

# EJJA

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of  
Anaesthesiology

**Euroanaesthesia 2012**  
**The European Anaesthesiology Congress**

**Abstracts Programme**  
**Paris, France, June 9-12, 2012**



*European Journal of Anaesthesiology*  
Volume 29, Supplement 50, June 2012

## **Abstracts and Programme**

# **EUROANAESTHESIA 2012**

**The European Anaesthesiology Congress**

Paris, France  
9-12 June 2012

# European Journal of Anaesthesiology

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**EUROANAESTHESIA 2012**  
 The European Anaesthesiology Congress  
 Paris, France, 09-12 June 2012

## ABSTRACT PRESENTATION PROGRAMME

Please note that all abstracts are presented as poster presentations: only the Best Abstract Prize Competition abstract and the 'Best Abstracts - Runner-up Session 1 & 2' presenters will make a formal presentation of their abstract in a separate room, using audiovisual aids. Two chairpersons will conduct, a short discussion of each abstract with the presenter and the audience, in front of each poster. Poster presenters will answer questions next to their poster for 45 minutes before and 30 minutes after their session.

### Poster Board location

All posters of regular abstract sessions will be displayed in the Poster Area: rows 1 to 14 are located on Level 1, and rows 15 to 26 are located on Level 2. Each abstract presentation session is displayed in a different poster board row. Rows are numbered, so that a given session can be easily located. The first board of each row contains an information board that lists the session reference, date, time and chairperson(s).

Note that the Best Abstract Prize Competition (BAPC), with session reference ESAPC1, takes place in Amphitheatre Havane. The 'Best Abstracts - Runner-up Session (ESAAP1) and the 'Best Abstracts - Runner-up Session 2' (ESAAP2) take place in Salle Passy. The posters of these 'best' abstracts will also be on display in Level 2 of the Poster Area for the whole duration of the Congress.

### Locating an abstract

The accepted abstract number format consists of the session reference, followed by a number denoting the order of the abstract within this session: for example, session 6AP1 stands for:

6 = Subcommittee 6

AP = Abstract Presentation

1 = First session of this Subcommittee

The first abstract to be presented in session 6AP1 will thus be called 6AP1-1, the second one 6AP1-2 and so on. There may be omissions in the numbering and/or some boards may be empty if abstracts are withdrawn.

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## ***Call for abstracts***

**The ESA solicits the submission of abstracts for the  
Euroanaesthesia 2013 Congress  
Barcelona, Spain  
1 - 4 June 2013**

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

**The submission module will be available to submitters  
from 1 November to 15 December 2012**

### **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

#### Impact of thoracic epidural analgesia on morbidity and mortality after major surgery - preliminary results of a meta-analysis

Pöpping D.M., Elia N., Van Aken H.K., Marret E., Schug S.A., Tramèr M.R.  
Münster University Hospital, Department of Anaesthesiology and Intensive Care, Münster, Germany

**Background:** There is an ongoing debate as to whether adding thoracic epidural analgesia (TEA) to general anaesthesia in patients undergoing major surgery provides any advantage that goes beyond simple pain relief.

**Methods:** Systematic search (databases, bibliographies, to 06.2011) for randomised trials comparing TEA (insertion level  $>T_{12}$ , with local anaesthetics with or without adjuvants), added to general anaesthesia compared with general anaesthesia alone. We included published full reports with at least 10 adult patients per group. Original authors were contacted for additional information. Meta-analyses were performed using fixed and random effects models.

**Results:** We included 95 trials (6,565 patients, 3,252 received TEA), published between 1971 and 2011. In 64 trials, mortality during hospital stay and up to two years postoperatively was 0.015% (44 of 2,899 patients) with TEA and was 0.025% (71 of 2,847) without; OR 0.74 (95%CI 0.53, 1.03). With TEA, there was a significant decrease in the incidence of arrhythmias (OR 0.66 [95%CI 0.52, 0.83]), atelectasis (OR 0.68 [95%CI 0.48, 0.94]), pneumonia (OR 0.51 [95%CI 0.38, 0.68]) and postoperative ileus (OR 0.45 [95%CI 0.20, 0.98]). TEA was also associated with a decrease in the incidence of sedation, dizziness and respiratory depression, whereas the risk of arterial hypotension was increased. No significant differences were found in the incidence of myocardial infarction, renal failure, pulmonary embolism or anastomotic leakage. Technical failure of TEA occurred in about 6%. Severe adverse effects, for instance, spinal cord compression, were not reported.

**Conclusion:** These preliminary analyses confirm that TEA, when added to general anaesthesia in patients undergoing major surgery, may have favourable effects on perioperative morbidity.

Our analyses do not allow drawing with confidence that TEA reduces mortality, although average mortality rates were very low in these trials. Further analyses may identify subgroups of patients that are most likely to profit from TEA.

### ESAPC1-2

#### Benefit and harm of high inspired oxygen fraction during general anesthesia: a systematic review and meta-analysis of randomized controlled trials

Hovaguimian E, Lysakowski C., Elia N., Tramèr M.R.  
Hôpitaux Universitaires de Geneve, Department of Anaesthesiology, Geneva, Switzerland

**Context:** The benefit of intraoperative high oxygen fraction to reduce the incidence of surgical site infection (SSI) or postoperative nausea and vomiting (PONV) remains unclear. Also, intraoperative hyperoxia has been incriminated as a risk factor for atelectasis formation.

**Objective:** To conduct a systematic review and meta-analysis of randomized trials to quantify benefit and harm of high inspired oxygen fraction during general anesthesia.

**Data Sources:** We searched MEDLINE, EMBASE, CENTRAL and bibliographies to November 2011 without language restriction.

**Study Selection:** Randomized controlled trials comparing "high" oxygen fraction (median, 80% [range, 70 to 100]) with "low" oxygen fraction (30% [30 to 40]) and reporting on SSI, PONV, or data on pulmonary outcomes (spirometry, blood gases, atelectasis, pneumonia).

**Data Extraction:** Information on patients, trial design, oxygen fractions in experimental and control groups, and outcomes were extracted using a standardized protocol.

**Data Synthesis:** Seventeen of 183 retrieved reports (3,601 patients) were eligible. In 5 trials (2,409 patients undergoing abdominal surgery), the risk of SSI was not significantly reduced with high oxygen fraction; risk ratio (RR) 0.80 (95% confidence interval [CI] 0.52 to 1.26). In 7 trials (580 patients), the 24 hours risk of nausea was lower with high oxygen fraction; RR 0.78 (95% CI 0.64 to 0.94). In 6 trials (540 patients), the 24 hours risk of vomiting was lower with high oxygen fraction; RR 0.71 (95% CI 0.55 to 0.92). In 2 trials (1,446 patients), the incidence of postoperative atelectasis was similar with high and low oxygen fraction; in 1 (142 patients), postoperative spirometric values were

significantly worsened with high oxygen fraction; and in 2 (78 patients), the effect of a high oxygen fraction on  $PaO_2/FIO_2$  ratio was conflicting.

**Conclusions:** An intraoperative high inspired oxygen fraction may be considered to further reduce the risk of PONV. There is no convincing evidence that a high oxygen fraction reduces the risk of SSI. Concerning pulmonary complications, it cannot be concluded that an intraoperative high oxygen fraction is safe or detrimental.

### ESAPC1-3

#### Assessment of short-term cognitive function in patients undergoing coronary artery bypass graft surgery with or without intraoperative external head cooling technique: pilot study

Mankute A., Usas E., Sirvinskas E., Andrejaitiene J.  
Lithuanian Health Sciences University Hospital, Department of Anaesthesiology, Kaunas, Lithuania

**Background and Goal of Study:** Cardiopulmonary bypass (CPB) for coronary artery bypass graft (CABG) surgery is associated with a substantial incidence of postoperative cognitive complications related to brain ischaemia. Mild hypothermia is the most efficacious neuroprotective strategy. Our goal of the study was to assess short-term cognitive function in patients undergoing CABG surgery with or without intraoperative external head cooling technique in order to generate mild hypothermia (33-34°C).

**Materials and Methods:** 50 patients ASA status II-III, age of 55-75 years, scheduled for CABG surgery, were enrolled into the study. Patients were divided into the two equal study groups to be cooled with CPB and intraoperative external head cooling technique (Hypothermic Group - H gr.) or only with CPB (Control Group - C gr.).

Before and 10 days after the surgery cognitive function was analyzed using Mini Mental State Examination (MMSE), Alzheimer's Disease Assessment Scale (ADAS), Trail Making (A/B), WAIS - Digit Span (WDS), WAIS Digit Symbol Substitution Test (WDSST). In order to assess cognitive impairment tests results were analyzed under recommendations of International Study of Postoperative Cognitive Dysfunction. During the surgery nasopharyngeal temperature protocol was recorded. Statistical analysis was performed using PASW® Statistics 18 software.

**Results:** There were no significant differences between the groups with respect to demographic characteristics. At the end of CPB, nasopharyngeal temperatures were  $35.9 \pm 0.5^\circ\text{C}$  and  $33.9 \pm 0.4^\circ\text{C}$  in control and hypothermic groups, respectively.

Cognitive function before surgery was similar in both groups ( $p=0.84$ ). The incidence of cognitive impairment at the 10 days after the surgery was 64% ( $n=16$ ) in the control group and 36% ( $n=9$ ) in the hypothermic group ( $p=0.039$ ).

Test scores according to the type of cognitive function test were significantly higher in the hypothermic group: MMSE: H gr.  $29.0 \pm 0.71$ , C gr.  $28.8 \pm 1.3$  ( $p=0.01$ ); ADAS: H gr.  $5.21 \pm 1.25$ , C gr.  $5.11 \pm 1.07$  ( $p=0.04$ ); Trail Making A: H gr.  $53.8 \pm 16.5$ , C gr.  $199.2 \pm 53.3$  ( $p=0.02$ ); Trail Making B: H gr.  $89.5 \pm 24.2$ , C gr.  $142.2 \pm 36.8$  ( $p=0.03$ ); WDS: H gr.  $5.02 \pm 1.03$ , C gr.  $6.7 \pm 1.1$  ( $p=0.04$ ); WDSST: H gr.  $21.9 \pm 6.3$ , C gr.  $24.8 \pm 5.9$  ( $p=0.04$ ).

**Conclusion:** Intraoperative external head cooling technique during coronary artery bypass graft surgery leads to less short-term cognitive dysfunction impairment because of mild hypothermia which has neuroprotective effect.

### ESAPC1-5

#### O-demethyl tramadol/tramadol ratio, a new tool to detect CYP2D6 poor metabolizers in postoperative patients: the CYTRAM study

Varin L., Richard N., Lelong-Boulouard V., Plaud B., Daccache G., de la Gastine B.  
Caen Teaching Hospital, Department of Anaesthesiology, Caen, France

**Background and Goal of Study:** Tramadol (T) is a synthetic opioid metabolized via cytochrome P450 2D6 (CYP2D6) to produce its major metabolite: O-demethyltramadol (ODT). ODT has a 200 fold higher affinity for the human opioid  $\mu$ -receptor than tramadol, inducing analgesia 2 to 4 times better than tramadol. CYP2D6 is inefficient in 5 to 10 % of Caucasians so-called, poor metabolizers' (PM) implying hypoanalgesia when they are treated by tramadol'. The objective was to detect CYP2D6 PM in postoperative patients by dosing ODT and T and using the ODT/T ratio.



**Material and Methods:** After institutional approval, we included 325 Caucasian adult patients, receiving tramadol for analgesia after digestive surgery. Patients daily treated with CYP2D6 strong inhibitors were excluded. Patients received tramadol from the end of surgery and for at least two days.

Blood samples were collected at the first (H24) and the second (H48) post-operative days. Genotyping CYP2D6 was made on H24 sample, and drug assays were performed on H24 and H48 samples with high performance liquid chromatography tandem mass spectrometry.

After genotyping, patients were separated in two groups: PM and others. ODT/T mean ratios were compared for the two groups with a Student test. A ROC curve analysis determined the cut-off ratio to identify PM.

**Results and Discussion:** Genotyping identified 26 PM (8%). The mean O-DT/T ratio (SD) was 0,055 ( $\pm 0,034$ ) for the PM and 0,178 ( $\pm 0,094$ ) for the other group ( $p < 0,0001$ ). The better line to detect PM was a ratio  $\leq 0,1$  with 88% sensibility and 82% specificity for H24, and 94% sensibility and 80% specificity for H48.

This study confirms the previously reported percentages of PM in Caucasians. We propose the ODT/T ratio as a new pharmacologic tool to identify PM. In the presence of unrelieved postoperative pain, an O-DT/T ratio  $\leq 0,1$  would advocate for a rapid switch to morphine instead of unnecessary increase tramadol posology.

Furthermore, once a patient has been identified as a PM, it will apply to all CYP2D6 metabolized drugs such as codeine, oxycodone helping clinicians to determine the adequate therapeutic strategy at the bedside.

**Conclusion:** ODT/T ratio is a new, simple and cost-effective tool that identifies CYP2D6 poor metabolizers.

**References:**

1. Stamer UM et al. Impact of CYP2D6 genotype on postoperative tramadol analgesia. *Pain* 2003; 105:231-8

## ESAPC1-6

### A physician staffed helicopter improves triage and reduces mortality for severely injured trauma patients

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**Background:** The use of physician staffed helicopters is widespread throughout Europe. Still the use of Helicopter Emergency Medical System (HEMS) is controversial and its impact on triage and mortality of severely injured trauma patients remains uncertain. This study aims to compare the pre-hospital trauma system before and after implementing a physician staffed helicopter in eastern Denmark.

**Methods:** A prospective, controlled, observational study, involving 7 local emergency departments and one regional Level 1 Trauma Center (TC). We included patients with an Injury Severity Score (ISS)  $> 15$  in a 5-month period (1. December 2009-30. April 2010) before, and a 12 month-period (1. May 2010- 30. April 2011) after implementing a physician staffed helicopter. The primary endpoint was time from dispatch of the first ground ambulance to arrival in the TC (system delay). Secondary endpoints were the proportion of secondary transfer and 30-day mortality.

**Results:** We included 204 patients with an ISS  $> 15$ . Before implementation of the physician staffed helicopter, 33/56 (59%) were referred to the TC within 48 hours vs. 114/148 (77%) after HEMS was instituted. The physician staffed helicopter transported 43 severely injured patients directly to the TC resulting in a reduction of secondary transfers from local hospitals from 50 % before to 34 % after implementation ( $p=0.04$ ). The median system delay was 218 minutes before and 90 minutes after implementation ( $p=0.002$ ). The 30-day mortality was reduced from 28.6 % (16/56) to 14.3 % (21/148) ( $p=0.02$ ).

**Conclusion:** Implementation of a physician staffed helicopter was associated with significantly reduced delay for arrival at the level 1 Trauma Center of severely injured trauma patients. The proportion of secondary transfer and 30-day mortality were also significantly reduced.

**Acknowledgements:** Co-investigators: Jans H, Jacobsen MB, Præst M, Buggeskov K, Andersen DL, Kowalski M, Ølgård L and the Trauma Center at Copenhagen University Hospital, Rigshospitalet

## Best Abstracts - Runner-up Session 1

### ESAAP1-1

#### Is it dangerous for anaesthesia trainees to drive after a shift of night duty? A simulation study in urban and monotonous conditions

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**Background and Goal of Study:** Drowsiness is an increasing national health problem in France. It was responsible for many crashes in towns and the first cause of death on highways in 2009 [1]. Medical staff is at risk to drive in a drowsy state when returning at home after a working night shift duty. We conducted an experimental study in a simulated driving laboratory to evaluate the consequences of sleep deprivation on driving performance of anaesthesia trainees after a working night shift duty.

**Materials and Methods:** Thirty residents were investigated after a shift of night duty (sleep deprived condition [SDC]) and after a night of normal sleep (control condition [CC]) in a comparative cross-over study. The order of sessions was randomized for each resident. Aptitude was tested in a simulated driving laboratory (INRETS-FAROS) where participants drove 15 minutes in town (urban conditions) followed by 60 minutes on a highway (monotonous conditions). Endpoints were the reaction time, the mean speed and the numbers of crashes in urban conditions and the standard deviation of lateral position (SDLP) and the standard deviation of speed (SDS) in monotonous conditions.

**Results and Discussion:** In urban conditions, residents tended to drive faster in CC than in SDC (43 km/h vs. 41 km/h,  $p=0,08$ ). No significant difference was found between groups in the reaction time and the number of crashes. In monotonous conditions, SDLP and SDS were significantly higher in SDC than

in CC (SDLP:  $F(1,27) = -2,19$ ;  $p = 0,02$ ) and SDS:  $F(1,27) = -2,25$ ;  $p = 0,03$ ). This difference appeared after 20 and 30 minutes driving, respectively, and continued until the end of the test.

**Conclusion(s):** The results showed the residents' performances decreased after a shift of night duty under monotonous conditions. They experienced more lateral deviation and had some difficulty to control their speed. Under urban conditions, residents in SDC seemed to use a preventive strategy by decreasing their speed. Our study confirms that it is dangerous to drive in monotonous conditions after a night shift duty. Further studies are mandatory to validate the simulation model for urban driving conditions.

**References:**

1. Observatoire national interministériel de sécurité routière. La sécurité routière en France, bilan de l'année 2009. La documentation Française 2010. Synthèse générale:8-34.

### ESAAP1-2

#### Mechanism of DIC induction - Staphylococcal extracellular adherence protein (Eap) induces activation of platelets and coagulation by stimulation of thiol isomerases

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**Background and Goal of Study:** Staphylococcus aureus can induce platelet aggregation. The rapidity and degree of this has been shown to correlate with the severity of disseminated intravascular coagulation (DIC) and to depend on platelet peptidoglycans. Surface located protein disulfide isomerase (PDI) plays an important role in platelet activation, as shown by us and others <sup>1,2</sup>. The extracellular adherence protein (Eap), secreted by S. aureus, functions as an adhesin for host matrix and plasma proteins. This prompted us to study the effect of EAP on platelet activation and coagulation.

**Materials and Methods:** The effect of Eap on platelet activation parameters was investigated via aggregometry, flow cytometry, fluorimetry and confocal laser scanning microscopy. Endogenous thrombin potential (ETP) of platelet rich plasma was measured. The influence of Eap on the reduction of the PDI-substrate was measured fluorometrically on the platelet surface as well as using purified recombinant proteins.

**Results and Discussion:** We observed a strong stimulation of platelet surface PDI by Eap. Furthermore, Eap induced PDI-dependent GPIIb/IIIa activation, granule secretion and platelet aggregation. Eap strongly enhanced thrombin formation on the platelet surface (thrombin burst). Treatment of platelets with thiol-blockers, the cell-impermeable PDI inhibitor bacitracin and anti-PDI antibody inhibited Eap-induced platelet activation. The effect of Eap on platelets and PDI activity was completely blocked by glycosaminoglycans, heparin and heparinoid (Orgaran®).

