	0point	1point	2point	3point	Score	Maximum score
Correct start on algorithm	1	11	11		22	24
Assess effective or ineffective coughing	1	11			11	12
Assess consciousness	2		10		20	24
Perform effective and correct back blows			12		24	24
Perform effective and correct abdominal thrusts		1		11	34	36
					93% (111)	120
Neonatal resuscitation performance checklist						
	0point	1point	2point	3point	Score	Maximum score
Turn on and set the resuscitator			12		24	24
Starts the clock or notes the time	3	9			9	12
Stimulating the neonate by drying it		12			12	12
Assess the neonates tone	7	5			5	12
Assess breathing and heart rate	4	8			8	12
The neonates gasps						
Places neonate in correct neutral position		12			12	12
Deliver 5 correct ventilations	1	0	11		22	24
Order	3		9		18	24
					83% (110)	132
I.O performance checklist						
	0point	1point	2point	3point	Score	Maximum score
Insertion technique		1	11		23	24
Fluid aspiration	2		10		20	24
Infusion of NaCl			12		24	24
Securing of the line	1	11			11	12
Angle of insertion	1		11		22	24
					93% (100)	106

[Table 2. OSCE]

The gaps seen in the OSCE may be due to specific points not being emphasized enough during the training sessions, or the fact that students' theoretical knowledge is difficult to apply in more complex clinical situations.

**Conclusion:** This small pilot study indicates that students can learn to perform pediatric emergency procedures, in an educational environment. The students performed well in the MCQ but OSCE identified gaps. Future research in students' ability to translate theoretical knowledge into practical skills is necessary.

## Patient Safety

### 17AP1-1

#### Anaesthesia-related and perioperative cardiac arrest in low- and high-income countries. A systematic review with proportional meta-analysis and meta-regression

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**Background and Goal of Study:** Considering the differences in patient safety between low- and high-income countries,<sup>1</sup> the current study compared the available global data on anaesthesia-related and perioperative cardiac arrest (CA) rates in low- and high-income countries according to a country's human development index (HDI) status.<sup>2</sup>

**Materials and methods:** A systematic review was performed to identify studies, in which patients underwent all types of anaesthesia for surgery with perioperative and/or anaesthesia-related CA rates. MEDLINE, EMBASE, SCIELO, LILACS, and extensive hand searches of the relevant reviews' bibliographies were done up to September 2, 2013. There was no language restriction. The proportional meta-analysis calculated the pooled estimate of the weighted rates of the studies with 95% confidence intervals (CI) to assess CA rates by country's HDI status (< 0.8 versus  $\geq 0.8$ ) and over decades (pre-1990s versus 1990s-2010s). Meta-regression was performed to assess CA rates over time and by country's HDI status.

**Results and discussion:** Fifty studies with 11.7 million anaesthetic administrations met the inclusion criteria. Anaesthesia-related and perioperative CA rates per 10,000 anaesthetics declined over decades in both high-HDI (1.9 [95% CI 1.9-2.0] to 0.6 [95% CI 0.5-0.6] and 7.2 [95% CI 7.1-7.3] to 6.1 [95% CI 6.1-6.2], respectively) and low-HDI countries (13 [95% CI 10-16] to 3.0 [95% CI 2.0-3.0] and 27 [95% CI 24-31] to 17 [95% CI 16-19], respectively).

Anaesthesia-related and perioperative CA rates were higher in low-HDI than in high-HDI countries ( $P < 0.0001$ ). A meta-regression showed significant relationship between the risk of anaesthesia-related and perioperative CA and HDI ( $P = 0.02$  and  $0.01$ , respectively).

**Conclusion(s):** Anaesthesia-related and perioperative CA rates declined significantly in both low- and high-HDI countries over decades, with a higher decline in low-income countries. However, anaesthesia-related and perioperative CA rates remain higher in low-HDI than in high-HDI countries in the 1990s-2010s.

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### 17AP1-2

#### Patient safety in continuous infusion epidural analgesia: prospective analysis of indicators in a general hospital

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**Background and Goal of Study:** The Helsinki Declaration on Patient Safety proposes the use of protocols for pain relief. Continuous infusion epidural analgesia (CIEA) is a routine method for the treatment of pain. Most complications following perioperative central neuraxial blocks occur after epidurals. The aim of this study was to analyse aspects related to the safety of CIEA.

**Materials and methods:** A prospective study was carried out for 12 months. The study included patients over 18 years treated with CIEA. Age, sex, body mass index (BMI), and the number of days the epidural catheter (EC) was in place were recorded. The following indicators were analysed:

- placement and fixation: level of training (staff physician, resident), number of EC insertion attempts, dural puncture, radicular pain, bleeding, type of EC fixation dressing;
- follow-up: filling-in of CIEA checklist, labelling of perfusion system, proper recording of dosage on patient records;
- incidents: administration route errors, EC removed before scheduled time, lost EC and side effects.

Data are expressed as median (10th-90th percentiles) and percentages. The  $\chi^2$  test was used for the bivariate analysis.

**Results and discussion:** We studied 318 patients (158 men/160 women). Median age was 62.3 years (42.0-80.1); BMI, 30.4 (21.8-41.8); and number of days EC was in place, 2.2 (1-4). Table 1 shows the results of the indicators analysed. The participation of residents in EC placement and more than 3 attempts at EC insertion increased the percentage of incidents and complications ( $p=0.002$  and  $p=0.05$ ). The use of non-transparent dressings compared to other types reduced EC loss ( $p=0.05$ ).

Placement and fixation		Type of fixation dressing		EC removed before scheduled time	11.3%
<b>Level of training</b>		Transparent	18.0%	EC lost	13.2%
Staff physician	68.7%	Reinforced transparent	21.5%	Post-dural puncture headache	0.6%
Resident	40.2%	Non-transparent	60.5%	Bleeding	0.3%
Both	8.9%	<b>Follow-up and record keeping</b>		Motor block	0.3%
<b>Number of attempts</b>	1.8 (1-3)	Filling-in of checklist	60.5%	Respiratory depression	0%
<b>Incidents</b>		Labelling of perfusion system	65.3%	Nerve lesion	0%
Dural puncture	2.5%	Recording of dosage on patient records	83.3%	Epidural abscess	0%
Radicular pain	4.4%	<b>Incidents and complications</b>		Epidural hematoma	0%
Bleeding	6.0%	Administration route errors	0.3%		

[Table 1]

**Conclusion(s):** Our study identified incidents and complications associated with CIEA and have led us to propose the following measures:

- limiting the number of EC insertion attempts,
- improving on resident supervision
- standardising techniques for EC placement and fixation,
- filling in the CIEA checklist.

### 17AP1-3

#### Quality control of anaesthesiologists' handovers from the OR to the postoperative ICU

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**Background and Goal of Study:** Handover has been considered one of the key elements for improving patient safety and minimizing risks of potential postoperative complications. The aim of this study was to analyse the levels of completeness of the anaesthesiologists' handovers of patients coming from the OR to ICU.

**Materials and methods:** This prospective, single-blind, descriptive, observational study collected over a period of two months all handovers of surgical patients admitted in our ICU from 8:00-16:00 staying at least 24 h in our unit. All handovers were recorded with a hidden voice recorder. The levels of completeness of the following 15 variables were analysed: name, age, allergies, preoperative coexisting diseases (PCD), home treatment (HT) of the patient; surgery indication, procedure and duration; anaesthetic technique (AT), airway management (AM), intraoperative complications (IC), intraoperative bleeding, venous/arterial cannulae, drains and antibiotics prophylaxis (ATP). Additionally, the handover duration, the numbers of interruptions during each

handover and reasons for them as well as the expertise of the reporting physician were analysed. Data are presented as percentages or absolute numbers.

**Results and discussion:** A total of 38 handovers were included. The levels of completeness measured were: procedure 89% of the cases, surgery indication 81%, PCD 78%, age 73%, AT 63%, ATP 60%, IC 55%, venous/arterial cannulae 50%, allergies 44%, bleeding 44%, name 42%, AM 39%, surgery duration 26%, HT 18% and drains 10%. Mean handover duration was 2min 13sec, mean number of interruptions per handover was 1. Most of them were phone calls or staff questions about ventilator setup or due to patient-related issues. Residents achieved higher levels of completeness than specialists. In 3 cases another faculty but not the responsible one transferred handovers. Levels of completeness lower than 50% were considered to be insufficient.

**Conclusion(s):** In our daily handovers, 7 out of 15 studied variables did not reach satisfactory levels of completeness. Data concerning the name, allergies, home treatment of the patient as well as surgery duration, airway management, bleeding and drains should be improved. A carefully completeness of handovers may improve the patient's care quality. This is a preliminary study leading to design a structured information transfer checklist for preventing omissions of relevant information during our handovers from the OR to the ICU.

### 17AP1-4

#### Swedish Surgical Outcome Study (SweSOS), a sub study of the European Surgical Outcomes Study (EuSOS). Characteristics and outcome of the Swedish subset of EuSOS to identify the predictors of short- and long-term mortality in Sweden. Analytical, descriptive and prospective cohort study

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**Background and Goal of Study:** European Surgical Outcomes Study (EuSOS 2012) revealed large variations in outcome among countries in Europe. In-hospital mortality and intensive care unit (ICU) admission rates in Sweden were low, going somewhat against the assumption that access to ICU improves outcomes. Possible reasons for this include the possibility that the Swedish population were less ill and that post anaesthesia care units (PACUs) were able to provide some critical care services.

In this study, we describe the population and surgery characteristics of the Swedish subset of EuSOS with 1 year follow-up to identify predictors of mortality in Sweden.

**Materials and methods:** Swedish data from EuSOS database was obtained. This was completed and confirmed by contacting local coordinators. We tested the association between 16 variables and short- (30-day) and long- (12 month) mortality in univariate analyses. Standardized mortality rates against an age and sex matched population were calculated.

**Results:** 303 patients were lost to follow-up, leaving 1011 included. The patient and operative demographic data of the SweSOS cohort were very similar to the EuSOS cohort.



Comparison between the 2 cohorts		SweSOS (n=1011)	EuSOS (n=46539)
Age	Years±SD	57.4±19.5	56.7±18.5
Sex	Male(%) / Female(%)	48.1/51.9	48.6/51.4
Smokers	%	15.4 %	19.9 %
ASA class	I	30.4 %	25.0 %
	II	38.4 %	46.4 %
	III	28.2 %	24.9 %
	IV	3.1 %	3.3 %
Comorbid disorder	Cirrhosis	1.1 %	1.1 %
	CCF	4.4 %	4.6 %
	COPD	10.0 %	11.1 %
	CAD	13.0 %	13.5 %
	NIDDM	5.0 %	4.5 %
	IDDM	5.6 %	7.5 %
	Metastatic cancer	5.9 %	4.7 %
	Stroke	5.3 %	4.3 %
Grade of surgery	Minor	33.0 %	25.9 %
	Intermediate	43.3 %	47.8 %
	Major	23.7 %	26.2 %
Priority of surgery	Elective	67.7 %	75.3 %
	Urgent	25.9 %	19.2 %
	Emergency	6.4 %	5.5 %
Surgical Category	Orthopaedic	26.3 %	26.2 %
	Breast	5.0 %	3.2 %
	Gynaecological	8.1 %	8.5 %
	Vascular	2.3 %	5.1 %
	Upper GI	5.5 %	4.8 %
	Lower GI	11.2 %	10.7 %
	Hepato-biliary	3.7 %	4.8 %
	Plastics/Cutaneous	5.3 %	5.2 %
	Urological	10.1 %	10.5 %
	Kidney	1.4 %	1.0 %
	Head and Neck	12.7 %	12.1 %
Other	8.4 %	7.4 %	
Days in hospital	Days (IQR)	2.0 (1.0-6.0)	3.0 (1.0-7.0)
ICU admission	%	3.6 %	8.0%
Days in ICU	Days (IQR)	7.5 (2.4-8.6)	1.2 (0.9-3.6)

[Characteristics of SweSOS and EuSOS cohorts]

In-hospital, 1-, 3-, 6 and 12-month mortalities were 1%, 1.8%, 3.9%, 5% and 8.5% respectively.

In univariate analyses, age, ASA class, multiple comorbidity, cirrhosis, coronary artery disease and cancer were significantly associated with 30d mortality. The urgency but not grade of surgery was also important. Mortality was doubled when WHO checklist was not used, although this was not frequent (only in 9.4%). ICU admission but not an extended PACU stay was associated with 30d and 12m mortality.

Notably, sex, BMI, smoking status, cardiac output monitoring and night surgery had no effect on mortality.

**Conclusions:** In Sweden, factors associated with short- and long-term mortality after surgery were age, multiple comorbidities, emergency procedures and admission to ICU. Patient and surgical characteristics were similar in SweSOS and EuSOS cohorts. The data do not support that the Swedish population was healthier, or that the provision of extended PACU care could explain differences in mortality and ICU admission rates.

## 17AP1-5

### Quality of registration and safety of moderate to deep sedations performed by sedation practitioners

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**Background and Goal of Study:** Deep sedation using propofol is more frequently used for diagnostic and therapeutic procedures outside the operating room. Propofol has a rapid onset and short effect of duration, but also a small therapeutic range associated with the risk of haemodynamic and respiratory side effects. In The Netherlands, qualified sedation practitioners (specialized anaesthesia nurses, non-physicians) perform moderate to deep sedation using propofol and opioids. We investigated the safety and quality of these nurse-administered sedations.

**Materials and methods:** An Adverse Event Reporting Tool (AERT), designed by the World Society of Intravenous Anesthesia (SIVA) Sedation Task Force

(1), was introduced and sedation practitioners were asked to fill in one form for each sedation performed. Data of 1615 cases were collected during the first 8 months of registration (October 2012 - May 2013), and 811 cases not involving an anesthesiologist at the scene were analysed for incidence of sedation related adverse events (e.g., changes in heart rate or blood pressure  $\pm$  25% of baseline, airway obstruction, decline of oxygen saturation). Analysis whether an AERT was made for every sedation and whether these AERT were filled in completely and correctly was used to determine quality of registration. **Results and discussion:** One or more adverse events occurred in 26.6% of all sedations, most frequently oxygen desaturation (< 90%) and hypotension (>25% lower than baseline). Event rates were (not-significantly) higher in patients with higher ASA classes. An adverse outcome was only determined in 2 cases.

An AERT was used in 92.4% of all sedations, however, only 48.1% of all AERT were filled in completely. According to the electronic registration system, adverse events were reported correctly only on 60.4% of all completed AERT.

**Conclusion:** Serious injury caused by sedation related adverse events was extremely rare, suggesting that deep sedations performed by sedation practitioners is safe under the local circumstances. The number of non-serious adverse events shows that there is still room for quality improvement. Sedations in patients with higher ASA classes go along with higher complications rates. Quality of registration in the first 8 months was poor and health professionals should keep in mind that proper evaluation of sedation quality can only be done when quality of registration is improved.

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- Mason KP et al., BJA 2012;108:13-20

## 17AP1-6

### Perioperative use and safety of colloids in patients undergoing hysterectomies

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In the perioperative period colloids are used to obtain circulatory stabilization. Distinction is made between natural (Albumin) and artificial colloids (e.g., Hydroxyethyl Starch, HES). Recently, HES has come under scrutiny after several trials suggested it to be associated with increased risk of mortality and acute renal injury in critically ill patients. While both major trials and large-scale observational data are lacking, the debate continues regarding the safety of perioperative HES use. Using a large national database we aimed to study the use and safety of HES vs Albumin in elective surgery.

**Methods:** After IRB approval, data on patients undergoing hysterectomies were accessed from the Premier Perspective database (Premier Inc., 2006-2012). Use of HES and Albumin was determined for the day of surgery and the day after surgery creating four groups: HES use only (HES), Albumin use only (ALB), HES/Albumin both used (COMB), no HES or Albumin used (NONE). Primary outcomes of interest were acute renal failure, need for blood transfusion, 30-day mortality, costs of hospitalization (COH), and length of stay (LOS). These were assessed in the four intervention groups, overall, and by patient subgroups based on intensive care unit admission, advanced age (75+ years), and cardiovascular compromise.

**Results:** Our analysis included 520,476 patients from 515 hospitals. HES was used in 2.9%, Albumin in 0.9% and both were used in 0.2% of the cases, respectively. Mean age for the HES group was 50.9 (SD 13.2) vs 56.4 (SD15.1) for ALB, 59.0 (SD 15.0) for COMB, and 47.2 (SD 11.6) years for the NONE group. A similar pattern was found for the primary outcomes: acute renal failure 1.8% vs 4.9%, 9.7% and 0.3%; blood transfusion 12.0% vs 25.6%, 29.1% and 2.6%; 30-day mortality 0.4% vs 1.0%, 2.5% and 0.05% (all P < 0.001). COH and LOS were \$13,417 vs \$26,249, \$33,837 and \$7,579; 4.1 days versus 8.1 days, 10.8 days and 2.0 days, respectively. Patterns did not change when analyzing the patient subgroups.

**Discussion:** While there have been safety concerns on HES use in critically ill patients, in this ongoing analysis we were able to show that patients receiving various types of colloids differed significantly in characteristics and more importantly in complication rates. Ongoing regression analysis is targeted to determine the independent impact of HES and Albumin on perioperative outcomes in this elective surgical population.

## 17AP1-7

### Perioperative anesthesia-related complications

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**Background and Goal of Study:** Surgical morbidity and anaesthesia related complications are important public health issues worldwide. Perioperative morbidity and major complications are associated with decreased long-term survival. In this retrospective study, we examined the anaesthesia related perioperative complications.

**Materials and methods:** The medical records of all the patients, who required any type of anaesthesia between December 2012 to October 2013, were reviewed retrospectively. The demographic data, types and durations of the procedures and anaesthesia, status of emergency, anaesthesia-related complications and management of those complications were recorded.

**Results and discussion:** Between December 2012 and October 2013, 10870 surgical procedures were performed under anaesthesia. Mean age of patients was  $32.1 \pm 20$  and mean duration of procedures was  $88.6 \pm 87$  minutes. Anaesthesia types were general anaesthesia (n=9500), central neuroaxial blocks (n=735), sedation (n=608) and peripheral blocks (n=27), respectively. Total rate of perioperative anaesthesia-related complications was 5.5% (hypo/hypertension 1.6%, intubation difficulty 0.6%, allergic reactions 0.4%, pain 1.2%, nausea/vomiting 1.2% and others 0.5%). Geriatric group patients' complications rate was significantly higher when compared to paediatric and middle-age group patients. ( $p=0.00$ ). Also their intensive care admission rates were significantly higher when compared to middle age group ( $p=0.01$ ). No significant difference was shown between laparoscopic and open surgeries among complications. The complication and intensive care unit admission rates of emergency and planned surgeries were similar.

**Conclusion(s):** Some anaesthesia-related minor complications cause significant patient discomfort but no long-term pathologies, whereas major complications are related with long-term morbidity and mortality. Recent reports has shown that estimated morbidity rate was between 3-17% (1). In our study minor and major complications' rate was totally 5.5%, similar to the recent outcomes. Good preoperative patient evaluation and postoperative care often decrease the rate of complications. Human factor and inadequate monitoring are major causes of these complications. In order to decrease failure rates and increase quality, guidelines and standardised procedures should be prepared and used.

## 17AP1-8

### Circadian, weekly, and seasonal variability of postoperative mortality

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**Background and Goal of Study:** Hospital mortality is subject to circadian, weekly and seasonal variability. This has been shown for various populations[1,2], settings[3,4], and in different regions of the world[1,2,4,5]. However, a cyclic influence on hospital mortality has not been shown in patients after surgery. Aim of this study was to investigate the circadian, weekly, and seasonal variability of hospital mortality in patients after surgery.

**Materials and methods:** The local ethics committee waived the requirement for consent (EA1/073/13) and we conducted a retrospective analysis of patients undergoing surgery between 2006 and 2011 by reviewing electronic case files at two hospitals of a tertiary care university center. Cyclic variability was assessed by fitting logistic regression models.

**Results and discussion:** In this preliminary analysis, a total of 218.758 patients was analysed. Hospital mortality showed variability over the course of the day, during different weekdays, and different months ( $p < 0.01$ ): Mortality was higher after surgeries conducted in the afternoon than in the morning, was higher on the weekends, and especially high in february.

**Conclusion(s):** Hospital mortality after surgery is subject to circadian, weekly and seasonal variability. The reasons for this variability remain cryptic, further data acquisition and analysis are required to answer these questions.

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## 17AP1-9

### Predictor equation for cystectomy mortality and morbidity risk: a prospective study

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**Background:** Preoperative estimation of morbidity and mortality risk is a useful tool in surgical decision-making. P-POSSUM estimates a patient's mortality and morbidity within 30 days validated for general surgery'. The study's aim was to assess the predictive ability of this equation in patients undergoing radical cystectomy in our hospital.

**Methods:** Prospectively collected physiological, operative parameters and 30-day morbidity and mortality in patients undergoing radical cystectomy, since January 2013. Applied P-POSSUM to calculate the expected morbidity and mortality for each patient. Patients(T) were stratified into 4 morbidity risk groups (MR): 20-40% | 40-60% | 60-80% | 80-100%. Each MR group included patients with any surgical complication(C), according to P-Possum, and patients without complications(NC). Expected morbidity(EM) was calculated(MR x T) as well as observed-to-expected morbidity ratio(O/EM) for each group. Applying the chi-square test the predictive ability was assessed. Preliminary results are presented.

**Results:** Included 17 patients; male-82%; older than 71 years-old-41%. The results are presented on the next table. Predictive value of P-POSSUM for mortality couldn't be calculated(only 2 patients included). The distribution of observed-to-expected morbidity was not significantly different (chi-square test  $p=0,71$ ).

Observed Morbidity (MR)	20-40%	40-60%	60-80%	80-100%
(NC) no surgical complications	3	3	1	0
(C) surgical complications	1	3	2	4
Total (T)	4	6	3	4
Estimated Morbidity (EM)	0,8 - 1,6	2,4 - 3,6	1,8 - 2,4	3,2 - 4
Ratio O/EM (EM=MRxT)	0,63 - 1,25	0,83 - 1,25	0,83 - 1,11	1 - 1,25

[P-Possum results and observed-to-expected morbidity]

**Conclusion:** In this preliminary results the P-POSSUM equation was a good predictor for morbidity. The observed results are within the expected range for the value of morbidity, despite the small sample size and the chi-square test showed that expected morbidity was no different from the observed morbidity. The predictor ability for mortality risk was not assessed due to the limited mortality outcomes, an issue that we hope to overcome increasing the number of patients.

So, the P-POSSUM equation can be a very useful tool in surgical decision-making for proposed radical cystectomy in our hospital. After these encouraging preliminary results we will continue with our study to get more accurate results.

## 17AP3-2

### Do comparative anaesthetic performance reports result in improved patient care?

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**Background and Goal of Study:** Revalidation and recent government policy documents highlight the importance of healthcare service quality measurement and improvement at both individual and organisational levels.<sup>(1,2)</sup> However, in anaesthesia, there is currently a lack of consensus on how 'quality' should be described, how clinical outcome data is provided, and whether this process results in improved patient care. We aimed to analyse a locally-developed PACU database to investigate whether the introduction of individual comparative performance reports was associated with an improvement in patient care.

**Materials and methods:** Starting in April 2010, patient outcome data has been recorded in our PACU. Parameters recorded include: lowest temperature, worst pain score (0-10), incidence of nausea, incidence of vomiting, and unexpected admissions. All theatre cases requiring an anaesthetist (excluding cataract surgery, paediatric cases and obstetric deliveries) are analysed, and individual comparative performance reports distributed every six months. Reported variables include incidences of: hypothermia (temperature < 36°C), severe pain (>5), moderate pain (>3), nausea, vomiting, and unexpected admissions. The database was investigated from April 2010 to February 2013 using time series analysis to assess for significant trends in reported clinical outcomes. The trend was tested against a null hypothesis of no trend using linear regression.

**Results and discussion:** Of the 24,025 cases meeting inclusion criteria, 21,217 (88.3%) had recovery data recorded. There were statistically significant yearly improvements in the odds of all outcomes other than vomiting: 39% improvement in hypothermia ( $p < 0.001$ ); 9.9% improvement in severe pain ( $P < 0.001$ ); 9.6% improvement in moderate pain ( $p < 0.001$ ); 9.7% improvement in nausea ( $p = 0.02$ ) and 30% improvement in unexpected admissions ( $p = 0.001$ ). Vomiting showed a non-significant trend in improvement, 6.8% ( $p = 0.28$ ).

**Conclusion:** This study demonstrates that recording clinical outcome measures in recovery, and the production of individual comparative performance reports has been associated with significant improvements in patient outcomes following surgery.

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## 17AP2-1

### Identifying patients using the wristband identification TAGS

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**Background and Goal of Study:** Recently, 236 incidents including near misses relating to improper patient identification were reported to the NPSA.<sup>1</sup> Changing work patterns means multiple handovers and hence its imperative to properly identifying patients.<sup>2</sup> The NPSA published patient identification policies to be implemented by all NHS organisations in England and Wales.<sup>1</sup> The aim of this study was to find out the compliance of the Hospitals in implementing the recommendations.

**Materials and methods:** Target groups were patients presenting for surgery and theatre staff. Each patient got tagged with an audit form at theatre reception that followed the patient through theatres and recovery. The wristbands were checked to ensure they met the NPSA's design requirements.<sup>3</sup> The documented accuracy of the core patient identifier information on wristbands was checked verbally with the patient and hospital notes. Staff knowledge of the health board patient ID policy<sup>4</sup> was assessed on an audit questionnaire.

**Results and discussion:** A total 178 patients and 50 staff members were audited. 99% patients had wristband on with accurate information when they entered the theatre complex. 8% of patients had their wristbands removed in the theatre complex. 2% of patients were not wearing wristbands in theatre and/or in recovery. Majority of staff were aware of the responsibility for replac-

ing patients ID wristband if it was removed or missing. Two thirds of the staff had sometime in their career removed patients ID bands. Only a third of the staff had reported incidents relating to patients not wearing ID bands or with wrong information on the ID band.

**Conclusion(s):** To achieve 100% compliance with the NPSA policy, Staff training and information dissemination needs to be intensified. Patient education and participation in the identification process should be encouraged.

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## 17AP2-2

### Validation of a questionnaire measuring exposure to negative intraoperative behaviors

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**Background & Goal:** Negative intraoperative behaviors (NIB), including incivility and bullying, undermine a culture of operating room (OR) safety. Although thought to be common, the predictors of NIB have not been well studied. Measuring the prevalence and predictors of NIB requires a validated questionnaire. Our purpose was to develop a validated questionnaire for use with OR workers (nurses, physicians and technicians).

**Materials and methods:** Exposure to NIB was taken to be a multidimensional construct, depending on the intended victims:

- 1) Not directed to any group (undirected);
- 2) Directed towards out-group members, i.e. others in the OR;
- 3) Directed towards patients;
- 4) Directed towards in-group members i.e. colleagues; and
- 5) Personal exposure.

Pretesting involved:

- 1) Use of the Fry readability formula to ensure wording was at an acceptable level;
- 2) Evaluation of individual question relevance and clarity by 19 OR workers and 3 psychometricians; and
- 3) "Think aloud trials" with 4 anesthesiologists. Between July-October 2013, the questionnaire was distributed (online and at perioperative conferences) to Canadian OR workers. Construct factor structure was examined using exploratory factor analysis. Eigenvalues (> 1) and cumulative explained variance (> 80%) determined the number of factors extracted. Extraction was done using principle axis factors. Interpretability was improved with promax rotation. Internal consistency was examined using Cronbach's alpha and other statistical methods (Table).

	N	Items	Cronbach's alpha	Tukey's test for non-additivity (p-value)	Highest alpha with deletion	Inter-item correlation (avg, range)	% Variance explained	Kaiser-Meyer-Olkin statistic	Bartlett's test of sphericity (p-value)
Exposure to NIB	1087	50	0.995	<0.001	0.995	0.83 (0.08-1.0)	99.8	0.990	<0.001
Factor 1- Major transgressions	1087	26	0.998	<0.001	0.998	0.961 (0.752-1.0)			
Factor 2-Minor transgressions	1087	24	0.997	<0.001	0.997	0.950 (0.738-0.99)			

[Questionnaire internal consistency and validity]



**Results and discussion:** 1088 Canadian OR workers completed the questionnaire. Exposure to NIB was best seen as a construct with 2 dimensions: 1) High-concern transgressions (directed towards self and witnessing egregious behavior); and 2) Low-concern transgressions (experiencing minor transgressions, witnessing minor and moderate transgressions, and witnessing undirected behaviors). The scale and its dimensions showed excellent internal consistency. Deletion of any one question was not found to improve internal consistency and all questions were therefore retained.

**Conclusion:** We have developed a questionnaire assessing exposure to NIB which employs appropriate language and has excellent internal consistency and validity. It will enable us to now better study the scope and antecedents of NIB.

### 17AP2-3

#### **Nurse administered propofol sedation with a refract bolus regimen for 7364 gastroenterologic endoscopies. A retrospective evaluation of regimen safety**

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**Background and Aim:** The use of Nurse Administered Propofol Sedation (NAPS) for endoscopies is a medico legal issue in many countries, including Denmark and propofol sedation has not been established as an alternative for the majority of endoscopic procedures performed. An age adjusted intermittent bolus strategy to achieve moderate sedation has been used in our unit since 2007. Only non-emergency gastrointestinal (GI) endoscopies and American Society of Anesthesiologists (ASA) class I, II and stable class III patients were sedated. We conducted this retrospective analysis to evaluate the safety of the regimen and patient selection criterion for moderate to deep sedation.

**Methods and Materials:** A retrospective case-control study of colonoscopy, sigmoidoscopy and gastroscopy performed in NAPS from May 2007 through December 2012. Data were age, procedure, ASA Class, sedation time, propofol dose and adverse events. For statistical analysis we used logistic regression.

**Results and discussion:** We included 6840 patients undergoing 7364 procedures for evaluation. Frequency of hypoxia (< 92%) and hypotension (>30% MAP reduction) were 3.2 % and 3.1 % respectively. Few needed assisted ventilation (0.5 %) or ephedrine (0.8 %). An anaesthesiologist was called 6 times and one patient needed endotracheal intubation. Overall, Age (p < 0.001), ASA class III (0.017) and propofol dose (p= 0.001) were individual predictors of adverse events. Patients > 60 years needed more airway manipulation, mask ventilation and more circulation support (p < 0.001) than patients < 60 years.

In accordance with previous studies [1;2], ASA class III was a predictor of adverse events even though only patients in stable ASA class III were included. Safety parameters were comparable to that of others [1;2].

**Conclusion:** NAPS is a generally safe procedure. ASA class III, total propofol dose and age are independent predictors of adverse events. Age > 60 years is a predictor for greater need of respiratory and circulatory support.

**References:**

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### 17AP2-4

#### **Ultra fast track anaesthesia for patients scheduled for robotic totally endoscopic coronary artery bypass is feasible and safe**

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**Background and Goal of Study:** The first robotic Totally Endoscopic Coronary Artery Bypass graft (TECAB) was initially described in 1999. Although this surgery offers significant reduction in recovery time, no study has reported the feasibility of Ultra Fast Track Anaesthesia (UFTA) for such procedure. The present observational retrospective study investigated the feasibility and efficacy of UFTA for patients undergoing robotic TECAB.

**Materials and methods:** After obtaining institutional ethics committee approval, we reviewed retrospectively 38 consecutive patients' charts scheduled to receive an internal mammary artery graft to the left anterior descending artery robotically-assisted with closed chest and beating heart. The same surgeon performed all the procedures and the authors realized the anaesthesia (AC, CZ). All patients received total intravenous anaesthesia using target controlled infusion (TCI) models for both remifentanyl and propofol. For the best surgical practice, one lung ventilation (OLV) was permitted with the insertion of a double lumen tube. At the end of extracorporeal life support, multimodal analgesia was administered. The main outcomes were feasibility and safety of UFTA, which were defined as the ability of tracheal extubation at the end of the surgery according to published criteria<sup>1</sup> and the incidence of postoperative complications, respectively. Data are expressed as mean±SD.