**Conclusion(s):** In this study, we found an additional and yet unknown mechanism of activation of platelets and coagulation by a bacterial adhesin, involving stimulation of PDI. The PDI-stimulatory and pro-thrombotic features of a microbial secreted protein are probably not restricted to *S. aureus* and Eap. As many microorganisms are coated with amyloidogenic proteins, it is likely, that the observed mechanism is a more general one.

**References:**

1. Lahav J, Jurk K, Hess O, Barnes MJ, Farndale RW, Luboshitz J, Kehrel BE. Sustained integrin ligation involves extracellular free sulfhydryls and enzymatically catalyzed disulfide exchange. *Blood*. 2002;100(7):2472-8.
2. Jurk K, Lahav J, Van Aken H, Brodde MF, Nofer JR, Kehrel BE. Extracellular protein disulfide isomerase regulates feedback activation of platelet thrombin generation via modulation of coagulation factor binding. *J Thromb Haemost* 2011;9(11):2278-90

### ESAAP1-3

#### Effect of blood pressure management during aortic coarctation repair in neonates on tissue oxygen saturation measured by near-infrared spectroscopy

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**Background:** The purpose of this study was to compare the effects of three commonly used blood pressure regulating strategies (sevoflurane, nitroglycerin (NTG), and sodium nitroprusside (SNP)) on oxygen saturation of both the brain and the peripheral tissues during aortic coarctation repair, using near-infrared spectroscopy. Based on the reported adverse effect of SNP on tissue oxygen saturation, we wanted to explore the hypothesis that the alteration in tissue oxygen saturation occurring with SNP would not be present with sevoflurane and NTG.

**Methods:** Physiological parameters, bilateral regional cerebral oxygen saturation ( $rS_cO_2$ ), renal oxygen saturation ( $S_rO_2$ ) and muscle oxygen saturation ( $S_mO_2$ ) (INVOS 5100, Somanetics Corporation, Troy, MI) were recorded continuously. During aortic cross-clamping, control of mean arterial blood pressure (MAP) was conducted according to the randomization sequence by the use of either SNP, NTG or sevoflurane, to obtain a mean target right brachial blood pressure of 120 to 150 % of the MAP value before cross-clamping. The primary endpoint was the maximum relative change in tissue oxygen saturation after aortic cross-clamping. Physiological variables and tissue oxygen saturations were compared within and between groups. Relationships between changes in tissue oxygen saturation, changes in MAP and age were evaluated by correlation and linear regression analysis.

**Results:** Per treatment group 10 patients were included. We observed no differences between the three blood pressure regulating strategies in their effect on  $rS_cO_2$ . Neonates treated with SNP experienced a larger decrease in  $S_rO_2$  and  $S_mO_2$  ( $-63.8 \pm 2.3$  % and  $-73.3 \pm 5.7$  %, respectively) compared to the sevoflurane group ( $-36.9 \pm 20.9$  %,  $p=0.042$  and  $-52.3 \pm 25.6$  %,  $p=0.063$ , for  $S_rO_2$  and  $S_mO_2$  respectively) and to the NTG group ( $-37.8 \pm 19.7$  %,  $p=0.086$  and  $-40.4 \pm 22.8$  %,  $p=0.011$ , for  $S_rO_2$  and  $S_mO_2$  respectively). Correlation and linear regression showed a lower MAP- $rS_cO_2$  dependence in the NTG group, however this difference was not significant.

**Conclusion:** This study confirms the hypothesis that SNP promotes impaired peripheral tissue oxygenation. Based on the lower MAP- $rS_cO_2$  dependence and the lower proportional decreases in  $S_rO_2$  and  $S_mO_2$  in the NTG group, our data suggest that NTG probably might be preferred for blood pressure regulating treatment during aortic coarctation repair.

### ESAAP1-4

#### Acute hypoxia during propofol-anesthesia, but not during sevoflurane-anesthesia, stimulates macro- and microcirculatory hemodynamics in dogs

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**Background & Goal:** To study the response to acute hypoxia in micro- and macrocirculatory variables during propofol- (PROPO) vs. sevoflurane- (SEVO) anesthesia.

**Materials and methods:** In randomized cross over design, chronically instrumented dogs (24-32 kg, n=6 per group) were anesthetized with PROPO or SEVO (equi-anesthetic dosages), mechanically ventilated ( $FiO_2 \sim 0.3$ ) and underwent a hypoxemic episode ( $FiO_2 \sim 0.1$  for 15 min [1]), followed by normoxic recovery ( $FiO_2 \sim 0.3$ ; 90 min). Microcirculatory perfusion of oral mucosa ( $\mu$ -mucosa) and hindlimb skin ( $\mu$ -skin) were measured by laser Doppler fluxmetry. Regional gastric intraluminal  $PCO_2$  (Pgi $CO_2$ ) was measured by tonometry. Macro-hemodynamics (cardiac output (CO), blood pressures), metabolism ( $O_2$ -consumption ( $VO_2$ ); indirect calorimetry) and blood-derived variables (art.  $O_2$ -content ( $CaO_2$ ), acid/base variables) were also measured. Statistics: Data are mean $\pm$ sem for n=6 experiments per group, and compared by two-way-ANOVA, corrected for multiple comparisons (Bonferroni). A  $p < 0.05$  was significant.

**Results and Discussion:** During normoxia, both CO and  $CaO_2$  were similar (both N.S.) under PROPO and SEVO. In addition, the hypoxia model achieved comparable drops in  $CaO_2$  (N.S.) under both anesthesia types. However, hypoxia elicited markedly different responses between PROPO and SEVO: Hypoxia during PROPO significantly increased  $\mu$ -mucosa and  $\mu$ -skin, but decreased both during SEVO. After hypoxia under PROPO, Pgi $CO_2$  was preserved, whereas under SEVO, Pgi $CO_2$  significantly accumulated. During PROPO, hypoxia generally stimulated macro-hemodynamics (e.g., CO increased from  $86 \pm 3$  to  $123 \pm 8$  ml/kg/min), whereas in contrast during SEVO-hypoxia hemodynamics were unresponsive (CO,  $72 \pm 8$  vs.  $71 \pm 6$  ml/kg/min) or even depressed. On the metabolic level,  $VO_2$  was maintained during PROPO/hypoxia, but significantly decreased with SEVO/hypoxia.

**Conclusion:** In this dog model, only PROPO permitted hemodynamic stimulation by acute hypoxia, resulting in (compensatory) increased micro- and macrocirculatory perfusion. In line, PROPO-hypoxia maintained  $VO_2$ , without aggravating anaerobiosis markers (lactate), and with preservation of Pgi $CO_2$ . In contrast, SEVO failed to permit hemodynamic stimulation by hypoxia and failed to preserve Pgi $CO_2$ . If our data can be transferred to the clinical setting, PROPO appears beneficial (vs. SEVO) to support the systemic and regional circulation during acute hypoxia.

**Reference:**

1. Schwarte LA et al, *Int Care Med* 2011;37:701-10

### ESAAP1-5

#### Painful nerve injury increases plasma membrane $Ca^{2+}$ -ATPase activity in axotomized sensory neurons

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**Background and Goal of Study:** Neuropathic pain remains an unsolved problem in pain management. We therefore studied its pathophysiological mechanisms in the primary sensory neuron in the dorsal root ganglion (DRG) in an animal model.  $Ca^{2+}$  is the most important second messenger in these neurons, and prior studies have shown that peripheral axotomy causes lower resting [ $Ca^{2+}$ ], depleted intracellular  $Ca^{2+}$  stores and decreased membrane  $Ca^{2+}$  currents. This investigation examined the main  $Ca^{2+}$  extrusion mechanism, plasma membrane  $Ca^{2+}$ -ATPase (PMCA) in rat DRG neurons after painful nerve injury.

**Materials and Methods:** Male rats were subjected to spinal nerve ligation or skin incision (control group), and neuropathic pain was confirmed by identification of hyperalgesic behavior after noxious mechanical stimulation. Three weeks after surgery, the fifth lumbar (L5) DRGs were harvested and the neurons were dissociated from them. Neuronal  $Ca^{2+}$  transients were recorded by  $Ca^{2+}$  microfluorometry using Fura-2. PMCA function was quantified by measuring the recovery constant of small depolarization-induced (50mM  $K^+$ , 0.3 sec)  $Ca^{2+}$  transients (not more than 400nM).

**Results and Discussion:** Blocking PMCA by increasing bath pH to 8.8 prolonged transient recovery, confirming PMCA function in DRG neurons. Selective blockade showed no contribution of mitochondrial uptake (oligomycin/antimycin) or the  $Na^+/Ca^{2+}$  exchanger (bath  $Na^+$  replacement by NMDG) to  $Ca^{2+}$

clearance from the cytoplasm for these small  $Ca^{2+}$  loads. Injury decreased the recovery constant ( $10 \pm 6$  sec,  $n=63$ ) compared to control neurons ( $16 \pm 8$  sec,  $n=86$ ,  $P < 0.001$ ). This indicates accelerated function of PMCA in axotomized neurons.

**Conclusion(s):** PMCA function is upregulated in DRG neurons after painful nerve injury, which may provide an explanation for the decrease in cytoplasmic  $[Ca^{2+}]$ . Since this  $[Ca^{2+}]$  decrease leads to greater repetitive firing in these neurons, PMCA hyperactivity may represent an important contribution to the pathogenesis of neuropathic pain.

## ESAAP1-6

### Chronic post-surgical pain after herniorrhaphy, hysterectomy and thoracotomy: incidence of pain at 3 and 12 months.

#### GENDOLCAT study

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**Background and Goal of Study:** To our knowledge few studies have prospectively analyzed chronic postsurgical pain (CPSP) for 1 year after surgery. Our aim was to evaluate the incidence of CPSP after 3 types of procedure: herniorrhaphy, hysterectomy and thoracotomy.

**Materials and Methods:** A prospective multicenter cohort study (GENDOLCAT study) was performed in 28 hospitals throughout 2009 and 2010. Eligible patients were aged 18 yr or older and undergoing elective herniorrhaphy (men only), hysterectomy or thoracotomy (men only).

Patients requiring reoperation because of surgical complications were excluded. We collected extensive clinical information. To diagnose CPSP we telephoned the patients to answer a structured questionnaire at 3 months after surgery, and those who reported pain were referred to a hospital for

an exhaustive physical examination and detailed pain history, in which we recorded worst pain in the last 24 hours on a numerical rating scale (0-10) (NRS), amount of analgesic medication taken, and answers to a modified brief pain inventory and the neuropathic pain diagnostic (DN4) (Spanish versions). Patients were called again at 12 months to evaluate CPSP. Data are expressed as median (10th - 90th percentiles) and percentages.

**Results and Discussion:** Table 1 shows the characteristics of patients enrolled and patients lost to follow-up for the recording of outcome variables and information on their CPSP evaluations at 3 and 12 months after surgery.

	HERNIORRHAPHY	HYSTERECTOMY	THORACOTOMY
<b>Patients enrolled</b>	2399	1013	535
<b>Patients lost to follow-up</b>	638 (26.6%)	247 (24.4%)	133 (24.9%)
<b>Age (median and 10th-90th percent.)</b>	60 (39-76)	54 (42-74)	64 (49-76)
<b>CPSP at 3 months</b>	13.6%	17.9%	37.6%
<b>NRS &gt; 3</b>	38.6%	48.3%	52.5%
<b>Taking analgesics</b>	24.9%	47.4%	60.5%
<b>Neuropathic pain</b>	38.7%	37.4%	55.1%
<b>CPSP at 12 months</b>	4.5%	5.9%	17.0%

[Table 1]

**Conclusion(s):** Our prospective study in a large sample of patients shows clearly that persistent postsurgical pain, identifiable by medical diagnosis, is a real problem after the 3 surgical procedures we studied. We found that neuropathic pain is present in 38% to 55% and that pain is moderate to intense in 38% to 52% at 3 months, depending on the surgical procedure. At 12 months CPSP was still found in about a third of the patients who had reported pain at 3 months.

## Best Abstracts - Runner-up Session 2

### ESAAP2-1

#### A combined EEG-fMRI analysis shows impaired cortical top-down processing during propofol induced unconsciousness

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**Background and Goal of Study:** Functional connectivity (FC) analyses of fMRI under propofol unconsciousness reported alterations in default networks of the resting brain [1]. These results are in accordance to recent EEG studies observing impaired top-down information processing during anaesthesia [2]. To investigate neural mechanisms of propofol induced unconsciousness, fMRI FC and EEG effective connectivity (EC) based on symbolic transfer entropy (STEn) [3] were analyzed in healthy subjects.

**Material and Methods:** Approved by the ethics committee, 15 volunteers were enrolled into the study. Volunteers were instructed to relax and close eyes while BOLD 3T-fMRI and 64-channel EEG baseline (BL) recordings were performed. Subsequently propofol was infused until loss of consciousness (LOC) using a TCI pump and BOLD fMRI/EEG were measured. Independent resting state network components of fMRI were identified and differences between BL/LOC tested. STEn quantifies the mutual information flow (EC) between two signals and was computed over all EEG channel pair combinations (0.5-30Hz total bandwidth, 50ms time delay). Effects of propofol on EC were indicated by the area under the curve (AUC) and bootstrap confidence intervals (CI).

**Results and Discussion:** fMRT analysis revealed a decreased FC from BL to LOC in the frontal default network and increased FC in primary sensory networks ( $p < 0.05$  corrected). This is in accordance to effects of propofol on EC in frontal-parietal (AUC = 0.90, CI = 0.71-0.97), frontal-temporal (AUC = 0.85, CI = 0.70-0.96) and frontal-occipital (AUC = 0.80, CI = 0.65-0.96) electrodes. Thereby, a decline of feedback information flow and maintained feedforward flow was observed ( $p < 0.05$ ). Results support the significant role of frontal and sensory cortex interaction for conscious perception. Impaired top-down access to sensory information during general anaesthesia strengthens the general relevance of findings in vegetative state patients reporting impaired

backward connectivity from frontal to posterior cortices as core feature of impaired consciousness.

**Conclusion:** Decrease of top-down feedback connection might be a general feature of unconsciousness and is compatible with theories attributing consciousness to the capacity of the brain to integrate distributed information.

#### References:

1. Boveroux P et al. *Anesthesiology* 2010;113:1038-53
2. Ku SW et al. *PLoS One* 2011;6:e25155
3. Staniek M et al. *Phys Rev Lett* 2008;100:158101

### ESAAP2-2

#### Reliability of an instrument for self-assessment of teamwork in intensive care

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**Background and Goal:** Teamwork is a key factor in patient safety. A valid and reliable self-assessment tool for anaesthetists and intensivists to assess their team performance would help to identify areas for improvement. However, the literature on self-assessment suggests doctors are not good at assessing their own performance. We previously reported the validity and reliability of a teamwork rating tool used by trained external'. However, with limited opportunities for external assessor feedback on teamwork, we investigated the reliability and validity of this tool for when used for self assessment by intensive care teams.

**Methods:** The teamwork rating tool consisted of 21 items each describing a specific component of team performance. 40 intensive care teams (one doctor, three nurses) participated in four highly realistic simulated emergency scenarios, and each participant independently rated their team's performance after each scenario. Scenarios were videotaped, randomised and independently rated by three expert assessors blinded to scenario order. Psychometrics were evaluated using Exploratory Factor Analysis (EFA), and Cronbach's  $\alpha$  and results were compared with external assessors.

**Results and Discussion:** EFA confirmed items grouped into three Factors, Leadership and Team Co-ordination; Verbalising Situational Information; and Mutual Performance monitoring. Reliability coefficients were .931, .957 and .888 respectively. Factors were identical to those generated by external as-

sensors. Significantly improved performance over time supported construct validity. There was high correlation between self-assessed and externally assessed scores (LTC .872, VSI .818, and MPM .642; all  $p < .0001$ ), but the stringency of the self-assessed scores was consistently lower than the external assessors.

**Conclusion:** We have demonstrated reliability and validity of a teamwork rating instrument when used for self-assessment. Self-assessed scores are reliable, but more lenient than those of external raters, suggesting the need for calibration exercises.

Ability of health professionals to reliably identify the strengths, deficiencies and improvements in different aspects of their teamwork could facilitate team debriefing after a crisis, with potential to improve team performance and patient safety.

**References:**

1. Weller J, Frengley R, Torrie J et al. Evaluation of an instrument to measure teamwork in multidisciplinary critical care teams *BMJ Qual Saf.* 2011;20:216-22.

## ESAAP2-3

### Bedside analysis of heart rate variability by Analgesia Nociception Index (ANI) predicts hypotension after spinal anesthesia for elective Caesarean delivery

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**Background and Goal of study:** Spinal anesthesia (SA) for elective caesarean section often induce hypotension and low placental perfusion that can be harmful. Heart rate variability (HRV) analysed with Fast Fourier Transform (FFT), may identify patients at risk for hypotension according to a low frequency / high frequency ratio LF/HF  $> 2.5$  [1], although not applicable in current clinical practice. Wavelet Transform provides HRV bedside analysis through Analgesia Nociception Index (ANI). Thus, this study aimed to determine if ANI can predict hypotension after SA for caesarean section.

**Materials and Methods:** After ethical committee approval and informed consent, 28 ASA I parturients were included in this prospective observational study. Before surgery, blood pressure, heart rate and ANI values were recorded at rest, while lying supine, then sitting upright, each for 5 min to mimic a "tilt test" trial. LF/HF ratio was measured *a posteriori* by FFT. All patients followed a standardised protocol for SA, prophylaxy and treatment of hypotension. After SA, women were classified into two groups according to occurrence of hypotension (group H,  $n=10$ ) defined as a SBP  $< 100$  mmHg or a 20% decrease in systolic blood pressure or not (group control C,  $n=18$ ).

**Results and Discussion:** Demographic datas, dermatome level of SA, volume of coloadung (crystalloids) and vasopressors were comparable between groups. There was no statistical difference in ANI values between groups in the supine (group H 65,5 [49-81] and group C 72 [64 - 85] ) or sitting position (group H = 75 [65-89] and group C = 70 [63-82]). Retrospective analysis of HRV with FFT failed to reach significance between groups ( $p = 0,09$ ). However differences in ANI values between sitting and supine positions were significantly higher in group H (14 [2-19]) as compared to the control group (-4 [-10-4]). A threshold of 5 points increase in ANI value at tilt test detected hypotension with 80% Sensitivity and 76,5% Specificity (ROC curve). Positive and Negative Predictive Values were respectively 66,7% and 86,7%.

**Conclusion:** Preoperative bedside analysis of HRV predicts hypotension due to SA in patients scheduled to undergo elective cesarean delivery. Preliminary findings with ANI must be confirmed on a larger scale.

**References:**

1. Hanss et al., « Heart rate variability predicts severe hypotension after spinal anesthesia for elective cesarean delivery », *Anesthesiology* 102, n° 6 (juin 2005): 1086-1093.

## ESAAP2-4

### Anesthetic depth and tolerance to acute isovolemic anemia in sepsis

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**Background and Goal of Study:** Experimental sepsis has been shown to reduced tolerance to acute isovolemic anemia (AIA). This is reflected by an increase in critical hemoglobin concentration (Hbcrit), defined as the hemoglobin value (Hb) below which O<sub>2</sub> consumption becomes delivery dependent (1). Anesthetic depth may influence tolerance to AIA through its effects on tissue oxygen demand and on cardiac function. This study tested the hypothesis that, during sepsis, increasing the depth of sevoflurane (SEVO) anesthesia is associated with a decreased tolerance to AIA, reflected by an increase in Hbcrit.

**Materials and Methods:** Following institutional animal research committee approval, 17 sheep were invasively monitored, anesthetized with fentanyl (10µg/kg) and SEVO (2%= 1MAC end-tidal), paralyzed with cisatracurium (0.15 mg/kg) and mechanically ventilated (FIO<sub>2</sub>: 0.4). Sepsis was achieved by caecal ligation and perforation. Four hours after surgical preparation, animals were randomly allocated into a low (group MAC1; 2% end tidal SEVO; N=8) or a high (group MAC2; 4% end tidal SEVO; N=9) anesthetic level. Animals were progressively hemodiluted using 6% HES 130/0.4 as the substitution fluid (ratio 1:1). For each sheep, Hbcrit was determined from a plot of O<sub>2</sub> consumption (VO<sub>2</sub>; indirect calorimetry) versus Hb (Co-oximeter measurement) and from a plot of blood lactate versus Hb using a last sum of squares technique (2). Hbcrit values were compared between the two groups using a Mann-Whitney U test. Data are presented as median [interquartiles].

**Results and Discussion:**

	Group MAC1	Group MAC2	p
Hbcrit (VO <sub>2</sub> ) (g/dl)	3,2 [2,5-4,0]	4,1 [3,6-5,8]	0,03
Hbcrit (Lact) (g/dl)	3,3 [3,0-4,0]	4,1 [3,7-5,5]	0,02
VO <sub>2</sub> crit (ml/min)	271 [236-315]	314 [294-449]	NS
Laccrit (mMol/l)	0,9 [0,4-1,1]	0,8 [0,4-1,4]	NS

[Results]

**Conclusion:** In this experimental model of sepsis, increasing sevoflurane concentration to achieve a deeper anesthetic level is associated with a decreased tolerance to AIA.

**References:**

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2. Samsel RW et al. *J Appl Physiol* 1988; 64:2074-82

## ESAAP2-5

### Tranexamic acid dose-dependently reduces GABAergic synaptic transmission in the mouse amygdala

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**Background and Goal of Study:** Tranexamic acid (TXA) is a lysine analogue that competitively inhibits the binding of plasminogen to fibrin. TXA is widely used for antifibrinolytic therapy in cardiac surgery. High doses of TXA (total dose  $> 100$  mg / kg) have been identified as risk factor for postoperative seizures (1). Potent antagonists against the  $\gamma$ -aminobutyric acid type A receptor (GABA<sub>A</sub>R) can evoke spontaneous epileptiform activity *in vitro* (2). As the amygdala is discussed to be an important key structure for the initiation and propagation of seizures (3), we investigated the effect of TXA on inhibitory GABAergic synaptic transmission in murine brain slices of the basolateral amygdala.

**Materials and Methods:** Coronal brain slices (350 µm) were obtained from male mice (Bl6; d 28-35). Principle neurones in the amygdala were identified by infrared-phase contrast-enhanced videomicroscopy. From these neurones, pharmacologically isolated GABA<sub>A</sub> receptor mediated postsynaptic currents (GABA<sub>A</sub>-IPSCs) were recorded using whole-cell patch-clamp technique. The currents were evoked upon electrical stimulation of the external capsule. Under control conditions, the slices were kept in carbogenated artificial cerebrospinal fluid. After 10 minutes of stable baseline recordings, TXA was added with final concentrations of 0.1, 0.3, 1, 3, 5 or 10 mM.

**Results:** TXA concentration-dependently reduced GABA<sub>A</sub>-IPSCs, with a half-maximum inhibition (IC<sub>50</sub>) of 0.92 mM ( $n=5$ ;  $p < 0.05$  for each data point). The effect on GABA-IPSCs was reversible after removal of TXA.

**Conclusion(s):** Here we demonstrate that TXA dose-dependently reduces GABA<sub>A</sub> receptor mediated inhibitory synaptic transmission in the mouse amygdala. The clinical treatment with 100 mg / kg TXA produces concentrations of 0.64-1.27 mM in the cerebrospinal fluid, when extrapolated from animal studies (4). Thus the inhibition of GABA<sub>A</sub>-IPSCs by TXA with an IC<sub>50</sub> of 0.92 mM seems to be within a clinical relevant range and might explain how TXA promotes epileptiform activity in the central nervous system.

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## ESAAP-2-6

### High flow oxygen therapy associated with noninvasive ventilation in hypoxemic acute respiratory failure: a prospective cohort study

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**Background and Goal of Study:** Noninvasive ventilation (NIV) is often used in hypoxemic acute respiratory failure (ARF) while controversial [1]. NIV failure (i.e. intubation) can be over 60 % [2]. The lack of early clinical and oxygenation improvement is a strong predictor of failure [3]. High flow nasal cannula oxygen therapy (HF-O<sub>2</sub>, Optiflow™) could improve oxygenation and help retain the benefit from one NIV session to the other. The aim of the study was to determine whether HF-O<sub>2</sub> in alternation with NIV could improve clinical status and gas exchange and avoid intubation.

**Materials and Methods:** The hospital ethics committee approved the protocol. This one-centre study investigated on non-COPD patients admitted in the ICU with an isolated ARF and a PaO<sub>2</sub>/FiO<sub>2</sub> ratio < 200 using a standard face mask. The strategy consisted in cycles that included, in this order, a HF-O<sub>2</sub> session (1h) and a NIV session (1 to 2h). The primary outcome was the response to the treatment after 2 cycles, defined by a PaO<sub>2</sub>/FiO<sub>2</sub> ratio > 200

or by a respiratory rate (RR) < 25 breaths/min or decreased by 20 % from baseline. Objective criteria for intubation had been defined. RR, heart rate, blood pressure and arterial blood gas were recorded at baseline and at the end of each session.

**Results:** During 12 months, 28 patients (age 61, SAPS II 36, medians) were eligible. Diagnoses included pneumonia (n=18), postoperative ARF (n=3), cardiogenic pulmonary edema (n=2) and others (n=5). The strategy allowed a quick and sustained improvement in PaO<sub>2</sub>/FiO<sub>2</sub> (187 vs 132,  $p < 0.001$ ) and tachypnea (26 vs 31 breaths/min,  $p = 0.002$ ) after 2 cycles (medians). PaCO<sub>2</sub> and arterial pH did not vary. 20/28 (71 %) patients were responders. Non-response was not correlated with subsequent need for intubation ( $p = 0.09$ ). Intubation was avoided in 18/28 (64 %) patients. Patients who did not require intubation had a lower RR at baseline ( $p = 0.02$ ) and after 2 cycles ( $p < 0.01$ ) than intubated patients, a shorter ICU length of stay ( $p = 0.003$ ) and fewer severe infectious complications ( $p = 0.003$ ).

**Conclusion:** The association HF-O<sub>2</sub>/NIV improves gas exchange and tachypnea. It could reduce the need for intubation. A multicentre randomized controlled trial comparing this strategy with conventional treatment is underway to assess the reality of this benefit.

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## Evidence-based Practice and Quality Improvement

### 1AP1-1

#### Development and validation of a questionnaire to estimate patients' satisfaction with perioperative anesthetic care

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**Background and Goal of Study:** Patients' satisfaction is a mainstay of quality of anesthetic care. However, since it is a multidimensional concept, it cannot be easily measured. The aim of our study was to develop and valid a simple, reliable questionnaire that could help us assess patients' satisfaction with anesthetic care.

**Materials and Methods:** 100 consented patients aged 18-70 of different sex and education level, ASA I-III, who had general anesthesia participated in our study. After reviewing the relevant bibliography and expert consultation, we compiled the pilot questionnaire. The questionnaire was distributed the first postoperative day by anesthetists that were not part of the patients' anesthetic team. Personal interviews with 30 randomly selected patients from the participants followed, in order to include questions they considered important. Difficult and ambiguous questions were reworded. The final form of the questionnaire contains patients' demographics, nineteen questions using a 5-point Likert scale and one open question, related to the anesthetic perioperative care in all important domains, such as physical health, information about anesthesia, emotional support and doctor patient relationship.

In order to validate the final questionnaire we estimated:

- The acceptability (percentage of patients that consented to take part in our study).
- The reliability (with "test-retest reliability" method, retest performed after 15 days).
- Face validity (assessment of reading simplicity by 20 patients of different age and education).
- Content validity (by three consultant anesthesiologists, one consultant surgeon and two anesthesia expert nurses rating the questions on a 4-point scale).
- Construct validity was not tested since, to the best of our knowledge, there is not a "gold standard" scale.

**Results and Discussion:** The acceptability of our scale was 96%. Scale's reliability revealed a value of 0.95 ( $p < 0.001$ ) for Pearson's correlation coefficient, which indicates a very strong association between the original and the retest scores. Assessment of face validity proved that all questions were simple and understandable. The content validity index was 97.5% (excellent content validity).

**Conclusion:** Our questionnaire seems to be a reliable and valid instrument of measuring patients' satisfaction with the anesthetic perioperative care. Further studies are needed in order to assess whether it can be widely applied.

### 1AP1-2

#### Radiation exposure of anaesthetists during endovascular aortic repair and neuroradiological procedures

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**Background:** Endovascular aortic repair (EVAR) and interventional neuroradiology (INR) are increasingly performed to treat aortic and intracranial vascular diseases. Anaesthetists are exposed to radiation during these procedures. Radiation to eyes can result in cataracts. However, data of occupational radiation exposure is scarce.

**Methods:** During 65 interventional radiology procedures (39 endovascular aortic surgery and 26 neuroradiology), a personal dosimeter (ALOKA MY-DOSE Mini x PDM-127; Hitachi Aloka Medical, Tokyo, Japan) was attached onto left temple of anaesthetists to measure radiation exposure. Total radiation emitted by a fluoroscopic equipment, duration of the procedure, and number of times when mechanical ventilation was interrupted during angiography were also registered.

**Results:** Numerical data in Table.1 are shown as median and [range]. Total radiation emitted by a fluoroscopic equipment during INR was more than three times greater than that during EVAR (Mann-Whitney U-test,  $p < 0.05$ ). Duration of the procedures was not different between EVAR and INR. Radiation exposure to anaesthetist's temple was significantly greater during EVAR than that during INR. In EVAR, duration of the procedures, total radiation dose, and number of interruption of mechanical ventilation were correlated with personal radiation exposure. On the other hand, there was no correlation between total radiation dose or duration of the procedure with anaesthetists' exposure during INR.

**Conclusion:** Although total radiation dose was greater during INR compared to EVAR, personal radiation exposure of anaesthetists measured at temple region was greater during EVAR. This discrepancy may be related to the necessity of interruption of mechanical ventilation, which was requested when a stent graft was deployed during EVAR. Hazards of radiation to anaesthetists' eyes are greater during EVAR than that during INR.

### 1AP1-3

#### Quality of life and post-operative delirium in critical care

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**Background:** Postoperative delirium (POD) is frequent in critical care patients and it is associated to complications and higher mortality. The relation of delirium and quality of life as not been fully understood. Our goal was to evaluate the relation between POD and prior quality of life in critical care patients.

**Methods:** Observational prospective study conducted in a post anesthetic care unit (PACU) with 5 beds, during a period of 10 months. Patients were excluded if they could not perform written informed consent, had a central nervous system or psychiatric disease, were submitted to neurologic or cardiac surgery, had stayed at PACU less than 24 hours, had permanent muscular relaxation or sedation, had been readmitted, had less than 18 years old or had a mini mental state examination (MMSI) less than 25. Patients pre-operative characteristics, intra-anesthetic management and outcome were evaluated. Patients were evaluated for the occurrence of POD with Intensive Care Delirium Screening Checklist. At admission patients completed the short-form 36 (SF-36) questionnaire and it was evaluated the dependency for Activities of Daily Living (ADL). Non parametric tests, Chi square or Fischer's exact test were used to comparisons and univariate analysis with multiple regression binary logistic were used calculating an odds ratio (OD) and its 95% Confidence Interval (95%CI).

**Results:** 679 patients were enrolled in the study and 18.9% developed POD. Patients with POD had worse SF-36 scores in physical function ( $60.3 \pm 29.3$  versus  $72.7 \pm 28.9$ ,  $p < 0.01$ ), bodily pain ( $54.6 \pm 30.5$  versus  $64.8 \pm 31.2$ ,  $p = 0.008$ ) and social function ( $61.2 \pm 23.2$  versus  $67.4 \pm 25.9$ ,  $p = 0.030$ ). POD patients had Katz and Lawton indexes indicating more dependency in personal ADL ( $0.5 \pm 1.5$  versus  $0.2$ ,  $p = 0.02$ ) and instrumental ADL ( $5.50 \pm 2.4$  versus  $6.2 \pm 1.9$ ,  $p < 0.001$ ) and they had more frequently dependency in ADL (12% versus 6% for instrumental ADL; 37% versus 17% in personal ADL).

**Conclusions:** Patients that developed POD, before surgery had worse scores some of the SF-36 scores, namely physical function, bodily pain and social function and had greater dependency in personal and instrumental ADL.

## 1AP1-4

### Relationships between incidence of delirium and initiating factors of delirium in cancer patients receiving palliative medicine

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**Background and Purpose:** Delirium is one of the most frequent symptoms in palliative medicine for cancer patients and it should be prevented. It not only rapidly impairs cognition and high brain function of patients themselves but also cause anxiety for the patient's families. Although many delirium-initiating factors have been reported, there are still few reports showing that which initiating factors are significantly related to delirium in advanced cancer patients. We retrospectively investigated the correlation between incidence of delirium and each initiating factor by multivariate analysis.

**Methods:** After approval by our hospital ethics committee and obtaining informed consent, this study was carried out between September 1, 2010 and November 15, 2011. Fifty-six patients in a high-performance palliative care unit with an estimated prognosis of less than six months were divided into a delirium group and a non-delirium group. Delirium was diagnosed using the confusing assessment method by our medical staff who did not know the intention of this study. Delirium-initiating factors were determined with reference to the Oxford textbook of palliative care medicine. The factors included brain tumor, epilepsy, hyperammonemia, hypercalcemia, hyponatremia, medication with a steroid, narcoleptic, opioid, anticholinergic, antiemetic or antibiotic drug, radiation, infection, anemia, malnutrition, over 60 year of age, cerebral infarction and Alzheimer's disease. The prevalence of each factor in the two groups, Spearman's rank-correlation coefficient and a multivariate analysis were performed for statistical analysis.

**Results:** Delirium occurred in 21 (42%) of the patients. Hypercalcemia (correlation coefficient: 0.265), steroid (-0.336), radiation (0.275) and narcoleptic (0.388) had significant correlations with incidence of delirium. Multivariate analysis demonstrated that hypercalcemia and narcoleptic were significant initiating factors ( $p = 0.037$  and  $p = 0.04$ , respectively; odds ratios: 8.07 and 6.90, respectively).

**Conclusion:** Despite highly professional palliative care, delirium was observed in almost half of the patients with end-stage cancer. We should pay more attention to calcium metabolism and medication with narcoleptics in end-stage cancer patients in order to decrease the incidence of delirium.

## 1AP1-5

### Patient satisfaction audit - what patients want?

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**Background and Goal of Study:** To audit the anaesthetic concerns and expectations of the patients having elective surgery and also to determine whether patients are satisfied with the anaesthetic experience.

### Materials and Methods:

- The audit was conducted from August to November, 2011
- All patients were seen preoperatively on the day of surgery
- The following data was collected,
  - patient's name, age, sex, date and type of surgery
  - place of pre-assessment (ward, holding bay or theatre)
  - did patients mind where they were pre-assessed
  - were patients happy with the anaesthetic explanation
  - duration of fasting
  - previous anaesthetic history
  - anaesthetic concerns
  - type of anaesthetic GA/ Regional or both
  - problems in recovery
  - were patients satisfied and their satisfaction score on a scale of 0-10
- recovery register was checked for anaesthesia related problems
- All patients were seen postoperatively and their satisfaction score obtained

### Results:

- 97 patients were audited
- 50 male and 47 female patients. Average age was 58 yrs
- patients underwent wide variety of surgeries
- Even though only 32% of patients were seen in the ward only 8% expected to be seen in the ward
- All patients were happy with the anaesthetic explanation
- 86% had history of previous anaesthetics
- The average starvation time was 13.2 hrs
- Common anaesthetic concerns were pain 10%, vomiting 6%, awareness 4%, needle phobia 2% and fear of GA 4%
- 72% had GA, 12% had spinal, 10% had GA with epidural, 4% had GA with spinal and 2% had GA with nerve block
- Common complications in recovery were pain 40%, vomiting 6%, hypothermia 6%, urinary retention 2%, sore throat 2% and dizziness 2%
- 96% of patients were satisfied. Average score was 7.94

**Conclusion(s):** 96% of the patients were satisfied with the anaesthetic care. Even though only 32% of patients were seen in the ward preoperatively only 8% expected the anaesthetist to assess them in the ward. The average starvation time was far too excessive, 13.2 hrs. Most common anaesthetic concerns were Pain, Vomiting, Awareness and Fear of General anaesthesia. Pain was the most common complication in recovery 40% followed by Vomiting 6% and Hypothermia 6%. Patients who had a Regional technique as a sole anaesthetic or as a supplement had lesser pain related problems in recovery 14.2% against patients who had only GA 50%. Pain and vomiting were the common reasons for lower satisfaction score.

## 1AP1-6

### Can't intubate, can't ventilate - a one lifetime situation? Incidence of major airway related complications in the largest Portuguese anaesthesiology department

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**Background and Goal of Study:** Some studies based on surveys regarding the management of DA and CICV situation focus on hypothetical scenarios (Wong *et al*, Green *et al*). The purpose of this study was to determine the incidences of cannot intubate-cannot ventilate (CICV) situations and serious complications associated with difficult airway (DA) management in our department.

**Materials and Methods:** We conducted an anonymous survey including all practising anaesthetists of our department. Data was analysed with the SPSS version 18.0 statistical software program, using the Pearson test ( $p < 0.05$ ).