**Results and discussion:** Duration of anaesthesia and one lung ventilation were 374±58 and 264±43 min, respectively. All patients were successfully extubated in the operating room immediately at the end of the surgery. No patients exhibited severe hypoxia or hypercarbia postoperatively requiring prompt reintubation. However, 10 patients required postoperative non-invasive ventilation. Intensive care unit and hospital length of stay were 33±22 hours and 8.5±3.5 days, respectively.

**Conclusion:** Robotic TECAB with OLV could trigger significant pathophysiological alterations conducting to intra-pulmonary shunting, activation of inflammatory process and changes in cardiac output resulting in oxygenation and hemodynamic disturbances. However, all patients included in our study met all the criteria to be extubated at the end of the procedure without requirement of reintubation. Our results strongly suggest that UFTA for patients undergoing robotic TECAB is feasible and safe.

**Reference:**

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### 17AP2-5

#### **Simulation instructor training to improve patient safety translation to clinical setting - crisis resource management, debriefing, speak up and close-loop communication**

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**Background:** There is good evidence that simulation training improves provider and team self-efficacy and competence on manikins.<sup>1</sup> Simulation instructors require specific training that includes many aspects that are also essential for the definition and the implementation of a safety culture.<sup>2</sup> Although patient safety has been increasingly recognized as a key dimension of quality care, systematic safety education for healthcare professionals is lacking.<sup>3</sup> The goal of this study is to evaluate simulation instructor course effect on anesthesiologist's behavioral changes in clinical setting towards patient safety.

**Methods:** For this prospective study, we developed a basic simulation instructor course that included overlapping themes with safety education. All participants provided their professional history review and completed the same psychometric and multidimensional survey, before, at the end and 6 months after the course. The survey was designed to evaluate the relevance (value given to the clinical translation of each concept) and the self-perspective of personal application of CRM, debriefing, speak up and close-loop communication on clinical practice, using a Likert scale of 5 points (1=in total disagreement, 5=in total agreement). To determine pre-post-6 months after course changes the Fisher's exact test was performed (p value < 0.05 was considered significant, SPSS® 20.0).

**Results:** Sixty-three anesthesiologists underwent the training. All participants agreed totally - pre, post and 6 months after the course - that all concepts were determinant to patient safety. The application on clinical setting improved after the course for each concept (CRM, p < 0.0001; debriefing, p=0,001; speak up, p=0,045 and close-loop communication, p=0,003) and was consistent during the following 6 months for all the concepts. Speak up was the concept with lower translation to clinical practice (32% agreed totally that applied speak up before the course, 48% at the end and 46% six months after).

**Conclusions:** Demand for curricula in patient safety have created new responsibilities for medical educators. Anesthesiologists give a major relevance to key-concepts of patient safety. Simulation instructor training may improve consistently the translation of these concepts to clinical setting. Based on the same ethical values, this study underlines the importance of simulation training for the implementation of a safety culture.

**Reference:**

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## 17AP2-6

### Validation of a questionnaire measuring responses to negative intraoperative behaviors

Villafranca A.<sup>1</sup>, Robinson S.<sup>2</sup>, Rodebaugh T.<sup>3</sup>, Villafranca P.<sup>4</sup>, Yasinski L.<sup>5</sup>, Jacobsohn E.<sup>1</sup>, Intraoperative Behaviors Research Group

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**Background and Goals:** Negative intraoperative behaviors (NIB) undermine a culture of safety in the operating room (OR). Adverse consequences to NIB are moderated by behavioral responses of those exposed to NIB. Currently, there is no model of behavioral responses to NIB, thus the purpose was to develop and validate one.

**Materials and methods:** Responses to NIB were conceptualized as falling on a continuum, ranging from responses aggressively opposing NIB to those enabling NIB. Five questions were developed for each of nine strategies on this continuum, including: coercing, competing, compromising, collaborating, ingratiating, being disingenuous, avoiding, acquiescing and promoting. Pre-testing involved:

- 1) Use of the Fry readability formula to ensure wording was at the appropriate level;
- 2) Evaluation of individual question relevance and clarity by 19 OR staff and 3 psychometricians; and
- 3) "Think aloud trials" with 4 anesthesiologists.

The questionnaire was distributed to Canadian OR staff between July-October 2013 (online and at perioperative conferences). This behavioral response questionnaire was an adjunct to another survey assessing exposure to NIB. Construct factor structure was examined using exploratory factor analysis. The number of factors extracted was based on Eigen values ( $> 1$ ) and cumulative explained variance ( $> 80\%$ ). Extraction was accomplished using the principle axis factor method, and interpretability was improved with promax rotation. Internal consistency of each extracted dimension was examined using Cronbach's alpha with and without item deletion, and through item-scale and inter-item correlations.

**Results:** 776 respondents completed the questionnaire. Behavioral response to NIB was best seen as a construct with 2 dimensions (see table):

- 1) Deviance, and 2) Temperance.

Deviance consisted of coercing, strong competing, being disingenuous, ingratiating, and promoting responses. Temperance consisted in acquiescing, avoiding, collaborating, mild competing, and compromising responses. Internal consistency for the extracted dimensions was excellent. All questions were retained, as deletion of any question was not found to appreciably improve internal consistency.

	N	# Items	Cronbach's alpha	Tukey's test for non-additivity (p-value)	Highest alpha with deletion	Inter-item correlation (avg, range)	% Variance explained	Kaiser-Meyer-Olkin statistic	Bartlett's test of sphericity (p-value)
Responses to NIB	726	45	0.995	<0.001	0.995	0.83 (0.194-1.00)	99.8	0.990	<0.001
Factor 1-Deviance	726	23	0.997	<0.001	0.998	0.95 (0.8-0.99)			
Factor 2-Temperance	726	22	0.999	<0.001	0.999	0.978 (0.857-1.00)			

[Questionnaire consistency and factor structure]

**Conclusions:** We have developed an appropriately worded, internally consistent and valid questionnaire measuring responses to NIB. Such a model will be useful to help understand the potential effect of responses to NIB on patient outcomes, OR staff well-being, and OR economics.

## 17AP2-7

### Measurements of fatigue in anesthesiologists with human herpes virus-6 DNA extracted from saliva

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**Background and Goal of Study:** We suspected that human herpes virus-6 (HHV-6) is part of the etiology of exanthema subitum in infants, and that HHV-6 stays in salivary gland cells as a latent infection. In addition, the involvement of HHV-6 has been noted in the relationship of chronic fatigue syndrome. To explore the possibility that HHV-6 DNA values can be used as an indicator of anesthesiologist's fatigue, extracted HHV-6 DNA from the saliva of anesthesiologists before and after they worked a night shift.

**Materials and methods:** We prospectively examined the relevance between the amount of HHV-6 DNA from saliva and the degree of fatigue. The study was approved by the ethics committee of University of Tsukuba Hospital. Informed consent was obtained from each subject. Saliva was collected from 11 anesthesiologists in our hospital before and after they worked a night shift, and 37 patients who were to undergo elective body surface surgery, when they were resting quietly. All patients were classified as American Society of Anesthesiologists-Physical Status (ASA-PS) I. The degree of fatigue among the anesthesiologists was measured using Visual Analog scale from 0 to 100. HHV-6 DNA was extracted from saliva. DNA in the saliva was collected with the ORAgene DNA kit. Reverse transcription-polymerase chain reaction was performed with the 7500 Fast Real Time PCR system and the TagMan Fast Universal PCR Master mix. The data were analyzed with unpaired or paired Student's t-tests.

**Results and discussion:** HHV-6 DNA was detected in 10 of the 11 (91%) anesthesiologists and eight of the 37 (22%) patients ( $p < 0.05$ ). The amounts of virus from the fatigued doctors after a night shift were higher than those collected before duty. The degree of fatigue after a night shift is conjectured to be strong, because HHV-6 DNA was detected in only very small quantities or not detected in the non-fatigued doctors and the resting patients.

**Conclusions:** The degree of fatigue of doctors can be predicted by using HHV-6 DNA extracted from their saliva. We suspected that the measurements of HHV-6 DNA extracted from saliva is a useful method for objectively quantitating an individual's degree of fatigue. This method could be used to help prevent medical accidents from overwork or burnout syndrome.

## 17AP2-9

### Crisis resource management - an audit of safety processes

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**Background and Goal of Study:** It is well recognised that human factors play a vital role in the outcome of an anaesthetic crisis. Stress can affect memory, cognition and situational awareness. The Association of Anaesthetists of Great Britain and Ireland (AAGBI) therefore mandates that emergency guidelines are immediately available<sup>1</sup> and in our theatres we display the contact details of an "emergency anaesthetist" for immediate assistance.

We performed an audit to see if these measures have become embedded in practice.

**Materials and methods:** 18 theatres were surveyed on a single day. The anaesthetist, assistant and a member of theatre staff were asked if they knew the name, location and bleep number of the emergency anaesthetist. Each theatre was checked for display of these details and a full set of emergency anaesthetic guidelines.

**Results and discussion:** Only 4/18 theatres displayed the emergency bleep number. Although 12/18 anaesthetists knew the number, as compared to 6/36 other staff, in crisis they would be relying on either memory or others to call for help. Emergency guidelines were missing entirely in 2 theatres and incomplete in one. This is concerning; we rely on having time-critical information and help available. These results were presented at our departmental meeting with discussion around process drift and our professional responsibility to know essential information<sup>2</sup>.

Crises are rare events, leading to complacency; also, emergency contact details can be too complicated. We will replace daily contact details with a single displayed telephone number, with clear responsibility for checking that both this and guidelines are present and re-audit outcomes in January.

**Conclusion(s):** This was a wake-up call, highlighting that initiating a process is not enough. The same human fallibility that necessitates the need for

memory aids and additional help during crises may also mean we become complacent. However, adoption of safety measures is part of our professional duty. Such tasks must be made as simple as possible and processes must be monitored to prevent drift into unsafe practice and normalisation of deviance.

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## 17AP2-10

### Feasibility of an intensive care quick reference checklist manual - a simulation-based trial

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**Background:** Checklists may improve medical staff performance during medical crises. We tested the effect of a quick reference manual (QRM) consisting of checklists for non-routine (abnormal) and emergency procedures in intensive care crises that were simulated in a high-fidelity simulation center modelling an intensive care unit (ICU).

**Methods:** 16 teams of one ICU resident and two ICU nurses each completed four crisis scenarios, in which they were randomized to use the QRM or to perform without any additional cognitive aid. In two of the scenarios, checklists could be used immediately (type 1 scenarios) and for the remaining, some further steps e.g. confirming diagnosis, were required first (type 2 scenarios). Outcome measurements were number of predefined critical treatment steps and time to completion of >50% and >75% of steps respectively.

**Results:** Participants initiated critical treatment steps faster and more completely according to appropriate treatment guidelines when using checklists (9 vs. 7 critical steps with and without QRM,  $p < 0.05$ ). Benefit of the QRM was better in type 2 scenarios than in type 1 scenarios (2 vs. 1 additional critical step,  $p < 0.05$ ). In type 2 scenarios, time to complete 50% and 75% of treatment steps was faster with the use of a QRM ( $p < 0.005$ ).

**Conclusions:** Use of checklists in ICU crises has a benefit on the completion of critical treatment steps. Within the type 2 scenarios, treatment steps were fulfilled faster with the QRM. The implementation of a QRM for intensive care crises is a promising approach that may improve patients' care, but further research is needed on checklist design, acceptance and implementation.

## 17AP2-11

### Anaesthesia assessment prior to the decision to offer bariatric surgery dramatically reduces post-operative ICU admissions

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**Background and Goal of Study:** It is difficult to reverse a decision to perform bariatric surgery on higher risk patients, once the patient has been promised an operation. For the last three years the NHS has required that patients considered for bariatric surgery be seen in a pre-operative clinic by a multi-disciplinary team (MDT) consisting of dietician, physician, psychologist and anaesthetist, before a decision on surgery is made.

We performed a retrospective analysis to see whether this system change had led to better patient selection with fewer high risk patients undergoing surgery, using number, type and duration of post-operative ICU admissions as an indicator.

**Materials and methods:** Analysis was performed on prospectively collected data of all bariatric patients treated between June 2008 and Nov 2012 at our regional centre. Patient demographics, length of stay and procedural data were collected from anaesthetic charts, theatre records and the Hospital Information System, then collated on an anaesthetic database. ICU admission information was collected from the ICU database.

Data was grouped into two 24-month periods, before and after the MDT model was introduced. Statistical significance was tested using Fisher's exact test.

**Results and discussion:** In the 24 months following the introduction of the MDT, almost all of the high-risk patients were seen pre-operatively, and the MDT accepted 410 patients for surgery and refused 30, mostly on the grounds that risks outweighed potential benefits. This was associated with a highly significant reductions in ICU admissions and bed usage. (see table 1).

	Median BMI	Median Age	ASA ≥3	No of ICU Admissions	Total No. of Level 2 bed days	Total No. of Level 3 bed days
2008-09	50	44	351 (45%)	46 (4.4%)	86	22
2010-11	49	45	268 (43%)	10 (1.3%)	8.5	2.2
p value			ns	<0.0001		

[Table 1: MDT changes 08-09 vs 10-11]

**Conclusions:** We already had an established and mature service with over 1000 patients operated on before the period of this study began (including 65 with BMI >70), so this change is not a learning curve. The implementation of an MDT system, with anaesthetic risk assessed and made apparent to surgeons before decisions to operate are made, has resulted in dramatic reductions in ICU admissions. The savings in ICU costs easily justify the expense of anaesthetic involvement in this pre-operative assessment clinic.

#### References:

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## 17AP3-1

### Preoperative evaluation - how changed the strategies two years after publication of the joint recommendations in Germany. Results from a nationwide follow-up survey

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**Background and Goal of Study:** With the joint recommendations of the German Societies of Anaesthesiology and Intensive Care Medicine, Surgery and Internal Medicine for "Preoperative Evaluation of Adult Patients Prior to Elective, Non-cardiac Surgery", which were published in November 2010, the first practical and comprehensive guidelines for preoperative evaluation were offered to anaesthetists in Germany (1).

Aim of this study is to analyse the state of implementation of these guidelines into clinical practice as well as change in strategies for assessing perioperative risk from the viewpoint of anaesthesia personnel in Germany.

**Materials and methods:** A 25-item-questionnaire concerning workplaces general characteristics, cognizance, reasonability and convenience of the joint recommendations was developed as an online-survey. Furthermore, changes in strategies for preoperative evaluation were polled.

**Results and discussion:** A total of 1840 anaesthetists completed the questionnaire. 84.2% were acquainted with the joint recommendations. 57.3% evaluated them completely and 18.2% partly reasonable, respectively. A total of 71.4% indicated that the joint recommendations were implemented completely or in parts within their department strategies for preoperative evaluation. Anamnesis and physical examination were performed more frequently by 25.7%, while routine medical testing was ordered less frequently by 39.1%. Advantages by implementing the joint recommendations were seen by 45.5%. Examples for improvement were simplification for medical staff (68.3%) reduction of waiting time for patients (30.5%) and reduction of radiological examinations (53.4%). Problems, such as increasing expenditure of time and personnel, due to implementation were mentioned by 20.3%.

**Conclusion(s):** The joint recommendations are well known and valued positively among anaesthetists in Germany reflecting an effective implementation process over the last two years. The use of the recommendations is leading to a more reasonable approach in preoperative risk evaluation which contributes to an increase in patients' safety and satisfaction.

#### References:

1. German Societies of Anaesthesiology and Intensive Care Medicine, Surgery and Internal Medicine. Anaesthesist 2010; 59:1041-1050.



### 17AP3-3

#### Burnout syndrome prevalence evolution among anaesthesiology residents in Catalonia over the last two academic years (2012-2014)

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**Background and Goal of Study:** The Burnout Syndrome (BS) is preconditioned by demographics, economics, social and professional factors affecting in general medical doctors and particularly medical trainees. The aim of this study was to evaluate the BS prevalence evolution among Catalan residents of Anaesthesiology over the last 2 years.

**Materials and methods:** This is an observational, cross-sectional and prospective study of Anaesthesiology residents performing their training during the academic years 2012-2013 and 2013-2014 in Catalonia. The survey was carried out during theoretical classes offered by the Catalan Society of Anaesthesiology, mostly visited by first (R1), second (R2) and third (R3) year residents. Social-demographics recorded were: gender, age, single or not, with children or not, salary, number of working hours/week, on-call shifts/month. The anonymous and voluntary Maslach Burnout Inventory questionnaire was used for the analysis of motional exhaustion, depersonalization and personal accomplishment. According to definition, BS is present when the questionnaire final score has more than 26 points for emotional exhaustion and more than 9 points for depersonalization. Statistical analysis was performed with SPSS®. Data are presented as percentages or absolute numbers;  $p < 0.05$  was considered to be significant.

**Results and discussion:** 154 Catalan residents answered the questionnaire in 2012-2013 (response rate 61.6%) and 110 in 2013-2014 (response rate 45.08%). There were no significant differences in social-demographics among groups. During the last 2 years the more years of residency they had, the more BS was significantly present (2012:  $p=0.00595$  and 2013:  $p=0.00277$ ). Comparing both academic years, we observed less prevalence of BS in 2013-2014 without statistical significance (see table1).

YEARS OF RESIDENCY	BS PREVALENCE 2012-2013 in %	BS PREVALENCE 2013-2014 in %	P VALUE
R1	56.6	46.3	0.326
R2	59.5	54.8	0.703
R3	76.5	76.2	0.979
GLOBAL	66.4	58.6	0.207

[Table1: BS prevalence/year of residency 2012-2014]

**Conclusion(s):** Currently, 58.6% of the Catalan residents of Anaesthesiology present BS signs. During this academic year we observe less prevalence of BS. Analysing BS dimensions will help us to understand better the underlying causes for this syndrome. Corrective measures should be designed in order to minimise the potential BS side-effects in the future among our Anaesthesiology residents in Catalonia.

### 17AP3-4

#### Safety in anesthesia and critical care. I. Risk associated with drug storage in two tertiary care hospitals without a safety culture. Preliminary data

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**Background and Goal of Study:** Regarding patient safety, serious adverse events can occur when high-alert medications (HAM) are accessible without adequate safeguards. Among safe actions, storing HAM separately is a simple one. Goal: to evaluate safety of storage and labeling of iv HAM in high pressure areas -HPA- (ICU, surgical and outside of the operating room areas).

**Materials and methods:** Prospective observational audit on the storage of HAM in HPA in two tertiary care hospitals, and location related risk. Approved by the institutional review board. HAM included: potassium chloride (KCl), succinylcholine (SUC), rapid insulin (INS), adrenaline (ADR), local anesthetics (LA), and unfractionated heparin (UFH). Drug location: out of the operating

room (OOR) any place, OOR freezer (OOF), inside OR specific place (IOS), inside the OR common place (IOC). In every hospital two observers performed the evaluation independently: one expert in safety issues, one briefly introduced in the topic. We evaluated HAM location and box storage labeling, and graded the objective ('A' unlabeled location, different drugs classes together, 'B' labeled location, unlabeled HAM, 'C' labeled location, labeled HAM) and subjective risk ('a' very prone to error, 'b' prone to error, and 'c' not prone to error) as perceived by the observer. Comparisons were made between observers (agreement).

Statistics: Descriptive data. Chi square for interobserver comparisons, and objective vs. subjective risk.

**Results and discussion:** There were 55 carts evaluated in hospital A (500 beds), 51 in hospital B (1000 beds). We report preliminary results for both hospitals. Drug location was quite variable among areas in both hospitals (except in OOF).

Expert observers tended to score HAM more prone to risk than the nonexpert ones (no strong agreement).

There was a relationship,  $p < 0.05$  to  $p < 0.0001$ , between objective and subjective scores for all HAM. Despite rating a location as specific, there are instances of scoring them as prone/very prone to error, due to unespecific HAM labeling.

In a setting of non-established safety culture, observational audit monitoring for HAM, can be the first step to improve patient safety. Among others, this might contribute to minimize risk of medication errors in HPA.

**Conclusion(s):** Safety centered approaches in HPA are needed, especially teaching on HAM, and risk related issues -as especific and labeled drug storage-. A safety culture needs to be started.

### 17AP3-5

#### Burnout syndrome in anesthesia trainees, our experience in a tertiary university hospital

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**Background:** Burnout syndrome (BOS) refers to the loss of idealism, energy and purpose as a result of work conditions. A study in USA among 2773 anesthesia trainees (AT) found a high risk of BOS in 41% AT. In the UK, 40% of AT under 30 years of age had high emotional exhaustion. Absenteeism related to BOS costs between 150.000-300.000 USD per year for each doctor who needs to be replaced in the USA. The purpose of this study was to evaluate the prevalence of BOS in AT and to determine its relationship with depression, scientific activity and other social factors.

**Methods:** An anonymous and voluntary questionnaire was proposed to AT. Demographic parameters were noted. The Maslach Burnout Inventory (MBI) was used to measure BOS's 3 dimensions: emotional exhaustion, depersonalization and personal achievement. The Harvard National Depression Test (HND) was used to screen for depression, and the Scholarly Activity Index to quantified scientific achievement (SA) performed by the AT in the last 12 months. We compared variables using Chi2 and ANOVA.  $p < 0,05$  was considered significant.

**Results:** 41/44 distributed questionnaires were collected. 17/41(41,5%) AT had BOS at the present moment, with no significant difference depending on the year of formation ( $p=0,83$ ). There was no difference between the year of formation and emotional exhaustion ( $p=0,27$ ), depersonalization ( $p=0,65$ ) and personal achievement ( $p=0,29$ ). 2/41(4,9%) AT had depression, and there was a relation between scores of HND and BOS ( $p < 0,001$ ). Residents with BOS had similar SAI scores to those without BOS (BOS:  $251 \pm 303$  points; no BOS:  $316,1 \pm 9,48$  points;  $p=0,79$ ). Tobacco consumption and drinking 5 or more alcoholic drinks per week were not risk factors for developing BOS ( $p=0,61$ ,  $p=0,27$ ). AT from Spain presented more BOS than foreigners (Spanish: 11/18, foreigners: 6/23;  $p=0,026$ ).

**Discussion and Conclusion(s):** Prevalence of BOS was high in our population, but it was in range according to other series. Although we could think that first year residents could be protected from BOS due to the relative short time they have work in the hospital environment, the results show no difference in BOS and the year of AT. Higher depression scores are related to the presence of BOS. Foreigner residents seem to be protected from the development of BOS, this might be related to different socio-cultural and family situations and the motivation they might have during their training.

### 17AP3-6

#### Should we improve our safety practice? Audit on fulfillment of the European and Spanish guidelines for safety in anaesthesia practice

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**Background:** Errors in medication administration represent a hazard to patients' health and have relevant economic impact. Prevention of such events and fulfillment of safety guidelines from the Spanish and European Societies of Anaesthesiology should become a primary outcome in our daily practice.

**Method:** To evaluate the compliance of safety guidelines in a tertiary university hospital, we performed an observational based audit on daily evaluation of labeling of syringes/pumps by anaesthesiologists during one week's work, assessing one surgery per operating room (OR) from the 2nd operation onwards, adult patients and excluding cardiothoracic OR. We assessed anaesthesiologist's years of experience (AYE), presence of anaesthesia residents (AR) and type of anaesthesia (TA).

We also performed a questionnaire-based transversal study on usual dilutions of common medication used by anaesthesiologists; and evaluated if the medication was correctly stored in the trolley. We compared variables using Chi2 with Yates correction,  $p < 0,05$  was considered significant.

**Results and discussion:** We audit 109 surgeries, 37 OR and 49 anaesthesiologists, reviewing 537 syringes/pumps. 29% (154/537) of medication wasn't labeled: atropine 14% (14/100), ephedrine 9% (6/69), midazolam 11% (7/61), fentanyl 16% (11/67), remifentanyl 33% (9/27), propofol syringe 91% (78/86) / pump 68% (13/19), muscle relaxant 12% (5/42), local anesthetic 25% (4/16), ketamine 20% (1/5) with no statistically significant difference among AYE and TA. Presence of AR in the OR acted as a protective factor ( $p=0,0093$ ).

On the dilution of medication, we observed a high homogeneity of preparation, although some drugs were subjected to variability: (47/49) atropine 1mg/ml, (39/48) ephedrine 5mg/ml (2 other dilutions), (39/46) phenylephrine 0,1mg/ml (4 other dilutions), (27/43) noradrenaline 0,2mg/ml (5 other dilutions), (19/35) dobutamine 2mg/ml (6 other dilutions). On medication storage, 6/37 OR had empty sockets, 27/37 had >1 medication per socket and 9/37 had muscle relaxants out of cold storage.

**Conclusion:** Although safety is our primary outcome, there is still a high amount of medication not correctly labeled. The presence of AR, probably due to higher level of safety awareness acted as a protective factor. Protocols on drugs preparation and informative sessions should allow to homogenize our practice. These results should set the basis for improvement and aim at creating a culture of safety among our colleagues.

### 17AP3-7

#### Facilitators and barriers for patient safety in a medicine labels - a simulation and interview study

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**Background and Goal of Study:** Medicine labels have an important role in patient safety, as can be seen in, e.g., incident reports. This study aimed at identifying features in a medicine label system that facilitated or hindered the correct identification of drugs and infusion liquids.

**Materials and methods:** 10 physicians and 10 nurses participated in two full-scale simulations (resuscitation and placing a CVK) that required to use several drugs. In following interviews they described how effective the labels features were for their selection of the correct medicine. They also described their perception processes. The label system comprises nine features, including color codes for the concentration, for the drug type (ATC code), as a warning sign and to distinguish different labels. The system also uses standardized placing of information. The label system is used on intravenous drugs and infusion liquids. It is intended to be used by Danish acute care physicians and nurses, including anaesthesiologists and anaesthesia nurses.

**Results and discussion:** The positive elements were the standardized construction of the labels, allowing to quickly learn where to find relevant information. The font was readable even on small ampoule labels. The color codes and TallMan lettering allowed for easy same/different decisions, if containers were seen in parallel. Striped warning signs to dilute a drug worked partly as

intended. The barriers were misunderstandings of the features (e.g. assuming that the "needs to be diluted" warning sign means "is diluted"). The large number of possible combination of features requires a learning time that might not be given in real practice. The color coding for the ATC code was unknown to the majority of users. Inconsistencies and double uses of colors made the system complex. The system is inconsistent with other systems (e.g. the anaesthesia drug label standards) and will be seen naturally in a work setting that features many competing color schemes. The results allowed to identify factors that influence the (in)correct interpretation of medicine labels. The use of simulation allowed for creating ecologically valid test conditions and to analyze the perceptive and cognitive processes in medicine label use.

**Conclusion(s):** We identified factors that facilitate or hinder the correct identification of medicine labels.

**Acknowledgements:** The study was funded by the Tryg Foundation (Trygfonden) in Denmark.

### 17AP3-8

#### Safety in anesthesia and critical care. II. Staff awareness of drug-related risk in two tertiary care hospitals without a safety culture. Preliminary data

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**Background and Goal of Study:** High-alert medications (HAM) bear risk of harm. Staff working in high pressure areas (HPA -surgical or ICU-) are especially prone to errors.

We evaluated exposed staff awareness about HAM in two hospitals without an established safety culture

**Materials and methods:** Study approved by the institutional review board. We asked (open verbal questionnaire) staff anesthetists, residents and nurses working in HPA, about several items (risk awareness focused) on the top 5 HAM: potassium chloride (KCl), rapid insulin (IN), succinylcholine (SUC), adrenaline (ADR), local anesthetics (LA), and unfractionated heparin (UFH).

Pharmacological effects-clinical use (a simple-single response was considered), ampoules volume and concentration, usual dosage (single response, any indication), adequate dilution for use, and main severe adverse effects (single response; i.e. "by iv wrong route at a dose enough for") were addressed.

Comparisons: Staff class (faculty, nurses, residents), main working area (surgical, critical care), years of experience (grouped >10, 6-10, and < 5). Individual drug knowledge was compared too.

**Statistics:** Descriptive data (N, %). Effect of experience in HAM awareness risk [multinomial logistic regression, the more experienced group being the reference group (N; OR, 95%CI)].

**Results and discussion:** We report partial results for hospital A (500 beds). 66 staff participated (faculty 22, nurses 37, residents 7). There was scarce knowledge of concentrations in ampoules (except LA), and of putative severe adverse effects (except INS and UFH). By staff class, faculty-residents lacks knowledge about drug concentrations (KCl, INS), nurses in drug concentrations (KCl, INS, ADR, SUC), and especially in dose (KCl, SUC), and adverse effects (KCl, INS, ADR). All results  $p < 0.05$ .

Years of experience did not influence the results (multinomial regression). Surprisingly staff in contact with HAM and using them daily, are unaware of harm possibility.

Adequate staffing, mainly lack of knowledge-awareness have been shown to be the most significant factors contributing to medication errors. Additional education, in particular for HAM, has been stressed.

**Conclusion(s):** Our results evidence doctors' insufficient knowledge in pharmacy presentations of HAM. Nurses' insufficient awareness of HAM should be cause of worry. Insufficient scientific basis, updating, and no institutional safety culture might contribute. A formative intervention is warranted.

## 17AP3-9

### Did your perfusion system occlusion alarm sound?

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**Background and Goal of Study:** Infusion devices are extensively used in anesthesia, and critical incidents involving these devices occur with high frequency and have been extensively studied. One of such situations is occlusion in an infusion system. We aim to study how different factors (infusion rate, system's length and compliance, type of device used and alarm setting) influence the timing to the sound of the alarm when an occlusion happens, and how it influences the post occlusion bolus when it is released.

**Materials and methods:** In an experimental setting, we selected two systems that are used commonly in our hospital, either in adult and children settings. A pressure measurement device was used to measure the pressure inside the i.v. system. Measurements were conducted in a laboratory setting using various infusion rates, system length and compliance, and alarm settings. After creating an occlusion, we measured how long did it take for the pressure in the system to build up to the setting of the alarm, and how long did it take from that moment to the sounding of the alarm. Maximum pressure attained was recorded. The occlusion was released, and we measured the volume of the post occlusion bolus.

**Results and discussion:** We found important discrepancies in the expected an obtained time to the sounding of the alarm, and post-occlusion bolus that could be potentially adverse in a clinical context. Results are still being subject of statistical analysis. Risk of accidental overdose or underdosing with increase with use of i.v. anesthesia, even with careful monitoring of anesthesia depth and muscle relaxant effect, since there is no concentration monitoring system for drugs used currently.

**Conclusion(s):** In an era of increased popularity (and need for?) of TIVA, i.v. drug delivery systems should receive the same amount of rigorous setup as the anesthesia machine checkup already does. Namely i.v. line length, compliance, rate of infusion and alarms level should be adapted to match both rate and potency of the drug(s) delivered.

## 17AP3-10

### Providing information online: a national survey of anaesthetist's attitudes

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**Introduction:** Despite growing evidence that online information promotes collaborative physician-patient relationships and fosters greater patient engagement with medical services the medical profession has not fully embraced this changing paradigm [1].

**Goal of Project:** Our aim was to find out what information anaesthetists felt should be included on the department website.

**Methods:** A national survey was carried out through the College of Anaesthesia, Ireland. Responses were anonymised. The survey consisted of 8 questions exploring the attitudes of anaesthetists towards information that might be provided on an anaesthesia website.

**Results:** 228 anaesthetists completed the survey, 60% of which were consultants. 51% of respondents felt it important for a department to provide a dedicated website, 9% of respondents felt this was not important. 52% of respondents believe that having accessible information on a website would impact on a patient's decision regarding their anaesthetic options. 76% of respondents agreed that information on location, contact details of the department should be provided. 65% believe that information should be provided on the medical staff working in the department and 61% believe information should be provided on the caseload and profile of the department. 60% believe that the professional qualifications of staff should be included. While 58% believe staff names should be provided only 18% of respondents felt it important to provide photographs of staff members. 93% of respondents rate the inclusion of information on the preoperative preparation and fasting to be important. 92% of the respondents to the survey felt it would be important to include information on post operative pain management. 90% of respondents felt it would be important to provide downloadable information leaflets.