**Results and Discussion:** The response rate was 100% ( $n = 100$ ). 53% of our anaesthetists never had a CICV situation (31% had one and 12% had two to four). 8% of the subjects experienced one death (1% three deaths) directly related with DA management. The majority (90%) didn't experience any death related with DA. 82% of the respondents didn't report severe complications associated with insufficient oxygenation concerning airway management (14% referred one). 21% of the anaesthetists had at least one episode of emergent surgical airway rescue caused by DA. In the last year, 18% postponed a surgery due to DA at least once and 30% never changed the anaesthetic plan to regional anaesthesia in order to avoid a DA. The number of CICV situations was correlated with: deaths by DA ( $r = 0.405$ ;  $p < 0.001$ ), the need for an emergent surgical airway ( $r = 0.456$ ;  $p < 0.001$ ), severe complications associated with insufficient oxygenation ( $r = 0.650$ ;  $p < 0.001$ ) and the use of LMA® as

rescue in CICV situation ( $r=0,499$ ;  $p < 0,001$ ). Serious complications related with insufficient oxygenation were negatively correlated with the use of LMA® ( $r=-0,250$ ;  $p < 0,05$ ) and LMA ProSeal® ( $r=-0,226$ ;  $p < 0,05$ ).

**Conclusion(s):** The main strength of our study relies on reporting the real clinical practice of our whole population. CICV situations correlate positively with deaths caused by DA and severe complications related with insufficient oxygenation, reflecting the need to improve our actions in DA management. The lack of experience with supraglottic devices may contribute to some cases of insufficient oxygenation leading to severe complications. CICV is a one life time situation for the most of us, training scenarios can help us to better deal with that.

### 1AP1-7

#### Genetic polymorphisms located in TGFB1, AGTR1, and VEGFA genes are associated to chronic renal allograft dysfunction

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**Background and Goal of Study:** Persistent inflammation and fibrosis have been related to active progression of renal deterioration and to reduce survival of kidney transplant. The aim of this study was to determine the impact of single-nucleotide polymorphisms (SNPs) located in regions related to inflammatory and immune processes on the development of chronic renal allograft dysfunction (CRAD).

**Materials and Methods:** A retrospective study was carried out on 276 patients who received kidney transplant (KT). SNPs were genotyped via the SNPlex platform. Statistical analysis was performed with SNPstat and regression logistic analyses were adjusted by age and gender of recipients and donors, cold ischemia time and the number of HLA mismatches

**Results and Discussion:** From 276 patients with KT, 118 were non-CRAD and 158 were CRAD. Three SNPs showed significant associations with CRAD development: rs1800471 in *transforming growth factor beta 1 (TGFB1)*, rs5186 in *angiotensin II receptor type 1 (AGTR1)*, and rs699947 in *vascular endothelial growth factor A (VEGFA)*. GC genotype of rs1800471 was associated with increased odds of CRAD compared to GG genotype (OR= 2.65 (95% confidence interval (CI)= 1.09; 6.47),  $p= 0.025$ ), as well as AC and AA genotype of rs699947 assuming a dominant model (OR= 1.80 (95%CI= 1.02; 3.20),  $p= 0.044$ ). Besides, AC and CC genotypes of rs5186 were associated with reduced odds of CRAD assuming a dominant model (OR= 0.56 (95%CI= 0.33; 0.96),  $p= 0.033$ ).

**Conclusion(s):** Our findings suggest that 3 genes related to immunity and inflammation (rs1800471, rs5186 and rs699947) are associated to susceptibility or protection to CRAD, and might have diagnostic utility in predicting the likelihood of developing CRAD

### 1AP1-8

#### SIRS and anaesthetic agents. Is there a relation?

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**Background and Goal of Study:** The aim of this study was to investigate the impact of propofol and sevoflurane anaesthesia on postoperative incidence of Systemic Inflammatory Response Syndrome (SIRS) which is up to date considered to be an initial response to injury as well to surgical stress and reflects activation of inflammatory cascades.

**Materials and Methods:** Patients 60-74 years of age, ASA II-III, scheduled for a non cardiac surgery, of more than two hours duration, with no preoperative criteria of SIRS were randomized in two groups. Patients of Group A were administered total intravenous anaesthesia with propofol and those of Group B propofol for induction and sevoflurane for maintenance. We recorded the body temperature, the day before the operation and up to 24 hours post-operatively every 3 hours. The day before the operation and 24 hours after we took a blood sample to evaluate the white blood cells and the platelets count, the TNF-a and the IL-10. The influence of age, gender, BMI, duration of operation, blood transfusion and Charlson comorbidity score, was analyzed. Statistical analysis included the Fisher's Exact test and the Mann Whitney U test. P-values  $< 0.05$  were considered statistically significant. Power analysis concluded that a sample of 180 patients would be necessary for a 80% power of the study.

**Results and Discussion:** We present the preliminary data of this ongoing study. At the moment 71 patients are enrolled in the study 35 (49.3%) were

randomly allocated into Group A and 36 (50.7%) into Group B. One of the patients in Group A was excluded from the study (surgery was cancelled) so 70 patients were finally analyzed. All the results were adjusted for age, gender, BMI, duration of operation, blood transfusion and Charlson comorbidity score.

The influence of gender, age, BMI, duration of operation, Charlson comorbidity score, TNF-a and IL-10 turned non significant in either group and with the Hosmer and Lemeshow test analysis they proved not to be predisposing factors of SIRS. SIRS presented in 9 (12.85%) patients, 7/35 in Group A (20%) and 2/36 in Group B (5.55%) and the difference of the incidence of SIRS between the two groups turned non significant with a borderline p value of 0.080.

**Conclusion(s):** Anaesthetic agents do not seem to influence the incidence of postoperative SIRS but due to the borderline p value of this result, we consider that further studies are a necessity.

### 1AP1-9

#### The influence of preoperative hypnosis on perioperative anxiety - a systematic review of the current literature

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**Background and Goal of Study:** Hypnosis is defined as a state of increased receptivity to suggestion and direction, initially induced by the influence of another person. It is suggested as a cheap, nonhazardous and useful therapy for a range of psychosomatic as well somatic diseases. In anesthesia, hypnosis was proposed as treatment for several indications, including pain therapy, PONV and perioperative stress. In this systematic review we aimed to evaluate the evidence for the application of preoperative hypnosis in reducing perioperative anxiety.

**Material and Methods:** A systematic search was performed in PubMed and EMBASE. Keywords were hypnosis and perioperative anxiety. Language was restricted to English and German.

**Results and Discussion:** Thirty-five abstracts were screened, resulting in 8 studies to be included in this review. Six studies had positive results, whereas two failed to show benefits.

The positive studies included preoperative anxiety prior major operations, e.g. cardiac surgery, as well as intraoperative anxiety during local anesthesia. Both, adult and pediatric patients were examined. A direct comparison of different parameters is hindered by heterogeneous study designs, especially in evaluating different time points, concepts and methods of induction of hypnosis.

**Conclusion:** In general, the current literature supports the use of preoperative hypnosis for reducing perioperative anxiety in a wide variety of operations and in different groups of age. However, the inhomogeneous results should encourage more engagement and research into this topic.

### 1AP2-1

#### Value of lung sonography to control of right-sided double lumen endotracheal tube location

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**Background:** Currently, placement of a right sided double-lumen endotracheal tube (RT) has to be confirmed by fiberoptic. The "lung pulse" (LP) is a dynamic ultrasound sign described as the association of absent lung sliding (LS) with heart rhythm perception at pleural line, it is used in early diagnostic of complete atelectasis [1]. In our experience, this sign can also be used in diagnostic of correct lung isolation for thoracic surgery [2]. The aim of this study is to determine the relevance of lung sonography in diagnosis of right upper lobe (RUL) isolation.

**Materials and Methods:** This prospective study was approved by the ethic committee of our hospital (56-2011-02). All consecutive patients undergoing thoracic surgery with RT, excluding surgery for pneumothorax, were included. After left lung isolation, patients were placed under mechanical ventilation with tidal volume about 5 ml/kg of theoretical weight and a positive expiratory pressure between 4 and 10 mmHg. Sonography was used to check correct RT location by placing the probe anteriorly on the right thorax just under the clavicle for diagnosis of RUL isolation, then laterally on the left thorax for diagnosis of left lung isolation. Thereafter regardless of sonographic results, RT location was checked by fiberoptic and RT was replaced if necessary. Sensibility (Sen), specificity (Spe), positive predictive value (PPV) and negative predictive value (NPV) were calculated according to contingency tables.

**Results:** Eighteen patients (sex ratio = 1.57 ;  $62.27 \pm 13.30$  years ; BMI =  $24.39 \pm 4.25$  kg/m<sup>2</sup> ; ASA = 3) were included in our study. All left lungs were correctly isolated. Sonographic diagnosis was correct in 100 % of cases. In nine patients, the RUL orifice was obstructed. In one case, the sonographer could not allow any diagnostic because no LS and no LP were observed. This case was not considered for the contingent table. Sonography, in the diagnostic of RUL isolation, presented: sen = 88.88 %, spe = 100 %, PPV = 100 % and NPV = 88.88 %.

**Conclusion:** Despite these encouraging results, lung sonography cannot be recommended yet to check RT location. More thorough study has to be performed to validate this original approach.

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## 1AP2-2

### Are we following the guidelines - a retrospective analysis of compliance with evidence based protocols in cases admitted to Intensive Care Unit (ICU) from Labour Ward (LW)

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**Background and Goal of Study:** We have established guidelines for treating sepsis, haemorrhage and pre-eclampsia. We analysed the ICU admissions from LW for 4 years comparing our performance to local guidelines. We believe in major illness 100% of these cases should follow the guidelines. Cases which did not follow the guidelines were assessed to see if this contributed to an avoidable ICU admission.

**Materials and Methods:** Our hospital is a tertiary referral centre with over 10 000 deliveries per year. Using our electronic database (Euroking), all women admitted to ICU during 2007-2010 period were identified. Notes were reviewed retrospectively assessing compliance to the guidelines in 3 major groups - massive obstetric haemorrhage, severe pre-eclampsia/eclampsia and sepsis. Other causes for ICU admissions were also analyzed. For all cases attempt was made to answer the question - "Was that admission preventable and could that patient have been treated in a maternal High Dependency Unit (HDU)?"

This was a CASE registered project and therefore not required full ethical committee approval.

**Results and Discussion:** 71 cases were reviewed. 37(52%) cases were admitted post massive haemorrhage, 11(15%) cases with severe pre-eclampsia, 15(21%) patients with sepsis and 30(42%) cases had other diagnoses (total number more than 71 because of multiple diagnoses). In 5(45%) of the severe pre-eclampsia patients the hospital guidelines were not followed; in 7(46%) of sepsis cases "Surviving Sepsis Campaign Guidelines" were not followed. There was poor adherence to the guidelines in 4(10.8%) of massive haemorrhage cases. We felt that in 7(nearly 10%) cases the ICU admission could have been prevented by better adherence to the hospital guidelines. 6 patients (8%) could have been treated in maternal HDU according to the national document (see references).

**Conclusion(s):** The causes for poor adherence were found to be:

- Lack of critical care education amongst the midwives/junior doctors
- Lack of awareness of relevant protocols
- Understaffed LW and interrupted continuity of care - frequent changes of midwives during the shift
- Overly complicated / repetition of paperwork

#### References:

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## 1AP2-3

### Cardiopulmonary exercise testing as a factor in prevention of early postoperative cardiopulmonary complication in surgery of bronchial cancer

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**Background and Goal of Study:** A cardiopulmonary exercise test(CPET) provides insight into cardiorespiratory and metabolic reserve of the body and is important in the preoperative evaluation of patients at the greatest risk in bronchial cancer surgery.[1] The goal is to determine the importance of mea-

sured maximal oxygen uptake (VO<sub>2</sub>max) during CPET in prevention of early postoperative cardiopulmonary complications.[2]

**Materials and Methods:** A prospective clinical study included 100 patients with the operable bronchial cancer. The patients were divided into two groups with 50 patients. Group 1: patients with low oxygen consumption (15ml/kg/min < VO<sub>2</sub>max ≤20ml/kg/min) and control group 2: patients with good lung function without indications for CPET. The groups were matched for age, sex, habits, preoperative treatment, applied anesthesia and surgical technique and the usual postoperative treatment. All collected data were analyzed by SPSS 13 program. Potential risk factors for complications were analyzed by univariate(p < 0.05) and multivariate regression analysis(p < 0.1) with the presence of cardiopulmonary complications as a dependent event.

**Results and Discussion:** The descriptive analysis showed that patients in Group 1 are with significantly higher respiratory comorbidity(p < 0.001), compensated cardiomyopathy(p=0.002), with higher ASA class(p < 0.001), more frequent preoperative chemotherapy(p=0.003), worse spirometry parameters(p < 0.001), significantly lower partial pressure of oxygen (PaO<sub>2</sub>) (p=0.003), compared to the control Group 2. Early postoperative cardiopulmonary complications occurred in 30% patients(Group 1: 28%; Group 2: 32%)(not significant). Myocardial infarct, cardiomyopathy and ASA class ≥ 3 were shown to be independent prognostic factors of overall postoperative cardiopulmonary, but pneumonectomy only of cardiovascular complications in multifactorial regression analysis. Univariate analysis proved to be statistically significant impact of PaO<sub>2</sub> < 9.3 kPa on the postoperative pulmonary complications.

**Conclusion(s):** The CPET is important for preoperative evaluation, preparation and determining the level of lung resection of high-risk patients with bronchial cancer, and reduction of postoperative cardiopulmonary complications on acceptable level in high risk patients.

#### References:

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**Acknowledgements:** Thanks to the staff of CPET laboratory.

## 1AP2-4

### Quantitative and qualitative evaluation of patients' anxiety in the operating room using the visual analog scale

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**Background and Goal of Study:** Patients' anxiety in the operating room is a common and poorly evaluated condition. The aim of this study is to determine the prevalence of anxiety in the operating room, to estimate what do patients are more concerned about and to assess any influencing patients' characteristics.

**Materials and Methods:** After Ethics Committee approval and informed consent, 110 unpremedicated patients, ASA I-III, aged 18-77, scheduled for non life-threatening surgery under general anaesthesia were interviewed in the operating room. Patients were asked to grade their anxiety level on a Visual Analog Scale (VAS) from 1 to 10 for anaesthesia and for surgery outcome separately, before induction of anaesthesia<sup>1</sup>. The anxiety scores were compared between the sex, age, education level and history of previous surgery. *T-test was used, with p < 0.05 considered statistically significant.*

**Results and Discussion:** The vast majority of our patients experience high levels of anxiety in the operating room, since 60% of patients have anxiety score >5 on VAS for anaesthesia and 25% have anxiety score >5 on VAS for surgery outcome. The overall mean anxiety scores for anaesthesia were significantly higher than for the surgical outcome (p < 0.001). The only statistically important difference as far as patients' characteristics are concerned, was regarding to patients' gender, with women being more anxious about anaesthesia than men (p < 0.001). None of the other demographics seem to affect patients' anxiety in the operating room. Patients' demographics and results (mean±SD) are demonstrated in table1.

	Number of patients	VAS for anaesthesia	VAS for surgery
<b>Total patients</b>	110	6.55± 3.04*	4.27± 2.93*
<b>Gender</b>			
<b>Male/Female</b>	30/80	4.83±2.56/7.20±2.97*	3.47±2.14/4.58±3.14
<b>Age (years)</b>			
<b>≤40/&gt;40</b>	53/57	6.23±3.08/6.86±3.01	4.04±2.67/4.49±3.17
<b>Education (years)</b>			
<b>≤9/&gt;9</b>	50/60	6.66±3.26/6.47±2.87	4.8±3.28/3.83±2.55
<b>Previous anaesthesia</b>			
<b>Yes/No</b>	50/60	6.86±3.3/6.05±2.52	4.54±3.21/3.83±2.38

[Table 1 (\*:p<0.001)]



**Conclusion:** In the operating room, patients are more anxious about anesthesia than the surgical outcome with women being more concerned about anesthesia than men. This indicates the need for a better anesthesiologist-patient relationship and for further patients' information about anesthesia.

**Reference:**

Kindler CH, Harms C, Amsler F et al. *Anesth Analg*. 2000 Mar;90(3):706-12

## 1AP2-5

### Anesthetic predictable variables for preoperative anxiety/depression state

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**Background:** There is evidence that emotional state affects the surgical outcome<sup>1</sup>. The aim of the study was to correlate the anesthetic variables registered on preoperative assessment with the anxiety (A)-depression(D) level of the patients.

**Patients and methods:** The study was carried out from October 2009 to October 2010. Patients emotional state information was obtained by self-administered questionnaire in the preoperative visit, it consisted on:

- 1) demographic data: age (> / < 55 years old), sex, level of studies (basic, high school, university),
- 2) A-D level using the Hamilton scale (HAD: normal = 0-7, doubtful = 8-10, pathological > 11), and
- 3) surgical-anesthetic variables:
  - a) ASA physical status,
  - b) Surgery with or without hospital admission,
  - c) surgical pathology (cancer surgery, non-cancer surgery),
  - d) degree of surgery (minor, moderate or major)<sup>2</sup>.

We performed an analysis of the sample and variables related to the HAD outcome. A multivariate analysis with the HAD test results was carried out. The statistical analysis was performed with SPSS 12.0.

**Results:** 503 questionnaires were evaluated. The average age was 54 years, no statistical differences were found in demographic data, with a female patient predominance (57.1%) and high school education level (59.8%). The average value of A was  $7.40 \pm 4.15$  (0-20) and  $4.25 \pm 3.87$  (0-18) for D. The HAD score for A > 11 was 30% in women vs. 11,6% in men ( $p < 0.001$ ) and the HAD score for D was 10,8% vs. 6%, ( $p < 0.05$ ). Patients over 55 years showed higher D level (12,9% vs. 4,9%,  $p < 0.001$ ). ASA III-IV physical status was associated with increased A ( $p = 0.007$ ) and D ( $p = 0.002$ ). Major degree of surgery was associated with higher D score ( $p = 0.013$ ). Surgical pathology and type of admission were not significant variables. Multivariate analysis showed as protective factors of A and D, being male, < 55 years, university education level and ASA 1.

**Conclusions:** Our results suggest that anesthetic variables registered on preoperative assessment correlate with the HAD test scores. This outcome is relevant because allows to identify patients at risk for high anxiety-depression level, that may influence postoperative morbidity/ mortality.

**References:**

1. Madelon LP et al. Somatic and psychologic predictors of long-term unfavorable outcome after surgical intervention. *Ann Surg* 2007; 245: 487-942. Donati A. et al. A new and feasible model for predicting operative risk. *Br J Anesth* 2004; 93 (3):393-9

## 1AP2-6

### Non-obstetric surgery during pregnancy, preliminary results

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**Background and Goal of Study:** Surgery and anesthesia during any stage of pregnancy is not unusual and it can occur to any anesthesiologist. Its incidence is variable, between 0,15% and 2% in the main published series. Following surgery during pregnancy the risk of preterm labour or abortion is increased. The knowledge about local hospital results in these patients can help us to improve their perioperative management.<sup>(1)</sup> Our goal is to analyze our anesthetic and surgical management, as much as the appeared complications of non-obstetric surgery during pregnancy (NOPDS) in a tertiary university hospital.