**Conclusion:** There is certainly a realisation amongst anaesthetists that departmental websites are an important way of communicating with patients, ensuring that they can make the right decisions about their care. Anaesthetists take a pragmatic approach to the content that should be provided on a website with most citing practical information as the most important to include on a website.

## References:

- Iverson SA, Penney BK. Impact of internet use on health-related behaviors and the patient-physician relationship JAm Osteopath Assoc. 2008 Dec;108(12):699-711.

## 17AP4-1

### Err is still human. Critical incidents in pediatric anesthesia: 2 years report from a tertiary care hospital

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**Background and Goal of Study:** Concerns about the complexities of the health care potentially causing significant unintended adverse effects are well spread over literature. In 2011, a Critical Incident (CI) report for collecting data was implemented in our Paediatric Anaesthesia Service of a tertiary hospital, as an additional form of quality assurance. Its goal is to better address critical risk factors and to give recommendations regarding patient's safety if necessary.

**Materials and methods:** After creating a multidisciplinary group, we define CI as "any situation that may contribute to a reduction in patient safety under anaesthetic care". We used an anonymous and voluntary paper reporting of CI in order to collect data. We used both the ALARM and the french ORION methods as well as the international World Health Organisation (WHO) classification to analyze them.

**Results and discussion:** Over 32.000 anaesthetic procedures performed over a 2 year period, 132 CI (0.4%) were reported and analyzed. Overall, 76% of them were considered avoidable, 67% had consequences for the patients (rapid recuperation in 65%, 3% of mortality) and 85% had consequences for the institution (56% unplanned care, 24% prolonged stay). The most common incidents concerned the airway and breathing systems (28%), drug related (23.5%) and vascular access (17.4%). The main Contributing Factors (CF) were human (53%) and patient's characteristics (24%). According to the WHO, 39% of the CI were "adverse events" (harmful and unnecessary incidents), 31% "non-harm unnecessary incident", 22% "health care associated harm" (including drugs adverse reactions) and 8% "reportable circumstances". 75% occurred in the operating theatre during elective surgery. Results were shared and corrective actions were implemented (update of protocols, weekly staff meeting, international drug labelling, etc.). Our study probably underestimates the number of CI, when compared to literature; this may be related to the voluntary declaration process and the cultural environment.

**Conclusion(s):** Human factor is the most important CF in our results. This revision underlines the importance of risk management and professional cultural change. Thus, CI reporting should be implemented in the anaesthesia departments as part of quality assurance programs to ensure improved patient care. However, efficiency of correctives actions needs further studies and a largest diffusion to professionals must be done.

## 17AP4-3

### Situation awareness errors during critical incidents in anaesthesia and intensive care

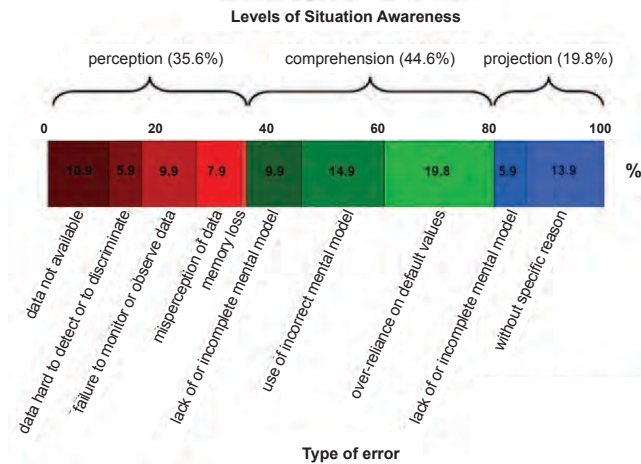
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**Background and Goal of Study:** Situation Awareness (SA) is the perception, comprehension and projection of a patient's state. Accurate SA is integral for providing optimal performance during the treatment of patients. We hypothesized that the majority of critical incidents reported in an anaesthesia critical incident reporting system (CIRS) is related to SA errors.

**Materials and methods:** After IRB approval, 127 consecutive cases of the German anaesthesia CIRS were reviewed by two independent experts. According to the definition of Endsley, the experts coded the type of SA error and contributing factors. In case of disagreement, cases were discussed until consensus was obtained. Distribution of SA errors is given as cumulative percentages. Inter-rater reliability (Cohen's kappa) of initial coding was assessed with respect to (A) whether an SA error occurred, (B) SA level on which the error occurred and (C) type of SA error on the respective SA level. Furthermore, frequency of suspected causes is reported.

**Results and discussion:** In 79.5% of CIRS reports SA errors were detected (see figure). Cohen's kappa was moderate for (A) whether a SA error occurred (0.452) and (B) the SA level on which the error occurred (0.461), and fair for (C) the specific type of error (0.236). The most frequent contributing factors identified were lack of training (23.1%), lack of vigilance (13.2%), deviation from standard procedures (12.3%), look-alike problem of drugs (11.8%), monitor equipment problems (10.8%) and poor communication (9.9%).





[Figure: Distribution of errors in 101 cases with inappropriate SA. All values are given as percentage]

The high incidence of SA errors emphasizes the central role of adequate SA for decision-making and performance. Distribution of errors between the levels of perception, comprehension and projection was similar to other domains. An inherent limitation of our study is the subjective perspective of the reports in the CIRS which contributed to low inter-rater reliability.

**Conclusions:** This pilot study assessed the incidence of SA errors and provides for the first time empirical evidence that SA is central for correct decision-making in anaesthesia and intensive care. Implementation of specific strategies for promoting SA is mandatory.

## 17AP4-4

### Clavicle surgery - a rare cause of venous air embolism

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**Background:** Venous air embolism (VAE) is a potentially life-threatening event. It has been well documented in central venous catheterization, neurosurgery, orthopedic surgery, laparoscopic procedure, cesarean delivery, and cardiac surgery.<sup>1</sup> But in the field of orthopedic surgery, most reports are related to joint arthroplasty, arthroscopy procedure, and spine surgery.<sup>2</sup> In the literatures, rare VAE was reported during the clavicle surgery.

**Case report:** A 63 years old female, ASA II, admitted for open reduction and internal fixation of right clavicle fracture. Anesthesia was induced with propofol 200mg mixed with lidocaine 40mg, then the laryngeal mask airway (LMA) was inserted smoothly. Maintenance anesthesia was provided with sevoflurane 2-4% in oxygen. Spontaneously breathing was maintained during entire surgery. The patient was in semirecumbent position.

During the exposure of fracture site, sudden onset desaturation (SpO<sub>2</sub> down to 78%) occurred with sinus tachycardia, hypotension, and slightly hypocapnia while wound bleeding. A mill wheel murmur was detected loudly at left sternum border. After 10 minutes of supportive care, the heart sound, pulse, blood pressure, and saturation were returned to baseline. Then the fracture was fixed. However, a similar episode happened when the orthopedist tried to check bleeding before wound closure. After compression hemostasis achieved and less than 10 minutes of resuscitation, the patient was stabilized and the heart sound was clear.

The LMA was successfully removed at the end of surgery. The chest radiograph, blood gas analysis, and cardiac enzymes were in normal range. There was no any cardiac, pulmonary, nor neurologic complication after 24 hours observation in intensive care unit.

**Discussion:** Clavicle fracture complicating with venous air embolism resulted from subclavian vessels injury was very rare. Differential diagnosis of desaturation during clavicle surgery should include laryngeal mask airway dislocation, myocardial infarction, pneumothorax, and rarely, venous air embolism.

#### References:

- Mirski MA, Lele AV, Fitzsimmons L, Toung TJ. *Anesthesiology*. 2007 Jan;106(1):164-77.
- Austin LS, VanBeek C, Williams GR. *J Shoulder Elbow Surg*. 2013 Oct;22(10):1449-54.

**Learning points:** The air embolism can occur during clavicle fracture surgery, especially when subclavian vessels injury were highly suspected simultaneously. Early detection and intervention of VAE may avoid possibly severe adverse outcome.

## 17AP4-5

### Evaluation of preoperative anxiety: a pilot study of the Turkish surgical patients in a single center in Ankara

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**Background and Goal of Study:** Preoperative anxiety and stress are undoubtedly the most difficult experiences in the group of patients undergoing elective surgery. These unpleasant sensations depend on several factors. The objective of this study was not only to evaluate the preoperative anxiety levels, but also to determine the underlying causes using the STAI anxiety scale in a sample of Turkish population.

**Materials and methods:** The study was conducted according to the Declaration of Helsinki and was approved by the local ethical committee. All participants gave written informed consent upon having received detailed information on the study. Upon entry in the study, the Spielberger State-Trait Anxiety Inventory I and II (STAI Form TX-1 and STAI Form TX-2) were completed by 109 ASA I-II patients scheduled for elective surgery. The influencing factors in regard to age, length of sleep the night before surgery, profession, operation and educational status were also reported.

**Results and discussion:** In the population studied, there was a significant negative association between STAI I and II. The factors increasing trait-anxiety significantly were being female and housewife; on the other hand, obstetrics surgery increased state-anxiety ( $p < 0.05$ ).

There were significant differences between STAI I and II scores. Type of surgery (orthopedics and urologic), ASA II status, > 30 years of age, having operation experience, sleeping >4 hr the night before surgery and educational level (none/primary school) were contributing factors for the increase in anxiety difference ( $p < 0.05$ ).

**Conclusion:** The factors affecting anxiety levels in different populations might vary among different countries. Interestingly, in this sample of Turkish population, the trait-anxiety levels were found to be higher from state-anxiety levels, especially in women, and less educated people. This could be attributed to the low to intermediate life standards of people admitting to our hospital. Thus, doubts about operation and anesthesia are a little bit disregarded. The continuation of this study with larger samples is needed to further investigate the clinical characteristics and personality traits of Turkish people.

## 17AP4-6

### Anaesthesia in patients with mitochondrial cytopathy: 6 years series review

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**Background and Goal of Study:** Mitochondrial cytopathies (MC) are a group of rare congenital disorders characterized by progressive multi-organ dysfunction and inappropriate production and conversion of adenosine triphosphate in the mitochondria. These patients are at risk for metabolic decompensation when undergoing anaesthesia and surgical procedures.<sup>(1)</sup> The aim of this study was to review the anaesthetic approach and complications in these patients during a period of 6 years.

**Materials and methods:** Retrospective study performed at our institution and approved by the ethics committee. Patients with MC underwent surgical procedures between 01/01/2006 and 30/11/2012 were evaluated. Medical records obtained via informatics clinical process. Data collected: gender, age, ASA classification, type of surgery, type of anaesthesia and complications in the per operative period

**Results and discussion:** 39 patients with the diagnosis of MC were evaluated. Sex: Female (F): Male (M): (51%: 49%); 26 patients (67%) were under 18 years. According to the ASA physical status 59% were ASA III and the remaining were ASA II. 73 procedures were performed, 20 patients (49%) underwent more than one intervention and 2 patients (5, 3%) underwent five surgeries. Pediatrics Surgery was the dominant surgical speciality with a total of twenty-nine interventions (40% of the surgeries), followed by Ophthalmology (12/16%), Orthopedics (6/8%), Ear Nose and Throat surgery (6/8%) and Cardiac Surgery (6/8%). Inhalation anaesthesia (45/ 62%) and general balanced anaesthesia (10/14%) were the most commonly used techniques followed by local anaesthesia (8/11 %) and sedation (4/5%). There were no complications.

**Conclusion(s):** This review suggests that the use of intravenous or inhaled anaesthetic in the routine management of mitochondrial patients did not influ-

ence the outcome, despite some references in the literature to the association between malignant hyperthermia and inhalational agents and propofol infusion syndrome<sup>(2)</sup>. Our results suggest there is no case for avoiding any particular anaesthetic agent.

There were no cases of metabolic decompensation. A limitation of this study is the lack of data regarding the time of fasting and preoperative use of fluids with glucose but as with any retrospective case notes review and medical records were incomplete or not available.

#### References:

1. *Anesthesiology* 2006; 105:819-37.
2. *BJA* 2008; 100:436-41.

## 17AP4-7

### Postoperative complications after major abdominal cancer surgery and relationship with tumor lymphocyte count

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**Background and Goal of Study:** The patients with advanced malignancy may have impaired immunological response, more postoperative complications and increased mortality. An aim was to compare postoperative complications after major abdominal cancer surgery and patients' survival with CD4+ and CD8+ lymphocytes in tumor and surrounding tissue.

**Materials and methods:** The study included 91 patients of both sexes, aged 18 years, ASA grades 1-3 who underwent surgery for colorectal, gastric, and pancreatic cancer. Comorbidities were determined using Charlson comorbidity index. Postoperative respiratory and other complications were identified after laboratory and clinical examinations on day 4 postoperative (PO) and outcomes one year after the surgery. Hystological samples taken from all patients were stained using immunohistochemical methods and analyzed under the light microscopy. A number of CD4+ and CD8+ cells in the tumor and in the surrounding tissue were analyzed. Statistical analysis was done Pearson correlation ANOVA. A level of significance of  $p < 0.05$  was considered as statistically significant.

**Results and discussion:** A comorbidity was significant: a history of hypertension in 51.5%, followed diabetes in 13.9%, and COPD 9.9% of patients. Patients with pulmonary comorbidity had highest complication rate and mortality as compared to other patients ( $P < 0.001$ ). No differences in the lymphocyte number were observed between age, gender or ASA subgroups. A significant correlation was found between Comorbidity index and CD4+ in normal tissue samples ( $r=0.254$ ,  $P=0.015$ ). In the patients with Charlson co-morbidity index  $\geq 5$  a higher number of CD4+ lymphocytes in the control was registered than in the patients with comorbidity index 1-4 ( $8 \pm 10.08$  vs.  $4.29 \pm 3.68$  cells,  $P=0.018$ ) and in the tumor tissue ( $9.20 \pm 11.47$  vs.  $4.53 \pm 5.82$ ,  $P=0.024$ ). CD8+ lymphocytes were not different between two comorbidity groups. CD4+ lymphocytes were higher in the patients with postoperative complications and nonsurvivors, in the normal ( $6.5 \pm 6.2$  vs.  $4.6 \pm 3.5$ ,  $P=0.04$ ) and in the tumor tissue ( $8.6 \pm 9.7$  vs.  $2.9 \pm 3.8$ ,  $P=0.019$ ) as compared to the patients with uncomplicated recovery respectively.

**Conclusion(s):** CD4+ lymphocytes showed a good correlation with patient co-morbidities and survival. Specific patients' groups having higher CD4+ infiltration and pulmonary comorbidities may have poor outcome.

## 17AP4-8

### Ketamine is safe for sedation during medical thoracoscopy

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**Background and Goal of Study:** Thoracoscopy under local anesthetic and intravenous sedation, also known as medical thoracoscopy (MT), is increasingly being performed. Respiratory depression is the main risk for patients undergoing procedures under sedation. Patients scheduled for MT usually complain of dyspnea, have low SpO<sub>2</sub> values and are therefore at a greater risk of apnea during IV sedation. The aim of this study was to evaluate the effect of ketamine to prevent hypoventilation in patients undergoing deep sedation for MT.

**Materials and methods:** 30 patients were included in the study. Patients were randomized to receive ketamine 0.5mg/kg bolus plus propofol (group A) or propofol alone (Group B). The same sedation protocol with propofol was used

in both groups. The primary outcome was the number of desaturation episodes (SpO<sub>2</sub> < 92%). Secondary outcomes included the median respiratory rate, the number of airway maneuvers, as well as patient satisfaction.

**Results and discussion:** There were no differences in the demographic and procedure characteristics between the two groups. The median number of desaturation episodes (1) and the number of maneuvers made by the anesthesiologist (0) were both lower in Group A compared to Group B (3 and 2 respectively). The median respiratory rate during the procedure was greater for Group A (18) than for Group B (13). Patient satisfaction was the same between the two groups.

**Conclusion(s):** When used in conjunction with propofol for sedation, ketamine reduced the episodes of desaturation and the need for maneuvers for airway control. It should therefore be considered as an important adjunct during sedation for MT.

## 17AP4-9

### Accidental drug exchange - error in drug preparation

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**Background:** Wrong drugs, overdose and incorrect administration route remain unsolved problems in anesthetic practice. Errors in drug administration cause harm to patients and increase the costs associated with healthcare. A significant minority of errors results in morbidity and mortality (1).

**Case report:** Male patient, 55 years, ASA 2, proposed for parietal craniotomy and partial excision of an anterior parietal lesion. Administration of balanced general anesthesia, induction with propofol, maintenance with sevoflurane and remifentanyl. A slight hypocalcaemia was detected and an infusion of calcium gluconate (CG) was initiated. Five minutes after starting infusion, hypertensive crisis (305/154 mmHg) and tachycardia (123 beats per minute) were detected. Monitoring was checked, perfusion GC was suspended and depth of anesthesia was increased. Hypertension lasts for about 6 minutes. The error was detected: the infusion of GS was prepared with a fluid, not labeled and placed near the other fluids for dilution drugs, which contained epinephrine 10 mcg/ml (that was prepared by another different nurse 2 hours before). This hypertensive crisis occurred after haemostasis test and closure of dura mater. No bleeding or other intraoperative complications were noticed. Awakening and recovery without complications. Postoperative brain computer tomography without complications. Discharged five days later without new neurological deficits.

**Discussion:** Failure to read the labels of the drugs and poor labeling are probably the second most common cause of errors in drug administration (2). Most errors in drug administration do not result in sequelae to the patient, but the occurrence of potentially serious errors, particularly those involving vasoactive drugs, is disturbing (3). Mechanisms to report accidents in drug administration should be implemented, as a way to identify possible causes, and establish measures to prevent future errors. Prospective and randomized studies investigating strategies to reduce the incidence of errors in administering drugs are still needed.

#### References:

1. *Can J Anaesth* 2001; 48:139-146.
2. *Anaesth Intensive Care* 2000, 28:300-304.
3. *S Afr Med J* 2006; 96:630-632.

**Learning points:** To reduce anesthesia-related medication errors, improvements of protocols for handling medication and establishment of a reporting program are essentials.

## 17AP4-10

### Patient safety: accidental adrenaline administration leading to cardiac arrest

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**Background:** We present a case report of a cardiac arrest which occurred due to an accidental intravenous administration of adrenaline. This is a rare, potentially lethal medication error, with very few cases published in the medical literature (1,2), which illustrates the importance of patient safety measures. We present the clinical scenario, its management and discuss the causes of the medication error and the mechanisms to avoid it.

**Case report:** A 48-year old woman, with history of asthma and hypothyroidism, classified as ASA physical status 2, was submitted to general anesthesia for an abdominal hysterectomy. At the end of the surgery, the anesthesiologist

asked the anesthetic nurse to administer 2.5 mg of neostigmine and 1 mg of atropine to reverse curarization. The nurse prepared a syringe with what she believed to be the mixture requested and administered it to the patient. Due to a very similar appearance to the neostigmine ampoules, the nurse had inadvertently administered 5 mg of adrenaline. Immediately after the injection, the patient presented with hypertension, tachycardia and bilateral midriasis. At this point, the mistake was identified. The cardiac rhythm evolved to pulseless electrical activity and advanced life support was performed for nearly 2 hours until recovery of spontaneous circulation. The patient was transferred to the Intensive Care Unit and in less than 24 hours she was extubated, hemodynamically stable and with no apparent neurologic sequelae.

**Discussion:** This case shows an adverse drug event due to an error in medication administration. The case was examined and various errors were identi-

fied, such as absence of checking and double-checking, absence of labelling and inexperience and fatigue of the nurse. We also identified a serious organizational error: neostigmine and adrenaline ampoules are very similar and were stored in adjacent compartments in the anesthesia cart.

#### References:

1. Arfi AM, Kouatli A et al. Acute myocardial ischemia following accidental intravenous administration of epinephrine in high concentration. *Indian Heart J* 2005; 57:261-4
2. Duran J, Carvalho S et al. Accidental intravenous administration of epinephrine: case report and literature review. *Revista Sociedade Portuguesa de Anestesiologia*; 2009;18:19-21

**Learning points:** It is essential to prevent errors by improving working habits and the organizational environment and also to be prepared to manage the effects of an error, when it does occur.

## Perioperative Care of the Elderly

### 18AP1-1

#### NT-proBNP as a clinical indicator for postoperative ambulatory outcomes in femoral fracture patients

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**Background and Goal of the Study:** Elevated NT-proBNP is a predictor for perioperative cardiovascular events. It also predicts disability incidents among elderly people living in the community<sup>1,2</sup>. Femoral fracture commonly occurs among the elderly through domestic accidents and falls. Associated with high mortality (>10%), a significant portion of patients are unable to return home due to postoperative ambulatory disability. In this study, we hypothesize that elevated NT-proBNP is a potential indicator of postoperative impaired walking ability.

**Methods:** Patients (≥70yrs) undergoing non-elective proximal hip fracture surgery in our institution, discharged between June 2012 and September 2013, were enrolled. Patients with coexisting heart failure or history of recent cardiac events were excluded. NT-proBNP was measured in routine preoperative blood exams. The variables recorded from medical records at discharge were patient demographic data, walking and residential status at admission and discharge, dementia, postoperative complications, anemia, catecholamine administration, type of anesthesia, and length of hospitalization. The study end-point was the incidence of preoperative elevated NT-proBNP and its correlation to change in postoperative walking and residential status. Multivariate logistic analysis was performed to identify predictive variables.

**Results and discussion:** Among 81 patients enrolled, 35 suffered deteriorated walking ability at discharge. Prior to injury 66 patients lived at home. 44 returned home and the rest transferred to institutions. The NT-proBNP cut-off values set by ROC curve in predicting postoperative change in walking ability and residential status were >521 and 987 ng L<sup>-1</sup> respectively. 25 patients (30%) had NT-proBNP >521 ng L<sup>-1</sup> and 10 patients (12%) had NT-proBNP >987 ng L<sup>-1</sup>. NT-proBNP >521 ng L<sup>-1</sup>, dementia and postoperative complications were the independent predictors for the decline of walking ability and NT-proBNP >987 ng L<sup>-1</sup> for post discharge change in residence.

NT-proBNP level among femoral fracture patients predicts postoperative walking disability and change of residential status after discharge.

**Conclusion(s):** Elevated NT-proBNP predicts postoperative walking disability. Measuring NT-proBNP at admission may help in setting realistic clinical goals after femoral surgery and assisting patients and families plan for discharge.

#### References:

1. J-H Choi et al. *Heart* 2010;96:56-62
2. A Hozawa et al. *J Am Geriatr Soc.* 2010;58:2439-41

### 18AP1-2

#### Audit of peri operative care of patients undergoing surgery for fracture neck of femur (NOF): A monitoring tool for improved perioperative care

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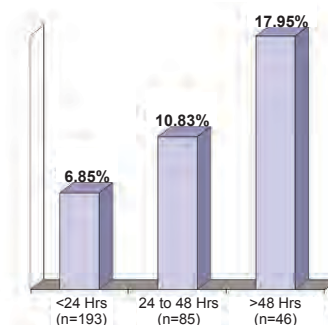
**Background and Goal of Study:** Previous audits on fracture neck of femur (NOF) at Medway Maritime Hospital (MMH) showed our 30 day mortality dropped from 18.9% to 9% over 5 years after various improvements made. We carried out a one year retrospective audit to review the management in terms of 30 day mortality, operating rate and to identify any new trends.

**Materials and methods:** 364 patients admitted at MMH over year. The data that was recorded to Hip fracture database from MMH was analysed.

**Results and discussion:** Mean age of patients is 80 yrs. with males 76.64 yrs. (30.85%) and females 81.6yrs (69.15%). 350(96.15%) patients managed surgically and 14(3.85%) patients managed conservatively had a 30 day mortality rates of 9.71%. and 35.71% respectively. Lower mean AMTS were noticed again in this year in patients who died (4.73) than survivors (7.54). The number (%) of patients operated in relation to timing of surgery and mortality are shown as below.

Operating time from admission	Number Patients Operated (%) 2011	Number Patients Operated (%) 2012	30 day Mortality (%) 2011	30 day Mortality (%) 2012
<24 Hours	193(56.56%)	175(50%)	12.43	6.85
24-36 Hours	34(10.49%)	81(23.15%)	14.70	7.41
36-48 Hours	51(15.74%)	39(11.15%)	7.84	17.95
<48 Hours	278(85.50%)	295(84.20%)	11.87	8.47
>48 Hours	46(14.19%)	55(15.70%)	8.69	16.36
All Patients operated	324(97.29%)	350(96.15%)	11.41	9.71
Males	76(22.88%)	108(30.85%)	22.82	11.11
Females	257(77.17%)	242(69.15%)	9.7	9.09

[Operating rate and 30 Day Mortality for 2011 & 2012]



[30 Day mortality vs Timing of Surgery (Hrs from time of admission)]



**Conclusion(s):** The audit findings reveal operating early within 48 hours keeps the mortality at its lowest (8.5% vs 16.35%). Following implementation of changes from previous audit mortality dropped in males (by 48.68%), and in non-surgically managed patients (by 53.57%). Good correlation noted between AMTS and 30 day Mortality i.e.  $6 < 6$  (21.29%) and  $7 > 7$  (6.32%)

**Recommendations:** Improve the operating rate by aiming to operate on all patients within 24 hours. Further improving the lessons from NCEPOD for the elderly 2010 by improving the care of patients with low AMTS and targeted high risk groups helps to reduce mortality further. Monitoring the key indicators of patient care by regular audits will not only help to improve the care but also reduce the mortality: Low AMTS ( $6 < 6$ ) could be used as predictor of high mortality.

**References:**

1. Management of hip fracture in older people A national clinical guideline ISBN 978 1 905813 47 6: June 2009 2.NECEPOD 2010 Elective & Emergency Surgery in the Elderly: An Age Old Problem (2010)

**18AP1-3**

**Epidural blockade in a patient with hip fracture and severe aortic stenosis**

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**Background:** Patients with hip fracture are often elderly and present to surgery with multiple co-morbidities. The following case describes the perioperative use of epidural blockade in a patient with hip fracture, severe aortic stenosis (AS) and a recent acute coronary syndrome (ACS).

**Case report:** A 90-yr-old man, with a history of severe AS and a recent ACS (< 1 month) managed conservatively presented for urgent hip hemiarthroplasty. The patient refused aortic valve replacement. He was clinically stable and pharmacological optimized. Before surgery the following day the patient's blood pressure (BP) was 111/65 mmHg with HR of 65 bpm. Besides ASA standard monitoring, the BP was monitored invasively. An epidural catheter was placed in the L4-L5 intervertebral space and test dose confirmed its correct placement. This was followed by the injection of 5 µg sufentanil 5 µg/mL and 15 mg ropivacaine 7.5 mg/mL supplemented 15 minutes after with the an equal mixture resulting in a T10 sensory level. BP fell from 150/70 to 100/40 mmHg. A bolus of 0.1 mg phenylephrine was administered. BP normalized and then remained stable. Heart rate was 70-75 bpm throughout the procedure. Blood loss was estimated at 100 mL. The recovery period was uneventful. Postoperative analgesia was maintained using a continuous epidural infusion (ropivacaine 1 mg/mL, fentanyl 2 µg/ml) by an elastomeric balloon. There were no new events of myocardial ischemia.

**Discussion:** There are no evidence-based recommendations for the best anaesthesia and postoperative analgesia in the patient with AS. When anaesthetizing a patient with severe AS, the haemodynamic goals include avoiding sudden and profound decreases in systemic vascular resistance, maintaining myocardial contractility and sinus rhythm and avoiding hypovolemia and tachycardia. Neuroaxial blockade potentially reduces mortality and other serious complications, including myocardial infarction, in lower extremity surgery<sup>1</sup>. Epidural block facilitates a gradual onset of sympathetic block and provides better postoperative analgesia compared to parental opioid analgesia.

**References:**

1. Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anesthesia: results from overview of randomized trials. *BMJ* 2000;321:1493-7.

**Learning Points:** The choice of anaesthesia must be evaluated in each case, especially is patients with AS, based on knowledge of pathophysiology and haemodynamic goals.

**18AP1-4**

**Comparison of the hemodynamic changes between old age and very old age(≥85) in the cemented bipolar hemiarthroplasty under spinal anesthesia**

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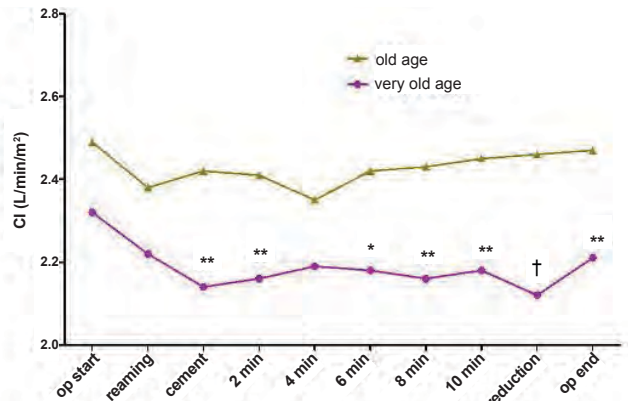
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**Background and Goal of Study:** There has been an increase in the number of very old age (85+) undergoing cemented hip arthroplasty in recent years. The using of bone cement in arthroplasty has been associated with hypotension, hypoxia and rarely cardiac arrest (bone cement implantation syndrome). It usually occurs when femoral reaming, cement implantation, insertion of

prosthesis and joint reduction are done. The purpose of this study was to compare the hemodynamic changes between old age and very old age during the cemented hip hemiarthroplasty.

**Materials and methods:** 99 patients scheduled cemented hemiarthroplasty due to intertrochanteric femur fracture under spinal anesthesia were included in this study. Patients were divided into two groups by the age; Old age group (< 85) : 67-84 yr (n = 66), Very old age group (>=85) : 85-98 yr (n = 33). Spinal anesthesia was done with 9-10 mg of hyperbaric bupivacaine and 10 µg fentanyl to reach the sensory level of T10. Monitoring during the surgery was EKG, pulse oximetry and radial artery catheterization connected with Flo Trac, which is able to record cardiac index, stroke volume, heart rate and blood pressure. Mean blood pressure, heart rate, stroke volume, cardiac index and oxygen saturation were monitored continuously and were recorded for data at starting of operation, femoral canal reaming, cement insertion, every 2 min after cement insertion for 10 min, femoral joint reduction and the end of operation. Significant hemodynamic change was defined as CO < 3.0 L/min or decrease >20% of stroke volume from the base line and it was supported with vasopressor and volume for hemodynamic stability.

**Results and discussion:** Table 1 showed patient characteristics. Fig1 showed significantly constant decrease in cardiac index after cementing in very old age compared with old age group during the cemented hemiarthroplasty. Table 2 showed that very old age group needed more dosage of ephedrine to maintain hemodynamic stability.



[Fig 1. The comparison of the changes in cardiac index (CI) between old age and very old age during the cemented bipolar hemiarthroplasty. \*: p<0.05, \*\*: p<0.01, †: p<0.001]

	Old age (n=66)	Very old age (n=33)
Age (yr)	78.86 ± 4.08	89.36 ± 3.12
Sex (M / F)	11 / 55	7 / 26
Height (cm)	155 ± 6.6	155 ± 8.5
Weight (Kg)	54 ± 10.1	49 ± 11.6
BMI	19 ± 7.0	18 ± 6.3
Hypertension	49 (74%)	20 (61%)
Diabetes Mellitus	22 (33%)	3 (9%)*
Ischemic heart disease	7 (11%)	6 (18%)
Heart failure	4 (6%)	2 (6%)
Chronic kidney disease	5 (8%)	5 (15%)
Cerebral stroke	10 (15%)	2 (6%)
Chronic obstructive pulmonary disease	6 (9%)	6 (18%)
Ejection fraction (%)	65 ± 7.9	64 ± 6.9
Hemoglobin (g/dl)	11.6 ± 1.2	11.1 ± 1.1

[Table 1. Patients Characteristics

Values are presented number (%) or mean ± SD. \*: p<0.05]

	Old age (n=66)	Very old age (n=33)
PRBC (n)	1.24 ± 0.43	1.57 ± 0.56
Patient using ephedrine (n)	34 (52%)	21 (64%)
Dosage of ephedrine (mg)	8.65 ± 6.38	13.52 ± 7.76
CPR (n, alive / die)	1 (1 / 0)	2 (1 / 1)

[Table 2. The comparison of the used PRBC and given ephedrine dosage between old age and very old age during the cemented bipolar hemiarthroplasty Values are presented number (%) or mean ± SD. PRBC: packed red blood cell, CPR: cardio-pulmonary resuscitation. \*\*: p<0.01]

**Conclusion(s):** After cementing, very old age showed constant decrease in cardiac index compared with old age with momentary decrease during the cemented hemiarthroplasty. To maintain hemodynamic stability after cement insertion, the requirement of ephedrine was higher in very old age than old age.

## 18AP1-5

### Factors associated with mortality in hip arthroplasty surgery: a six-months retrospective study in a university hospital

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**Background and Goal of Study:** Hip arthroplasty (HA) is common in elderly patients. Mortality was described between 0,29 and 0,56% (1, 2). This observational study was realized to identify risk factors for mortality among patients operated of HA in a university hospital.

**Materials and methods:** Clinical histories of consecutive patients operated of HA between January and June of 2013 were revised. Data were collected for demographic parameters, co-morbidity factors, peri-operative anaesthetic and surgical management, and one-month survival. Chi-2 test or Fisher's exact test were used for qualitative variables, and non parametric test for quantitative variables. A multivariate analysis searched for independent risk factors for mortality.  $p < 0,05$  was considered significant.

**Results and discussion:** Ninety patients were operated, 58,4% of total (THA), and 41,6% of partial HA (PHA). 7(7,8%) presented severe postoperative complications and 4 (4,4%) died. Patients who died were older than survivors ( $88,8 \pm 4,1$  yrs vs  $73,6 \pm 13,9$  yrs ;  $p=0,009$ ), presented more preoperative renal failure (OR 11,3 [1,4-92,8]), with higher plasmatic creatinin levels ( $1,50 \pm 0,58$  mg/dL vs  $1,08 \pm 0,28$  mg/dL,  $p=0,007$ ) and lower hemoglobin values ( $11,8 \pm 1,7$  g/dL vs  $13,9 \pm 1,8$  g/dL,  $p=0,03$ ). They had spent more days in the hospital before surgery ( $4,75 \pm 2,8$  days vs  $2,6 \pm 3,1$  days,  $p=0,04$ ), were more frequently operated of PHA than THA (OR 1,12 [1,002;1,254]). No differences were found concerning ASA score ( $p=0,61$ ), anaesthetic technique ( $p=0,79$ ), intraoperative fluid administration ( $p=0,59$ ) and blood transfusion ( $p=0,83$ ). Their hospital stay was longer than survivors ( $20,0 \pm 6,6$  days vs  $11,0 \pm 8,0$  days,  $p=0,007$ ). They presented more frequently early postoperative complications (OR 1,11 [1,00; 1,24]), postoperative anemia (OR 1,13 [1,00; 1,26]  $p=0,023$ ) and infection (OR 20,50 [2,27; 185,38]), and complications of pre-existing diseases (OR 18,5 [1,78; 192,81]). Preoperative creatinine level (AOR 22,6 [1,1; 465,8]  $p=0,045$ ) and total hospital stay (AOR 1,4 [1,1; 1,8]  $p=0,004$ ) were identified as independent risk factors of mortality.

**Conclusion(s):** Mortality in this study is higher than described in the literature for hip replacement, but risk factors described here are similar. The inclusion of patients operated of PHA might be the reason for this difference. A larger sample size would probably improve the statistical power of the study.

#### References:

- Hunt et al., Lancet 2013;
- Aynardi et al., Clin Orthop Relat Res 2009

## 18AP1-7

### Predictive factors for postoperative mortality in patients undergoing acute hip fracture surgery. A retrospective cohort study

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**Background and Goal of Study:** Elderly patients with a fracture neck of femur have a high 1-year mortality following surgery. Several studies have identified predictive factors for death. With an increasingly elderly population and a wide spectrum of co-morbidities, it is possible that the current scenario in Sweden is not identical to that identified 10 years ago. This study was performed to further identify risk factors for 3- months and 1-year mortality.

**Materials and methods:** Following ethics committee approval, a study cohort was identified from a national database (rikshöft) to include patients > 65 years old and operated at the University Hospital, Örebro in the year 2011 (Jan 2011 - Dec 2011). Chronic health status and acute physiological changes were identified and data extracted from patient records by blinded observers. Following an initial univariate analysis, stepwise logistic regression analysis was performed to identify independent risk factors for mortality.

**Results and discussion:** The in-hospital mortality was 5.3 %, the 3-month mortality 13.6 % and the 1-year mortality 26.2 %. The following predictive fac-

tors were found to be significantly associated with an increased 1-year mortality following multivariate analysis: low albumin, cortisone or other immunosuppressive therapy, chronic renal disease, age  $\geq 85$  years, dementia, malignant disease, congestive heart disease and ischemic heart disease. Similarly, predictive factors for 3-month mortality included: low albumin, chronic renal failure, dementia, and ischemic heart disease.

**Conclusion(s):** We have identified several independent predictive factors for death after 3 months and 1 year. All these factors were related to the chronic health status of our patients and no acute physiological parameter could be identified as an independent risk factor for postoperative mortality.

## 18AP1-8

### Impact of a consultant-delivered service on 30-day mortality in patients with fractured neck of femur

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**Background and Goal of Study:** There is conflicting evidence regarding the importance of a specialist (consultant) delivered service for Fractured Neck of Femur (#NOF) surgery. In recent years the UK mortality following #NOF is around 8.3% at 30 days, according to the National Hip Fracture Database (NHFD). We set #NOF as a priority service and report how our mortality has been affected by the change in grade of operating anaesthetist and surgeon.

**Materials and methods:** Analysis was performed on data of all fractured neck of femur patients admitted between January 2009 and Nov 2013. Patient demographics, ASA status and 30-day mortality were collected from our submissions to the NHFD.

This data was then cross-referenced against theatre logbooks to ascertain grade of anaesthetist and operating surgeon. The information was further cross-referenced against calculated 30 day deaths, derived directly from admission date and date of death on the Hospital Information System.

The patient groups were split into two ASA categories to adjust for case mix (ASA 1-3 and ASA 4&5). Statistical significance was tested using Fisher's exact test.

**Results and discussion:** Data was fully complete for 1059 (74%) of 1440 patients from Jan 2010 - Nov 2013. The median age was 85 years (IQR 79.5-90) and 76% were female. Over this period there was an overall decrease in 30-day mortality from 9.0% (2010-11) to 7.4% (2012-13), associated with an increased anaesthetic consultant involvement, from 54% (2010-11) to 70% (2012-13)

The difference in mortality between consultants and non-consultant is shown below.

Anaesthesia	Consultant Mortality	Non-consultant Mortality	P value
All Patients	52 of 669 (7.8%)	35 of 390 (9.0%)	0.49
ASA 4 & 5 Patients	15 of 71 (21%)	6 of 30 (20%)	1.0

[Table 1]

Surgery	Consultant Mortality	Non-consultant Mortality	P value
All Patients	31 of 340 (9.1%)	56 of 658 (7.8%)	0.81
ASA 4 & 5 Patients	9 of 39 (23%)	12 of 61 (20%)	0.81

[Table 2]

**Conclusion(s):** Surprisingly we have been unable to demonstrate any significant difference between outcomes following anaesthesia and surgery delivered by consultants vs non-consultants in our unit.

Recommendations from national and international bodies suggest that anaesthesia should be provided by the highest grade of anaesthetist available. We suspect that with the overall improved standards of anaesthesia and systems in place, and the seniority of non-consultants doing these cases, resources may be better allocated to improving post-operative ward care.

## 18AP1-9

### The influence of apoptosis on the outcome of multiple trauma in the elderly

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**Aim:** The aim of the study was to investigate the dependence of systemic oxygen transport on the level of markers of apoptosis and its effect on the course of traumatic disease in old patients with multiple trauma.

**Methods:** 36 patients treated for multiple trauma (APACHE II 22.8±3.6) were prospectively studied. Patients were divided into two groups which received the same complex of intensive care: under the age of 60 years were the first group (n = 16) and over the age of 60 years were the second group (n = 20). We analysed parameters of central hemodynamics, morphometry parameters of erythrocytes, level of cytokines, level of caspase 8, endothelin-1, oxygen transport parameters. We studied oxygen metabolism in peripheral tissues using polarography method on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 10<sup>th</sup> and 21<sup>st</sup> days.

**Results:** During the examination of patients we did not reveal the differences in the parameters of central hemodynamics and morphometric parameters of erythrocytes between the patients of I and II groups. In patients of the I group the level of TNF- $\alpha$ , IL-1, IL-6 was higher (p < 0,05) than in patients of group II on the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> and 10<sup>th</sup> days of treatment, indicating a better reactivity of the organism. The oxygen transport parameters and the state of oxygen metabolism in tissues were significantly lower in patients in II group during the survey period. Endothelin-1 level also was significantly lower in patients in II group from 3<sup>rd</sup> to 21<sup>st</sup> days of treatment. The oxygen transport parameters and endothelin-1 level had a negative strong correlation with the level of caspase-8 in II group, the level of which they have been significantly higher than in group I during the observation period.

**Conclusion:** Thus, we can conclude that the course of traumatic disease in old patients with multiple trauma depends on the state of endothelium and decreasing precisely of functional activity of erythron system. These changes are caused by increased activity of apoptosis, particularly caspase-8. This fact shows the requirements for endolum protection therapy and antihypoxant drugs in the complex of intensive therapy in old patients with multiple trauma.

## 18AP2-1

### Is Rhabdomyolysis; an anaesthetic complication in robot assisted radical prostatectomy patients?

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**Background:** In Robot Assisted Radical Prostatectomy (RARP) patients, preoperative bowel preparation, intraoperative fluid restriction (for urineless surgical vision) and prolonged steep trendelenburg position (STP) can cause complications such as rhabdomyolysis (RM) due to hypoperfusion of lower extremities and renal impairment (RI) Although interest in the safety and complications of RARP technique is growing, data on these factors are still lacking. We aimed to determine the effects of these factors on RM and RI during periop-postop periods.

**Materials Methods:** 49 patients, ASAII, aged 50 to 80, BMI >25 scheduled for RARP, were enrolled in this prospective study. Renal, hepatic diseases were excluded. BUN, Crea, AST, ALT, Na, K, Cl, Ca, Urine Density tests were applied 1 week preoperatively (T<sub>p</sub>). Bowel preparation was applied 8h preoperatively. At the beginning of operation (T<sub>0</sub>) samples for BUN, Crea, AST, ALT, Na, K, Cl, Ca, LDH, CK, CKMB, trop-I, Urine test were taken. After induction, STP was given. 1ml.kg<sup>-1</sup>.h<sup>-1</sup> 0.09%NaCl and 1mlkg<sup>-1</sup>.h<sup>-1</sup> 6%HES 200/05 were infused. At 6,12,24 and 48th hrs (T<sub>6</sub>,T<sub>12</sub>,T<sub>24</sub>,T<sub>48</sub>) samples were retaken. RM was defined by serum CK levels >5000 IU/L.

	CREA	AST	Cl	CK	CKMB	LDH	Urine Density	pH	Lac
T <sub>p</sub> policlinic	0,91 ±0,19	19,08 ±6,26	102,57 ±1,62						
T <sub>0</sub> ±SD	0,92 ±0,30	20,31 ±5,83	107,84 ±4,50	120,02 ±91,61	22,47 ±10,02	179 ±48,09	0,37 ±0,75	7,42 ±0,04	10,10 ±4,07
T <sub>6</sub> ±SD	1,13 ±0,39	22,39 ±13,81	107,55 ±2,91	272 ±651	32,51 ±29,58	191,69 ±63,05	1,47 ±0,91	7,30 ±0,06	14,12 ±7,20
T <sub>12</sub> ±SD	1,13 ±0,40	31,41 ±31,21	105,59 ±2,82	1169 ±2258,04	48,57 ±58,09	235,5 ±90,68	1,10 ±0,54		
T <sub>24</sub> ±SD	1,03 ±0,36	38,4 ±39,76	105,98 ±3,53	1948 ±6858,68	40,61 ±43,48	227,86 ±115,62	1,02 ±0,69	7,40 ±0,06	13,02 ±5,35
T <sub>48</sub> ±SD	0,93 ±0,27	34,20 ±28,50	105,88 ±3,69	861,06 ±1539,43	34,73 ±3,41	107,12 ±61,50	0,76 ±0,72		

#### [Laboratory Test Values]

**Results:** Median operation time (OT) was 212.65(180-260) min, median trendelenburg time(TT) was 182.76 (140-220) RM developed in 6 patients. No difference was determined between RM(+) and RM(-) cases in respect of BMI, OT, TT and ASA (p>0,05). No postop RI occurred in any patients with RM. CK and AST were significantly elevated at T<sub>6</sub>, peaked at T<sub>24</sub>. No correlation was determined between CK values and BMI, OT and TT. CKMB, Crea, LDH levels were significantly elevated at T<sub>6</sub>, peaked at T<sub>12</sub>. There was a positive correlation between CK and Crea values at T<sub>6</sub> (r:0.339p: 0.017), T<sub>12</sub> (r:0.736p:0.001) T<sub>48</sub> (r:0.447p:0.004) No statistically significant changes were determined in BUN, ALT, Trop I, Na and K.

**Conclusion:** These results determined that STP and fluid restriction may have negative effects on RM and this is critical in the first 24 hours. The slight increase in Crea values and that BUN values did not increase, was thought to be associated with CKMB increase and not with the reason of RI. Patients at risk should be monitored closely in this respect.

## 18AP2-2

### Transfusional practice in the extreme old: peri-operative needs and clinical outcomes

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**Background and Goal of Study:** The number of patients in their 4<sup>th</sup> age undergoing elective surgery is growing. Accordingly, they represent an important challenge in terms of peri-operative blood management. The aim of this study is to describe our transfusional practice in this group, and to analyse whether there is an association between transfusion and clinical outcomes.

**Materials and methods:** All patients aged 85 years and above admitted for elective surgery between 2010 and 2013 were included. We collected demographic data, comorbidities, ASA score and surgical complexity. To assess transfusion practice, we recorded haemoglobin (Hb) values pre, post-operatively, and at discharge. We also considered the threshold Hb and the number of red blood cells (RBC) units transfused. The main outcome variables were morbidity, 30-day mortality, length of hospital stay and discharge status. We used X<sup>2</sup> and Fisher's exact test for categorical variables, and T-test for continuous variables. A p < 0.05 was considered significant.

**Results and discussion:** We included 63 patients (32 females, 31 males) undergoing elective surgery of diverse complexity. The median age was 87. Regarding pre-operative comorbidities, hypertension, neoplasms, diabetes and peripheral vasculopathy were the most prevalent, both among the transfused and the non-transfused cohorts. Overall, 36.5% of the patients were transfused. The Transfusion Index was 1.68 RBC units per patient (CI 95% 0.78-2.59).

Regarding postoperative complications, our results showed an association between RBC transfusion and both cardiac ischemic events (p < 0.05) and congestive cardiac failure (p < 0.01). Conversely, no statistical relationships could be found with respiratory compromise nor with sepsis. Blood transfusion was associated with higher morbidity (p < 0.05), higher 30-day mortality (p < 0.05), and a longer hospital stay (23.35 vs. 11.38 days; p < 0.01).

**Conclusions:** Our results suggest that peri-operative blood transfusion is associated with higher risk of 30-day mortality, cardiac morbidity and a substantial longer hospital stay in extremely elderly patients. Nevertheless, we cannot be sure whether this association is due to adverse effects of blood transfusion or, instead, it is the result of a previous worse clinical condition. These findings should lead to further studies to clarify this point in this emerging population.



## 18AP2-3

### Abdominal aortic injury during vertebroplasty: a case report

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**Background:** Percutaneous vertebroplasty (PVP) is a less invasive treatment, while these cases are often high risk and in prone position, thus life-threatening events can be catastrophic (1). Here we report the first case of penetration of the aortic wall by needle insertion during PVP.

**Case report:** In an 80-yr-old female undergoing PVP, the cement injection needle was advanced into the L1 vertebral body and arterial blood spurted from the needle hub. Fluoroscopic imaging revealed needle penetration of the aorta. To minimize bleeding, we reduced blood pressure and stabilized the needle. We monitored radial arterial pressure and prepared for blood transfusion, and consulted the cardiac surgery and radiology departments. Contrast medium injected via the needle revealed a hematoma pressing the aortic wall beyond the needle. As the (pulse) pressure of the insertion needle decreased, the hematoma was thought to coagulate. The needle was cautiously withdrawn. Angiography showed minimum extravasation and vital signs remained stable, thus she was moved to the ICU for conservative treatment.

**Discussion:** Immediate surgical repair is generally recommended for an aorta penetrating injury. However, for PVP, the patient is in a prone position surrounded by instruments. In our case, bleeding seemed to be attenuated by a tamponade, because the injury occurred in the posterior wall of the aorta at the L1 level. Induction of hypotension and holding the insertion needle stable might also have helped to reduce bleeding and promote coagulation, allowing time for consultation, and blood transfusion and surgical treatment preparation. Notably, the penetrating needle was useful for elucidating the needle tip location and nature of the hematoma. Conservative treatment can be applied in affected cases when hemodynamic state is stable and hemostasis is confirmed. However, prompt removal of the insertion needle and surgical repair should be considered in the presence of circulatory collapse.

#### References:

1. Cardiovasc Intervent Radiol 2008;31:1249-51

**Learning points:** Key points for anesthetic care following aortic injury during PVP:

- 1) Minimize bleeding by inducing hypotension and stabilizing penetrating needle.
- 2) Prepare for crisis, i.e., massive infusion/transfusion, cardiac surgeon/radiologist consultation.
- 3) Use penetrating needle for angiography and pressure monitoring.
- 4) Conservative treatment can be applied when circulation is stable and hemostasis confirmed.

## 18AP2-4

### The recovery of autonomic nervous function assessed by heart rate variability after general anesthesia in elderly patients: a comparison between desflurane and sevoflurane

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**Background and Goal of Study:** Although desflurane is associated with faster recovery than sevoflurane after general anesthesia in elderly patients(1), recovery of autonomic nervous function has never been compared before. The objective of this study was to compare the recovery of autonomic nervous function after general anesthesia between desflurane and sevoflurane in elderly patients using heart rate variability (HRV).

**Materials and methods:** After institutional approval and informed consent was obtained, 35 patients (ASA PS 1-3, 72(10) years) having elective surgery under general anesthesia were randomly assigned to receive either desflurane or sevoflurane-based anesthesia. Anesthesia was induced with fentanyl, propofol, and rocuronium bromide. After the trachea was intubated, inhalation anesthetics equivalent to 1MAC and remifentanyl was administered for the maintenance of anesthesia. When the surgery was completed, the administration of all anesthetics was terminated. The monitoring of ECG was initiated before the induction of anesthesia. The raw ECG wave was digitally transferred and stored to a personal computer. HRV was evaluated using MemCalc method (Bonaly/Light®, GMS, Tokyo). The power of very low (0.003-0.04Hz;VLF), low (0.04-0.15Hz;LF) and high (0.15-0.4Hz;HF) frequency component of HRV were calculated. Ultra short-term entropy of HRV (UsEn) as an index of non-

linear analysis of HRV was also obtained. These indices were averaged for each 30 min after emergence from anesthesia and the recovery of HRV was compared between the two groups.

#### Results and discussion:

	control	0-30 min	30-60 min	60-90 min	90-120 min
UsEn (D)	100	92(43)	106(45)	106(46)	97(36)
UsEn (S)	100	63(38)*#	79(45)*#	79(42)*#	80(39)*#
VLF (D)	100	88(24)	100(22)	98(17)	93(19)
VLF (S)	100	79(17)#	79(17)*#	76(13)*#	78(13)*#
LF (D)	100	97(28)	109(33)	105(33)	98(31)
LF (S)	100	82(21)	84(35)*	82(31)	83(28)
HF (D)	100	108(31)	113(37)	110(41)	102(41)
HF (S)	100	96(39)	101(64)	94(48)	95(48)

[The recovery of HRV after anesthesia]

Values are shown as mean (SD) of percent of control every 30min after emergence from anesthesia. D:desflurane, S:sevoflurane. \*: p< 0.05 vs D, #: p< 0.05 vs control.

**Conclusion(s):** The recovery of HRV indices were faster after desflurane anesthesia than sevoflurane anesthesia. The desflurane might enhance the recovery of autonomic nervous function after general anesthesia.

#### References:

1. Anesth Analg 1995;80:1223-32.

## 18AP2-5

### Anesthetic considerations in carotid paraganglioma: a case report

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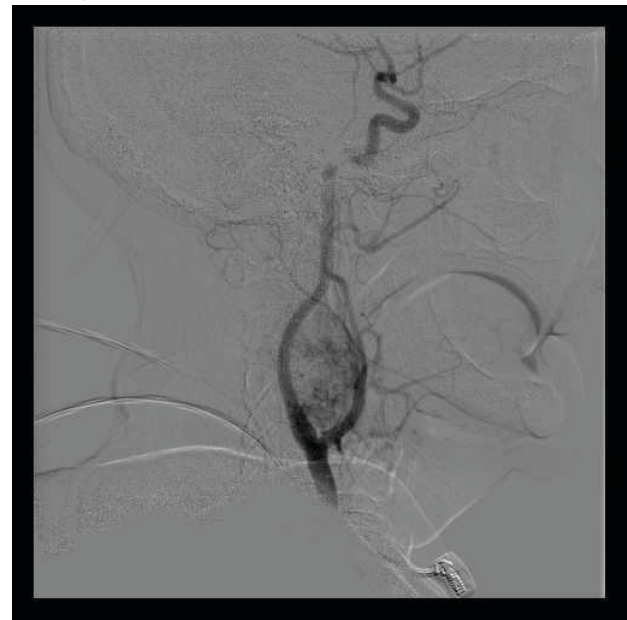
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**Background:** Carotid body tumors are uncommon, usually slow-growing, asymptomatic masses, the resection presents potentially life threatening anesthetic challenges and risks. We present the report about anesthetic management during exeresis of Shamblin's class III carotid paraganglioma.

#### Case report:



[Arteriography]

A woman aged 79 years presented with a 4- month history of a slowly growing laterocervical left mass. CT scan showed a highly vascular tumor at the left carotid space including both internal and external carotid arteries, an arteri-

ography and embolization was planned 48 hours before surgery. Anesthesia was induced with thiopentone, fentanyl and cisatracurium, n<sup>o</sup> 7 nasotracheal tube was inserted. We used INVOS oximeter. During the dissection of the tumour, systolic blood pressure temporarily dropped to 70-80 mmHg and pulse rate from 90 to 40-50 beats/min with no changes in oximetric values.

**Discussion:** Glomus tumors are uncommon, only 0.03% of all neoplasms and 0.6% of head and neck tumors.[1]. Most frequent in middle age females. Surgery remains the treatment of choice but usually starts on embolization of arteries that supplies the tumor. Resection carotid paraganglioma surgery must be performed through a complete monitoring, that also includes cerebral oximetry, and ensuring an adequate cerebral protection.[2]

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- Jensen NF Glomus tumors of the head and neck: anesthetic considerations. *Anesth Analg*. 1994 Jan;78(1):112-9.2.
- Granel M, Tommasi M, Ubeda J, Chaves S, Soriano JL, Todolí J, Grau F. Anesthesia for carotid paraganglioma exeresis. Report of 3 cases. *Rev Esp Anesthesiol Reanim*. 2001 Oct;48(8):387-92.3.
- Hallett JW Jr, Nora JD, Hollier LH, Cherry KJ Jr, Pairolo PC. Trends in neurovascular complications of surgical management for carotid body and cervical paragangliomas: A fifty-year experience with 153 tumors. *J Vasc Surg* 1988;7:284-91.

**Learning points:** Anesthetic management can be a challenge because of the risks of bleeding, hemodynamic instability and catecholaminergic storm. The best way to get optimal outcomes includes a thorough preoperative anesthesia; with urine catecholamin levels, tumor extension study and preoperative embolization.

## 18AP2-7

### Extracranial internal carotid aneurysm - anaesthetic approach

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**Background:** Extracranial internal carotid aneurysm is a rare pathology with an incidence of 0.3% between the aneurysms in general. The actual knowledge of their aetiology, treatment, anaesthetic and surgical approach results from small series of cases and isolated case reports.

**Case report:** We describe a case of an 80 years old female patient, with history of drop attacks for three months. An eco-doppler was performed for etiological study and aneurismatic kinking was described in left internal carotid artery (20,1mm x 16,3mm). Attending to the proximal location and high embolic risk, the patient was submitted to open aneurysm resection under cervical blockage with 0,75% ropivacaine. Before the blockage, their feasibility was evaluated by ultrasonography in the operating room. Besides the standard monitoring, both invasive blood pressure and cerebral oximetry (Somanetics INVOS ®) were monitored and remained stable throughout the procedure.

The surgery went uneventfully and patient was discharged from hospital, on the 3rd day post surgery without any neurologic deficits.

**Discussion:** Although surgical treatment of carotid aneurysm is suitable in most cases because of the high risk of stroke, very few cases are described in the literature, and of those mainly under general anaesthesia. Our choice of cervical plexus blockage, besides having provided good surgical conditions, allowed the continuous assessment of the neurological status of the patient, ensuring the identification and early intervention in the event of a marked decrease of cerebral perfusion.

#### References:

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**Learning points:** Cervical plexus blockage is a good option for carotid aneurysm surgical repair where the size, configuration and location of the aneurysm do not contraindicate. Ultrasound assumes a key role in this context, since it allowed us to handle safely a potentially distorted nerve territory.

## 18AP3-1

### Nutritional status in the fourth aged patients undergoing elective surgery

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**Background and Goal of Study:** The extreme elderly are increasingly presenting for elective surgery. In many instances, there is a coexisting nutritional deficit that can adversely affect their health and postoperative outcomes. The mininutritional assessment test (MNAT) has proved to be a useful tool to detect risk of malnutrition. Consequently, we aimed to analyze the potential relationship between nutritional status according to MNAT and poor postoperative outcomes in this population.

**Materials and methods:** We included every patient aged 85 years and above undergoing elective surgery between 2011 and 2013. We recorded demographic data, ASA score, level of dependency according to Katz index, preoperative comorbidity and complexity of surgery. Nutritional status was assessed with MNAT and levels of serum albumine and proteines. The main outcome variables were morbidity, in-hospital mortality, 30-day mortality, length of hospital stay and discharge status.

We used Spearman's rank correlation coefficient, X<sup>2</sup> for categorical variables and ANOVA for multiple combinations.

**Results and discussion:** 63 patients were included (32 female, 31 male). The median age was 87 (range 85-96). According to the MNAT, 11% were malnourished, 56% at risk of malnutrition and 33% well nourished. The mean albumine and proteine serum levels were 3,49 (CI 95%: 3,34-3,64) g/dL and 6,32 (CI: 6,13-6,50) g/dL respectively, with a statistically significant correlation with the MNAT score (R<sup>2</sup> = 0,302, p < 0,001 for proteines and R<sup>2</sup> = 0,512, p < 0,001 for albumine). When stratifying patients according to nutritional status, well-nourished patients were younger (p = 0,016) and more independent than those with any degree of nutritional deficit (p = 0,05), regardless of their preoperative habitational status. No statistically significant differences were found for most of the outcome variables, except for the incidence of postoperative atrial fibrillation (p = 0,01).

**Conclusion(s):** There is a high incidence of nutritional deficit among the fourth aged patients undergoing elective surgery, with an statistically significant relation with age and dependency. The incidence of poor postoperative outcomes was found higher- though no significative- in patients with some degree of malnutrition. This tendency might become significative with a bigger sample. Prospective studies are needed to determine whether preoperative nutritional intervention could improve postoperative outcomes.

## 18AP3-2

### Impact of anaesthesia assessment in ophtalmic surgery in a central hospital

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**Goal of Study:** To evaluate and characterize the importance of preoperative anaesthesia assessment in ophthalmic surgeries and its relation with patient morbidity in the perioperative period. The study was conducted in a central hospital, during one year, from January, the 1st to December the 31<sup>st</sup> of 2012.

**Methods:** Observational retrospective cross-sectional study of all anaesthesia assessments of patients proposed for ophthalmic surgery from January, the 1<sup>st</sup> to December the 31<sup>st</sup> of 2012. We collected demographic data (name, age and sex), ASA grade assigned, type of anaesthesia proposed, assessment final result (classified as "fit", "conditional", "not fit").

**Results and discussion:** A total of 2395 anaesthesia assessments were reviewed. The population studied was mostly female 60.2% (n=1442) with a mean age of 72.25 years old. The most frequent ASA classifications attributed were grade II, 54.2% (n=1299) and grade III 42.8 % (n=1026). About 363 patients were considered "conditional" due to variable reasons including pending or not done blood test (n = 220), needing of other specialist's evaluation due to other comorbidities (n = 47), or absence of criteria for outpatient surgery (n = 6). Only 1 % (n = 46) of the patients were classified as "not fit", from these group 30 patients had severe comorbidities requiring urgent evaluation by a specialist and 8 had acute diseases that precluded the surgical procedure and required hospitalization.

**Conclusion:** The population in need of ophthalmological care is enriched in older people with multiple associated pathologies. This study shows the

importance of making a careful anaesthesia assessment to avoid perioperative complications. Complications associated with eye surgery range from blindness, haemorrhage, increased intraocular pressure, acute myocardial infarction, stroke, arrhythmias, decompensated heart failure and even death. The anaesthesiologist assessment of the patient allows pathologic and social condition evaluation of the patient that prevents and decreases the likelihood of complications and avoids some last minute surgery cancelations. The anaesthetist has a main role in triaging and choosing the most adjusted type of anaesthesia and must be part of the team that manages the patient in order to prevent perioperative complications.

### 18AP3-3

#### Implementation of a chronic medication protocol in patients undergoing inpatient urologic surgery

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**Background and Goal of Study:** Aging is associated with important pathophysiological changes. Polypharmacy is common and carries risks, namely drug interactions with anesthesia.

We assess the implementation of a chronic medication protocol on the morning of the surgery and at 24 hours (h), characterizing the patients and their coexisting disease.

**Materials and methods:** Study approved by the hospital's ethics committee. Patients underwent urologic surgery (May-September 2012). The protocol (table 1) was applied by anesthesiologists and by nurses from the Urology department. Consultation of the electronic prescription record and administration of drugs was performed. Failure of prescription and/or administration was classified as non-compliance of the protocol. The results are presented in percentage.

Pharmacological group	Indications	Exceptions
ACEI, ARA, diuretics	NO on the morning	Maintain on the morning if severe CHF and/or HT difficult to control
Calcium channel blockers, beta blockers, nitrates e digitalis	YES on the morning	
Aspirin	STOP 5 days before	NO STOP if secondary prevention or high risk for CV complications
Dipiridamol	STOP 2 days before	NO STOP if secondary prevention or high risk for CV complications
Clopidogrel/Ticlopidine	STOP 7 - 10 days before	
LMWH	Prevention: last administration 12h before Treatment: last administration 24h before	High risk for thrombosis/embolism
ODM/Insulin	Diabetic patient protocol	

[Table 1: Chronic medication protocol]

ACEI: angiotensin conversion enzyme inhibitor;  
 ARA: angiotensin receptor antagonists;  
 LMWH: low molecular weight heparin;  
 ODM: Oral diabetes medication;  
 CHF: congestive heart failure;  
 HT: Hypertension;  
 CV: cardiovascular.

**Results and discussion:** 124 patients included. 37%: >65 y-old; 62%: more than 1 coexisting disease. 12%: under medication with 3 different pharmacological groups, 15% with 4 and 21% with >4. The protocol was fulfilled in 72%. The prescription was 100%. Protocol failed 41% on the morning and 12% at 24h. ACEI/ARBs administration failed in 78% on the morning and 3,5% at 24h. Diuretics administration failed in 39% on the morning and 2,5% at 24h.

**Conclusion(s):** Failure on drug administration was detected. This underlines the need for awareness of nurses to comply with the protocol. Maintenance of some drugs is crucial for perioperative patient stability. The implementation of protocol and their evaluation identifies nonconformities and promotes continuous quality improvement.