**Materials and Methods:** We prospectively collected every patient who underwent NOPDS during 8 months (april 1st- november 30th,2011), we obtained this data from daily surgical registry activity. Analyzed variables were: women's age, pregnancy gestational age (we categorized this as: first, second and third trimester), surgical diagnosis, type of surgery, type of anesthesia, abortion in the following week of surgery, and by telephonic interview after hospital discharge, we asked about: premature labour, preterm delivery, intraoperative awareness episodes and immediate neonatal problems.

**Results and Discussion:** Nine patients were included. Women's age, pregnancy gestational age, preoperative diagnosis, type of surgery and type of anesthesia are shown in table 1.

Patient age (years)	33,55 ± 5,52 SD			
Pregnancy gestational trimester (Trim.)	1st Trim. n=5(55,5%)	2nd Trim. n=2(22,2%)	3rd Trim. n=2(22,2%)	
Surgical diagnosis	Adnexal gynecological pathology n=3(33,3%)	Abdominal pathology n=3(33,3%)	Trauma n=2 (22,2%)	Neuropathology n=1 (11,1%)
Type of surgery	LPS n=4 (44,4%)	Primary laparotomies n=2 (22,2%) Secondary laparotomies n=2(22,2%)	Trauma n=2 (22,2%)	Neurosurgery n=1(11,1%)
Type of anesthesia	General n=8 (88,8%)		Spinal n=1 (11,1%)	

[Table 1. Descriptive general data.]

(Data expressed in number of patients [n] and percentage [%]).

There were 3 abortions in the first week. All of them occurred after adnexial laparoscopic (LPS) procedures. Neither intraoperative awareness nor immediate neonatal problems were reported. Preterm labour occurred in 1 woman (29th week) and preterm delivery at 36th week in another patient.

**Conclusion(s):** Abdominal LPS, specially when adnexial procedures are performed, seem to be the most dangerous for pregnancy outcome. General anesthesia is mainly used in our patients. Self analysis could help us to improve our results and to adequately inform our patients.

**References:**

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3. Ann Fr Anesth Reanim 2006;25:11-6.
4. Arch Gynecol Obstet 2007;276:201-9

## 1AP3-1

### Total intravenous anaesthesia with propofol reduces postoperative nausea and vomiting in patients undergoing robot-assisted laparoscopic radical prostatectomy: prospective randomised trial

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**Background and Goal of Study:** Postoperative nausea and vomiting (PONV) management is important to reduce complications related to PONV and facilitate early mobilization after Robot-assisted laparoscopic radical prostatectomy (RLRP). However, RLRP could be an important risk factor of postoperative nausea and vomiting due to steep trendelenburg position with prolonged intraperitoneal carbon dioxide insufflations and increased intraabdominal pressure. Previous clinical studies suggested that total intravenous anaesthesia (TIVA) with propofol reduced PONV significantly compared to inhaled anaesthetics.<sup>1</sup> We investigated the effect of TIVA with propofol on PONV in patients after RLRP.

**Materials and Methods:** Ninety three patients with lower PONV risk factors undergoing RLRP were randomly assigned to the control, TIVA, and TIVA-P group in 1:1:1 ratio. Propofol and remifentanyl were used for induction in all groups and in maintenance of anaesthesia in TIVA and TIVA-P group. In the control group, anaesthesia was maintained with desflurane and remifentanyl. In the control and TIVA-P group, ramosetron 0.3mg was administered at the end of surgery. The incidence of postoperative nausea and vomiting, severity of nausea and pain were measured. The variables were compared using 1-way ANOVA or Chi-square appropriate.

**Results and discussion** The incidence of nausea at postoperative 1-6 hr was 22.6% in TIVA group ( $p=0.009$  vs. control group), 16.1% in TIVA-P group ( $p=0.001$  vs. control group), and 54.8% in control group. However, at postoperative 6-24 hr, significantly more patients (45.2%) complained of nausea in TIVA group compared to control and TIVA-P groups (19.4%,  $p=0.03$  and 12.9%,  $p=0.005$ , respectively). Although patient related PONV risk factors were low in the study subjects of this study, the surgical method itself (RLRP) eventually lead to a high incidence of PONV in the control group. Therefore, anaesthesia with TIVA seems to be beneficial for preventing PONV in patients undergoing RLRP regardless of the presence of patient related risk factors.

**Conclusion:** In order to prevent PONV after RLRP during both early and late postoperative periods, anaesthesia using TIVA with propofol together with antiemetic prophylaxis is needed regardless of patient related risk factors.

**References:**

1. Gupta A, et al. Comparison of recovery profile after ambulatory anesthesia with propofol, isoflurane, sevoflurane and desflurane: a systematic review. *Anesth Analg* 2004;98:632-41.

**1AP3-2**

**Prevention of postoperative nausea and vomiting by administration of sub hypnotic doses of propofol and midazolam during spinal anesthesia for Cesarean section**

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**Background and Goal of Study:** We chose this study because nausea and vomiting disturb most of the mothers after delivery and even they call it more intolerable than pain, also can affect relation of mother with neonate in first hours after delivery, so we looked for a safe and non-expensive way to reduce it and evaluated the efficacy of sub hypnotic doses of midazolam and propofol in prophylactic control of PONV during spinal anesthesia for C/S.

**Materials and Methods:** In a double-blind, placebo-controlled, randomized trial, 114 ASA physical status I-II parturient undergoing elective cesarean section under spinal anesthesia (using 0.5% bupivacaine 12 mg) were allocated randomly to receive propofol (20 mg bolus and 1.0mg/kg/hr infusion, n= 38) or midazolam (1 mg bolus and 2.0mg/hr infusion, n= 38) or saline (2 cc IV, n= 38) immediately after clamping of umbilical cord. The occurrence of nausea and/or vomiting and respiratory depression was recorded during operation until 12hr after that.

**Results and Discussion:** The incidence of PONV was significantly lower in midazolam and propofol groups compared with saline group in all 12hr, (nausea: 19%, 15.8% versus 57.9%), vomiting (7.9%, 5% versus 34.2%). There was not manifestation of respiratory depression at the time of surgery and after it. one of the advantages of our drug protocol was lack of respiratory depression despite of it's efficacy in preventing PONV.

**Conclusion(s):** Sub hypnotic dose of midazolam was as effective as the sub hypnotic dose of propofol for preventing of PONV in parturients undergoing cesarean section under spinal anesthesia. We undertook this study in regard to examine a simple, safe and non-expensive antiemetic method.

**References:**

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2. Naylor RJ, Inall FC. The physiology and pharmacology of postoperative nausea and vomiting. *Anaesthesia*. 1994;49 Suppl:25.  
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**1AP3-3**

**Satisfaction with spinal anaesthesia service and pain management in early postoperative period in patients undergoing spinal lumbar hernia microdiscectomy**

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**Background and Goal of Study:** Spinal anaesthesia may be used for spinal lumbar hernia microdiscectomy to maintain blockade of spinal nerves roots in particular area. During the last decade patient satisfaction ratings have been highlighted as an important objective of healthcare: it ensures the quality of anaesthesia care, improves and intensifies the anaesthesiologist-to-patient relationship, and can also be seen as a marketing tool in terms of customer orientation. The goal of study was to explore how patients are satisfied with spinal anaesthesia during lumbar microdiscectomy and pain management in early postoperative period.

**Materials and Methods:** Anonymous questionnaire combined of 28 closed type questions for satisfaction assessment of anaesthetic care and pain management. Visual analogue scale (VAS) for evaluation of patients' pain before, during and after anaesthesia. Statistical analysis was performed using PASW® Statistics 18 software.

**Results:** 193 patients were enrolled into the prospective study: 80 women (41.5%) and 113 men (58.5%). 79.4% of all patients felt anxiety before anaesthesia and surgery. 27 patients (13.9%) were dissatisfied with spinal anaesthesia service. Dependence between sex, age, education, and satisfaction with anaesthesia service were not found ( $p > 0.05$ ). 27.2% of patients identified they had experienced unpleasant sensations during the anaesthesia (8.3% drowsiness, 6.7% dizziness, 5.3% shivering, 3.1% feeling of cold, 1.7% nausea, 1.5%

numbness of hands and shoulders, 0.6% sweating) and 19% during the first day after the procedure (6.7% headache, 5.3% dizziness, 4.1% nausea, 2.9% nausea and vomiting). There was a strong relation between patient dissatisfaction and discomfort during anaesthesia ( $p=0.005$ ) and first day period after the procedure ( $p=0.004$ ). 76.3% of patients required additional analgesia after  $5.2 \pm 2.4$  hours of surgery with  $5.1 \pm 1.9$  pain scores by VAS. Despite high requirement of additional analgesia all the patients were satisfied with the pain management.

**Conclusion(s):** The majority of patients consider spinal anaesthesia is a high quality service. Anaesthesia satisfaction depends directly on the unpleasant senses incurred during anaesthesia or the first day period after the procedure. In the early postoperative period the demand for additional analgesia is high but it has no impact to satisfaction with the pain management.

**1AP3-4**

**A double-blind placebo controlled trial comparing alizapride and ondansetron in the prevention of postoperative nausea and vomiting (PONV) in patients undergoing laparoscopic gynaecological surgery**

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**Background:** PONV is a common complication after surgery with an incidence up to 30% despite modern anaesthesia and up to 80% in high-risk patients<sup>1</sup>. Following the guidelines, only patients with a moderate to high PONV risk receive prophylaxis with anti-emetics<sup>1</sup>. This is cost-effective as compared to placebo. Prevention of PONV could also be cost-effective in low risk patients when cheap anti-emetics are used. In this trial alizapride, an old and less expensive anti-emetic, and ondansetron were compared in the prevention of PONV. The goal of the present study is to demonstrate non-inferiority of alizapride to ondansetron.

**Methods:** Alizapride 100 mg was compared to ondansetron 4 mg in a randomized, double-blind trial in 520 ASA I/II patients undergoing laparoscopic gynaecological surgery. The trial medication was given 30 minutes before the end of surgery. Postoperatively for 24 hours, nausea was evaluated with a visual analogue scale and the presence and frequency of vomiting was registered. If PONV occurred, it was treated in accordance with departmental guidelines. Data were statistically analyzed with the Fisher Exact test, Chi-square test and StatXact-9 based on Agresti and Min for non-inferiority testing of alizapride. If a relative risk ratio (RR) of more than 1.125 was found, we considered alizapride to be less effective than ondansetron.

**Results:** Demographic data were similar in the 2 groups. The overall incidence of PONV in the alizapride group was 0.368 (95%CI. 0.296-0.441), versus 0.315 (95%CI. 0.246-0.383) in the ondansetron group, resulting in a RR of 1.171 (95%CI. 0.874-1.569). Hence, alizapride compared to ondansetron is not non-inferior. Subgroup analysis revealed that in patients without a history of PONV and who smoked, the risk of PONV was only 12.5%. In this population with only 2 risk factors according to the Apfel score (female and opiates intraoperatively)<sup>1</sup>, there was no significant difference between the alizapride and ondansetron treated patients (RR 0.473; 95%CI. 0.163-1.368).

**Conclusion:** Our results suggest that alizapride is not equally effective as ondansetron in the prevention of PONV in female patients undergoing elective laparoscopic gynaecological surgery, except in patients with 2 or less risk factors. In this subgroup alizapride can be a cost-effective alternative.

**References:**

1. Apfel et al. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. *N Engl J Med* 2004; 350:2441-51.

**1AP3-5**

**Craniotomy type and postoperative nausea and vomiting: a matched case-control study**

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**Background and Goal of Study:** The role of surgical risk factors for postoperative nausea and vomiting (PONV) following elective craniotomy are uncertain. Evidence examining surgical location (infra vs. supratentorial) is conflicting.<sup>1,2</sup> However, the indication for craniotomy may be more discriminative than its location. To test this hypothesis, we designed a matched case-control study of neurosurgical PONV.

**Materials and Methods:** A perioperative database was used to identify PONV cases as

well as controls following elective craniotomy between 2008-2010 in the Service of Neurosurgery. Wherever possible, cases were matched in a 2:1 fashion with controls on the following confounders: gender, age ( $\leq$  or  $>$ 50), and anesthetic time period.

Hospital charts were reviewed and data collected on smoking status, craniotomy type (tumor, epilepsy, vascular, micro vascular decompression [MVD], and acoustic neuroma [AN]), craniotomy location (infra vs. supratentorial) and anesthetic type (balanced vs. total intravenous anesthesia [TIVA]). We then performed conditional logistic regression adjusting for additional confounders (smoking status, surgical location, PONV prophylaxis, as well as anesthetic type and duration) to evaluate the relationship between craniotomy type and PONV.

**Results and Discussion:** 168 cases were matched to 185 controls. Patients had a mean age of 50 (SD 13) and 65% were female. Matching factors were balanced between cases and controls. The majority of craniotomies were supratentorial (70%) with MVD and AN surgery being each performed in 9% of patients. TIVA and PONV prophylaxis were used in 22% and 80% of procedures, respectively. Compared to controls, cases were more likely to be non-smokers (86 vs. 74%,  $p=0.01$ ). On multivariable analysis, MVD (OR 5.8, 95%CI: 1.8-18.4,  $p=0.003$ ) and AN surgery (OR 3.8, 95% CI: 1.2-12.2,  $p=0.02$ ) were associated with increased odds of PONV compared to tumor surgery. Infratentorial location (OR 1.01, 95% CI: 0.47-2.3,  $p=0.90$ ), adequate prophylaxis (OR 0.70, 95% CI: 0.35-1.4,  $p=0.31$ ) and TIVA (OR 0.77, 95% CI: 0.40-1.5,  $p=0.42$ ) were not independently associated with PONV.

**Conclusion(s):** Compared to tumor resection, MVD and AN surgery were associated with increased odds of PONV. Strategies to reduce PONV, including increased prophylaxis, should be examined in this high-risk population.

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### 1AP3-6

#### Haloperidol as an antiemetic: what is its real efficacy?

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**Background and Goal of Study:** PONV continue to be a problem, especially in high-risk patients. After the droperidol FDA black-box warning in 2001, haloperidol appears as a substitute, both share the same mechanism of action. Two years ago, we developed an antiemetic protocol for high-risk patients. We have reviewed the efficacy of: ondansetron 4 mg iv in combination with haloperidol 1mg iv (O&H1), haloperidol 2 mg iv (O&H2) or dexamethasone 8 mg iv (O&D).

**Materials and Methods:** After obtaining approval from Navarra's Ethics Committee and written informed consent, we selected 150 ASA I-II women (50 per group), aged 18-70, undergoing elective gynecological, thyroid or abdominal surgery, under general anesthesia, with high risk of PONV according to Apfel's risk score ( $\geq 3$  risk factors). It was confirmed that the anesthetic management followed department's protocol and all the variables needed to complete the study were recorded. Exclusion criteria: the use of any antiemetic drug during the previous week, nausea or vomiting 24h before surgery, BMI  $> 35$  kg/m<sup>2</sup>, nasogastric tube during postoperative period and locoregional anesthesia. We registered at PACU, 2, 6, 12, 24, 48h after recovery from anesthesia: nausea, emetic episodes, pain intensity, sedation, rescue therapy, side effects and satisfaction.

We performed a descriptive analysis of patient characteristics and a chi-square test (with Bonferroni's correction) to study prophylaxis efficacy.

**Results and Discussion:** All groups were homogeneous (age, BMI, type of surgery, fasting time, duration of surgery, fluid therapy, pain...). O&H2 and O&D were significantly more effective than O&H1 mainly as of 12h into post-operative.

In the O&H2 group, 40% of patients suffer side effects (mainly headache, dizziness, restlessness and anxiety) compared with 29% and 31% in O&D and O&H1.

Period Time		O&D	O&H1	O&H2	P
0-6h	No PONV/ PONV	35(70%)/ 15(30%)	26(52%)/ 24(48%)	33(66%)/ 17(34%)	0.148
0-12h	No PONV/ PONV	34(68%)/ 16(32%)	19(38%)/ 31(62%)	32(64%)/ 18(36%)	0.005
12-24h	No PONV/ PONV	33(66%)/ 17(34%)	19(38%)/ 31(62%)	29(58%)/ 21(42%)	0.015
24-48h	No PONV/ PONV	30(60%)/ 20(40%)	18(36%)/ 32(64%)	29(58%)/ 21(42%)	0.029

[Cumulative incidence]

All patients in the O&D group were satisfied (20%) or very satisfied (80%) with the postoperative period. On the other hand 6% and 8% in O&H1 and O&H2 groups were dissatisfied ( $p=0.354$ ).

**Conclusion(s):** In patients at high risk of PONV, O&D and O&H2 are more effective than O&H1. O&H2 causes a greater incidence of side effects and less satisfaction in the postoperative period.

### 1AP3-8

#### Bispectral index-guide anesthesia may reduce postoperative nausea and vomiting

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**Background and Goal of Study:** Many studies have demonstrated that PONV occurring between 20% and 30% of patients and between 70% to 80% of patients at high risk(1). Pharmacological prophylaxis should be administered to patients with moderate or high risk of developing 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).

**Material and Methods:** We have studied 300 cases of gynecological laparoscopy surgery in women, age 22-68( mean 43), ASA I-II, 150 with BIGA ( A) and 150 not ( B). We have divided these 2 groups in three sub-groups, low, moderate and high risk of PONV according risk score(2). All patients were given a balanced general anesthesia (induction with Propofol and maintenance with Desflurane, no nitrous oxide). Prophylactic antiemetic has been administered to patients with moderate (ondansetron) or high risk (ondansetron + dexamethasone), no one for low risk.

**Results and Discussion:** The incidence of PONV in the group A (20%) was lower than in the group B (25%) in all three sub-group especially in the patients with moderate ( 18% versus 24%) and high risk (28% versus 36%) of PONV. The incidence of PONV in low risk patients was 12% in A and 16% in group B. The use of BIS monitoring reduced Desflurane consumption by 34,6% between group A and B ( $p < 0.001$ ). Statistical analysis of data showed no significant difference between groups in the incidence of PONV: these data confirm the importance of drug treatment to prevent PONV, data also showed an interesting reduction of PONV when anesthesia was performed under Bispectral index monitoring. BIGA is usually used to control the depth of anesthesia may also affect secondarily on PONV.

**Conclusion:** Our data suggest that a BIGA, associated with antiemetic therapy, could further reduce the incidence of PONV especially in patients with moderate or high risk. This difference is due to the reduction of volatile anesthetic used during anesthesia in group A with the use of BIGA. The statistical significance could not be due to the small sample examined, further study is in progress.

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### 1AP3-9

#### Effects of a preoperative carbohydrate-rich drink on postoperative nausea and vomiting after mastectomy

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**Background:** Evidence suggests that the administration of a preoperative carbohydrate-rich drink (CHO) may reduce postoperative nausea and vomiting (PONV). The aim of this study was to investigate the postoperative alleviation of PONV in mastectomy patients who ingested an 18% CHO (125 mL, 100 Cal, 22.5 g carbohydrate, 2.5g protein, 225 mg phosphorus, 10 mg zinc, 1 mg copper) just before undergoing their surgeries.

**Methods:** A total of 200 patients who underwent mastectomies over the period from August 2010 to March 2011 were enrolled in the study (ASA physical status 1 or 2). The patients were divided into two groups: the CHO group (n=100) treated with preoperative CHO and the Control group (n=100) treated with intravenous infusion of lactate Ringer's solution alone. The CHO group ingested 250 mL of CHO at 2 hours before the surgery, and the Control group was infused with the lactate Ringer's solution (about 200 ml) also at 2 hours before the surgery. Both groups were managed under general anesthesia maintained with sevoflurane, oxygen, air, remifentanyl, and fentanyl. PONV was assessed for 48 hours following the operation based on subjective medical reports from the two groups. Statistical analyses were performed using the *t* test for the patient groups and the  $\chi^2$  test for PONV.

**Results:** No significant differences between the CHO group and Control group were found in the patient age, weight, height, operation time, anesthesia time, opioids, or smoking history. The volumes of preoperative fluid volume, oral re-hydration, and intravenous drip administered were all approximately equivalent. The incidence of PONV was significantly lower in the CHO group (17/100) than in the Control group (37/100,  $p = 0.001$ ). All PONV occurred within 24 hours after the operation.

**Conclusion:** The preoperative ingestion of CHO was found to significantly reduce PONV compared to the intravenous infusion of lactate Ringer's solution, when other factors, e.g., the anesthesia method, type of surgery, and patient background, were set at equivalent levels. PONV in the early postoperative stages hinders oral ingestion for enhanced recovery after surgery (ERAS). As such, the measures to prevent PONV are just as important to surgeons as the measures to relieve pain are to anesthesiologists. We conclude that the CHO should be more widely used.

### 1AP3-10

#### Dexamethasone compared with metoclopramide in prevention of postoperative nausea and vomiting in orthognathic surgery

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**Background and Goal of Study:** Prevention of postoperative nausea and vomiting (PONV) for orthognathic surgery is very important because of intermaxillary fixation. The aim of this study is to compare the efficiency of dexamethasone and metoclopramide in prevention of PONV.

**Materials and Methods:** 42 patients age 15-50, ASA I-II, undergoing orthognathic surgery were randomly allocated in two groups. Group D  $n = 21$  -using dexamethasone 8 mg IV and Group M  $n = 21$  - using metoclopramide 10 mg IV. The incidence and severity of PONV was evaluated for 24 hours postoperatively based on scoring system: 0=no emetic symptoms, 1=nausea, 2=vomiting. Whereas the severity of nausea was assessed using a four-point Likert scale, with 0=none, 1=mild, 2=moderate, 3=severe.

**Results and Discussion:** There was significant difference among the groups in the incidence of moderate to severe nausea (2-3 Likert scale) in the dexamethasone group 9.0 % compared to the metoclopramide group 27.2%, in early post-operative period (0-6 hrs) ( $p > 0.05$ ). During late post-operative period (6-24 hrs), no significant difference was found between groups ( $p = NS$ ). There was significant difference among the groups in incidence of vomiting or retching (score 2) in early post-operative period (0-6 hrs), in-group D was 0% compared with 18.1% in-group M ( $p > 0.05$ ). In late post-operative period (6-24 hrs) in-group D no patient suffered from vomiting or retching, whereas in-group M 9.0% which was statistically insignificant ( $p = NS$ ).

**Conclusion(s):** The prophylactic administration of 8 mg of IV dexamethasone, one-minute prior induction of anesthesia, reduces the incidence of PONV during the first 24 h postoperatively, with no increase in adverse side effects or delay in PACU discharge, when compared with the intravenous metoclopramide 10 mg, in patients undergoing orthognathic surgery.

### 1AP4-1

#### The efficacy and safety of ondansetron, dexamethasone and droperidol in preventing postoperative nausea and vomiting (PONV) after thyroidectomy

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**Background and Goal of Study:** Patients undergoing thyroidectomy may be especially at risk of experiencing PONV which would cause unexpected bleeding, distressed patients or delay in hospital discharge. This study intends to compare the efficacy and safety of ondansetron, dexamethasone or droperidol, used as prophylaxis of PONV in adults undergoing elective thyroidectomy.

**Materials and Methods:** A total of 147 ASA I-II patients scheduled for thyroidectomy were included in this randomized study. Patients were randomly divided into three groups ( $n = 49$  each), receiving in induction of anesthesia, either 4 mg ondansetron or 8mg dexamethasone or 1.25 mg droperidol. The same anesthetic protocol, consisting of 5 micrograms.kg-1 of fentanyl, 5 mg.kg-1 of thiopental, and 0.1 mg.kg-1 of pancuronium, was used in all patients. Anesthesia was maintained with 60% nitrous oxide in oxygen with 1.2 to 2% end tidal concentration of sevoflurane and additional boluses of 0.1 mg of fentanyl as required. The incidence and intensity of nausea, graded as mild, moderate or severe, and the incidence of vomiting was recorded postoperatively at 0- to 4-h and 4- to 24-h intervals. The continuous variables were

presented as average, standard deviation, while categorical variables were reported in percentage data.

**Results and Discussion:** There was no significant difference among the groups, regarding to the medical and demographic variables. In the first four hours after surgery, early nausea was present in 11.8% of patients in the ondansetron group (I) (4.7% mild, 3.4 % moderate and 3.7% severe), in 21.8% of patients in dexamethasone group (II) (8.4% mild, 7.1 % moderate and 6.3% severe) and in 14.4% of patients in the droperidol group (III) (5.9% mild, 4.6 % moderate and 3.9% severe). Early vomiting occurred respectively in 6.4%, 20.4% and 4.2% of patients. In the second period (4 - 24 h intervals) the late nausea and vomiting in the ondansetron group was 32% and 21%, in the dexamethasone group was 36% and 24%, and in the droperidol group was 40% and 22%. The difference among three groups was statistically significant only in the early period (0 - 4 h intervals):  $p = 0.025$  for nausea and  $p = 0.042$  for vomiting. No clinically important unpleasant events were observed in any of the groups.

**Conclusion(s):** Prophylactic therapy with ondansetron is superior to droperidol or dexamethasone for preventing PONV after thyroidectomy.

### 1AP4-2

#### Ramosetron vs. ramosetron plus dexamethasone on the PONV after laparoscopic cholecystectomy

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**Background and Goal of Study:** Patients undergoing general anesthesia for laparoscopic cholecystectomy have a high risk of postoperative nausea and vomiting (PONV). Ramosetron and dexamethasone have been reported to be effective for the prophylaxis of PONV following laparoscopic cholecystectomy but their synergistic effect has not been investigated. We compared and investigated the effect of ramosetron and ramosetron plus dexamethasone on PONV prophylaxis after laparoscopic cholecystectomy.

**Materials and Methods:** Forty patients scheduled for laparoscopic cholecystectomy were allocated randomly to one of two groups ( $n = 20$  in each) to receive 0.3 mg ramosetron (group I), or 0.3 mg ramosetron plus 8mg dexamethasone (group II) intravenously. Balanced anesthesia with desflurane and remifentanyl was used in all patients. Postoperative nausea, retching, vomiting, pain (100 point verbal rating scale, VRS) and side effects were assessed at 2 h, 24 h and 48 h after surgery.

**Results and Discussion:** No statistical differences were observed among the three groups with regard to patient characteristics and information on surgery and anesthesia. The ratio of PONV was higher in groups I than group II; 35% ( $n = 7$ , group I) vs. 5% ( $n = 1$ , group II) during the first postoperative 24 h ( $p = 0.044$ ). In addition, rescue antiemetics were used in significantly fewer patients in group II ( $n = 1$ , 5%) than group I ( $n = 7$ , 35%) ( $p = 0.044$ ) during the first 24 h after surgery. In addition, postoperative pain was significantly lower group II than in group I during postoperative 2 h ( $75 \pm 16$  in group I vs.  $42 \pm 26$  in group II,  $p = 0.00$ ). The use of rescue analgesics and the incidences of adverse effect were comparable between the two groups. There was no clinically serious adverse event due to study drugs.

**Conclusion(s):** Ramosetron plus dexamethasone was more effective than ramosetron alone for the prophylaxis of PONV and postoperative pain control after laparoscopic cholecystectomy (24 h).

#### References:

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- Ryu J, So YM, Hwang J, Do SH. Ramosetron versus ondansetron for the prevention of postoperative nausea and vomiting after laparoscopic cholecystectomy. *Surg Endosc.* 2010;24:812-817.

### 1AP4-3

#### Postoperative nausea and vomiting in a post-anesthetic care unit: validation of the Portuguese version of the postoperative nausea and vomiting intensity score

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**Background:** The Postoperative Nausea and Vomiting (PONV) Intensity Scale was developed to define clinically important PONV. This score was developed and tested in surgical population and performed well in the domains of validity, reliability and responsiveness.<sup>1</sup> The aim of this study was to translate, retranslate and validate the PONV Intensity Scale for use in Portuguese Post Anesthetic Care Unit (PACU) settings.

**Materials and Methods:** The PONV Intensity scale was formally translated and back-translated in accordance with available guidelines<sup>2</sup> To validate the translated PONV Intensity scale, an observational and cohort prospective study was conducted in a PACU. 157 adult patients were consecutively admitted and evaluated for the occurrence of PONV after elective surgery during three weeks. Patient pre-operative characteristics, intra-operative and postoperative data were collected. Measurements included nausea visual analogic scale (VAS) at 6 and 24 hours postoperatively. Descriptive statistics were used to present data and comparisons were made using the Mann-Whitney U-test to compare continuous variables and Chi-square or Fisher's. The correlation between PONV Intensity Scale and the nausea VAS score was made using Spearman rank correlation. Agreement was measured using interclass correlation (ICC).

**Results:** 39 patients (23%) had PONV at 6 hours and 54 (34%) had PONV at 24 hours. 19 and 30 patients had vomiting or stretch at 6 and 24 hours respectively. 36 and 54 patients experienced nausea at 6 and 24 hours respectively. Among patients with PONV, 6 patients (15%) and 9 patients (23%) had a clinically significant PONV intensity scale score at 6 and at 24 hours respectively. The median nausea visual analogic scale (VAS) scores at 6 and 24 hours were higher in patients with clinically significant PONV Intensity score (75 vs 30,  $p=0.022$  at 6 hours and 70 versus 40,  $p=0.001$  at 24 hours). Test-retest and inter-rater reliability were completed in 24 patients using PONV intensity scale and VAS for nausea. The reliability coefficient was excellent for the PONV Intensity Scale [ICC 0.95 (95% CI 0.88-0.98),  $p < 0.001$ ] and for VAS [ICC 0.99 (95% CI 0.97-1.00),  $p < 0.001$ ].

**Conclusions:** The Portuguese version of the PONV Intensity Scale showed a good correlation with the original version. The PONV Intensity Scale appears to be an accurate and reliable assessment and monitoring instrument for PONV in the PACU settings.

#### References:

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### 1AP4-4

#### Combination of ramosetron and naloxone added to patient controlled analgesia; antiemetic efficacy

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**Background and Goal of Study:** Patients undergoing gynaecological surgery have been associated with high risk for developing PONV. Ramosetron is a recently developed selective 5-HT<sub>3</sub> receptor antagonist. However, 50% to 60% of patients who received ramosetron after gynaecological surgery still experience PONV<sup>1,2</sup>. Small dose of naloxone added to morphine PCA decreased PONV without affecting analgesia<sup>3</sup>. Therefore, we investigated the antiemetic efficacy of combination of ramosetron and naloxone added to PCA compared with ramosetron alone in patients having gynaecological surgery.

**Materials and Methods:** A total of 80 nonsmoking women (ASA I or II) scheduled for elective gynaecological surgery under general anaesthesia. Anaesthesia was induced with propofol 2mg/kg and fentanyl 1 µg/kg, and rocuronium 0.8 mg/kg and was maintained with sevoflurane 2-3% and 50% nitrous oxide. At 30 minutes before end of surgery, ramosetron 0.3 mg was iv administered. Group RN (n=40) received PCA mixture of naloxone 1µg/ml and morphine 1 mg/ml. Group R (n=40) received PCA morphine 1 mg/ml. The PCA pump was programmed to deliver morphine 1mg per demand with a 5 min lockout interval and no basal infusion. PONV, use of rescue antiemetic, pain intensity and pruritus were assessed at 6 and 24 hours after surgery.

**Results and Discussion:** The incidence of PONV was significantly lower in RN group (35%) than R group (60%) during the first 24 hours after surgery ( $P < 0.05$ ). In addition, the use of rescue antiemetic (metoclopramide) was significantly lower in RN group (35%) than R group (18%) ( $P < 0.05$ ). There was no significant difference in the pain scores and pruritus between two groups.

**Conclusion(s):** Combination of ramosetron and naloxone added to PCA is more effective than ramosetron alone in preventing PONV following gynaecological surgery.

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### 1AP4-5

#### Incidence of PONV occurrence related to anesthesia and airway management in patients undergoing mastectomy

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**Background and Goal of Study:** Surgery for breast cancer has become a 1-day outpatient or short-term inpatient procedure. However, when postoperative nausea and vomiting (PONV) develop, abstinence from food and drink and bed rest are needed, which affect activities of daily living and quality of life.

Accordingly, it is important to select anesthetic management to avoid PONV. To clarify anesthesia and airway management procedures associated with avoidance of PONV, its frequency in accordance with anesthetic procedure (inhalational vs. intravenous) and airway management technic (endotracheal intubation vs. supraglottic airway mask) was retrospectively studied.

**Materials and Methods:** The present study was approved by the Clinical Research Ethics Committee of our hospital. We examined 319 adult patients who underwent a mastectomy under general anesthesia over a 3-year period. The subjects were divided into 4 groups according to the method used for maintaining anesthesia and airway management method. TIVA (propofol, remifentanyl) + endotracheal intubation (group 1, n=43), TIVA+supraglottic airway method (laryngeal mask airway: LMA proseal) (group 2, n=61), AOS (air, oxygen, sevoflurane) + endotracheal intubation (group 3, n=106), and AOS + LMA (group 4, n=99), then PONV frequency within 24 hours after surgery was investigated.

No antiemetic was used during surgery and no iv-PCA was given after surgery in all patients. For comparisons among the groups, a chi-square test was used.

**Results and Discussion:** PONV occurred in 3 (6.9%), 9 (14.8%), 27 (25.5%), and 28 (28.3%) patients in groups 1, 2, 3, and 4, respectively. The TIVA groups had a significantly lower frequency of PONV than the AOS groups (11.5% vs. 26.8%,  $p < 0.03$ ), while there was not a significant difference between the tracheal intubation and LMA groups (20.1% vs. 23.1%). In addition, there was no significant difference regarding perioperative dose of fentanyl among the 4 groups.

**Conclusion(s):** Our findings showed that anesthesia maintenance using TIVA avoids PONV incidence to a greater degree than that using AOS. This is the first known study of PONV incidence related to airway management, and our findings indicate that the incidence was the same in the tracheal intubation and LMA groups. We emphasized that TIVA using propofol is advisable for preventing PONV irrespective of the type of airway management employed.

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### 1AP4-6

#### The comparative study to evaluate the effect of palonosetron monotherapy versus palonosetron with dexamethasone combination therapy for prevention of postoperative nausea and vomiting

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**Background and Goal of Study:** It is usually accepted 5-hydroxytryptamine type 3 (5-HT<sub>3</sub>) receptor antagonists are effective and safe on postoperative nausea and vomiting (PONV). Palonosetron, the newest 5-HT<sub>3</sub> antagonist, has potent antiemetic property. We hypothesized that a combination of palonosetron and dexamethasone could more decrease PONV than palonosetron alone.

**Materials and Methods:** Patients scheduled to undergo laparoscopic gynecologic surgery, mastoidectomy with tympanoplasty and thyroidectomy under general anesthesia were randomized to receive 0.075 mg palonosetron + 4 mg dexamethasone (group C) or an equivalent volume of saline + 0.075 mg palonosetron (group P). Rhodes index, VAS score and complete remission were checked at 2 and 24 hours postoperatively.

**Results and Discussion:** We enrolled 84 female patients, with American society of anesthesiologists physical status 1 or 2 with at least 2 PONV risk factors. Both groups had a low incidence of nausea and vomiting. There were no difference between two groups in overall incidence of PONV (group C versus group P: 14.0% versus 9.8%).

**Conclusion(s):** The palonosetron monotherapy might be as effective as combination therapy of palonosetron and dexamethasone in patients with high emetogenic risk.

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**1AP4-7****Effectiveness of antiemetic prophylaxis with methylprednisolone, granisetron and their combination on postoperative nausea and vomiting following thyroid surgery**

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**Background and Goal of Study:** Patients undergoing thyroid and parathyroid surgery have a high risk for postoperative nausea and vomiting (PONV). We investigated the effect of methylprednisolone (M), granisetron (G) and their combination (MG) on PONV prophylaxis after thyroid surgery. The aim of the trial was to assess which antiemetic prophylaxis was the most effective in reducing the incidence of PONV in our department.

**Materials and Methods:** One hundred ninety five (195) patients scheduled for elective thyroid and parathyroid surgery were randomly allocated (n=65 in each group) to receive 40 mg methylprednisolone iv one hour before induction and 8 hours after skin closure (group M), granisetron 1mg iv at the end of surgery (group G) or combination of two drugs (group GM). Recruited patients were adult, euthyroid, with predicted risk for PONV >40% according to Apfel's score. They were operated under GA with standardized anesthetic technique (propofol for induction, and sevoflurane/N<sub>2</sub>O/opioid for maintenance) and after surgery transferred to PACU. Postoperative analgesia was achieved only by NSAIDs and not opioids. Patients were interviewed after surgery whether they had any early (0-2h), delayed (2-24h) or overall (0-24h) PONV to report. Side effects, pain and vocal function were assessed as well. Incidences of PONV were also compared with the incidence recorded in the cohort of patients operated in our department during last year without prophylaxis. (historical control, n=291).

**Results and Discussion:** A total of 192 patients were finally analyzed. Groups were comparable with regard to demographic and clinical data. The overall (0-24) PONV incidence was 40.6% in group M (26/64) vs. 14.3% in group G (9/63) [p=0.0018] and 13.8% in GM group (9/65)[p=0.0013]. There was no difference in the PONV rate between G and GM groups [p=0.86]. Compared to historical control where PONV incidence was 45% (131/291), only G and GM groups had significantly lower incidence [p< 0.0001]. Postoperative pain was comparable among three study groups while vocal function was better in M and GM groups [p< 0.001]. There were no serious drug adverse effects in none of the groups.

**Conclusion(s):** Granisetron is effective in PONV prophylaxis after thyroid surgery, and its combination with methylprednisolone is not superior to monotherapy. Monotherapy with methylprednisolone is not effective enough to justify its use as antiemetic.