### 18AP3-4

#### Validity assessment of preanesthetic transthoracic echocardiography in non-cardiac elderly patients

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**Background:** Preoperative evaluation of cardiac function is very important especially in elderly patients (Pts.). In ASA practice advisory, preanesthetic transthoracic echocardiography (TTE) has been classified into Category B2 evidence, because an observational study reported abnormal TTE findings in 25% of asymptomatic or non-selected patients. However, nobody reports about the usefulness of preanesthetic TTE examination in elderly non-cardiac Pts. without cardiac disease. Therefore, this retrospective study was conducted to assess the usefulness and validity of preanesthetic TTE for the elderly Pts. and also to reveal the relevance of the positive findings of the preoperative electrocardiogram test and/or the complications related with cardiac risk.

**Materials and methods:** 70 years or older Pts. undergoing non-cardiac surgery after TTE examinations during any three months were enrolled in this study. The Pts., who were diagnosed coronary artery disease, valvular disease or chronic cardiac failure or who underwent cardiac surgery previously, were excluded from this study. Our standard preanesthetic examination consists of chest radiography, electrocardiogram (ECG), spirometry and blood test. TTE exam is additionally performed by individual opinions of surgeon or anesthesiologist. The coexisting disease as the cardiac risk factors (i.e. hypertension, hyperlipidemia, diabetes mellitus) were also reviewed. We assessed that the relation among Pts. with the abnormal finding of ECG (ECG+), Pts. with the abnormal finding of TTE (TTE+) and Pts. with the coexisting cardiac risk disease (CR+). The abnormal TTE was judged by the following findings; an enlarged left ventricle (LV), a reduced LV systolic or diastolic function, an existing valvular disease and regional wall motion abnormality. The sensitivity, specificity, and accuracy among ECG+, TTE+ or CR+ were examined.

**Results:** 176 patients' data were examined (Female : Male=99 : 77, Mean Age=79yo). 102 of 176 Pts. were diagnosed as ECG+. 92 Pts. as TTE+. 164 Pts. as CR+. Sensitivity and accuracy compared ECG+ with TTE+ were low. However, compared both ECG+ and CR+ with TTE+, sensitivity increased to 95.2% (95% CI: 88.3-98.7) and negative predictive value was 75.0%.

**Conclusion:** Our results suggested that preanesthetic TTE should be examined in elderly Pts. with both an abnormal finding in ECG and a coexisting cardiac risk disease.

#### References:

Anesthesiology 116(3):522-38, 2012

### 18AP3-5

#### Predicting the risk of pressure ulcers in elderly patients in the postoperative period

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**Background and Goal of Study:** Although it is well known that pressure ulcers are associated with negative patient outcomes and increased hospital cost, there is little research related to pressure ulcers in postoperative period. In this study we want:

- to determine the risk factors for pressure ulceration in the postoperative period
- to evaluate the Braden scale as a predictor of pressure ulcer risk in elderly patients,
- to determine whether pressure ulcers are likely to occur early in the hospital stay.

**Materials and methods:** In our study (1.01.2013-1.07.2013) elderly postoperative patients, aged 65 and older, were enrolled within 24 h of admission to the postanesthesia care unit ( PACU ) ; data were collected every other day until discharge from the PACU. We collected data, using a form we developed that contained demographic and clinical factors found in previous research and in our clinical practice to be associated with pressure ulcers. The Braden scale was used to assess repeatedly 120 elderly patients without pressure ulcers in a PACU, and the patients' skin was inspected routinely for pressure ulcers.

**Results and discussion:** Twenty-six of 120 patients developed at least one pressure ulcer (incidence = 21.6%) after an average stay of 5.3 days. The Braden scale, which measures six characteristics of skin condition and patient status, proved to be a primary predictor of ulcer development. No ulcers devel-



oped in the 41 patients whose Braden score was 14 or higher. The likelihood of developing a pressure sore was predicted mathematically from the Braden score. A lower Braden Scale score, the presence of diabetes mellitus, being underweight independently predicted the development of a pressure ulcer.

**Conclusion(s):** Findings from this study suggest that, in addition to a low Braden Scale score (Braden scores B 13), a diagnosis of diabetes may represent clinically relevant pressure ulcer risk factors in the elderly PACU population and that patients with these factors may benefit from more aggressive preventive care.

### 18AP3-6

#### Is delirium after general anesthesia in the elderly an independent predictor of hospital length of stay?

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**Background and Goal of Study:** The consequences of delirium in the perioperative period remain unclear. In this study, we sought to determine if delirium in the perioperative period was an independent predictor of prolonged hospital length of stay (LOS).

**Materials and methods:** This prospective cohort study was conducted in Surgery Clinic of the Constanta County Emergency Hospital from July 2012 to July 2013. The study included patients aged 65 and older who were in the postanesthesia care unit (PACU) for less than 8 h at enrollment. After surgery, each patient was evaluated for a Diagnostic and Statistical Manual of Mental Disorders IV diagnosis of delirium. To determine if delirium in the ICU was independently associated with time to discharge, Cox proportional hazard regression was performed adjusted for age, comorbidity burden, severity of illness, functional impairment, and surgical procedure.

**Results and discussion:** A total of 124 patients met enrollment criteria. The median age was 75 years, interquartile range (IQR) = 69-81, 54.8 % patients (68) were delirious in the PACU. Median LOS was 8 days (IQR = 3-12.5) for delirious PACU patients and 4 day (IQR = 2-8) for nondelirious PACU patients (p 0.001). The hazard ratio (HR) of delirium for time to discharge was 0.81 (95 % CI 0.47 to 0.89) and indicated that elderly PACU patients with delirium after general anesthesia were more likely to have prolonged hospital LOS compared with those without delirium.

**Conclusion(s):** Delirium in older PACU patients after general anesthesia is an independent predictor of hospital length of stay.

### 18AP3-7

#### Spiritual distress assessment tool a valid instrument for elderly patients in the perioperative period

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**Background and Goal of Study:** Researchers' interest in the connections between mind and body coincides with increasing interest in the holistic view of health care, in which emotional and spiritual needs are considered inextricable from physical and psychological needs. The Spiritual Distress Assessment Tool (SDAT) is a 5-item instrument developed to assess unmet spiritual needs in elderly patients and to determine the presence of spiritual distress. The objective of this study was to investigate the SDAT psychometric properties.

**Materials and methods:** This cross-sectional study was performed in Surgery Clinic of the Constanta County Emergency Hospital. Patients (N =72), aged 65 years and over with Mini Mental State Exam score [greater than or equal to] 20, were consecutively enrolled over a 12-month period. Data on health, functional, cognitive, affective and spiritual status were collected upon admission. Interviews using the SDAT (score from 0 to 15, higher scores indicating higher distress) were conducted by a trained doctor. Factor analysis, measures of internal consistency (inter-item and item-to-total correlations, Cronbach alpha), and reliability (intra-rater and inter-rater) were performed. Criterion-related validity was assessed using the Functional Assessment of Chronic Illness Therapy-Spiritual well-being (FACIT-Sp) and the question :Are you at peace? - as criterion-standard.

**Results and discussion:** SDAT scores ranged from 1 to 12 (mean 5.1 ± 1.9). Overall, 62.5 % (48/72) of the patients reported some spiritual distress on SDAT total score and 37.5% (24/85) reported at least one severe unmet spiritual need. A two-factor solution explained 52 % of the variance. Inter-item correlations ranged from 0.11 to 0.38 (eight out of ten with p 0.05). Item-to-total correlations ranged from 0.57 to 0.64 (all p 0.001). Cronbach alpha was acceptable (0.60). Intra-rater and inter-rater reliabilities were high (Intraclass Correlation Coefficients ranging from 0.78 to 0.93. Compared with patients showing no severely unmet spiritual need, patients with at least one severe unmet spiritual need had higher odds of occurrence of a family meeting (95 %CI 1.3-15.8, P = 0.02) and were more often discharged to a nursing home (12.3 % vs. 3.1 %; P = 0.027).

**Conclusion(s):** SDAT has acceptable psychometrics properties and appears to be a valid and reliable instrument to assess spiritual distress in elderly hospitalized patients.

## Airway Management

### 19AP1-1

#### "Can't intubate, can't ventilate" - a learning case outside the operating room

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**Background:** The "can't intubate, can't ventilate" (CICV) scenario is rare within elective anesthesia practice and it's an emergency. Remote locations include different organizational aspects and hazards. We report a CICV case that occurred during an elective procedure outside the operating room (OR).

**Case Report:** A 69-yr-old woman (BMI 27.5 Kg.m<sup>2</sup>) presented for elective repositioning of the implantable cardioverter-defibrillator, outside the OR. She had almost no neck mobility. Intubation was anticipated to be difficult, although mask ventilation was not. A diagnostic laryngoscopy was made after anesthesia induction without neuromuscular block agents with videolaryngoscope (C-MAC ® with D-blade) with no success. Ventilation with bag-mask and supraglottic devices also proved to be ineffective. A CICV situation was recognized, help was called and attempt for cricothyroidotomy was tried unsuccessfully. A second anesthetist arrived 2 minutes after help being called. Collaboration for performing an emergent tracheostomy was asked and another attempt to intubate with the same videolaryngoscope was made with success. Oxygen saturation levels were below 80% for about 4 minutes and

30 seconds. Hemodynamics was always stable. Extubation was made in the OR in the presence of a surgeon after precluding trauma of the airway. There was no neurological deficit.

**Discussion:** CICV situations are an anesthetic emergency requiring rapid and decisive management. The final step in guidelines for the management of this situation is cricothyroidotomy. There is increasing evidence that muscle relaxants are beneficial in overcoming difficult mask ventilation in adults. It is a shifting view and even recommended in a situation of CICV and waking the patient is not an option<sup>1</sup>. The number of diagnostic and interventional procedures outside the OR has been increasing in the last years. One of the first principals in difficult airway management, to call for assistance and help, is not so obvious. Not all strategies, especially fiberoptic intubation or the installation of a surgical airway, might be readily available.

#### References:

1. Cook TM, Woodall N, Harper J, et al. Major complications of airway management in the UK: NAP4 of the Royal College of Anaesthetists and the Difficult Airway Society. Br J Anaesth 2011;106:632-42.

**Learning Points:** Difficult airway management outside the OR challenges the practitioner and needs the implementation of algorithms including the new airway devices.

## 19AP1-2

### Intraoperative endotracheal hemorrhage successfully managed by occlusion with an inflated endotracheal tube cuff during endovascular aortic repair: a case report

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**Background:** Endotracheal hemorrhage is a major emergency and is often associated with high mortality (1). We report a case, in which endotracheal hemorrhage found during thoracic endovascular aortic repair (TEVAR) was successfully managed with an inflated endotracheal tube (ETT) cuff.

**Case report:** The patient was an 82-year-old man with a past history of myocardial infarction, hypertension and hemodialysis. He had previously undergone endovascular aortic repair (EVAR) for a 59mm-large abdominal aortic aneurysm of the subrenal aorta. Three months later he experienced back pain of a sudden onset and an impending rupture of thoracoabdominal aneurysm was diagnosed based on a contrast CT exam. An emergency operation under general anaesthesia was immediately commenced. Following tracheal intubation, a large amount of blood was found in the central airways. Since the hemorrhage persisted even after insertion of an intra-aortic stent, additional fluoroscopy of the aortic arch was performed. This revealed an outflow of the contrast medium into the trachea and the site of endotracheal bleeding. The position of the ETT cuff was adjusted to match the bleeding site and the cuff was then inflated to stop hemorrhage. Due to suspected bronchial artery-tracheal fistula an additional stent was inserted into the distal part of the aortic arch. The surgery was uneventfully completed and the patient was postoperatively managed in the ICU before being transferred to a general ward at day 21.

**Discussion:** EVAR has become a widely performed procedure and more anaesthetists are asked to provide perioperative care for patients presenting with post-EVAR complications (i.e. end-leak, aorto-tracheal fistulas etc.). Aorto-bronchial fistulas pose particular management difficulties and are often associated with 100% mortality if not aggressively treated (2). The reported case of bronchial artery-tracheal fistula was a rare occurrence of intra-respiratory tract hemorrhage that could be successfully managed during the endovascular procedure.

#### References:

1. Hakanson E. et al., Br J Anaesth 2002;88:291-5;
2. Picichè M. et al., Ann Thorac Surg 2003;75:1998 -2006.

**Learning points:** Aggressive surgical treatment of endotracheal hemorrhage could be avoided because fluoroscopic assistance allowed precise localization of the bleeding site and provided guidance for its occlusion by an inflated ETT cuff. Our case stresses the importance of intraoperative surgeon-anaesthetist cooperation.

## 19AP1-3

### Airway rescue in the prone position with the Pro-Seal™ laryngeal mask airway - case report

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**Background:** Endo-tracheal tube (ETT) misplacement or accidental extubation during surgery is a life-threatening anesthesia-related complication, especially if the patient is placed in a way that complicates re-intubation. We describe a case of emergent Pro-Seal™ Laryngeal Mask Airway (LMA) insertion after ventilation problems in a patient placed in prone position (PP) for lower back surgery.

**Case report:** A 66-yr-old female, ASA II, scheduled for spine surgery due to scoliosis submitted to general anesthesia with muscular relaxation and orotracheal intubation. Placed in PP after induction, face supported by ProneView®. One hour after surgery started SpO<sub>2</sub> decreased and airway pressure increased. Suspecting accidental extubation we confirmed the correct ETT placement with a flexible fibroscope. As SpO<sub>2</sub> continued decreasing in spite of increasing FiO<sub>2</sub> and fresh gas flow with big difference between inspired and expired volumes, we thought of a leak due to ETT damage. We decided to remove the ETT and placed a LMA Pro-seal™ 4, with a nasogastric tube as a guide with the patient still in PP, without difficulty. Patient was mechanically ventilated with peak airway pressure < 20cmH<sub>2</sub>O, CO<sub>2</sub>ET 44mmHg and rapid recovery of SpO<sub>2</sub> to 100%. Preparations were simultaneously made to turn the patient supine for direct laryngoscopy. Surgery continued with the LMA *in situ*. Postoperative period was uneventful, with no neurological or respiratory sequelae.

**Discussion:** Several studies support using LMA as an airway management option in elective surgery requiring PP. There is little evidence supporting its use as a rescue device after accidental extubation in PP but case reports describe it as an easy, fast technique and an useful adjunct in securing an airway emergently allowing for adequate ventilation, if done by experienced personnel, as in this case.

Although direct or fiberoptic laryngoscopy can be attempted in the PP if airway control is lost, this position is not optimal for these techniques and it may take too much time to perform. Turning the patient supine during a spine surgery may impose neurological injury and compromise the surgical field sterility. We decided to place a LMA maintaining the PP. In case of an unsuccessful attempt patient would be turned supine and re-intubated.

**Learning points:** LMA can be a rapid, easy, low morbidity solution in an emergent airway management in a patient in the PP when executed by experienced personnel and after adequate ponderation.

## 19AP1-4

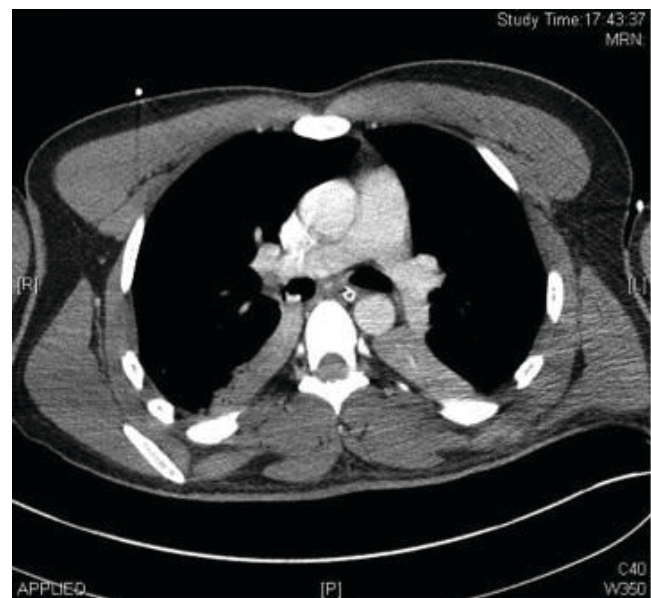
### A case of aspiration of chewing gum in a poly-trauma patient following high impact motorcycle accident and its emergency management

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**Background:** Aspiration of chewing gum in motorcyclists following high impact trauma can cause significant airway problems and needs to be managed early and appropriately to avoid problems with oxygenation and ventilation.

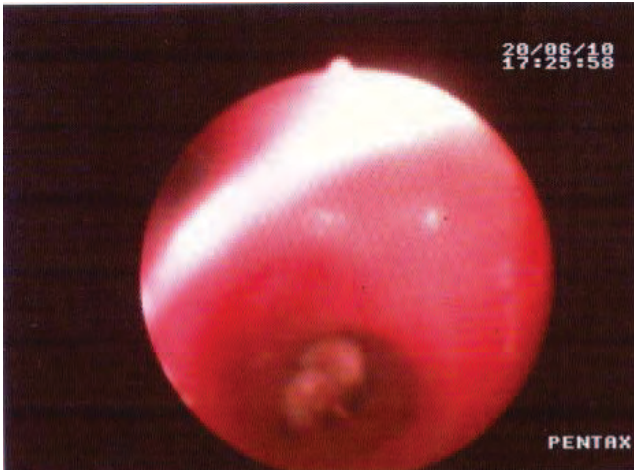
**Case report:** A 27 yr old motorcyclist with polytrauma involving head injuries, maxillofacial injuries and orthopaedic injuries was transferred intubated and ventilated for head injury management to tertiary centre. CT head showed significant intraparenchymal bleed, CT neck and abdomen did not demonstrate any significant injuries. CT thorax showed a soft tissue shadow in right main bronchus with no significant collapse distal to it (*Image 1*). Chest X-ray showed partial collapse involving the right upper lung fields. Clinically decreased air entry right infraclavicular region. An emergency Bronchoscopy was performed when two chestnut shaped foreign bodies were visualized.

(*Images 2,3*). It looked like a piece of chewing gum. It was possible to aspirate one fully large piece of chewing gum onto the end of the scope and removed in one piece. Other piece was small to aspirate completely and broke up into tiny pieces when suction was applied to it. Numerous small pieces passed through scope into suction jar after which visualization was lost. We were unable to find any physical evidence of foreign body on reexamination of bronchial tree. Subsequently he had no chest signs, his oxygenation and ventilation was stable throughout his stay in ITU, chest Xray did not show any collapse, CT scan Chest showed no further evidence of any foreign bodies. The entire procedure lasted twenty five minutes with stable ICP. He underwent decompressive craniectomy on the 6<sup>th</sup> day, went to the ward on the 16<sup>th</sup> day and was later repatriated to the parent hospital for neuro-rehabilitation.

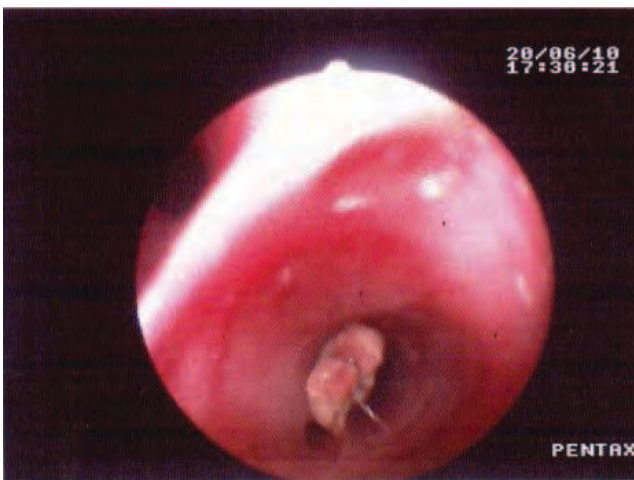


[CT scan showing soft tissue shadow Rt bronchus]





[Bronchoscopy image of the chewing gum]



[Bronchoscopy image of the chewing gum]

**Discussion:** There are very few cases of this unusual aspiration reported in literature. It highlights need for thorough examination, high index of suspicion and emergent action for foreign body removal

**References:**

Foreign body aspiration after high-velocity trauma. Wilcox SR, Arbelaez C, Nadel ES, Brown DFJ Emerg Med. 2009 Nov;37(4):411-4  
Adult sudden death caused by aspiration of chewing gum. Njau SN. Forensic Sci Int. 2004 Jan 28;139(2-3):103-6

**Learning points:** Motorcyclists on long journeys have the habit of chewing gum, which can be aspirated following an RTA. A high index of suspicion and emergency bronchoscopy needed to remove the foreign body to avoid oxygenation and ventilation problems.

### 19AP1-5

#### Supraglottic airway device in laparoscopy surgery in patient with recent history of thyroplasty

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**Background:** Type I thyroplasty technique (TIT) with Montgomery implant for vocal cord medialization to improve voice dysfunction and chronic microaspirations has been introduced as treatment for unilateral vocal cord paralysis. There is limited literature about the best anesthetic technique for this procedure and for further interventions under general anesthesia.

**Case report:** 51-year-old woman scheduled for laparoscopic hysterectomy with bilateral salpingo-oophorectomy due to severe metrorrhagias. Past medical history was relevant for obesity (BMI=31), long-term treatment for COPD with bronchodilators and inhaled corticosteroids and right vocal cord paralysis, associated to aspiration pneumonia, as consequence of cervical ar-

throdesis. She had undergone to TIT 19 days before. Anesthesia was induced with midazolam, fentanyl, propofol without neuromuscular blocker and insertion of size 4 ProSeal™ Laryngeal Mask Airway (PLMA). Ventilation was set with tidal volumen 8 ml/kg and peak pressure (PP) + 18 cmH<sub>2</sub>O. Oropharyngeal leak pressure was 38 cmH<sub>2</sub>O. Anesthesia was maintained with sevoflurane and remifentanyl infusion. After positioning in Trendelenburg and insufflating pneumoperitoneum, PP increased to +26 cmH<sub>2</sub>O and EtCO<sub>2</sub> was maintained between 35-39 mmHg. Rocuronium bolus was required in order to improve surgical conditions. The rest of procedure was uneventful.

**Discussion:** TIT is the elective treatment for most of permanent unilateral paralyzed vocal cord, but it might have adverse events. Laccourreye et al found misplacement of the implant (2.1%), dyspnea (2.7%) or extrusion (1.6%) after TIT. Harrison et al noted that patients with previous TIT had higher incidence of perioperative airway complications (6.8%) in further surgeries. When they compared endotracheal tube (ETT) vs laryngeal mask, stridor appeared only in ETT group, including a case report which required emergency tracheostomy. Supraglottic airway devices with drain tube in gynecologic laparoscopic surgery (GLS) represents an advanced airway management and it should be performed by anesthesiologists with extensive experience in PLMA.

**References:**

Lin HW, Bhattacharyya N. Incidence of perioperative airway complications in patients with previous medialization thyroplasty. Laryngoscope 2009, 119:675-678

**Learning points:** Supraglottic devices for GLS are safe and seem to be the preferred option in patients with previous history of TIT due to lower incidence of airway adverse events, specially after recent TIT.

### 19AP1-6

#### Emergency management of aspirated tracheostomy cannula

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**Background:** To report a case with acute respiratory distress due to the aspiration of fractured tracheostomy tube.

**Case report:** A 9 year old boy with Cri-du-chat syndrome, who had undergone tracheostomy when he was 2 years old, admitted to ER with a suspicion of broken tracheostomy cannula. Direct inspection showed that cannula was partially fractured at the junction of the inner tube and connector. While changing the cannula, it was broken completely and the patient aspirated the inner tube causing acute respiratory distress. The inner tube cannot be grabbed through the stoma nor the patient could be intubated. He was accepted to the operating room with 78% SpO<sub>2</sub>. We closed the stoma and started oral mask ventilation. After stabilizing vitals, we performed laryngoscopy. Vocal cords were visible with active movement, anesthesia induction was performed using propofol-rocuronium bromide. Following orotracheal intubation the patient was ventilated with 100% oxygen, vital parameters were safely stabilized and the patient was extubated. Using rigid bronchoscopy the broken cannula part was removed from the left main bronchus. Tracheostomy cannula was replaced with a new one and the patient was ventilated uneventfully via the new cannula until recovery from anesthesia.

**Discussion:** We reviewed 48 cases of fractured and aspirated tracheostomy cannula from 34 published reports from 1960 until now. Only one pediatric patient had asphyxia at the time of admission. Rest of the patients admitted with more chronic symptoms like cough, progressive dyspnea and bloody sputum (1). It is reported that, when the aspirated cannula part blocks the carina or trachea completely, pushing the tube into main bronchi via endotracheal intubation or bronchoscopy can make ventilation more easier (2). We were also able to ventilate our patient and stabilize his vital parameters by pushing the cannula part into the left main bronchus.

**References:**

1. Lynrah ZA et al. Fractured tracheostomy tube as foreign body bronchus: our experience with three cases. Int J Pediatr Otorhinolaryngol. 2012 Nov;76(11):1691-5.  
2. Fraga JC et al. Bronchoscopy and tracheostomy removal of bronchial foreign body. J Pediatr Surg. 2002 Aug;37(8):1239-40.

**Learning points:** The evaluation of the tracheostomy cannula should be performed by an experienced team providing appropriate emergency conditions. Although aspiration of the cannula is a rare complication, it should be kept in mind in patients with tracheostomy, suffering acute or chronic respiratory distress.



**19AP1-7****Case report: tracheal intubation with King Vision in a patient with oral opening <1 cm**

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**Background:** The King Vision laryngoscope is a newly developed video laryngoscope (King Systems, Noblesville, IN, USA). There are few publications on this device<sup>1</sup>. This report aims to describe the use of this video laryngoscope for tracheal intubation in a patient with multiple predictors of difficult airway<sup>2</sup>.

**Case report:** Patient with cavum lymphoepithelioma with proposed surgical placement of tympanostomy and bilateral ventilation tube. After the previous surgery and adjuvant radiotherapy evolved with reduced mouth opening (< 1 cm), limitation of neck mobility and extension, Mallampati IV. Unavailability of fiberoptic intubation, we opted for the use of awake video laryngoscopy, despite the mouth opening < 1 cm. It was possible to introduce King Vision video laryngoscope standard blade (non-channeled blade) and perform tracheal intubation.

**Discussion:** It is important that anesthesiologists master different techniques for airway approach. Patients with impaired mouth opening can usually be intubated by fiberoptic endoscopy. Most modern video laryngoscopes need a mouth opening of at least 2.5 cm<sup>3</sup>. The objective here was to evaluate the possibility of video laryngoscopic tracheal intubation in a patient who had a mouth opening of 1 cm. Currently, King Vision is the only video laryngoscope having such a thin blade.

**References:**

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- Law JA, Broemling N, Cooper RM et al; Canadian Airway Focus Group. The difficult airway with recommendations for management--part 2--the anticipated difficult airway. *Can J Anaesth*. 2013;60(11):1119-38.
- Niforopoulou P, Pantazopoulos I, Demesthi T et al. Video-laryngoscopes in the adult airway management: a topical review of the literature. *Acta Anaesthesiol Scand*. 2010;54(9):1050-61.

**Learning points:** This case demonstrates that video laryngoscopy for tracheal intubation consists of an alternative tool for fiberoptic intubation even in cases of greatly reduced oral opening. It is important to master new techniques and test the limits taking into account the safety of patients. Further studies are needed to confirm and establish what are the limits of video laryngoscopy.

**19AP1-8****Can maxillo-facial surgery be a threat to patient's life?**

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**Background:** The maxillo-facial surgery represents a challenge for anesthetic practice given the restrained access to the airway during surgical intervention and direct contact of nasotracheal tube with the operative field [1]. The required instrumentation for surgical procedure may inadvertently sever the nasotracheal tube, whose ripped size can vary from a limited cut to a total transection.

**Case report:** Is here reported the case of a surgical laceration of a nasotracheal tube during a Lefort osteotomy and with this case we seek to emphasize the importance of an immediate action, as well as the existence of ready and available material. Female patient, 33 years old, ASA II, by background of hypothyroidism, submitted to balanced general anesthesia. After the induction of anesthesia, the patient was intubated with a nasotracheal tube wired 6.5. Thirty five minutes after the beginning of surgery, it was found an air leak through the tube, confirmed by a sparkling effect on blood in the oral cavity. As a measure of protection to the airway, it was performed aspiration of the oral cavity and ventilation of the patient with 100% oxygen, in continuous aspiration. The next step was the immediate replacement of the tube by one of the same size, using a tube exchanger, laryngoscope and Magill forceps. The removed tube had an extensive cut between 23 and 24 centimeters. By persistence of the air leak and low pressure cuff, the second tube was removed which allowed the discovery of cuff's disruption. For the third time, the nasotracheal tube was exchanged using merely a tube exchanger. The surgery proceeded, vital signs remained stable and patient was extubated at the end of the intervention.

**Discussion:** The present case demonstrates a rare complication, but possibly fatal [2], with different reported approaches in the literature. The use of a tube exchanger was decisive in the resolution of this complication.

**References:**

- Anaesthesia & Intensive Care Medicine 2008; 9 (8): 351-354
- European Journal of Anaesthesiology 1999; 16 (3): 201-203

**Learning points:** This case alerts the anesthesiologist for the need to pay attention in situations where the airway is shared with the surgeon, because during a complication, the immediate recognition, confirmation and fast acting, with easily available technical resources as the tube exchangers, can be decisive.

**19AP1-9****Submandibular tracheal intubation in a facial trauma patient**

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**Background:** Maxillofacial(MF) surgery is a challenge to the anesthesiologist once the airway is shared with the surgeon. Orotracheal intubation(OTI) may not be feasible in some procedures because it may interfere with the surgical field and dental occlusion, often required to adjust and fix maxillary fractures<sup>1</sup>.

**Case report:** A 57years old male, ASA II, proposed for the reduction and fixation Le Fort II fracture and closed reduction of the nasal bone. A maxillofacial CT showed multiple fractures of the facial mass, Le Fort II and ethmoid fracture. Anesthetic induction was performed with fentanyl 2µg/Kg, propofol 2mg/Kg and succinylcholine 1.5mg/kg iv. Maintenance was obtained with remifentanyl, rocuronium, sevoflurane 2 % and FIO2 50% under standard ASA monitoring. After OTI with wired 8.0mm tube, the surgeon performed a transverse skin incision of 2cm in the submandibular region. Using a Kocker tweezer, an opening to the oral cavity was done, always maintaining contact with the jawbone to prevent injury to the structures of the oral floor. After disconnecting and removing the tube, it was held in the oropharynx by the anesthesiologist, assuring its position with the aid of a laryngoscope, and subsequently externalized through the incision. At the end of the procedure, the same was done in the reverse way. Surgery progressed uneventfully.

**Discussion:** Although nasotracheal intubation(NTI) is often the technique of choice in most MF trauma, it may be contraindicated in certain situations such as nose bones and cribriform plate fractures because of the potential risk of infectious complications and cranial intubation<sup>2</sup>. Tracheostomy may present as an alternative, however, it's associated with major risks as damage to adjacent structures. Submandibular approach consisting in the insertion of the tracheal tube through a submandibular incision after conventional OTI, in order to free the surgical area and avoid the possible major complications of tracheostomy, can be performed<sup>1,2</sup>.

**References:**

- Br J Anaesth 2007;98:835-40;
- J Oral Maxillofac Surg 2008;66:1404-9

**Learning points:** Based on the existing literature and our experience, intubation in MF trauma patient is complex and requires both a good judgement and considerable experience. Submandibular tracheal intubation is a simple technique with low morbidity and fast execution that can be used in patients with contraindications to the OTI and NTI, and as an advantageous alternative to more invasive methods such as tracheostomy.

**19AP1-10****Iatrogenic large distal tracheal rupture**

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**Background:** Tracheal rupture secondary to intubation is a very rare complication (incidence <0.1%) but with high mortality. It's usually associated with the combination of multiple factors: anatomical, mechanical and demographics(1).