**1AP5-1****Fasting blood glucose: is an independent risk factor for postoperative complications?**

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**Background and Goal of Study:** Hyperglycemia in patients with or without Diabetes Mellitus (DM) is a common finding in perioperative period<sup>1</sup>. There is evidence that stress induced hyperglycemia is related with increased perioperative morbimortality. The association between hyperglycemia and increased morbimortality is already known in specific medical situations, such as patients who suffered cerebral vascular accident, head trauma, myocardial infarction, or in severely ill patients in ICU. Despite the evidence, hyperglycemia is not included in the predictive indexes of cardiac risk or perioperative complications. The purpose of this study was to evaluate the significance of fasting blood glucose levels as a risk factor for postoperative complications.

**Materials and Methods:** This was a randomized retrospective study, based on analysis of 100 medical records of patients undergoing various surgical

procedures under general anesthesia. Analyzed independent factors were: age, gender, physical status (ASA), previous history of diabetes mellitus and serum fasting glucose. Patients were divided into three groups according with fasting blood glucose levels: Group A: < 100mg/dL, Group B: 100-125mg/dL e Group C: ≥126mg/dL. We evaluated the relationship between the variables described above and postoperative complications. Statistical analysis was performed using SPSS® 17.0. ANOVA and X<sup>2</sup> test were used for analysis.

**Results and Discussion:** Were considered valid for the sample 88 cases. Patient distribution showed that 68.2% were females and 31.8% males. Patient distribution according blood glucose levels was as follows: Group A (55.7%); Group B (31.8%), Group C (12.5%). The eight patients who had complications had an average of blood glucose levels of 151.13±22.58 mg/dL. Only one patient had no previous diagnosis of DM. ASA III patients had the highest number of postoperative complications.

**Conclusion(s):** The results of the present study, with the limitation of having analyzed data restricted to the period of hospitalization contained in medical records, suggest an association between fasting blood glucose ≥126 mg/dL, previous diagnosis of DM, the ASA and a higher incidence of postoperative morbidity. Identification of the glycaemic profile and the presence of associated comorbidities help guide the perioperative approach of patients, making it possible to create strategies to reduce the incidence of undesirable outcomes.

**References:**

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**1AP5-3****High sensitive troponin T as a prognostic tool of the perioperative mortality and for development of cardiac related adverse events after major abdominal surgery**

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**Background and Goal of Study:** Cardiac troponins have been used as potent prognostic and diagnostic tool in a variety of clinical scenarios. Therefore, it was the aim of the study to evaluate the value of the high sensitive troponin T (hsTnT) as a prognostic tool of the perioperative mortality and development of cardiac related adverse events after major abdominal surgery.

**Materials and Methods:** In this prospective, single centre observational study, 53 patients underwent major abdominal surgery were enrolled. Inclusion criteria were: age above 55 years and at least one cardiovascular risk factor. In-hospital mortality and the combination of cardiac related adverse events including: death, acute myocardial infarction, cardiac arrest, cardiopulmonary resuscitation and acute decompensated heart failure were pre-defined endpoints. High sensitive troponin T levels were measured with a newly introduced high sensitive assay with a LOD of 3 pg/ml, 99th percentile of 14 pg/ml and the 10% CV at 13 pg/ml. Blood was sampled within 4 days prior to surgery.

**Results and Discussion:** From total 53 patients were involved, 5 patients (9.43%) died and 18 (33.96%) patients experienced the combination of cardiac related adverse events. Preoperative levels of high sensitive troponin T were elevated in those patients who died as compared to those who survived (19.4 pg/ml vs. 7.9 pg/ml; p< 0.001). In the ROC curve analyses for the prediction of mortality an AUC for hsTnT of 0.813. Applying a cut-off value for hsTnT of 14 pg/ml those patients with elevated hsTnT had a mortality of 6.9% vs. 1.2% (p< 0.001). In a multivariate binary logistic regression analyses, including the variables Lee index, hsTnT, age, creatinine, BMI, haemoglobin, hsTnT was the strongest independent predictor for mortality (HR 4.5 (95% CI 1.6-11.9); p=0.01). Similar results were obtained for the combination of cardiac related adverse events.

**Conclusion(s):** High sensitive troponin T supplies strong prognostic information in patients undergoing major abdominal surgery compared to the widely established composite scoring systems and individual risk variables. Therefore, measurements of high sensitive troponin T for risk stratification prior to major abdominal surgery should be advocated.

**1AP5-4****Preoperative evaluation: how we do it, how should it be done.****Results from a nationwide online-survey**

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**Background and Goal of Study:** While assessing the medical history and physical examination are the cornerstones of preoperative risk evaluation, "routine" testing has been critically discussed in recent studies (1). 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, are the first comprehensive practice guidelines for preoperative evaluation in Germany (2). Aim of this study is to analyse former strategies for assessing perioperative risk at anaesthesia departments in Germany.

**Materials and Methods:** A 29-item-questionnaire concerning hospitals general characteristics, strategies for preoperative evaluation and cognizance of the joint recommendations was developed as an online-survey. In particular the reasons for technical assessment were surveyed. All hospitals with departments of anaesthesiology in Germany were polled. Data are presented as percentages.

**Results and Discussion:** A total of 396 hospitals (32.1%) completed the questionnaire. Physical examination is not performed regularly (37%), but instead when the medical history indicates the need for it. Criteria for performing preoperative electrocardiograms are comorbidities of the cardiovascular (80.1%) and the pulmonary system (42.2%), but also patients' age (52.8%) and as routine measures (10.1%). Laboratory testing was performed by routine (43.2%), because of the patients' age (52.8%) or pre-existing condition (37.3%). Preoperative chest x-ray was carried out when the medical history or the physical examination suggest intrathoracic pathologies (81.3%) or was based on patients' age (35.9%).

**Conclusion:** According to the joint recommendations, preoperative testing is more and more directed to patients with an increased perioperative risk which is clinically indicated by medical history and physical examination. However, routine or age-related medical testing is still a frequently-used strategy. German medical societies should focus on advanced implementation strategies to change current practices in order to avoid unnecessary diagnostic procedures and to increase patients' safety and satisfaction.

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## 1AP5-5

### Usefulness of routine chest X-ray in preoperative evaluation of patients undergoing non-cardiopulmonary surgery: a prospective observational study

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**Background and Goal of Study:** The use of chest radiography, along with the use of laboratory testing, has long been a part of preoperative evaluation of patients. Ideally, preoperative tests should be ordered after medical history and physical examination have been performed. However, standard preoperative procedure in our Institution, which is similar to most Croatian hospitals, is such that the surgeon provides the patient with a list of routine preoperative tests that are to be done preoperatively and refers the patient with results of these tests to the preoperative anesthetic Clinic for the preoperative assessment. Routine preoperative chest X-ray (CXR) are therefore commonly done for all patients in preoperative set of examinations, most often in the absence of any specific indication. The aim of this study is to discuss the practice of routinely ordering CXR before surgery and its usefulness in preoperative evaluation of the patients scheduled for elective, non-cardiopulmonary surgery.

**Materials and Methods:** In this study we included 865 patients who visited preoperative anesthetic Clinic before scheduled non-cardiopulmonary surgery. In addition to general clinical data we collected data on whether CXR screening was done before surgery and the impact of its finding on perioperative management in way to indicate further investigation, in-hospital referral to a specialist physician or postponement of surgery.

**Results and Discussion:** A total of 749 CXR was done. Routine preoperative CXR was not routinely performed in pregnant and children. Of these, 591 (78,91%) were normal, 142 (18,96%) had chronic changes and 10 (1,34%) had acute changes. Surgery was postponed in only 16 (2.1%) patients with an abnormal CXR because an anesthesiologist required additional investigation. Additional CXR was required by the anesthesiologist in four patients. Twelve patients were referred to pulmonologist, spirometry and arterial blood gas analysis. After additional review all of these 16 patients were scheduled for the primary surgery. ASA status was found to correlate with the finding of acute and or chronic changes, but did not correlate with the need for additional CXR examination.

**Conclusion:** In our study we confirmed that preoperative CXR did not significantly influenced preoperative management. If there is no sound history and clinical reason, we would not advise for requesting a routine preoperative CXR.

## 1AP5-6

### Cardiac events after vascular surgery: risk factors and the role of perioperative beta-blockers

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**Background:** Vascular surgery is associated with higher rates of morbidity and mortality. Postoperative events have been correlated with perioperative ischemia and perioperative beta-blockers have been shown to benefit these patients.<sup>1,2</sup> The aim of the study was to identify risk factors for cardiac events in patients undergoing vascular surgery, and the role of perioperative use of beta-blockers in postoperative outcome.

**Materials and Methods:** Prospective study conducted in the multidisciplinary Post-Anaesthesia Care Unit (PACU) with five intensive care beds. All adult patients submitted to vascular surgery were eligible to the study during a 10 months period. We recorded demographic data, perioperative variables including peri-operative beta-blocker treatment, perioperative major cardiac events (MCE) and mortality at 6 months follow-up. MCE were defined as myocardial infarction, pulmonary embolism, ventricular fibrillation, cardiac arrest and complete heart block. Simple and multiple logistic regression analysis were used to evaluate the determinants of cardiac events and for mortality at 6 months follow-up with calculation of Odds Ratio (OR) and its confidence interval 95% (95% CI).

**Results:** 139 adult patients were submitted to vascular surgery during the study period. The incidence of cardiac events was 11%. The mortality rate at 6 months was 9%. Univariate analysis identified as risk factors for cardiac events high risk surgery (OR 5.09 95%CI(1,54-16,87), p=0,008), ischemic heart disease (OR 5,24 95%CI(1,68-16,37), p=0,004). RCRI>2 (OR 3,17 95%CI (1,06-9,47), p=0,039) and troponin I at admission (OR 1957 95% CI(17-214114), p=0,002). Multivariate analyses identified troponin I(OR 1957 95% CI (17-214114), p=0,002) as an independent risk factor for MCE. Independent risk factors for mortality at 6 months follow-up were: amount of erythrocytes used during surgery (OR 1.82, 95%CI 1.30-2.56) and RCRI>2 (OR 16.75, 95%CI 3.39-82.79 p=0,039) The use of perioperative beta-blockers was not a protective factor either for MCE neither for mortality at 6 months.

**Conclusions:** Vascular surgery is associated with a high incidence of major cardiac events and mortality.<sup>1,2</sup> The identified risk factors for MCE were high-risk surgery, ischemic heart disease, RCRI and troponin I at admission. The use of peri-operative beta-blockers was not associated with any improvement on outcome.

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## 1AP5-7

### Patients with STOP-BANG score $\geq 3$ , in a surgical population

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**Background and Goal of Study:** The Obstructive Syndrome Apnea (OSA) has been described as a risk factor for post-operative adverse event. STOP-BANG score (snore; tired; observed apnea; arterial pressure; body mass index; age; neck circumference and gender) can predict the risk of a patient to have OSA, when that score is  $\geq 3$ . The aim of this study was to evaluate the incidence STOP-BANG score  $\geq 3$ , in surgical patients admitted in the Post-Anesthesia Care Unit (PACU).

**Materials and Methods:** Observational, prospective study conducted in a post-anaesthesia care unit (PACU) during three weeks (2011). The study population consisted in 357 adult patients after non cardiac and non-neurologic surgery. Patients' demographics, intraoperative and postoperative data were collected. We also recorded PACU and hospital length of stay (LOS). Patients' characteristics were compared using Mann-Whitney U test, t test for independent groups, chi-square or Fisher's exact test.

**Results and Discussion:** A total of 357 patients were admitted to de PACU and of these, 340 met the inclusion criteria. 179 (52%) had a STOP-BANG score  $\geq 3$ . These patients were older (62 vs. 49 years, p < 0.001), were more likely to be masculine (63% vs. 21%, p < 0.001), had higher BMI (28 kg.m<sup>2</sup> vs. 24 kg.m<sup>2</sup>, p < 0.001); had a higher ASA physical status (ASA III, IV or V 26% vs. 10%, p < 0.001); had an higher incidence of ischemic heart disease (10% vs. 2%, p=0.001), heart failure (8% vs. 3%, p=0.032), hypertension (62% vs. 19%, p < 0.001), hyperlipidemia (41% vs. 12%, p < 0.001) and underwent more frequently insulin treatment for diabetes (24% vs. 4%, p < 0.001). These patients had more frequently mild/moderated hypoxia in the PACU (9% vs. 3%, p=0.012) and had a higher incidence of residual neuromuscular blockade (NMB) (20% vs. 16%, p=0.035). Patients with STOP-BANG score  $\geq 3$  had a higher length of hospital stay (5 days vs. 3 days, p=0.01).

**Conclusion(s):** Patients with STOP-BANG score  $\geq 3$  had an important incidence among patients scheduled to surgery in our hospital. These patients had more co-morbidities and were more prone to have post-operative complications like residual NMB and respiratory events. They also had a longer hospital stay.

## 1AP5-8

### 'Food for Thought' closing the audit loop on perioperative fasting in adult and paediatric cancer patients

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**Background:** Pre-operative fasting has moved away from prolonged fasting to the encouragement of patients to keep well hydrated and nourished before surgery. It is well documented that prolonged fasting before surgery leads to patient dissatisfaction, thirst, hunger, anxiety and increased nausea and vomiting. The European Society of Anaesthesiologists are the first to provide Level 1A evidence of safety and benefits on the use of Pre-operative Carbohydrate loading<sup>1</sup> shown to reduce preoperative discomfort and insulin resistance post-operatively.<sup>2</sup>

Our audit served to reinforce the implementation of change, with the introduction of carbohydrate drinks in the largest cancer centre in the United Kingdom.

**Method:** After local Ethics approval, we performed the audit over a prospective period of three months in 2011. A fasting questionnaire was used to collect fasting times, and included what and who had given the information to the patient. Adults and children, in all cancer surgical specialities, were included.

**Results:** 108 randomised patient questionnaires (83 adult, 25 paediatric) were analysed against the proposed standard that is 100% of patients should be able to drink and eat up until 2 and 6 hours respectively. The mean starvation time was 14 h 6m, ranging from 6h 30m to 21h 50m, and mean dehydration time was 7h 29 m ranging from 2h to 19h.

One in five patients understood the importance of fasting and 23% of patients were given written information. A third of patients could distinguish 'clear fluids' and 40% had more than 400mls to drink before surgery.

**Conclusion:** Cancer can often leave patients malnourished, so our results were disappointing. We have since designed a preoperative, 10 step checklist<sup>1</sup>, enabling patients to feel empowered in their treatment pathway, emphasized by the Enhanced Recovery programme. The use of Carbohydrate drinks in the form of 'Pre-load' has also been introduced at our hospital.

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## 1AP5-9

### Prognostic value of hidden kidney disease in the postoperative period of major surgery

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**Background and Goal of Study:** Early detection of hidden kidney disease (HKD), is one of the measures to reduce progression to CKD and its consequences. We realized this study to assess the importance of the HKD in the perioperative period and its prognostic implications in the postoperative. We also analyzed the factors associated with HKD.

**Material and Methods:** Retrospective single-center study, including consecutively all surgical patients undergoing major surgery between 2007 and 2009 with further income in the resuscitation unit.

Statistic analyse of the data was realized using the SPSS program (version 17.0).

**Results and Discussion:** Data were collected from 433 patients. Mean age  $65.8 \pm 14.9$  years. 34.6% were women. Mean BMI was  $30.6 \pm 7.7$  kg/m<sup>2</sup>. 18% had diabetes mellitus, 51.3% hypertension and 18.5% had chronic kidney disease. 57.3% were ASA  $> 2$ . The mean plasma creatinine was  $1.1 \pm 0.6$  mg/dL and blood urea was  $52.8 \pm 37.7$  mg/dL. GFR was estimated before surgery by the Cockcroft-Gault with a mean of  $85.9 \pm 45.1$  and by MDRD-4 equation with a mean of  $83.4 \pm 35.7$ .

Of the 433 patients only 24 (5.6%) had HKD, defined as one subtype of renal failure according to the concept of  $GFR < 60$  ml/min/1.73m<sup>2</sup> but with normal plasma creatinine levels.

HKD patients had a higher age ( $71.6 \pm 10.8$  years vs.  $63.4 \pm 15.1$  years,

$p=0.009$ ), higher percentage of females (75.0% vs 32.8%,  $P < 0.001$ ) and higher percentage of hypertension (70.8% vs 47.2%,  $p=0.026$ ).

There were no significant differences in BMI ( $p=0.868$ ) or diabetes mellitus ( $p=0.290$ ).

The presence of HKD was associated with higher death rate in the first 30 days post-surgery (16.7% vs 4.9%,  $p=0.017$ ), but not in the follow-up (29.2% vs 23.6%,  $p=0.539$ ).

The HKD implied worse prognosis in the short term (OR for mortality at one month, 3.875, 95% CI 1.184 to 12.678,  $p=0.025$ ) but not in the medium term (HR for death during follow-up: 1.307, 95% CI: 0.631 to 2.964,  $p=0.478$ ).

After adjustment for potential confounding variables (female gender and BMI), as well as those variables that were associated with mortality at 30 days (age, diabetes, ASA  $\geq 3$ , urgent surgery and hemoglobin levels), we found that the presence of HKD was an independent predictor of poor postoperative outcome, increasing risk of death in the first month after surgery by 12.

**Conclusion:** HKD is an independent predictor of poor postoperative course and short-term mortality.

## 1AP5-10

### Preoperative carbohydrate administration prevents catabolism of fat and protein in patients undergoing elective laparoscopic colectomy: final report

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**Background:** Conventionally, before surgery, an intravenous solution not containing carbohydrates has been administered in patients. Recently, however, preoperative administration of carbohydrates such as glucose has been reported to prevent such clinical changes. Besides, the effects of preoperative fasting on patients, including an improvement of insulin resistance and effects of other nutrients on fat metabolism, have not been studied in detail. In the present study, we investigated the effects of preoperative carbohydrate administration (glucose load) on intraoperative and postoperative clinical conditions of patients.

**Methods:** 40 patients aged 20 years or older who were scheduled to undergo elective laparoscopic colectomy. ASA-PS 1 or 2 with no history of abnormal glucose tolerance. The glucose administration group (G group) and the control group (GF group). In the G group, 1500 mL of a maintenance solution containing 10% glucose (glucose load: 150 g) was administered from the day before surgery, and in the GF group 1500 mL of a glucose-free extracellular fluid replacement solution was administered in a similar manner.

**Results and Discussion:** Changes in blood glucose and HOMA-IR, an indicator of insulin resistance, were within normal range because patients with diabetes were excluded from the study, and preoperative glucose administration in patients with normal glucose metabolism did not affect insulin resistance. In addition, glucose administration that started before surgery suppressed the excess of fat catabolism. In contrast, administration of the solution not containing glucose during surgery enhanced fat catabolism. These findings indicate that glucose loading, even a small amount, may be necessary before and during surgery. Furthermore, administration of a glucose-free solution significantly affects fat metabolism before and during surgery. Glucose administration did not affect protein catabolism. Changes in blood glucose due to stress hormone were negligible. Although further studies on protein and fat administration and administration in patients suspected of abnormal glucose tolerance are necessary in the future, the results suggest the administration of carbohydrates such as glucose before and during surgery may be essential to maintain perioperative metabolism.