**1<sup>o</sup> Case report:** Woman, 64 years old, 65 kg and 160 cm. She had a history of acromioplasty and difficult airway in this last surgery 2 days before. The patient presented subcutaneous emphysema in the cervical, facial and thoracic level that oriented towards the suspected tracheal rupture. The airway was approached through fiberscope intubation with a 37 French Left Double Lumen tube and an Arndt Endobronchial Blocker.

**2<sup>o</sup> Case report:** Woman, 61 years old, 60 kg and 150, with history of alcoholic cirrhosis and smoker. She was operated to study a cervical adenopathy. The airway was controlled through endotracheal tube cuffed, size 7.0, guided with

stylet. After the extubation, she showed persistent cough and immediate subcutaneous facial emphysema and dyspnoea.

**Discussion:** Tracheal rupture is a rare complication especially when it is performed by trained medical personnel. It's necessary confirm the early diagnosis and perform appropriate treatment. However, up to 50% of patients with tracheal rupture there is a lag of at least 24 hours after iatrogenic intubation maneuvers until reaching the diagnosis. The signs and symptoms are subcutaneous emphysema, pneumothorax, pneumomediastinum or dyspnea after extubation. Factors associated are intubation in emergency situations, difficult intubation, use of endotracheal tube stylet, hyperinflation of endotracheal tube cuff, repositioning of tube without deflating cuff or movements of the patient intubated with cuff inflated (2), female, age over 50 years and use of double light tubes.

**References:**

1. Elliott H. A case of tracheal injury after emergent endotracheal intubation: a review of the literature and causalities. *Anesth Analg* 2001; 93:1270-1.
2. Hyungsun L. Tracheal rupture after endotracheal intubation, a report of three cases. *Korean J Anesthesiol* 2012 March; 62 (3): 277-280.

**Learning points:** Early diagnosis by fibroscopy and early treatment seem essential to improve the prognosis.



[Image]

### 19AP2-1

**A simple and no-cost face tent is more efficient than high nasal cannula oxygen flow in reducing severe oxygen desaturation and the risk of fire hazard in patients under monitored anaesthesia care**

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**Background and Goal of Study:** Patients under monitored anaesthesia care (MAC) routinely receive IV sedation and nasal cannula (NC) O<sub>2</sub> (3-5 L/min). Over-sedation and/or airway obstruction may cause severe desaturation (Desat). Raising NC O<sub>2</sub> flow in order to improve oxygenation may increase the risk of fire hazard, especially during upper body procedures. A plastic sheet was shown to reduce Desat without raising NC O<sub>2</sub> flow by transforming NC to a face tent<sup>1,2</sup>. We compared it with high NC O<sub>2</sub> flow in patients under MAC.

**Methods:** Review of patients who underwent minor surgical procedures (breast biopsy, a-v fistula, melanoma excision, etc.) identified 2 groups. NC (n=43) received NC O<sub>2</sub>. FT (n=101) received NC O<sub>2</sub> and a face tent using a fluid-shield surgical mask to cover patient's mouth and nose<sup>1,2</sup>. Patients re-

ceived NC O<sub>2</sub> (3-5 L/min or higher) and IV propofol. NC patients were separated into NC1 (3-5 L/min, n=23) and NC2 (6-10 L/min, n=20). Student t-test and Chi Square test were used. A p value < 0.05 was considered as significant. (Mean±S.D.)

**Results:** There were no differences in mean age (50-56 yrs), propofol dose (139-160 mcg/kg/min) and ASA Status (III/II: NC1:3/20 & NC2:9/9 vs. FT:32/66). CN2 had more ASA III patients than CN1.

There were significant differences in BMI (NC1:25±4 kg/m<sup>2</sup> vs. NC2:29±7 & FT:29±6), the highest NC O<sub>2</sub> flow (NC2:7.2±1.8 vs. NC1:4.1±0.5 L/min & FT:4.4±1.0.), room air O<sub>2</sub> Sat (NC1:99±1% vs. NC2:98±2% & FT:98±2%), duration (NC1:32±17 min vs. NC2:49±27 & FT:48±28), the lowest O<sub>2</sub> Sat (NC1:95±6% & NC2:91±8% vs. FT:97±3%), severe Desat (O<sub>2</sub> Sat≤85%) (NC1: 2/23 & NC2: 4/20 vs. FT: 1/101) and bag-mask ventilation (NC1: 1/23 & NC2: 2/20 vs. FT: 0/101), FiO<sub>2</sub> (NC1: 0.29±0.07 & NC2: 0.35±0.10 vs. FT: 0.59±0.18) and O<sub>2</sub> level under surgical drapes near surgical site (NC1:44±16% & NC2:42±11% vs. FT:22±1%).

Five NC patients had severe Desat (O<sub>2</sub> Sat:87±4%) and one required assisted ventilation. The others' NCs were converted to FTs and O<sub>2</sub> Sat was improved to 95±5%, 96±2% and 99±1% at 5 min intervals.

**Conclusion:** Data show that this simple face tent is more efficient than high NC O<sub>2</sub> flow in reducing severe desaturation and bag-mask ventilation in patients under deep propofol sedation during various minor surgical procedures. It also reduces the risk of fire hazard by preventing O<sub>2</sub> from pooling under the surgical drapes. Using this face tent prior to sedation may improve patient safety at no extra cost.

**References:**

1. *Anesth* 107:A922, 2007;
2. www.TSEMask.com

### 19AP2-2

**A simple and no-cost face tent for pre-oxygenation prior to rapid sequence induction of general anaesthesia in a patient with large bowel obstruction, anxiety and claustrophobia**

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**Background:** Rapid sequence induction (RSI) of general anaesthesia (GA) is routinely performed after pre-oxygenation in patients with full stomach. It is difficult to pre-oxygenate a patient who is claustrophobia and irritated by a nasogastric tube (NGT) with a face mask. A simple plastic bag was shown to improve oxygenation by transforming a nasal cannula (NC) to a face tent in sedated patients<sup>1,2</sup>. We report its use in a patient with large bowel obstruction and claustrophobia.

**Case report:** A 65 y/o woman (BMI 23 kg/m<sup>2</sup>) presented with large bowel obstruction for colonoscopy. She had diverticulosis, hypertension, depression, anxiety and claustrophobia. GA with endotracheal intubation (ETI) was planned for colonoscopy. She had pain even with gentle manipulation of NGT and requested not to have a face mask due to claustrophobia. She agreed to NC and a face tent using a clear plastic bag covering her nose and mouth. Her O<sub>2</sub> saturation (Sat) increased from 98% to 100% after 4-5 min with 4 L/min NC O<sub>2</sub>. RSI (with cricoid pressure) of GA was then induced with 100 mg lidocaine, 150 mg propofol and 100 mg succinylcholine. ETI was easily accomplished with a video-laryngoscope. O<sub>2</sub> Sat was 100% throughout. Anaesthesia was maintained with sevoflurane and propofol. She was extubated awake without problem at the end of colonoscopy. Two days later, she was brought to OR for urgent exploratory laparotomy and Hartmann's procedure. She requested to be pre-oxygenated in the same manner. Her O<sub>2</sub> Sat increased from 95% to 100% after 4 min with a face tent and 4 L/min NC O<sub>2</sub>. Modified RSI (with cricoid pressure) of GA was induced with 100 mcg fentanyl, 80 mg lidocaine, 150 mg propofol and 60 mg rocuronium. ETI was again quickly and easily accomplished with a video-laryngoscope. O<sub>2</sub> Sat was again 100% throughout. GA was maintained with desflurane and the surgical procedure was completed without complication. She was extubated awake in PACU without problem. She was discharged home after an uncomplicated postoperative course.

**Discussion:** This patient might not gain adequate pre-oxygenation with a face mask prior to RSI of GA due to extreme claustrophobia and an irritating NGT. She was very pleased and comfortable with a face tent and NC O<sub>2</sub> for pre-oxygenation. After pre-oxygenation with this technique, GA with RSI and ETI can be performed without desaturation. This simple face tent may improve patient comfort and safety at no extra cost.

**References:**

1. *Anesth* 107:A922, 2007;
2. www.TSEMask.com

## 19AP2-3

### Glo.be (glidescope obese) group and the efficacy of the "Besta Airways Algorithm" in a group of severe morbidly obese patients (BMI>40kg/m<sup>2</sup>)

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**Background and Goal of Study:** Morbidly obese patients are at increased risk of difficult intubation as well as increased risk of hypoxemia during tracheal intubation. Reported occurrence of difficult tracheal intubation is 14.3-28% with Macintosh direct laryngoscopy. In 2011 the "Besta Airways Algorithm" based upon the El Ganzouri Risk Index (EGRI) and GlideScope® videolaryngoscopic intubation has been introduced. The result was a 0.14% occurrence of difficult intubation and no failed intubation in lean patients. We applied the "Besta Airways Algorithm" in a group of severe morbidly obese patients (BMI>40kg/m<sup>2</sup>).

We want to assess efficacy of the "Besta Airways Algorithm" in severe morbidly obese patients (BMI>40kg/m<sup>2</sup>) measured primarily in occurrence of difficult tracheal intubation define with Cormack and Lehane (C&L)  $\geq 3$ , Intubation Difficulty scale (IDS)  $>$  and Modified IDS  $\geq 5$ , where M-IDS take also into account number of laryngoscopies. We want also to measure occurrence of first attempt success intubation and failed intubation.

**Materials and Methods:** We introduced Glidescope intubation and the "Besta Airways Algorithm" for all severe obese patients. Since march 2012 from september 2013 we prospectively included all obese patients scheduled for bariatric surgery or other kind of surgery. All patients with EGRI of six or lower were scheduled for Glidescope intubation. All patients with EGRI of seven or higher were scheduled for flexible fiberoptic bronchoscopy (FFB) intubation while conscious. For all patients we recorded age, sex, BMI, EGRI, time to Cormack, time to intubation, IDS and M-IDS.

**Results:** Hundred and forty severe obese patients were intubated since march 2012 to September 2013. Median EGRI was 3 (min 0, max 7). 99.8% patients were successfully intubated with GVL. Occurrence of C&L  $\geq 3$  was 0% and occurrence of difficult intubation determined as IDS and M-IDS  $\geq 5$  was 2.2% and 3.7% respectively. Median IDS and M-IDS was 0 and 0 respectively. Occurrence of first attempt success was 80%. There was only one failed GVL intubation with a C&L 2b. There was one scheduled FFB intubation in a patient with EGRI of 7 and one unplanned FFB intubation in a patient with a failed intubation.

**Conclusion:** "Besta Airways Algorithm" was successful in reducing occurrence of difficult tracheal intubation compared with occurrence reported in literature. A failed intubation occurred in a period in which Glidescope was not routinely used for device shortage.

## 19AP2-4

### Pentax-Airway Scope® provides the best view of the glottis and fastest intubation: comparative study of McGrath® MAC and Coopdech videolaryngoscope Portable VLP-100®

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**Background and Goal of Study:** Various video laryngoscopes have recently been developed and have provided a better view of glottis than that provided by the conventional Macintosh laryngoscope. In this study, three video laryngoscopes, Coopdech videolaryngoscope Portable VLP-100® (VLP) (Dai-ken Medical, Osaka, Japan), which is similar to the conventional Macintosh laryngoscope, Pentax-Airway Scope® (AWS) (Hoya, Tokyo, Japan), which has an endotracheal tube-guiding groove, and McGrath® MAC (McG) (Air-craft Medical, Edinburgh, UK), which has a thin and mildly curved blade, were compared with regard to the view of the glottis and time taken for tracheal intubation.

**Materials and methods:** After approval of the study protocol by the ethical committee of our institution, informed consent was obtained from each patient. Patients with predictors of difficult intubation were excluded. Ninety patients (ASA physical status 1 or 2) who were scheduled to undergo elective surgery under general anesthesia were enrolled in this study. Patients were randomly assigned to one of three video laryngoscope groups: Group VLP (n=30), Group AWS (n=30), and Group McG (n=30). After induction of general anesthesia and muscle relaxation, patients were intubated with each video laryngoscope. We recorded Cormack-Lehane classification, time from the beginning of laryngoscope blade insertion into the mouth to visualizing

the glottis (Time V) and time from the beginning of tube insertion to passing the tube through the glottis (Time I).

Data are expressed as medians [interquartile range] and were statistically analyzed by the Kruskal-Wallis test followed by the Steel-Dwass test. A P value  $<$  0.05 was considered statistically significant.

**Results and discussion:** There were no significant differences in patients' backgrounds among the three groups. Although there was no significant difference in Time V among the three groups, Cormack-Lehane classification in Group AWS (1 [1-1]) was significantly lower than those in Group VLP (2 [1-2]),  $p = 0.0002$  vs Group AWS) and Group McG (1 [1-2]),  $p = 0.048$  vs. Group AWS,  $p = 0.085$  vs. Group VLP). Time I in Group AWS (3.0 [2.0-3.8] s) was significantly shorter than those in Group VLP (4.0 [3.1-9.0] s,  $p = 0.01$  vs. Group AWS) and Group McG (5.0 [4.0-7.0] s,  $p = 0.01$  vs. Group AWS,  $p = 0.96$  vs. Group VLP).

**Conclusions:** The results suggest that AWS provides the best view of the glottis and fastest intubation time among the three video laryngoscopes.

## 19AP2-5

### A comparative study of patients' response after two types of endotracheal intubation: direct laryngoscopy and fiberoptic intubation

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**Background and Goal of Study:** Patients classified as having a difficult airway must be considered as potential candidates for endotracheal fiberoptic intubation (FI) as well as patients with failed intubation. FI is included in practice guidelines for management of the difficult airway (1).

However, FI learning curve must always be developed in patients with a normal airway (2). Our goal of the study was to compare normal airway intubation techniques - direct laryngoscopy (DL) and FI - according to patients' response after the procedure.

**Materials and methods:** We performed prospective, double-blind, randomized controlled study. The protocol was approved by the Bioethics center and written informed consent was obtained from all of the patients. 100 adult patients ASA status I-III, Mallampati class I-III scheduled for laparoscopic cholecystectomy under general anesthesia were randomized into two equal groups: direct laryngoscopy (DLG) and bronchoscopy (BG). Patients' demographic data, local complications of throat, general pain, were noted in questionnaires after 6 and 20 hours (h) after surgery. The pain level was determined with numeric rating scale 0-10 points (0 - no pain, 10 - severe pain). Data were analyzed using Chi square test. Results are presented as mean  $\pm$  standard deviation and mode (Mo).  $P < 0.05$  was regarded as significant.

**Results and discussion:** There were no significant differences to demographic data and local complications of throat. Patients complain about these local complications of the throat (%): dryness (65.0), hoarseness (55.0), sore throat (42.0), cough (24.0), strange taste (4.0) and nausea (1.0). In both groups patients had 1-2 complains. There were no differences in the sore throat level between groups after 6 h (BG 1.24  $\pm$  1.802, Mo=0, DLG 0.86  $\pm$  1.309, Mo=0,  $p=0.441$ ) and 20 h (BG 0.68  $\pm$  1.571, Mo=3, DLG 0.38  $\pm$  0.923, Mo=4,  $p=0.53$ ). General pain level did not differ between groups after 6 h (BG 2.96  $\pm$  2.157, Mo=0, DLG 3.26  $\pm$  1.759, Mo=0,  $p=0.46$ ) and 20 h (BG 2.72  $\pm$  2.232, Mo=2, DLG 2.3  $\pm$  1.568 Mo=2,  $p=0.569$ ). The data shows that it is ethical to use both methods of tracheal intubation for patients' with normal airways.

**Conclusion:** The patient's local complications of throat (sore throat), general pain do not depend on the pattern of tracheal intubation applying DL and FI.

#### References:

1. Apfelbaum JL, et al. Anesthesiology. 2013; 118:1-20.
2. Lema EF, et al. Rev Colomb Anestesiol. 2012; 40:60-66.

## 19AP2-6

### Dexmedetomidine for awake fiberoptic orotracheal intubation in a morbidly obese patient

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**Background:** Dexmedetomidine (DEX) is a selective alpha-2 adrenergic agonist with several desirable pharmacologic properties for sedation of patients with risk of ventilatory dysfunction (1).



**Case report:** We report a case of sedation with DEX for awake fiberoptic orotracheal intubation of a morbidly obese patient. A 42-year-old male, BMI: 74 (237 kg, 179 cm), with known severe OSAS and poorly controlled hypertension was scheduled for the placement of a gastrostomy tube. Premedication was atropine 1mg, ranitidine 50mg and metoclopramide 10mg. The patient received nasal oxygen at 4lt/min and conventional monitoring. Topical anaesthesia was achieved in oropharynx, hypopharynx and glottis using lidocaine 8% spray. DEX infusion started at 1.5 mcg/kg/10 minutes, based on estimated ideal weight of 100kg. Infusion of DEX continued at 0.7 mcg/kg/h. During awake intubation, Ramsay sedation status was 2-3, SatO<sub>2</sub> remained over 96%, and patient was hemodynamically stable.

After intubation was achieved (5min) DEX infusion was stopped and the procedure was carried on under general anaesthesia (desflurane/remifentanyl/rocuronium) adding TOF monitoring. Patient received sugammadex reversal before education. No opioids were needed either intra or postoperatively. Post-operative was uneventful.

**Discussion:** As anaesthesiologists, we face the challenge of providing adequate sedation for airway management of patients at high risk of ventilatory or airway complications (1). Alpha 2- agonists have been associated with good sedation scores and minimal respiratory depression (2,3)

**Conclusions:** DEX may offer a beneficial profile for sedation of obese patients, allowing comfort during fibrobronchoscopy, preservation of ventilatory function and reduction in the need for opioids. Dosage for obese patients is still unclear. Future studies should focus in the pharmacologic and pharmacokinetic profile of DEX on this population to minimize the risk of adverse effects.

#### References:

1. Ramsay MA, Saha D, Hebel RF: **Tracheal resection in the morbidly obese patient: the role of dexmedetomidine.** *J Clin Anesth.* 2006 Sep;18(6):452-4.
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3. Yenn RM, Hell J, Grounds RM: **Respiratory effects of dexmedetomidine in the surgical patient requiring intensive care.** *Critical Care* 2000; 4:302-8

## 19AP2-7

### Glidescope videolaryngoscope vs Frova entotracheal introducer in difficult unexpected airway management

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**Background and Goal of Study:** In unpredicted difficult orotracheal intubation (OTI), both national and international guidelines suggest to avoiding more than three attempts in order to reduce the risk of "cannot intubate - cannot ventilate" situation. The second attempt should be performed with some modified elements such as laryngoscope blades, position of the patient's head, BURP, etc., but the third one should be performed using alternative devices. The guidelines don't provide any precise indications about videolaryngoscopes as alternative to fibrobronchoscopy. The aim of this study is comparing the efficacy of the Frova and Glidescope in the unpredicted difficult OTI in patients admitted to elective interventions and the evaluation of stress induced by the maneuver performed using the two devices, through hemodynamic monitoring.

**Materials and methods:** A randomized controlled trial was performed on 40 consecutive patients, through the ages of 18 to 70, under general anaesthesia with more than one attempts of the OTI maneuver. A Frova Introducer or Glidescope were used while comparing the duration of the first attempt to the duration of the OTI using Frova Introducer or Glidescope. Cardiorespiratory monitoring predicted the registration of the following parameters: BP, HR, SaO<sub>2</sub> and EtCO<sub>2</sub> at T<sub>0</sub>= before induction; T<sub>1</sub>=before direct laryngoscopy with a Macintosh laryngoscope, T<sub>2</sub>=during direct laryngoscopy, T<sub>3</sub>= OTI with Frova or Glidescope, T<sub>4</sub>= 10 minutes later.

**Results and discussion:** There were 40 randomized consecutive patients with unpredicted difficult OTI in the Frova group (FI) (n=20) and in the Glidescope group (GS) (n=20). Most of the patients of both groups were intubated at the first attempt using Frova (n=13) patients and patients with Glide (n=12); the rest of the patients at the second attempt. The overall time needed for the correct placement of the endotracheal tube was significantly briefer (P < 0.001) in the FI group (12.1 ± 4.1 sec) compared to the GS group (39.9 ± 11.8 sec). Monitoring BP and HR in various times has shown a significant increase in both groups corresponding to T<sub>2</sub> and T<sub>3</sub> (P < 0.001) corresponding to direct laryngoscopy.

**Conclusions:** All patients in this study were successfully intubated; already in the first attempt with Frova or Glidescope in most cases. The SaO<sub>2</sub> values were always above the security levels (< 97%). The OTI with a Frova was faster and less traumatic compared to the one with Glidescope.

## 19AP2-8

### Anesthesia for flexible diagnostic bronchoscopy: comparison of two different techniques

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**Background and Goal of Study:** The ideal sedation for flexible bronchoscopy (FOB) has not been defined[1]. The aim of the study was to compare to perform FOB on deep-sedation associated with the insertion of laryngeal mask with a more common technique of consciousness sedation provided by midazolam in terms of safety, patient's comfort, success of the previously mentioned procedure at the first attempt.

**Materials and methods:** 24 patients, mean age 61.9 ± 10.25 years, ASA physical status I-III undergoing diagnostic bronchoscopy were enrolled. Data collected from each procedure were: cough episodes, dyspnea, procedures' duration. Patients were randomized in two groups: in TIVA-LMA Group after induction (Propofol 2 mg/Kg, remifentanyl 0,10 µg/Kg/min) LMA (Ambu AURA-i) was inserted (maintenance was provided by propofol 2% at 1,5-2 mg/Kg/min and remifentanyl 0,10-0,15 µg/Kg/min) and bronchoscopy was performed through the LMA; breathing was achieved through manual ventilation. Flexible bronchoscope (Pentax 6 mm) was inserted through Mount catheter (DAR/Covidien) and advanced into the LMA. In Control Group: before starting procedure 0,03-0,05 mg/Kg of Midazolam (5-6 mg) were administered, spontaneous breathing was maintained for the entire procedure. At the end of the procedure all patients were discharged after evaluation of Aldrate's score. Patient's comfort was evaluated by VAS scale.

**Results and discussion:** There were no differences between two groups in term of age, sex, ASA, BMI, comorbidity. TIVA-LMA group showed lower number of cough episodes during procedure (30% vs. 80%), better comfort for patients before discharge (8,88 ± 0 vs. 2,33 ± 3; p < 0,00005) and after one week (8,75 ± 4,24 vs. 1,94 ± 4; p < 0,001) (verified by a phone interview, longer duration of procedure (38,8 ± 13,2 vs. 18,56 ± 6,3 minutes, p = 0,001) . In both group all procedures had success at the first attempt. None of patients showed major complications.

**Conclusion(s):** Deep-sedation-LMA technique seems to have lower side effects and better comfort for patients. A longer time of lasting of the procedure could be related to a major accuracy, but a largest patient's population is needed to confirm this hypothesis.

#### References:

1. Honeybourne D et Al. *Thorax.* 2001

## 19AP2-9

### Use of videolaryngoscopy by physicians for pre-hospital emergency intubation: preliminary data of a prospective, randomized, multicenter trial

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**Background and Goal of Study:** Videolaryngoscopy may be a valuable technique for pre-hospital endotracheal intubation (1). However, the performance of different videolaryngoscopic systems in this setting is unclear. The aim of the present study was to compare three new portable videolaryngoscopes, the A.P Advance® (APA; VENNEN Medical, Kiel, Germany), the C-MAC® PM (CM; Karl Storz, Tuttlingen, Germany), and the channeled-blade King Vision® (KV; King Systems, Noblesville, USA) for pre-hospital emergency endotracheal intubation.

**Materials and methods:** Approval of the institutional review board was obtained. We report for the first time of 45 matched patients (15 for each device; age, median [range]: 65 [18-87]; 24 female), that had the need for pre-hospital emergency intubation, and that were treated by a physician introduced in the use of the devices.

**Results and discussion:** Glottic visualization was comparable with all 3 devices (Best achievable Cormack-Lehane classes: I: APA 8, CM 7, KV 8; II: APA 5, CM 8, KV 4; III: APA 1, KV 1; IV: APA 1). Median [range] time to successful

intubation for the APA was 30 [10-135] seconds, for the CM 45 [20-90] seconds, and for the KV 70 [20-140] seconds. Intubation success on the first attempt with APA, CM, and KV was 73%, 67%, and 47%, respectively. Overall success for APA, CM, and KV was 100%, 100%, and 60%, respectively. Direct laryngoscopy for successful intubation after failed videolaryngoscopic attempts was necessary with the APA in 2 patients, with the CM in 1 patient, and in the KV group, 6 patients were intubated with a conventional Macintosh laryngoscope.

**Conclusion(s):** A.P Advance, C-MAC PM, and King Vision® showed comparable glottis visualization during pre-hospital emergency endotracheal intubation; however, intubation success rates in these non-standardized conditions may vary between the different videolaryngoscopic devices.

**References:**

Cavus E, et al. *Emerg Med J* 2011;28:650-653.

## 19AP2-10

### Flexible bronchoscopy through laryngeal mask Ambu Aura-i™ for diagnostics procedures

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**Background and Goal of Study:** The ideal technique to ensure airway control during flexible bronchoscopy (FOB) has not been defined [1]. The aim of the study is to describe a technique of deep-sedation associated with the use of Aura-i™ disposable intubating laryngeal mask (Ambu A / S, Ballerup, Denmark), as a conduit for flexible bronchoscope (FOB) during procedures of Trans Bronchial Needle Aspiration (TBNA), Trans Bronchial Biopsy (TBB) and endobronchial ultrasound TBNA (EBUS-TBNA).

**Materials and methods:** 25 patients, both sex (male n° 15/female n°10), mean age 62±1.4, ASA physical status I-III undergoing diagnostic bronchoscopy were enrolled between January-April 2013. Data collected from each procedure included: feasibility of FOB through laryngeal mask (LMA), quality of airway images, dyspnea and pain at the end of procedure and patients' comfort. Anesthesia was provided by standard induction with Propofol 2 mg/Kg and remifentanyl 0,10 µg/Kg/min, then LMA was inserted and maintenance was provided by propofol 2% at 1,5-2 mg/Kg/min and remifentanyl 0,10-0,15 µg/Kg/min. Bronchoscopy was performed through the LMA and breathing was achieved through manual ventilation. Flexible bronchoscope (Pentax 6 mm) was inserted through Mount catheter (DAR/Covidien) and advanced into the LMA. At the end of the procedure all patients were discharged after evaluation of Aldrate's score. Patient's comfort and pain was evaluated by VAS scale before discharge.

**Results and discussion:** In this setting LMA was used as both a ventilation device and a conduit for flexible bronchoscope. FOB introduction was feasible in all patients. For each patient we found a higher satisfaction before discharge and the entire group would be repeated, if necessary, this procedure with the same anesthesia technique. Referred comfort was high after the procedure (VAS 8±2) and also after one week (VAS 9±1). None of the patients referred dyspnea before discharge as well as pain. All procedures had success at the first attempt. No major complications occurred during procedures.

**Conclusion(s):** FOB associated with deep-sedation-LMA technique has good results in terms of patient's comfort and in terms of lower incidence of pain and dyspnea at the end of procedure.

**References:**

1. Wahidi MM et al *Chest*. 2011

## 19AP3-1

### Optimal dose of propofol for tracheal intubation conditions during inhalation induction with sevoflurane: a randomized controlled trial

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**Background and Goal of Study:** Intubation without prior administration of muscle relaxants is a common practice in children and adults with potential difficult airways. Sevoflurane is a non-irritating inhalational anesthetic agent used for anesthesia induction in difficult airways. Propofol is a short-acting, intravenously administered hypnotic agent which causes oropharyngeal muscle relaxation during induction. The aim of this study was to investigate

the optimal dose of propofol in combination with 8% sevoflurane to provide acceptable intubating conditions and the minimal time for the return of spontaneous ventilation in ASA I or II adults.

**Materials and methods:** In a prospective, randomized and double-blinded design, after obtaining the approval from Hospital Ethics Committee (registration number: ChiCTR-TRC-12002795) and written informed consent, 90 ASA I-II patients undergoing operations were randomly divided into three groups: 1.0, 1.5, and 2.0 mg/kg propofol. All patients were given propofol iv after inhalational induction with 8% sevoflurane, then tracheal intubating conditions and time to resumption of spontaneous breathing (RSB) were evaluated. At the meantime, systolic blood pressure (SBP), heart rate (HR), and the end-tidal concentration of sevoflurane were measured and the postoperative hoarseness was assessed.

**Results:** Tracheal intubation was successful in all patients. Intubating conditions were acceptable in 15/30 (50%), 23/30 (76.7%) and 30/30 (100%) in those subjects given 1.0, 1.5 and 2.0 mg/kg propofol, respectively. There were no significant differences in clinically acceptable intubating conditions between those given 1.5 and 2.0 mg/kg propofol, but they had greater acceptance than the group given 1.0 mg/kg propofol. The time to RSB were 103.6, 134.1, and 196.2 seconds for the groups given 1.0, 1.5 or 2.0 mg/kg propofol, respectively, and the time to RSB of the group given propofol at 2.0 mg/kg was significantly longer than that of other groups ( $p < 0.05$ ). All three groups had a decreased mean SBP after induction but returned to the baseline values after intubation. All the patients had a continued increase in mean HR. There were more patients with no hoarseness post operation in the group given propofol at 2.0 mg/kg than those in 1.0 mg/kg propofol group.

**Conclusion(s):** After induction with sevoflurane, 1.5-2.0 mg/kg propofol could produce satisfactory intubating conditions, and 1.5 mg/kg propofol showed a shorter time to RSB.

## 19AP3-2

### Visual recognition of airway structures in a circulated patient and in a non-circulated cadaver

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**Background and Goal:** Airway management during cardiopulmonary resuscitation can be challenging. Unrecognized esophageal intubation occurs frequently (1) and the gold standard for correct tube placement, capnography, can be misinterpreted (2). We have reported about a novel intubation technique, Camera In Tube Intubation (CITI) (3). Under continuous view, a VivaSight™ is placed in the trachea through a supraglottic device. We believe this technique can be particularly useful in patients in cardiopulmonary arrest. One precondition is that airway structures are recognized. With this study we aimed to investigate whether airway management providers recognize these structures both in patients with and without cardiac output.

**Materials and methods:** Review Board approval was obtained for this study. To simulate the view on airway structures in a patient in cardiopulmonary arrest we intubated a cadaver, provided by the anatomy department of our institute, with a VivaSight™. Three pictures at different locations in the trachea and one in the esophagus were obtained. Pictures at the same locations in a well-circulated patient during general anesthesia were also acquired. Ten anaesthetists, ten trainee anaesthetists and ten paramedics were asked what structures they recognized. Data were compared with a Chi<sup>2</sup> test (IBM SPSS 20.0).

**Results and discussion:**

	circulated airway		non-circulated airway	
	n	%	n	%
Anaesthetists	38	98%	24	40%
Trainee Anaesthetists	39	78%	16	30%
Paramedics	31	90%	12	43%

[Correct recognition of airway structures]

Airway structures in a circulated patient were more often recognized than in a non-circulated situation: 90% vs 43% ( $p < 0.001$ ). However, almost all participants (97%) were able to correctly recognize the anatomy at least at one point in a non-circulated situation. Anaesthetists performed better than paramedics, which suggests training can improve performance.

**Conclusion:** Airway structures in a circulated patient are better recognised than in a non-circulated situation. Since almost all participants recognized the anatomic structures in a non-circulated airway at least at one point, we believe CITI could be useful for airway management during cardiopulmonary resuscitation.

#### References:

1. Wang HE, Mann NC, Mears G, et al. Resuscitation 2011; 82:378-85
2. Cook TM, Woodall N, Frerk C. Br J Anaesth. 2011;106:617-631
3. Huitink JM, Koopman EM, Bouwman RA, et al. Anaesthesia 2013;68:74-78

### 19AP3-3

#### Alkalinized lidocaine in a tracheal tube with a tapered cuff suppresses hemodynamic changes and tube-induced emergent phenomena during extubation

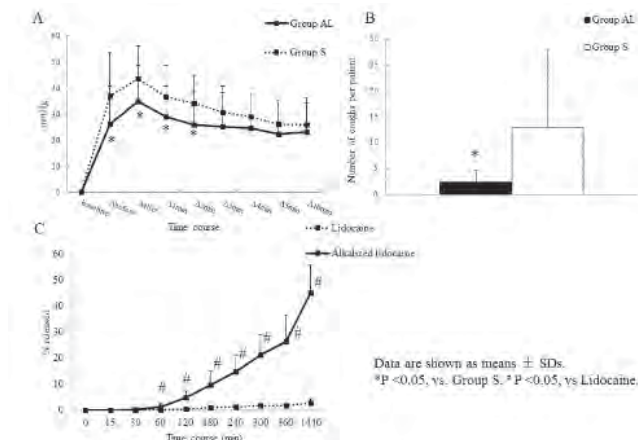
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**Introduction:** An endotracheal tube cuff filled with alkalinized lidocaine, which can diffuse across the cuff and block irritable nerve endings of the tracheal membrane, is useful for suppressing endotracheal extubation-induced adverse effects (EIAE) such as hypertension, tachycardia, coughing and post-operative sore throat. A unique tapered-cuff endotracheal tube, which has recently been developed to prevent microaspiration, can achieve better tracheal sealing than that with a standard cuff. We thus hypothesized that a tapered cuff filled with alkalinized lidocaine can prevent EIAE.

**Materials and methods:** After approval of the protocol of the randomized, controlled study by the Institutional Ethics Committee, written informed consent was obtained from each patient. Endotracheal tubes (Mallinckrodt Taper-Guard™, Covidien) with IDs of 7.0 and 8.0 mm were used for women and for men, respectively. After tracheal intubation, 62 patients (ASA physical status I or II) were randomized into one of two groups and received 4 ml of 2% alkalinized lidocaine (Group AL) or 4 ml normal saline (Group S). Mean blood pressure (MBP) and heart rate (HR) were recorded at before and after extubation. The number of coughs at extubation and the degree of sore throat assessed by using a visual analogue scale (VAS, 0-100 mm) were recorded. In a separate in vitro study, the release of lidocaine from tube cuffs filled with 2% plain lidocaine and alkalinized lidocaine was investigated.

**Results:** The increases in MBP and HR in Group AL were significantly smaller than those in Group S after extubation ( $P < 0.05$ ). The number of coughs during extubation was significantly smaller in Group AL than in Group S ( $P < 0.05$ ). In the in vitro study, the release of lidocaine was markedly increased when the cuff was filled with alkalinized lidocaine compared to lidocaine alone (Fig. A-C).



[Figure]

**Conclusion:** Alkalinized lidocaine in a tapered cuff suppresses hemodynamic changes, coughing and hoarseness during extubation in addition to its potential advantage of preventing microaspiration.

### 19AP3-4

#### Preoperative airway assessment. No national consensus in Denmark - a survey from 29 departments of anaesthesia

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**Background:** Unanticipated difficult airway management (DAM), including difficult intubation (DI) and difficult mask ventilation (DMV) can be associated with increased risks for the patient. Many studies have sought to identify predictors of DAM. But still, no clear Danish or international guideline for preoperative airway assessments (AA) exist.

We therefore hypothesised, that Danish AA was of a non-uniform character. Our aim was to examine guidelines for AA used in anaesthesia departments in Denmark.

**Methods:** All heads of anaesthesia departments, which at start-2012 recorded data to the Danish Anaesthesia Database, were sent a six questions questionnaire. It included questions on mandatory predictors of DI and DMV used for preoperative assessment and if predictors were pre-printed on the anaesthesia record.

Further, we asked if a multivariate risk score for prediction of DI was implemented and in particular if the Simplified Airway Risk Index was a standard for AA.

Descriptive data were calculated as fractions and percentages. AVONA was used to analyse the variance between departments.

**Results:** 29 of 31 (94%) departments responded. The number of predictors of DI pre-printed on anaesthesia records ranged from two to seven. Besides BMI, no other predictors than the ones included in the SARI score were used anywhere. SARI was implemented in two of Denmark's five regions. In the remaining regions, 2 hospitals used the SARI score, corresponding to a total of 9 of 29 (31%). No other risk scores were implemented. Mallampati classification (MP) (95%), previous difficult airway (85%), ability to prognath (80%) and neck mobility (80%) were main predictors in departments not using SARI. Thyromental distance and mouth opening were standard for AA in 5 and 10% of these departments, respectively. All departments recorded weight, but not necessarily as a predictor for difficult airway. Study of edentulism (55%) and MP (66%) were the most frequently studied risk factors for DMV.

**Discussion:** There were large inter-hospital and regional differences in methods of AA. SARI was the only multivariate risk score, which was implemented. There was no uniform pattern in the registration of risk factors for DI or DMV. However, all but one department uses the MP. We speculate that this lack of consensus is not an isolated Danish issue.

**Conclusion:** We demonstrated large differences in standards for preoperative AA in Denmark. Evidence-based guidelines might be of use.

### 19AP3-5

#### One more step in the thyroplasty anesthetic management: the role of neuromuscular relaxants

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**Background and Goal of Study:** Thyroplasty surgery is a technique used in unilateral paralysis of vocal cord, developed in the 1970s by Isshiki. It consists of a medialization of the sick cord by a prosthesis inserted through the thyroid cartilage, improving the hoarseness and gastric aspiration. As the airway is involved, an important anesthesiologist challenge arises. The aim of this study is to evaluate the benefits of neuromuscular relaxation in addition to general anesthesia for Thyroplasty as we have observed that traditional anesthetic management (sedation with local infiltration and general anesthesia without relaxation) sometimes does not allow us to optimize the surgical exposure. This happens when the healthy cord is not opened enough to push the paralyzed cord to midline without any ventilation trouble.

**Materials and Methods:** The same anesthetic technique was developed in all patients. A standard non-invasive monitoring was applied, including a train of four monitor (TOF-WATCH SX®) and brain function evaluation (Physiometrix SEDLine®). Total intravenous general anesthesia was used with continuous perfusion of propofol (5-7 mg/kg/h) and remifentanyl (0.05-0.2 µg/kg/min). Rocuronium (0.6 mg/kg) was added before placing the laryngeal mask Proseal (MLP; Intavent Orthofix, Maidenhead, UK). The use of this mask al-



lowed a volume-controlled ventilation, a gastric drainage and the introduction of a flexible laryngoscope through it for continuous glottis visualization during the procedure. To avoid leaks, a T-tube connector (Double Swivel Connector-Mallinckrodt™) was attached to the mask.

**Results and Discussion:** The thyroplasty was performed in 8 patients (5 women and 3 men) between January 2012 and June 2013, by the same surgeon. In every case, the healthy cord was fully abducted, evidenced by the continuous laryngoscopy, which allowed the medialization of the sick cord to midline easily. No airway complication was found intraoperatively nor postoperatively. The neuromuscular block was completely reversed. The mean operative time was 80 minutes and the postoperative maximum phonation time improved in all the patients.



[Airway Management]

**Conclusion(s):** Neuromuscular relaxation associated to general anesthesia and the use of laryngeal mask could be an interesting alternative to the traditional thyroplasty management as it seems to improve surgical exposure and the airway control.

**References:**

Karmarkar A, Wisely NA, Wooldridge W, et al. *Eur J Anaesthesiol.* 2007 Dec;24(12):1041-4.

### 19AP3-6

#### Anesthetic management in tracheal stenosis surgery Puerta de Hierro Hospital

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**Background:** Tracheal resection and reconstruction (TRR) is the treatment of choice for most patients with tracheal stenosis or tracheal tumors. Anesthesia for TRR offers distinct challenges: the preoperative assessment, strategies for induction and emergence from anesthesia, the coordination between the surgical and anesthesia teams during airway excision and anastomosis, and postoperative care.

**Materials and methods:** An observational retrospective study was conducted with 5 patients undergoing resection subglottic tracheal stenosis and termino-terminal anastomosis from October 2008 to November 2013. The data were analyzed with a descriptive method.

**Results and discussion:** 5 patients were treated in our hospital: 80% women-20% man. The middle age is 55 years. The causes of tracheal stenosis: 60% idiopathic, 20% secondary to tuberculosis and 20% prolonged intubation. All patients were considered to have a difficult airway and this is why we need an adequate preoperative assessment and choose the right airway devices: different size of endotracheal tubes, laryngeal masks and high-frequency jet ventilation. Intraoperative: The induction technique was inhaled by tidal volume with sevoflurane, nitrous oxide and air. After this a laryngeal mask was introduced while the patient kept a spontaneous breathing until the trachea was opened. Then a total intravenous anesthesia was started. The surgeons placed a flexo-metallic endotracheal tube and an intermittent positive pressure ventilation mode was initiated. After the posterior suture of the trachea a retrograde intubation was made through a Cook's guide with nasotracheal tube. When the surgery finishes spontaneous breathing was checked and the tube removed, maintaining the Cook's guide and perforated nasogastric tube. The patients were taken to the postoperative intensive care unit with forced flexion of the neck. Average stay in intensive care was 2.4 days. Postoperative complications: on 20% the extubation was not possible on the operating room due to vocal cord edema tested with fibrobronchoscopy, 100% presented al-

terations in voice tone after surgery but they recovered over time.

**Conclusions:** Resection of subglottic tracheal stenosis is an uncommon surgery. Surgery on the upper respiratory tract anesthesiologists and surgeons are in a kind of competition because of the close spatial relationship between the airway of the patient and the surgical area, the coordination between these teams is very important.

### 19AP3-7

#### Comparison of intubating condition of the McGrath® videolaryngoscope with and without muscle relaxant

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**Background:** Difficult intubation and difficult mask ventilation are frequently associated in general anesthesia. Intubation without muscle relaxants were useful in patients with difficult intubation. The McGrath® videolaryngoscope (VL) Series 5 is a new device for tracheal intubation (Aircraft Medical, Edinburgh, UK). The effect of muscle relaxants (regarding intubating conditions), when using McGrath® VL Series 5 has not been evaluate.

**Objectives:** To evaluate intubating condition using the McGrath® VL Series 5, with and without muscle relaxant. Success rate in the first attempt of intubation, time to intubation, the required propofol dosage for intubation, anesthetic events during intraoperative period and recovery room period were evaluated.

**Methods:** Thirty-four patients with ASA classification I-II who required oroendotracheal tube intubation were studied in this prospective, double-blinded randomized clinical trial. Anesthesia was induced using fentanyl 1.5mcg/kg, xylocaine 1.5 mg/kg and propofol 3 mg/kg. Patients were randomly assigned to one of the two groups to receive rocuronium 0.6 mg/kg or saline intravenously. McGrath® VL intubation was initiated after 90s, when the patients were fully relaxed.

**Results:** The intubating conditions in the rocuronium group were regarded as more acceptable (excellent and good condition) than placebo group (88.2 vs. 41.2%; P=0.007). Patients in both groups had no significant difference in success rate regarding the first attempt intubation, and the time to intubation were the same (54 (45,65) VS. 66 (46,102) seconds; NS). The placebo group required a higher dosage of propofol than rocuronium group (218±44 mg vs. 186±32 mg; p=0.023). The intraoperative and recovery room events rate were similarly in both groups.

**Conclusion:** Intubating condition by McGrath® VL Series 5 using muscle relaxants was more acceptable than not using muscle relaxants. But number of attempts, time to intubation and anesthetic events rate did not differ between groups.

### 19AP3-8

#### Help seeking behavior of anesthesiologists during airway crisis management

ter Horst L.H.<sup>1</sup>, Boland E.<sup>2</sup>, Huitink J.M.<sup>1</sup>

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**Background and Goal of Study:** Airway related problems are still an important cause of mortality and morbidity in daily practice of Anesthesiology<sup>1,2</sup>. When an unanticipated airway management crisis situation (AMCS) arises there is immediate need for extra devices and experienced help. The aim of this study was to gather qualitative data to obtain a better insight in help seeking behavior during AMCS.

**Materials and methods:** An anonymous qualitative study was performed with a questionnaire amongst Dutch anesthesiologists and trainees. Eight questions addressed AMCS in the past year: cannot ventilate (CV), cannot intubate (CI), cannot intubate cannot ventilate (CICV). The questions covered why, when and who was asked for help and what complications were observed.

**Results and discussion:** Forty-nine responses were received from colleagues who had been involved in AMCS. Figure 1 shows the provider of assistance during AMCS. Figure 2 demonstrates complications. In the CI or CV situation most often random colleagues were asked for help. There was a high incidence of desaturation < 70% in the CV situation.

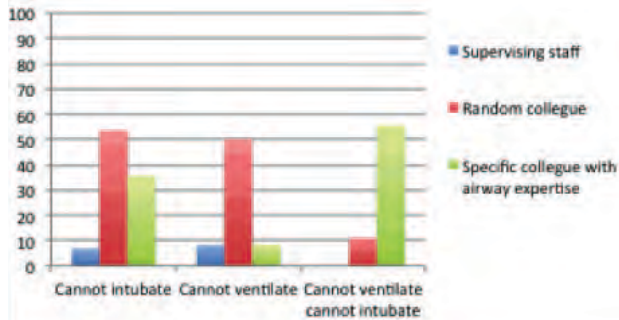
Staff members never answered they were inexperienced in contrast to trainees (resp. 0% vs 86%, p < 0.05).

This might lead to staff members delaying call for help and cause loss of valuable time.

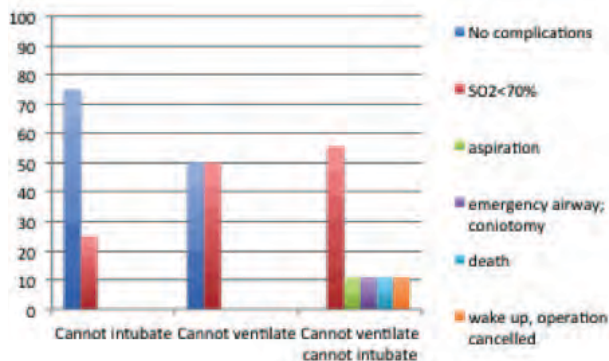
**Conclusion(s):** During AMCS a random colleague is often asked for help. The severity of the situation might not be recognized. Especially the risk of hypoxia during CV seems underestimated. Early help of an expert could optimize care in these situations. Fear of admitting inexperience or loss of face may delay the help seeking process. This needs further study.

**References:**

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2. Flin R, Fioratou E, Frerk C et al. Anaesthesia. 2013 Aug;68(8):817-25



[Figure 1. Who was asked for help (%)]



[Figure 2. Complications (%)]

### 19AP3-9

#### Training surgery residents in Mallampati score evaluation. Is it efficient?

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**Background and Goal of Study:** Mallampati class, along with thyromental distance is the main factors that are evaluated for the prediction of difficult airway. Assessment of Mallampati score has been thought to have a small learning curve. We determined the agreement in Mallampati evaluation between an anesthesia and a surgery resident.

**Materials and methods:** Two observers assessed 61 patients without a difficult airway history. One resident in anesthesia and one in surgery, who has been trained 6 hours every day for two weeks in Mallampati class evaluation, performed the Mallampati class assessment. Inter-observer agreement between surgery and anesthesia residents, separately, was analysed using kappa statistics and the limits of agreement were evaluated using the 95% confidence interval.

**Results and discussion:** Considerable discrepancy was detected between anesthesia and surgery residents when evaluating Mallampati classification (kappa=0.099, with p-value= 0.308 >0.05 which means that the null hypothesis that there is no inter-observer variability is rejected).

**Conclusion(s):** We demonstrated poor inter-observer agreement regarding the Mallampati classification. It can be thus assumed that training a doctor in Mallampati score evaluation is a time-consuming and not easy task.

### 19AP4-1

#### An attempt of tubes placed into tracheal through the left side of oral cavity during videolaryngoscope in clinic

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**Background and Goal of Study:** For some patients whose some upper incisors in the middle or on the left side are loose or lose, the conventional administration of videolaryngoscope is hard and the loose teeth is easy to fall off. We can place the videolaryngoscope into oral cavity through the middle or right side of mouth and then the tube is placed into tracheal through the left side of videolaryngoscope handle in this condition. This study was performed to compare intubation during videolaryngoscope through the left side of oral cavity with that of through the right side in terms of time to intubation, number of attempts and the influence on hemodynamics.

**Materials and methods:** Forty patients were randomly allocated to one of two groups, left or right group, by using computer-generated numbers. Tracheal intubation was attempted randomly by one of two anesthesiologists with extensive experience using Bigger videolaryngoscope through both sides. The operator recorded ease of visualization of glottic structures based on the classification described by Cormack and Lehane. Number of failures, number of attempts and their duration, total intubation time, and events during the whole procedure were recorded.

**Results and discussion:** The time to intubation had no significant difference between the left group and right group (62.6±12.7 vs 61.2±10.7s). Glottic views obtained at intubation, number of intubation attempts and the influence on hemodynamics were also similar between two groups. As usually, tubes are used to be placed into tracheal through the right side of oral cavity during videolaryngoscope in clinic, however this study results demonstrated that it was feasible to place tubes into tracheal through the left side of oral cavity during videolaryngoscope in patients with normal airways. Of course, this method may be feasible to these patients whose some upper incisors in the middle or on the left side are loose or lose.

**Conclusion(s):** This study demonstrate that it's feasible to place tubes into tracheal through the left side of oral cavity during videolaryngoscope in patients with normal airways.

**References:**

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### 19AP4-2

#### Double-lumen tube vs video assisted (ETview) uniblocker for single lung ventilation in distal oesophageal surgery: efficacy and safety

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**Background and Goal of Study:** The oesophageal surgery is one of the thoracic procedures requiring single lung ventilation. The most commonly devices are double-lumen tube (DLT) and different models of bronchial blockers. The aim of this RCT is to compare the efficacy and the safety of Uniblocker (UB) placed with Etview vs DLT in oesophageal surgery.

**Materials and methods:** After the EC approval and informed written consent 60 patients undergoing elective distal oesophageal surgery in left thoracotomy were included. Exclusion criteria: age < 18, ASA III, patients with suspected difficult airway. The patients were randomly allocated into two groups: DLT and UB. The DLT group was intubated using a left-sided DLT using a conventional laryngoscopy. The UB group was intubated with ETview tube and under continuous bronchial vision was placed the UB into the left bronchus. Efficacy parameters: time to initial tube placement (TIP); incidence of dislocation and time for correct replacement; grade of satisfaction of surgeons on lung's collapse; grade of difficulty in using the devices; postoperative incidence and intensity of sore throat (ST); postoperative incidence and intensity of hoarseness.

**Results and discussion:** There was one unsuccessful intubation in DLT group with the necessity of use the UB video assisted. The placement of DLT was faster than UB (TIP: 90sec +- 40 vs 195sec +- 95). After the placement of patients from supine position to lateral one there were 3 cases of dislocation of DLT with necessity of fibrobronchoscopy (means time 180sec) vs 1 case in UB groups immediately resolved thanks to ETview (mean time 50sec). There

was no difference about grade of satisfaction of surgeons. The difficulty of the anesthesiologists was (DLT vs UB very easy 66% vs 50%, easy 16% vs 33%, medium 0 vs 10%, worse 13% vs 6%, impossible 3% vs 0). The incidence of ST was 60% in DLT group vs 45% in UB with no difference in the intensity. The incidence and the intensity of postoperative hoarseness were similar.

**Conclusions:** Although time for intubation was longer in UB group, there was a minor incidence of dislocation and more rapid replacement of UB, thanks to Etview. The efficacy of single lung ventilation is equal. There were also advantages of Etview UB into case of unsuspected difficult airway, so it could be considered a valid alternative device into thoracic non lung surgery.

### 19AP4-3

#### Use of Arndt bronchial blocker and the Fastrach laryngeal mask airway for differential lung ventilation in patient with thyroplasty

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**Background:** The airway management and one-lung ventilation (OLV) in patients with previous thyroplasty have important anesthetic considerations.

**Case report:** A 62 year-old woman with history of arterial hypertension, paroxysmal supraventricular tachycardia (treated by cardiac ablation) and COPD. She presented an episode of foreign body impaction in relation with paralysis of left vocal cord (LVC).

Following that, a thyroplasty type I was done without complications.

Six years later she was scheduled to a left upper lobe pulmonary resection under general anesthesia because a solitary pulmonary nodule was discovered. After induction, a vision of vocal cords was obtained through C-MAC™ videolaryngoscope. LVC was observed near the midline by thyroplasty.



[Image 1]

Then, a LMA- Fastrach™ (LMA-F) was inserted using fiberoptic bronchoscope and afterwards an Arndt bronchial blocker was introduced through the LMA-F in left main bronchus.

The LMA-F allowed us to establish a safe seal of the airway in supine and lateral decubitus. The bronchial blockade was checked with fiberoptic during the change to lateral position.

Adequate ventilation was achieved with recruitment maneuvers and PEEP using pressure ventilation control mode during OLV. Arterial blood gas analyses showed an appropriate oxygen saturation and CO<sub>2</sub> levels. Pulmonary reexpansion was obtained without complications. The patient has satisfactory evolution nowadays.

**Discussion:** In patients who require OLV and present thyroplasty, a key element is safe management airway. Lung isolation in these patients is achieved best with the use of an independent bronchial blocker. However, potential disadvantages include poor quality of suctioning, longer time for placement and for lung collapse.

**Learning Points:** An alternative to achieve OLV in patients with previous phonsurgery is with the use of a supraglottic device in conjunction with the use of a bronchial blocker.

#### Reference:

Lung isolation using a laryngeal mask airway and a bronchial blocker in a patient with a recent tracheostomy. Robinson AR 3rd, Gravenstein N, Alomar-Melero E, Peng YG. J Cardiothorac Vasc Anesth. 2008 Dec;22(6):883-6.

### 19AP4-4

#### Blind nasal intubation - how to teach a dying art?

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**Background and Goal of Study:** The technique of blind nasal intubation was popularized during WWI, but its popularity has declined in face of advances in airway management. The lack of skilled personnel and appropriate patient populations restricts teaching of the technique to medical trainees. The goal of this study was to develop and test a simple model to teach the technique of blind nasal intubation.

**Materials and methods:** Two training manikin models were created to simulate a normal breath cycle through the tracheal tube and BAAM (Beck Airflow Airway Monitor) whistle (TTB unit) during blind nasal intubation.

In Model 1, the artificial lungs of the manikin were disconnected. One of the mainstem bronchi was sealed with tape while the other was attached to an adult self-inflating ventilation bag. Inflation and deflation of the bag creates airflow through the TTB unit.

In Model 2, bimanual compression of the artificial lungs simulates airflow in a breathing patient. The whistle intensities between the two models were compared using a sound meter. Model 2 was selected as the training model in view of the higher whistle intensity. The efficacy of the teaching model was tested in a Rwandan Airway Workshop in a Global Outreach Program funded by the Canadian Anesthesiologists' Society International Medical Fund. The airway workshop consisted of didactic lectures with instructions for blind nasal intubation, followed by practical sessions using the study manikins.

**Results and discussion:** There were a total of 37 participants at the airway workshop, consisting of anesthesia staff, residents, and technicians. All participants successfully performed a blind nasal intubation on the first attempt. Despite the myriad of airway devices available, blind nasal intubation remains a useful adjunct in the difficult airway management armamentarium. Its utility in clinical settings with limited resources cannot be overlooked, and the skill of the practitioner is the key determinant to a successful blind nasal intubation.

**Conclusion(s):** Our teaching model is not only a good alternative to teach blind nasal intubation, but it is also easy to set up, inexpensive, and cost-effective, requiring only an intubating manikin, tracheal tubes, and a whistle device. This model can equip practitioners with an important set of life-saving skills, which can be invaluable, particularly in austere environments.

#### References:

1. J Clin Anesth 1993;5:431-2.
2. Am J Emerg Med 1995;13:180-3.

### 19AP4-5

#### Assessment of four methods of endotracheal tube cuff inflation in terms of optimal cuff sealing

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**Background and Goal of Study:** To assess the comparative applicability of three common methods of endotracheal tube cuff (ETTc) inflation such as finger estimation, minimal occlusive volume or minimum leak technique and a less applied method involving air return back into the syringe after cuff overinflation, with a view to ascertain optimal ETTc sealing practice in a surgical population.

**Materials and methods:** Prospective, randomized, controlled study enrolling 84 candidates (38M/46F, aged 54.4±16 years, ASA 1-3, BMI 29.6±4.9 kg/m<sup>2</sup>), scheduled to undergo surgical procedures under N<sub>2</sub>O free general anaesthesia. Participants were assigned into four groups of 21 patients each according to the ETTc inflation method applied: a) finger estimation (Palpation), b) air return back into the syringe following overinflation (Air-return), c) minimal occlusive volume assessed by direct auscultation of air leak (MinVol) and d) minimum air leak assessed by stethoscope (MinLeak). The ETTc pressure was measured with a non-invasive manometer via the pilot balloon. The volume of air applied in each method and post-intubation airway complications, were also recorded. Oneway ANOVA and linear regression were used for data analysis.

**Results and discussion:** The ETTc pressure and air volume values recorded in the studied groups are presented in the Table (as mean±SD). Significant between-methods differences of both cuff pressure and volume were detected among Air-return and MinVol (P< 0.01) or MinLeak (P< 0.05), but not among auscultation for air leak techniques.



Table.	Palpation	Air-return	MinVol	MinLeak	p-value
Pressure (cmH <sub>2</sub> O)	28.7±4.3	19.2±3.4*	16.2±2.6*	16.7±2.9*	0.000
Air (ml)	8.8±1.2	7.1±0.9*	6.1±1.1*	6.3±1.2*	0.000

[\* $p < 0.001$ ; each method vs palpation]

The correlation coefficient (R) between the cuff pressure and the volume applied was 0.762 ( $p < 0.001$ ), illustrating a fairly strong relationship, indicative of no abrupt increase in slope of the pressure-volume curve as volume increases. No case of tracheal leaks, sore throat, hoarseness, dysphagia or aspiration pneumonia was observed.

**Conclusion(s):** It seems that, finger estimation performs rather poorly regarding optimal ETTc pressure inflation. Albeit both auscultation for air leak maneuvers keep cuff pressure in low levels, under certain circumstances they might be implicated with underinflation. Thus, the method involving air return back into the syringe emerges as an attractive alternative for maintaining ETTc pressure within the safe range.

## 19AP4-6

### Endotracheal tube displacement during head mobilization

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**Background and Goal of Study:** Depending on the type and location of the surgery, head mobilisation after endotracheal intubation (ETT) and tube fixation may be required for better surgical access or exposure and can lead to ETT displacement. The purpose of this investigation was to assess the displacement of the ETT by measuring changes in distances between the ETT tip and carina during a standardized trial of head and neck movements.

**Materials and methods:** After standardized orotracheal intubation (Mallinckrodt® size 6.5 respectively 7.5 for female and male patients) and appropriate ETT fixation, a fiberoptic was introduced in the ETT to assess tube displacement on 50 adults patients in 5 specific situations, i.e. neutral position, maximum head extension and flexion and maximal right and left rotations.

**Results and discussion:** Despite the ETT being positioned by the in-charge anaesthesiologist according to the marks printed by the manufactures, the distance between tube extremity and carina varied from 1-10cm (median of 5.0 cm, SD 3.5;7.0). Maximal head extension led to tube extremity withdrawal in 68% of cases while flexion led to further caudal tube movement displacement in 76%. Maximal ranges of movement up to 7.0 cm after head extension and 4.8 cm after head flexion were observed and led to selective intubation in 4% of our population, while no extubations were observed. Left and right head rotation led to median tube displacement of respectively 0.1cm caudally (SD -0.5;0.55) and 0.05cm (SD -0.5;1).

**Conclusion(s):** This is the first clinical study assessing tube displacement in a standardized head and neck movement trial. Proper tube positioning is an essential part of endotracheal intubation. Head mobilisation can lead to tube extremity displacement which may create clinically relevant issues. Selective endobronchial intubation must be suspected for small distances between tube extremity and carina. Reassessment of proper tube positioning after head and neck mobilisation is mandatory.

## 19AP4-7

### Quick and reliable confirmation of tracheal tube placement by NEW type of Airway Scope™

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**Background and Goal of Study:** The Pentax-AWS Airway Scope™ (AWS; HOYA, Tokyo) is a rigid video laryngoscope for tracheal intubation that is equipped with a video monitor. The AWS is superior to other laryngoscopes for visualization of the glottis and tracheal tube guidance, and it is widely used not only in cases of difficult intubation but also in normal cases. However, cases of esophageal intubation even using the AWS have been reported, and detection of end-tidal CO<sub>2</sub> is essential for confirmation of tracheal intubation. The video monitor of the new type of AWS can be switched from the video taken from the tip of the laryngoscope to a video taken from a fiberoptic placed at the tracheal tube tip, thus enabling rapid confirmation of tracheal tube placement. In this study, the performance of the new AWS was compared with that of a conventional Macintosh laryngoscope (Mac).

**Materials and methods:** Thirty ASA-PS 1-3 patients scheduled to undergo surgery were randomly divided into a new AWS group and Mac group. Time from insertion of the laryngoscope to confirmation of the glottis, time to tracheal placement and time to confirmation of tracheal tube placement were recorded in the two groups. Tracheal tube placement was confirmed by fiberoptic view of trachea in the new AWS group, and by detection of end-tidal CO<sub>2</sub> using a capnometer in the Mac group. Statistical analysis was performed using the Mann-Whitney test, and median (minimum-maximum) values are shown.  $P < 0.05$  was considered significant.

**Results and discussion:** The time from tracheal placement to confirmation of tracheal placement was significantly shorter in the new AWS group (2.1 (1.0-5.0) vs 14.4 (7.0-22.0) sec). The time to confirmation of the glottis was significantly shorter in the Mac group (10.0 (5.2-30.0) vs 8.0 (4.22-31.0) sec), and the time to confirmation of tracheal tube placement was significantly shorter in the new AWS group (19.0 (11.8-34.0) vs 30.7 (19.9-48.0) sec). Since the new AWS enables visualization of the site of trachea by using fiberoptic in the tracheal tube, confirmation of tracheal tube placement is more definite than that when using the Macintosh laryngoscope. The new AWS does not require ventilation to confirm end-tidal CO<sub>2</sub> waveform, and there is therefore no risk of air flowing into the stomach if the tracheal tube has been placed in the esophagus.

**Conclusions:** Use of the new AWS enables quick and reliable confirmation of tracheal tube placement.

## 19AP4-8

### Fresh tracheostomized patients and one-lung ventilation procedures

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**Background:** Anesthesiologists often have to isolate and selectively ventilate a single lung. Double-lumen endotracheal tube (DLT) is still the most common device used in one-lung ventilation (OLV), yet bronchial blockade technology is increasing; in some specific situations, offering more advantages than DLT. This report aims to present a case of a tracheostomized patient requiring OLV.

**Case report:** A 57-year-old man was admitted into the emergency department for cervicotomy and left thoracotomy. The patient was in septic shock secondary to cervical, mediastinal and pleural abscesses. He had cardiovascular, respiratory, neurological and renal impairment, ASA IV. Medical history included hypertension and alcoholism. He was intubated, ventilated and sedated. Sevoflurane, fentanyl, oxygen and air were used to maintain anesthesia. Standard and invasive monitoring was applied. After drainage of cervical abscesses, the tracheostomy was performed. OLV techniques were used during left thoracotomy. We used the wire-guided endobronchial blocker (EB). A flexible fiberoptic bronchoscopy examination was used during placement and for confirmation of proper placement. Hypoxemia during OLV required periodic inflation of the collapsed lung with oxygen. The surgery lasted eight hours without interurrences. He was then transferred to Intensive Care Unit, sedated and ventilated.

**Discussion:** In tracheostomized patients one must consider if it is a fresh or a chronic tracheostomy. The alternatives to OLV in tracheostomized patients include insertion of a single lumen tube followed by an independent EB passed coaxially; the use of a disposable cuffed tracheostomy cannula with an independent EB passed coaxially; replacement of the tracheostomy cannula with a specially designed short DLT; placement of a small DLT through the tracheostomy stoma; or if possible, oral access to the airway for standard placement of DLT or EB. In this specific case, because it is a fresh tracheostomy, the most adequate plan is to use an EB through the tracheostomy cannula. The current use of bronchial blockade technology, supported by scientific clinical evidence, dictates that EB should be available in any service performing OLV techniques.

#### References:

Br. J. Anaesth 2009;103(Suppl. 1):i66-i75

**Learning points:** The optimal method of OLV depends on the patient's airway anatomy, indication for OLV, available equipment, and the anesthesiologist's training.

## 19AP4-9

### A comparison of two endotracheal tubes for intubation via i-gel depended from fiberoptic score

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**Purpose of the Study:** The i-gel is a new single-use, noninflatable supraglottic airway for use in anesthesia during spontaneous or intermittent positive pressure ventilation (1). Its wider and shorter stem suggest that it may be an ideal conduit for intubation using a fibrescope or blindly. A size 4 i-gel has a channel length of 192 mm and an internal diameter of 12.3 mm and will accept a 6.5-7.0-mm cuffed tracheal tube.

**Materials and methods:** After approval of our IRB and written informed consent was obtained, in 56 patients (ASA 1-3), undergoing minor routine gynaecologic surgery, standardised anesthesia was induced (Remifentanyl and Propofol). A size 4 i-gel was inserted in all. After insertion, the position of both devices was controlled using a fiberoptic bronchoscope (FOS) (4=only vocal cords visible; 3=vocal cords plus posterior epiglottis; 2=vocal cords plus anterior epiglottis; 1=vocal cords not visible but functions adequately; 0=vocal cords not visible and functions inadequately) and after sufficient ventilation the patient were relaxation with 0.6 mg/kg rocuronium. All patients were randomly allocated to an intubation attempt via the i-gel device using either an ID 6.5 mm silicon's Portex (PT-group) or an 6.5 mm Mallinckrodt ETT (MT-group) made of conventional clear polyvinylchloride (PVC). Both ETTs were inserted blindly by a single experienced anesthesiologist. In 20 patients with Portex ETT and in the other 29 patients, the Mallinckrodt ETT was inserted. Failure rate and time to successful intubation were recorded.

**Results:** Fiberoptic control of the position of the devices was comparable in both groups. In the PT-group, intubation was successful in 17 patients (FOS 4-8 patients, FOS 3-8 patients, FOS1-1) and failed in 6 cases (FOS4-2, FOS3-1, FOS2-1 and FOS1-1).

In MT-Group successful intubation was performed in 10 patients (FOS 4-3, FOS 3-3, FOS 2-1 and FOS 1-3) and intubation failed in 23 patients (FOS4-13, FOS3-3, FOS2-1 and FOS1-3). Successful intubation was significant higher in PT group ( $P < 0,0001$ ).

Time to intubation with Portex ETT and with Mallinckrodt ETT was (mean  $\pm$  standard deviation)  $11 \pm 9$  seconds and  $14 \pm 8$  seconds, respectively.

**Conclusions:** The successful intubation with ETT via i-gel is not depended from fiberoptic score. Significantly higher failed rate suggest, that the i-gel is not suitable for intubation blindly with conventional PVC ETTs.

#### References:

Levitan et al.: *Anaesthesia* 2005; 60:1022-6

## 19AP4-10

### The correlation of waist circumference with Cormack and Lehane grade of laryngoscopy in bariatric surgical patients: a prospective study

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**Background and Goal of Study:** Difficult laryngoscopy is more common in morbidly obese patients [1, 2]. Correctly anticipating airway difficulty could potentially prevent catastrophic events; The aim of this study was to evaluate the association between waist circumference and difficult laryngoscopy.

**Materials and methods:** Waist circumference, Laryngoscopy grade and basic patient demographics were prospectively collected for patients who underwent bariatric surgery from August 2011 to November 2013 in St Richards Hospital (Chichester, UK). Patients were stratified into cohorts according to waist circumference. Difficult laryngoscopy was defined as Cormack & Lehane grade 3 or 4. All anaesthetics were performed by consultant anaesthetist or fellows in bariatric anaesthesia.

**Results and discussion:** Data was available for 683 patients. The median BMI was  $49 \text{ kgm}^{-2}$  and the median waist circumference was 135 cm (IQR, 123-147 cm). Overall 42 difficult laryngoscopies (6.1%) were encountered in this patient cohort. Out of 342 patients with waist circumference  $\leq 135$  cm, there were 16 (4.7%) difficult laryngoscopies while 26 (7.6%) difficult laryngoscopies were encountered in the 341 patients with waist circumference  $> 135$  cm;  $p=0.11$

**Conclusion(s):** We have previously shown that BMI per se is a very poor predictor of difficult laryngoscopy. In this study, the overall incidence of difficult laryngoscopy (6.1%) approaches that of the general population [3]. Although no statistically significant correlation was found between difficult laryngoscopy and waist circumference in this patient cohort, we report an

increasing incidence of difficult laryngoscopy with increasing waist circumference strongly suggesting that patterns of fat distribution are important in predicting this adversity.

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## 19AP5-1

### Randomized prospective trial comparing two supraglottic airway devices: I-gel™ and LMA- Supreme™ in paralyzed patients

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**Background and Goal of Study:** Many features can influence the choice of a supraglottic airway device (SAD) such as the ease of insertion, adequate ventilation pressures and lack of adverse effects. The goal of this randomized prospective trial was to evaluate the performance of the i-gel™ and the LMA-Supreme™.

**Materials and methods:** One hundred adult patients (ASA I-III) scheduled to undergo elective surgery under general anesthesia were randomized either to an i-gel™ (n=50) or an LMA-Supreme™ (n=50). The primary objective was to compare ventilation pressures. Secondary objectives included time and number of attempts needed to introduce the device, adverse effects and repositioning. Endoscopic view of the glottic aperture and position of the drain tubes with regard to the oesophagus were also evaluated.

**Results:** The devices were inserted successfully in 46 (92%) patients in both groups. There was no significant difference in the leak pressure [mean (SD)] [i-gel™: 23 (7) vs. LMA-Supreme™: 21 (8) cmH<sub>2</sub>O;  $P = 0.14$ ] or peak inspiratory pressure between both devices. Insertion time was shorter with the i-gel™ than with the LMA-Supreme™ [19 (7) vs. 27 (17) s;  $P = 0.003$ ]. The vocal cords were completely visualized more often through the i-gel™ (70%) than through the LMA-Supreme™ (50%) ( $P = 0.007$ ). Oesophageal mucosa was easily visualized through the drain port in all patients except four, two in each group. There was no difference between groups regarding perioperative or postoperative complications. Postoperative patient discomfort was generally mild and comparable for both devices.

**Conclusion(s):** Both the LMA-Supreme™ and the i-gel™ offer similar performance for positive pressure ventilation in paralyzed patients during general anesthesia. The i-gel™ was associated with a slightly faster insertion time and better fiberoptic visualization of the glottis.

	I-gel™ (n = 50)	LMA-Supreme™ (n = 50)	
Attempts (1/2/ crossover/intubation)	43 / 3 / 2 / 2	44 / 2 / 3 / 1	$P = 0,77$
	I-gel™ (n = 46)*	LMA-Supreme™ (n = 46)*	
Insertion time (s)**	19 $\pm$ 7	27 $\pm$ 17	$P = 0,003$ ; Difference (95% CI): 8 (3-13)
Leak pressure (cmH <sub>2</sub> O)**	23 $\pm$ 7	21 $\pm$ 8***	$P = 0,14$

#### [Insertion and ventilation data]

	I-gel™ (n = 46)	LMA-Supreme™ (n = 44)*	
Glottic Visualization Scale (4 / 3 / 2 / 1)**	37 / 6 / 2 / 1	22 / 13 / 8 / 1	$P = 0,0067$
Oesophageal mucosa seen (yes/no)	44 / 2	42 / 2	$P = 1,0$

#### [Fiberoptic evaluation]

#### References:

- Anaesthesia. 66(6):481-7. 2011  
British Journal of Anaesthesia. 109 (6): 996-1004. 2012  
Anesth Analg. 114(2): 349-68. 2012

## 19AP5-2

### Use of supraglottic devices with drainage channel in laparoscopic cholecystectomy: a prospective, randomized comparison of LMA ProSeal™, LMA Supreme™ and i-gel™

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**Background and Goal of Study:** LMA ProSeal™ (LMA-P), LMA Supreme™ (LMA-S) and i-gel™ are probably the three most used supraglottic airway devices (SADs) with an inbuilt drain channel. We compared them with regard to safety, efficacy, ease of use and incidence of adverse events for laparoscopic cholecystectomy. To our knowledge, this is the first work comparing the three devices for laparoscopy in a single study setting.

**Materials and methods:** We present a prospective, randomized, controlled study of 180 patients divided in three groups (60 patients each), undergoing elective laparoscopic cholecystectomy. After induction of general anaesthesia, we evaluated speed of insertion, success rates, ease of insertion of the drain tube, leak pressure, tidal volume (TVm), peak pressures (PAW-pk) and the "margin" on leak pressure. We also recorded intraoperative adverse events and postoperative oropharyngeal discomfort (OPD).

**Results and discussion:** Insertion times were lower for i-gel, 1.7 s quicker than LMA-P ( $p = 0.005$ ). Insertion success rate on first attempt was higher for the LMA-S ( $p = 0.004$ ). Ease of insertion of the drain tube differed significantly and it was easily inserted in the LMA-S group ( $p < 0.001$ ). Leak pressure was significantly higher for LMA-P (LMA-P 30.87; i-gel 29.28; LMA-S 29.02 cm H<sub>2</sub>O,  $p = 0.005$ ) and it was consistent with a higher maximum tidal volume achieved ( $p = 0.003$ ). I-gel showed higher sore throat scoring at 2 h postoperatively ( $p = 0.005$ ) and reported lower OPD drop during the first 2 h-period studied ( $p < 0.001$ ). An interesting contribution of our study, is actually the introduction of a novel concept related to the safety of SADs during laparoscopy: the margin on OLP (MOLP). Analysing this variable, we found the value for the margin of pressure between the highest PAW-pk during pneumoperitoneum and the maximum safety's seal pressure value (OLP). All SADs showed similar MOLP: LMA-P 5.80 ± 4.10; LMA-S 5.48 ± 3.95, i-gel 5.28 ± 2.97 cm H<sub>2</sub>O. Based on these values, mean MOLP was 5.52 cm H<sub>2</sub>O, when using the kind of SAD as tested.

**Conclusions:** We found that LMA-S was the easiest device to insert (including drain tube insertion), LMA-P achieved the best leak pressure and i-gel was the quicker SAD to insert but it reported the worst postoperative OPD scoring.

## 19AP5-3

### The comparison of LMA ProSeal™ and I-gel™ in anesthetized adult patients under controlled ventilation

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**Background and Goal of Study:** In appropriate patients, supraglottic airway devices are good alternatives to endotracheal intubation in airway management; and more advanced models of these devices are put in practice to decrease the complications caused by endotracheal intubation(1). In this study insertion time, difficulty during insertion, airway leakage pressure and complications were compared between LMA ProSeal (P-LMA) and I-gel groups.

**Materials and methods:** Between 18-65 years old 80 patients who underwent elective surgery were involved in the study after the ethical committee approval. Patients were equally randomized to two groups. In both groups same senior assistant inserted the supraglottic airway devices under the control of the same specialist. During induction and maintenance same anesthetic protocol was applied to all patients. Insertion time of the devices, difficulty during insertion, airway leakage pressures and complications were recorded. Oneway ANOVA, Kruskal Wallis, paired t and chi square test in the SPSS 17.0 were used for statistical analysis.

**Results and discussion:** Mean insertion time in I-gel group (8 ± 3 s) was significantly lower than that of P-LMA group (13 ± 5s) ( $p < 0.05$ ). Insertion success rate was higher in I-gel group (100 % in the first attempt) than P-LMA group (82 % in the first attempt, 17.5 % in the second attempt) ( $p < 0.05$ ). Nasogastric tube placement success rate was higher in I-gel group than P-LMA group (In I-gel group 92.5 % [n=37] in the first attempt and 7.5 % [n=3] in the second attempt. In P-LMA group 72.5 % [n=29] inserted in the first, 10 % [n=4] inserted in the second attempt and 17.5 % [n:7] could not be inserted)

( $p=0.001$ ). Airway leakage pressures of the two groups were similar (P-LMA: 35 ± 6 cmH<sub>2</sub>O; I-gel: 32 ± 4 cmH<sub>2</sub>O). In the postoperative period only sore throat was seen as a complication and it was higher in P-LMA group (17.5%) than I-gel group (7.5%) ( $p < 0.001$ ).

**Conclusion(s):** Both of the devices were adequate for airway control and ventilation. However, I-gel insertion was easier, insertion time was significantly lower and also nasogastric tube insertion was easier with I-gel application. We decided that I-gel can be a better choice as a supraglottic airway device than P-LMA.

#### References:

1. Teoh W.H.L, Comparison of the LMA Supreme vs i-gel in paralysed patients undergoing gynaecological laparoscopic surgery with controlled ventilation. Anaesthesia, 2010; 65: 1173-9.

## 19AP5-4

### Management of difficult airway in neonate with giant anterior encephalocele

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**Background:** Management of the difficult airway in an infant is a challenge for the anesthesiologist.

We present a full-term newborn infant who was presented to neurosurgeon from neonatal intensive care with .naso-orbito- ethmoidal gigantic encephalocele (28cm).

**Case report:** On preanesthetic evaluation, the neonate was found to be underweight for age (2.8 kg). It was difficult to keep the patient supine for long, and even in the upright position. This mass was large enough to disturb swallowing and breathing. CT scan was performed.

Physical examination did not reveal any other congenital malformations.

There was anticipated difficulty in airway management due to the .naso-orbito- ethmoidal gigantic encephalocele and a high-risk consent was taken.

Endo tracheal intubation was planned under local anesthesia with heavy sedation. In the operating room, we could not place the baby supine and so the neonate was kept in lateral position with the head-up tilt on the operation table. The infant has been sedated with . midazolam , promethazine , and pentazocine administered slowly IV, followed by atropine IV. A nasal catheter was inserted into the right nostril and oxygen flow was started at 2 l/min.

Local anesthesia was achieved with 2 ml lignocaine 1% solution .We attempted laryngoscopy in the lateral position, intubation could not be done. Next, we lifted the baby and placed her head beyond the edge of table with an assistant supporting it while another assistant stabilized the baby's body, taking adequate care to support the encephalocele so as to prevent a rupture. Laryngoscopy in this position provided a better view and we intubated the trachea with a 3 mm uncuffed endotracheal tube.

**Discussion:** Airway management in pediatric patients with craniofacial malformation poses many challenges to the anesthesiologist. Anesthetic management of these neonate requires carefully attention because the size of anterior encephalocele is too large which caused restriction of head movement. This led to difficulty in positioning for laryngoscopy and in visualizing the glottic opening. We tried two different positions for airway management, applying heavy sedation with local anaesthesia. Different airway management has been defined by various authors for encephaloceles.

**Learning points:** Careful perioperative management allowed us to achieve successful outcome in this case.

## 19AP5-5

### Use of supraglottic airways (SGA) in patients with difficult access: a prospective, controlled, randomized manikin trial

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**Background and Goal of Study:** Airway management is crucial in many emergency situations. Endotracheal intubation (ETI) is still considered gold standard. However, studies have shown that success rate is unacceptably low, especially when performed by less experienced personnel [1, 2]. Supraglottic airway devices (SGA) have become an important alternative in this setting for primary or secondary (rescue) manoeuvres. The aim of this study was to compare the time needed for first ventilation when using different airway devices in a model of an entrapped traffic accident victim.



**Material and methods:** A standardized airway manikin (AMBU Airway Man, Ambu, Bad Nauheim, Germany) was placed on the driver's seat of a sports car, the seat at the furthest position with an upright position to simulate an entrapped motor vehicle accident victim. In this setting, the rescuer only had access through the opened driver's door. Participants were 25 anaesthesiologists with experience in prehospital emergency medicine. They were asked to promptly secure the airway by ETI or an SGA (standard laryngeal mask (Ambu, Bad Nauheim, Germany), iGel laryngeal mask (Intersurgical, St. Augustin, Germany), laryngeal tube (VBM, Sulz a. N., Germany)); the order of the devices was randomized prior to the beginning. Performance was compared using Wilcoxon signed ranks test, a  $p < 0.05$  was considered statistically significant.

**Results and discussion:** Effective ventilation was achieved fastest with the use of the iGel, followed by laryngeal mask and laryngeal tube. iGel ( $p < 0.001$ ), laryngeal mask ( $p < 0.001$ ) and laryngeal tube ( $p < 0.001$ ) facilitated the first effective ventilation significantly faster than ETI. iGel ( $p < 0.001$ ) and laryngeal mask ( $p = 0.01$ ) also significantly outperformed the laryngeal tube, with iGel facilitating ventilation faster ( $p = 0.004$ ) than the laryngeal mask. ETI required more than twice the time of the insertion of an SGA.

**Conclusion:** The results of our manikin study show that first ventilation in this emergency medicine setting was achieved significantly faster with each of the supraglottic airways as compared to endotracheal intubation.

**References:**

1. Katz SH, Falk JL. Misplaced endotracheal tubes by paramedics in an urban emergency medical services system. *Ann Emerg Med.* 2001;37:32-7.
2. Timmermann A, Russo S, Eich C, et al. The out-of-hospital esophageal and endobronchial intubations performed by emergency physicians. *Anesth Analg.* 2007;104:619-23.

**19AP5-6**

**Clinical limitations of pediatric-sized supraglottic airway devices as a conduit for fiberoptic intubation**

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**Background and Goal of Study:** Pediatric supraglottic airway devices (SAD) may be used as a conduit for intubation. No recommendations are available about the feasibility to advance the tracheal tubes (TT) and their cuff-pilot balloons (CB) through these SADs. This study provides an easy reference guide for safe tracheal intubation through pediatric SADs

**Material and methods:** This in-vitro study evaluated 7 pediatric SADs, sizes 1.0 to 2.5. Three SADs are marketed for intubation: air-Q™ (inflatable), air-Qsp™ (self-pressurizing), Ambu Aura-i™. The other 4 SADs were: Ambu Aura-Once™, Ambu AuraStraight™, i-gel™, LMA Unique™.

Four cuffed pediatric TTs with ID 3.0 to 5.5mm were used: Mallinckrodt™, Rüsch™, Microcuff™, Sheridan™. Each TT (and CB) was advanced in random order through each SAD and tested whether the TT and their CB passed the lumen of the SAD. Three anesthesiologists had to find agreement on the passage of the tubes.

**Results and discussion:** Even when the TT passed through SAD, the CB sometimes did not (see tables). Surprisingly, the inner diameter of the Ambu Aura-i was smaller than the ID of the standard Ambu, interfering with safe SAD removal (see figure). In general, the air-Q showed the largest inner diameters. Of the standard SADs, the Ambu AuraOnce and the i-gel offered the largest inner diameters. The differences between the tracheal tubes were less pronounced.

**Conclusion:** Pediatric anesthetists need to be aware of potential mismatch between the CB size and the inner diameter of the supraglottic airway device. This may interfere with the removal of the SAD after intubation. TT-SAD combination must be assessed prior to anesthesia induction. Tube exchangers or uncuffed TT may have to be used instead of the preferred cuffed TT in pediatric patients.

Tables: Showing all tracheal tube - supraglottic airway device combinations tested.

		air-Q™ (both)				Aura-i™							
		1.0	1.5	2.0	2.5	1.0	1.5	2.0	2.5				
Mallinckrodt™	3.0												
	3.5												
	4.0												
	4.5												
	5.0												
	5.5												
		Intubation and SAD removal possible				Intubation possible, but SAD not removable				Combinations not recommended by the manufacturers			

[Table1]

		1		2		2.5		1		1.5		2		2.5		1.0		1.5		2.0		2.5			
		Mallinckrodt™	3.0																						
	3.5																								
	4.0																								
	4.5																								
	5.0																								
	5.5																								
Rüsch™	3.0																								
	3.5																								
	4.0																								
	4.5																								
	5.0																								
	5.5																								
Microcuff™	3.0																								
	3.5																								
	4.0																								
	4.5																								
	5.0																								
	5.5																								
Sheridan™	3.0																								
	3.5																								
	4.0																								
	4.5																								
	5.0																								
	5.5																								
		Intubation and SAD removal possible				Intubation possible, but SAD not removable				Intubation NOT possible.				Combinations not recommended by the manufacturers											

[Table2]

**19AP5-7**

**Clinical performance of five pediatric supraglottic airway devices**

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**Background and Goal of Study:** Pediatric supraglottic airway devices (SAD) are usually marketed without independent clinical evaluation. This study evaluated the performance of three standard SADs (i-gel™, Ambu AuraOnce™, LMA Supreme™) and two intubation SADs (Air-Q™, Ambu Aura-i™). The primary hypothesis was that the 95% confidence interval (CI) for the mean airway leak pressure (ALP) would be between 18 and 22 cmH2O.

**Material and methods:** With local IRB approval (no. 12-011), this prospective controlled observational cohort study evaluates 400 children scheduled for elective surgery and standardized anesthesia with an SAD and controlled positive pressure ventilation. Part of the data of the i-gel and Ambu AuraOnce cohorts were taken from a previously published paper to serve as historic controls. (1) The primary outcome was ALP. Secondary outcome parameters included first attempt and overall success rates and the insertion time. Data was analyzed using SPSS version 21.0. Kruskal-Wallis test, chi-square test and fisher's exact test were used and Bonferroni correction for multiple comparisons was applied.

**Results and discussion:** So far, 351 children were included (at the ESA meeting we will present the full data set). Mean ALP was lower than in adults (16-21 cmH2O), possibly influencing the decision for or against controlled ventilation in pediatrics. It differed significantly between the devices, with i-gel showing

highest values (see table). First attempt success rates ranged 87-100%, overall success rates were about 90% or above. Only LMA Supreme and Ambu Aura-i reached the desirable success rates of 95%. Insertion times were within clinically acceptable limits.

**Conclusion:** Most SADs tested showed lower ALP than anticipated, but positive pressure ventilation was still possible. Intubation SADs generally perform less well.

**References:**

1. Theiler LG, Kleine-Brueggene M et al. Performance of the pediatric-sized i-gel compared with the Ambu AuraOnce laryngeal mask in anesthetized and ventilated children. *Anesthesiology*. 2011;115(1):102-10.

Table: Preliminary results after 351 patients

	Airway leak pressure (cmH <sub>2</sub> O)	First attempt success	Overall success	Insertion time (s)
i-gel (n = 80)	21 ± 5** 95% CI: 19.5 - 21.7	71 (89)*	74 (93)	19 ± 7**
Ambu AuraOnce (n = 80)	18 ± 4 95% CI: 17.7 - 19.3	72 (90)	75 (94)	23 ± 8
LMA Supreme (n = 80)	18 ± 3 95% CI: 17.2 - 18.7	80 (100)	80 (100)	24 ± 6
Air-Q (n = 53)	16 ± 4* 95% CI: 14.7 - 16.9	46 (87)*	47 (89)*	25 ± 7
Ambu Aura-i (n = 58)	17 ± 4 95% CI: 15.6 - 17.9	55 (95)	55 (95)	23 ± 9
p-value	< 0.01	< 0.01	0.03	< 0.01

[Table]

Data are given as mean ± standard deviation or numbers (%)

\*statistically different to LMA Supreme, \*\*statistically different to all other four devices (Bonferroni correction for multiple comparisons applied)

**19AP5-8**

**Jaw Elevation Device (JED) is able to maintain jaw trust and keep the airway open**

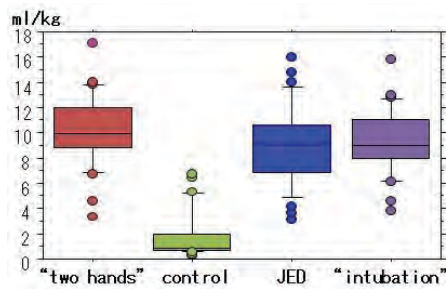
Itosu M.<sup>1</sup>, Yogo H.<sup>1</sup>, Shimajiri T.<sup>1</sup>, Fujimura T.<sup>1</sup>, Shinzato T.<sup>1</sup>, Isono S.<sup>2</sup>

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<sup>2</sup>Graduate School of Medicine, Chiba University, Dept of Anaesthesiology, Chiba, Japan

**Background and Goal of Study:** Jaw Elevation Device (JED, HYPNOZ Therapeutic Devices, Inc.) is designed to mechanically hold jaw thrust position for preventing airway obstruction in unconscious humans. However, its efficacy for maintaining facemask ventilation (FMV) during anaesthesia induction has not been systematically evaluated. The purpose of this study is to compare ventilation efficacy during JED-assisted FMV (JED) with that during FMV with no airway maneuvers (control), two hands FMV ("two hands"), and ventilation through a tracheal tube ("intubation").

**Materials and methods:** With approval of the IRB, we recruited 33 ASA PS I-II adult patients with normal upper airway anatomy scheduled for elective surgeries under general anaesthesia (age: 17 to 85 years old, BMI; 18.3 to 36.7 kg/m<sup>2</sup>). Anaesthesia was induced and maintained by propofol, remifentanyl and rocuronium. Ventilation efficacy was assessed by tidal volume per body weight (TV/BW) during pressure controlled ventilation (PIP = 17cmH<sub>2</sub>O, PEEP = 5cmH<sub>2</sub>O, I/E ratio = 1:2, 12 breaths/min) under elimination of air leak with an elastic facemask head band. The order of FMV for three different conditions (JED, control, "two hands") was randomly predetermined. After tracheal intubation, TV/BW was assessed again ("intubation"). Statistical analyses were performed by ANOVA and Bonferroni method, and P < 0.05 was considered significant.



[Ventilation efficacy (tidal volume per body weight)]

**Results and discussion:** Compared to TV/BW during control (1.7±1.8, mean±SD), TV/BW was significantly larger during JED (9.0±3.2), "two hands" (10.1±2.8) and "intubation" (9.2±2.6) (P < 0.001). There were no differences among the JED, "two hands" and "intubation" conditions. These results support clinical usefulness of the JED. However, we encountered 2 patients in whom TV/BW during JED was only half of that during "two hands" and "intubation". Two failures out of 33 trials are to be clinically significant and we did not include patients with difficult airways in this study, suggesting further studies to conclude clinical usefulness and limitations of this device.

**Conclusion:** JED may be an effective airway device for achieving adequate FMV during anaesthesia induction in normal persons.

**19AP5-9**

**Difficult airway algorithm in obstetrics: development and implementation**

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**Introduction and Goal of Study:** Difficult airway is defined as the clinical situation in which a trained anesthesiologist experiences difficult with facemask ventilation, difficult with tracheal intubation, or both<sup>1</sup>. The pregnant woman has a potential difficult airway. Although the use of general anaesthesia has been declining in obstetrics, it may be required and is always a challenge. Locally adapted, simple and comprehensive failed intubation algorithms are recommended.<sup>2</sup>

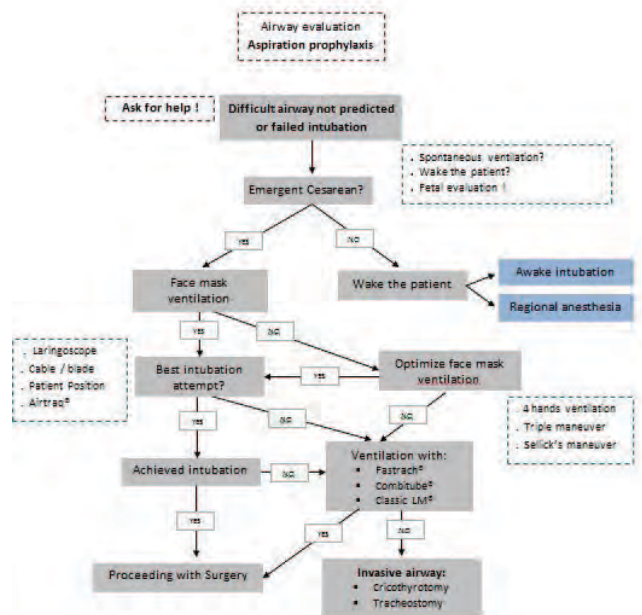
The aim of our study was to present the methodology and final result on the elaboration of our own difficult airway management algorithm in the obstetric setting.

The purposes of the algorithm are simplifying the management of a difficult airway and reduce the incidence of adverse outcome in our institution.

**Methods and Materials:** Information was obtained from scientific literature and expert opinion and proficiency. Opinion-based results was obtained from a survey to the anesthesiologist with obstetric practice and open forum commentary and discussion at the anaesthesiology department.

**Results and discussion:** We designed an algorithm based on the recommendations of the literature. Expert consultants participate in a survey on the effectiveness of this difficult airway management algorithm and also about their experience on the management of difficult airway in obstetrics.

After analysis of the surveys the algorithm was redesigned and we began its implementation (Fig. 1).



[Obstetric Difficult Airway Algorithm]

We also make a difficult airway cart with all the equipment mentioned in the algorithm. The potentials users of the airway cart where informed about where is held, what it contains and how to apply its components. The algorithm was placed in the operating theater wall.

A multi professional training program was implemented in order to test the availability of the algorithm and also to instruct all the professionals involved.

**Conclusions:** The management of failed tracheal intubation in obstetrics is rare but a potentially catastrophic event. Its anticipation and preparation are crucial to improve outcome. High priority was given to the Laryngeal Mask Airway, in preference to Fastrach® and cLMA. Before performing an invasive rescue technique, maximum effort should be made to achieve ventilation and oxygenation.

We are now evaluating if the algorithm is effective and if it will result in an increase in safety of general anesthesia in obstetric population.

**References:**

1. Anesthesiology 2013;118;2Curr Opin Anesthesiol 2011;24:289-254

## 19AP5-10

### The AMBU Aura-i Laryngeal mask and LMA Supreme: performance and fibreoptic positioning in unparalysed anaesthetised patients by novices

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**Background:** The newer Ambu Aura-I has an integrated bite block in its airway tube; its curvature between the mask and the airway tube more compliant/ bendable versus the unweilding rigid curvature of the LMA Supreme. The Ambu's angulation may make it easier to insert but its absence of epiglottic bars could potentially cause epiglottic downfolding thus affecting ventilatory efficacy, despite its added advantage of direct intubation capability.

**Methods:** We studied the clinical performance of the Ambu Aura-I and LMA Supreme in this randomized controlled trial involving 100 ASA 1-2 unparalysed anaesthetised patients undergoing minor gynaecological surgery. We excluded obese patients, those with aspiration risk and preoperative sore-throat. Apart from the senior author, investigators had <20 aura-i insertions. Anaesthesia was induced with IV fentanyl and propofol; the device inserted upon loss of eyelash reflex and adequate jaw relaxation. Our primary outcome measure was time to achieve effective ventilation (first capnogram). Secondary outcomes were insertion parameters, oropharyngeal leak pressures (OLP), fibreoptic positioning and pharyngeal morbidity. The position of the Ambu Aura-i was evaluated with the Ascope; the fiberoptic view of the glottis was scored (0 = failure to function with no cords seen, 1 = cords not seen but function adequate, 2 = cords plus anterior epiglottis seen, 3 = cords plus posterior epiglottis seen, 4 = only cords seen).

**Results:** Baseline demographics and anthropometric airway features of both groups were similar. 43 (86%) AMBU aura-i and 44 (88%) LMA Supremes were successfully inserted on first attempt ( $p=0.59$ ), with similar ease ( $p=0.79$ ), and comparable times to first capnograph trace (mean (SD) 18.2(6.0) vs 17.3(6.4) sec,  $p=0.9$ ). The aura-i needed significantly less volume of air to inflate its cuff to 60cmH20, 17.7(3.5) vs 23.1(4.4)ml,  $p<0.001$ . Both devices exhibited similar OLP, aura-i vs LMA Supreme, mean(SD) 28.8(7.1) vs 27.3(5.3) cmH20,  $p=0.24$ . There was no difference in ease of insertion or adjustment manoeuvres to aid ventilation. 90% patients had good positioning of AMBU aura-i on fibreoptic check. In 5 patients (10%), the vocal cords were not seen, but ventilatory function was unaffected. Pharyngeal morbidity was insignificant.

**Conclusions:** The aura-i handled well in novices hands, with comparable times to insert and establish ventilation, and similar successful first attempt insertion rates to the LMA Supreme.



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