**Conclusion(s):** Preoperative Carbohydrate Administration Prevents Catabolism of Fat and Protein in Patients Undergoing Elective Laparoscopic Colectomy.

## 1AP5-11

### Relationship between the preoperative echocardiographic findings in patients submitted to bariatric surgery with the obesity surgery mortality score in the appearance of postoperative complications

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**Background and Goal of Study:** Patients with morbid obesity are associated with cardiovascular risk factors which imply a greater surgical risk, for that reason in many preoperative protocols the use of the echocardiography is



mandatory. The role of this test to be able to predict cardiovascular complications is on a continuous debate. The objective of this study was to ascertain whether the pathological results of test were correlated with the obesity surgery mortality risk score grade of surgical risk for gastric bypass. Furthermore if the factors that determine this risk imply a greater number of immediate or long term post operative cardiovascular and digestive complications.

**Materials and Methods:** Retrospectively, all patients that underwent bariatric surgery at our hospital from 2007 to June 2011, in total 203, were gathered. The patients were classified depending on mortality risk score grade proposed by American Heart Association: age 45 years, hypertension, male sex, body mass index higher than 50 and risk of pulmonary embolism. We then classified it on low surgical risk (A), those that had 0-1 factor, moderate (B), 2-3 factors or high risk (C) 4-5 factors. Complications were defined as early (before 6 months) and late (latter 6 months).

**Results and Discussion:** The average age was  $42.5 \pm 10.1$  years, IMC of 50,  $2 \pm 8.14$  kg / m<sup>2</sup>. 84 patients were classified in group A (41,6%), 98 in group B(48,5%) and 20 in C (9.9%). There were no cardiovascular complications in none of the three groups. Of the 202 patients, in 146 (71.9%) there were no pathological findings, and 56 (27.7%) lesser echocardiographic findings except a left ventricular ejection of 35% in one patient. In group A 13 pathological echocardiographic (15%) were registered, in group B 32 (32.7%) and in group C 11 (55%) (p=0,001). Digestive complications are described in the following table:

Time	Group A	Group B	Group C	P
<6 months	17 (20,2%)	25(25,5%)	7(35%)	P=0,354
>6 months	3(3,5%)	13(13,3%)	0(%)	P=0,021

**Conclusion(s):** In our studied population the findings in echocardiography didn't correlate with the appearance of cardiovascular complications, even do the worst group had more pathological findings. There was a trend to higher early digestive complications in the higher risk factors group. The results in the latter group of complications were no reliable due to the small sample of patients in the group.

## 1AP6-1

### A prospective quality assurance audit of critical incidents in anaesthesia over a 5 year period in a Singapore hospital

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**Background and Goal of Study:** This is a quality assurance audit which aims to improve future patient care by identifying and correcting preventable causes contributing to critical incidents in anaesthesia.

**Materials and Methods:** We collected information of the critical incidents over a 5 year period from 2006 to 2010. Critical incidents were reported anonymously using a standardized Anaesthesia Incident Monitoring Study (AIMS) form. This comprises of a descriptive narrative of the incident followed by a series of check boxes detailing the contributing and mitigating factors of the incident. This information was then analysed within the department. Corrective strategies were proposed and implemented after discussion at departmental quality assurance meetings.

**Results and Discussion:** A total of 165 critical incidents were reported in 159 patients in the 5 year period. 74% of critical incidents occurred in patients undergoing general anaesthesia. 41% during induction, 22% during maintenance and 9% during emergence from the anaesthetic. The majority of incidents (33%) were airway related, though equipment failure (25%), pharmacological (12%) and circuitry incidents(13%) contributed significantly as well. The majority of events (57%) did not result in any morbidity. 24% lead to minor morbidity while 2% contributed to major morbidity. Prolonged admission to the hospital was noted in 5% of patients while 10% had an unplanned intensive care admissions. 50% of such incidents were deemed preventable. 57% of all incidents were attributable to human factors, 16% to systemic factors and 11% to equipment malfunction. As a direct result of this study, the department has been able to better propose corrective strategies targeted at preventing future incidents. Among these strategies are quality assurance activities such as mortality and morbidity meetings as well as enforcing equipment discipline and additional training for its staff in an academic teaching hospital.

**Conclusions:** Anonymous critical incident reporting serves as a precursor to and allows for analysis and identification of root causes leading to clinical adverse events. Strategies to optimize patient care can be targeted at the primary factors identified which consist mainly of human and systemic workflow issues. Quality assurance activities remain the most cited preventive strategies for anaesthetic incidents.

## 1AP6-2

### Audit on outcome of major orthopaedic emergency surgery in elderly in Waterford Regional Hospital, Ireland

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**Background:** Emergency surgery in elderly is associated with higher morbidity and mortality than elective surgery. NCEPOD has in 1990 outlined recommendations and risk factors for emergency surgery in elderly but outcome remained poorer than expected. In 2001 morbidity and mortality after emergency surgery in patients >80 years were 51% and 7%, respectively. The aim of this audit was to determine 30-day outcome of elderly patients undergoing major emergency orthopaedic surgery Waterford Regional Hospital, Ireland.

**Materials and Methods:** We performed a prospective audit of patients aged 70 years or older undergoing urgent major orthopaedic surgery in our hospital from 19.9. - 25.10.11. Audit form was completed by senior anaesthetist on the day of surgery; and followed up during hospital stay and 1 month after the surgery. Patient data was stratified according to outcome (well, worse than baseline, died). Mean and SD were calculated and compared between patients who were well 1 month after surgery and the other two groups, using independent t-test. P < 0.05 was considered statistically significant.

**Results:** We collected data on 36 consecutive patients. 16 (44.5%) were worse after the surgery than their baseline before the incident that required surgery, 5 (13.9%) of patients died. All surgeries were done during daytime hours and 89% by a consultant. Median age was 82, 85 and 91 years in well, worse and dead patients, respectively. Average ASA score was 2.5, 2.7 (p=0.38) and 3 (p=0.01). Average value of urea, creatinine and INR were significantly higher in patients who died compared to patients who were well 1 month after surgery. There was no difference in Haemoglobin concentration. Average interval between admission and surgery was 1.2, 1.75 (p=0.19) and 2.4 days (p=0.048). Average duration of surgery was 70 min.

**Discussion and Conclusion(s):** Emergency surgery in elderly at our hospital was associated with higher mortality rates than reported in literature. Patients who died had a higher ASA score and were operated on later compared to patients who returned to their baseline health status 1 month after surgery. Poorer outcome may be due to lack of routine multidisciplinary team involvement and late anaesthetic preoperative assessment. On the other hand, our audit is small and may not represent the population adequately. Higher mortality may also be due to clustering and therefore an extended audit is planned.

## 1AP6-3

### Analysis of anesthesiological errors in malpractice claims

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**Background and Goal of Study:** The relative importance of the different factors that cause anesthesiological error is unknown. Malpractice claim file analysis may help to identify leading causes of anesthesiological errors and identify opportunities for prevention.

**Materials and Methods:** We retrospectively reviewed 313 anesthesiological malpractice claims from 3202 malpractice liability cases in which patients alleged error between 1996 and 2006. Specialist-reviewer examined the litigation file and medical record to determine whether and injury attributable to anesthesiological error had occurred and, if so, what factors contributed. Detailed descriptive information concerning etiology and outcome was recorded.

**Results and Discussion:** The reviewer identified anesthesiological errors that resulted in patient injury in 313 studied claims. Eighty percent of these cases involved minor or significant injury; 6% involved death. In most cases (43 %), errors occurred in operation/procedure care; 39 % in preoperative procedure care; 13 % in postoperative procedure care. Nine percent of the cases had errors occurring during multiple phases of care. In thirty-seven percent more than 1 clinician played a contributory role. Systems factors contributed to error in 90 % of cases. The leading system factors were error in judgment, failure of vigilance, memory and communication breakdown. There were no clear contributions to error from multiple personnel, lack of clear guidelines and errors in multiple phases of care. In addition technical error cases were more likely to have been caused by university hospitals than those without technical errors. On the other hand, they were less likely to have been caused by urgent procedure, lack of technical competence / knowledge, patient-related factors, abnormal anatomy, workload / inadequate staffing or judgment errors. There were significantly more problems caused by the numbers of personnel involved in university hospitals than in non-university hospitals. On the other hand, they were less likely to have been caused by lack of supervision in university hospitals than in non-university hospitals.

**Conclusion(s):** Systems factors play an crucial role in most anesthesiological errors, including technical errors and some non technical errors. Malpractice claims analysis could reveal the leading areas for intervening to reduce errors.

## 1AP6-4

### Self-reported allergies in surgical population in Serbia

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**Background and Goal of Study:** Information regarding drug allergies is inevitable part of every medical record. Since patients are exposed to a variety of drugs during perioperative period, history of drug hypersensitivity is of major concern in anesthetic practice. The aim of our survey was to assess the prevalence of self-reported drug allergies in adult surgical population in Serbia and to investigate to what degree it influences drug prescription during perioperative period.

**Materials and Methods:** A prospective study enrolled 1126 consecutive patients scheduled for elective general surgery. Patients were questioned by their anesthetist about whether they had any allergy to report. Anesthetists also had to complete a formatted questionnaire about the nature of previous allergic reactions, previous diagnostic work-up, and recorded patients' demographic and clinical data. Medical records were examined afterwards to obtain if prescribed drugs conflicted with those self-reported as allergies.

**Results and Discussion:** During study period 434 patients (38.5%) considered themselves allergic to a total of 635 drugs. Most frequently implicated drugs were: antibiotics(68.0%), NSAIDs(16.4%), iodine(3.9%), contrast medium(2.1%), ACE inhibitors(1.1%), atropine(0.7%) and latex (0.5%). Women (OR=4.3), patients from urban areas (1.8) and those regularly taking herbal medications (3.2) were significantly more likely to claim a drug allergy. Most common clinical manifestations were cutaneous(72%), respiratory(34%), cardiovascular(32%) and gastrointestinal (8%), being rather mild than severe. 36 patients (8.3%) reported previous anaphylactic reaction. Only 38 patients (8.7%) underwent further allergology investigation and in 18(4.1%) it was requested by the anesthetist prior to surgery. In most cases (96%), the suspected agent was completely avoided by patient and his health care providers after allergic reaction. Medical records revealed that 26(6.0%) patients were administered a drug to which they claimed to be allergic, with no adverse reactions. 82% of patients with reported allergy to penicillin (and 86% without,  $p > 0.05$ ) were given cephalosporins for antibacterial prophylaxis.

**Conclusion(s):** Self-reported drug allergies are highly prevalent and poorly investigated among surgical patients in Serbia. Thorough interview revealed that in majority of cases they were simple adverse drug reactions.

## 1AP6-5

### Acute kidney injury after living-donor hepatectomy according to AKIN criteria: experience of 939 donors in a single center

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**Background and Goal of Study:** Living-donor liver transplantation has increasingly gained attention worldwide and is greatly needed as a safe surgery. However, the low central venous pressure (CVP) anaesthetic technique has been strongly advocated to minimize hepatic venous bleeding during hepatectomy. We evaluated incidence of acute kidney injury (AKI) using recently developed Acute Kidney Injury Network (AKIN) criteria and risk factors associated with AKI after living donor hepatectomy.

**Materials and Methods:** Between 2004 and 2011, 939 living donors who underwent a hepatic resection were assessed retrospectively, with an institutional review board (IRB) approval, at Asan Medical center, Seoul, Korea. To achieve low-CVP anaesthesia during hepatectomy, furosemide was administered after the induction of sevoflurane (n=640) and desflurane (n=299) anaesthesia when CVP was  $> 8$  mmHg. Changes of serum creatinine were assessed during the first postoperative 48 h according to the AKIN criteria. The risk factors evaluated included age, sex, body mass index, anaesthetics, anaesthetic time, graft volume, administered fluid, administered furosemide, administered vasopressor, urine output, changes in hemoglobin level and CVP during hepatectomy. Univariate and multivariate logistic regression analysis was performed.

**Results and Discussion:** The overall incidence of AKI was 1% (9/939). The rates of AKI in sevoflurane and desflurane anaesthesia showed no significant difference (0.8% vs 1.3%,  $P=0.42$ ). Univariate analysis revealed that anaesthetic time ( $P=0.007$ ), administered fluid ( $P=0.087$ ) and furosemide dose ( $P=0.005$ ) were possible risk factors. On multivariate analysis, only anaesthetic time (OR=1.008, 95% CI=1.002-1.015,  $P=0.01$ ) and administered furo-

semide  $> 20$  mg (OR=11.1, 95% CI=2.0-60.4,  $P=0.01$ ) were independent risk factors of AKI after donor hepatectomy.

**Conclusion(s):** Based on AKIN criteria, AKI occurred in 1% of living hepatic donors and was associated with an anaesthetic time and furosemide administration. Our results suggest that special attention need to be paid to prevent AKI in donors having a longer anaesthetic time with increased dose of furosemide.

## 1AP6-7

### Preoperative renal disease and postoperative anemia

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**Background and Goals of Study:** One of the main functions of the kidney is the synthesis of erythropoietin. Because this, renal failure and anemia are associated with high frequency. The aim of this study was to analyze the relationship between preoperative renal dysfunction and postoperative anemia.

**Material and Methods:** Retrospective single-center study, including consecutively all surgical patients undergoing major surgery between 2007 and 2009 with further income in the resuscitation unit.

Statistic analyse of the data was realized using the SPSS program (version 17.0).

**Results and Discussion:** Data were collected from 433 patients. Mean age  $65.8 \pm 14.9$  years. 34.6% were women. Mean BMI was  $30.6 \pm 7.7$  kg/m<sup>2</sup>. 18% had diabetes mellitus, 51.3% hypertension and 18.5% had chronic kidney disease. 57.3% were ASA  $> 2$ . The mean plasma creatinine was  $1.1 \pm 0.6$  mg/dL and blood urea was  $52.8 \pm 37.7$  mg/dL. GFR was estimated before surgery by the Cockcroft-Gault with a mean of  $85.9 \pm 45.1$  and by MDRD-4 equation with a mean of  $83.4 \pm 35.7$ . Of the 433 patients included in the study, 169 (39.1%) had anemia before surgery, according to the WHO definition. 45.5% had anemia post-surgery, defined as a drop in hemoglobin  $> 3$  mg/dL.

Anemia prior to surgery was associated with increased mortality both short-term (OR 7.160, 95% CI: 3.203 to 16,005,  $p < 0.001$ ) and long term (HR 2.872, 95% CI: 1.839 to 4.484,  $p < 0.001$ ). However, anemia post-surgery was not associated with hospital mortality or during follow-up (log rank  $p=0.291$ ). Of the patients who had preoperative anemia, 33.1% had renal dysfunction ( $p < 0.001$ ). But there was no association between postoperative renal function and anemia ( $p=0.208$ ).

**Conclusion:** Preoperative renal dysfunction is associated with increased percentage of anemia before surgery, however it does not associate more anemia post-surgery.

These results demonstrate the association between renal failure and anemia and the relationship with a higher mortality.

## 1AP6-8

### The effect on peri-operative outcome of peribulbar block ropivacaine in conjunction with general anaesthesia versus general anaesthesia alone in patients undergoing retinal detachment surgery

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**Background and Goal of Study:** Retinal detachment surgery (RDS) is frequent associated with a high incidence of significant perioperative pain. It's also frequently associated with oculocardiac reflex (OCR) intraoperatively, as a result of traction on the extraocular muscles. General anaesthesia (GA) or regional anaesthesia (RA) either with retro or peribulbar blocks, are the usual methods of providing anaesthesia for RDS. The incidence of intraoperative OCR, hemodynamic stability, surgical bleeding interfering with the surgical field, postoperative pain and rescue analgesia requirements were recorded. The aim of this study was to evaluate the effect of peribulbar block (PB) when used in conjunction with GA on perioperative outcome after RDS versus GA alone.

**Materials and Methods:** We studied 88 patients (ASA I-IV) scheduled for RDS in this study. Exclusion criteria included age  $< 12$  years, the usual contraindications for eye RA, clotting abnormalities and impaired mental status. All operations were performed only by two experienced surgeons.

In the PB-GA group, 0,75% ropivacaine 3-4 ml was injected into the peribulbar space. The PB was performed in the operating room prior to the induction of GA under ASA standard monitoring. GA was induced with remifentanyl, propofol and rocuronium and LMA flexible was inserted. Maintenance of anaesthesia with a mixture of O<sub>2</sub>/air and sevoflurane.

**Results and Discussion:**

	PG-GA group (n = 53)	GA group (n = 35)
Age (years)	63 ± 14	64 ± 16
Sex (Male/Female)	27/26	23/12
ASA physical status (I/II/III/IV)	3(5,7%) /35(66%) /14(26,4%) /1(1,9%)	2(5,7%) /19(54,3%) /14(40%) /0(0%)

[Patient characteristics]

	PB-GA group (n=53)	GA group (n=35)
Duration of surgery (min)	108 ± 33	124 ± 46
Incidence of OCR (n)	4 (7.5%)	12 (34.3%)
Hemodynamic stability (n)	28 (52,8%)	16 (45,7%)
VNS > 4 in the 1st hour in UCPA (n)	3 (3,4%)	17 (19,3%)
Rescue medication (n)	19 (35,8%)	23 (65,7%)

[Surgery characteristics and perioperative events]

The use of PB plus GA was associated with a better hemodynamic stability, lower incidence of intraoperative OCR, provided more effective post-operative analgesia with lower opioid consumption and fewer patients requiring rescue analgesia medication. No cases of bleeding interfering with surgery in both groups. No complications or incidents occurred in either group.

**Conclusion(s):** In this study, PB plus GA was superior for RDS as this technique provided superior postanesthesia recovery improving postoperative analgesia and reduced the incidence and severity of OCR.

**1AP6-9****Mortality and quality of life after renal transplantation - a single center analysis**

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**Background and Goal of Study:** Renal transplantation (RT) is the treatment of choice for selected patients with end-stage renal disease.<sup>1</sup> Few studies examined the dependency of patients and how they perspective their own health changes after RT. Portugal is one of European countries where more RT are performed.

Our aim is to identify the incidence, risks factors of mortality and outcome 6 months after RT.

**Materials and Methods:** This prospective single center study was performed during 2010 in University Hospital of Coimbra, Portugal. Patient's demographic, intra and postoperative data were recorded. 6 months after discharge the Short Form-36 (SF-36) was applied and an assessment of dependency in Activities of Daily Living (ADL) was performed.

Statistical analysis was performed with SPSS (non parametric tests, Chi square test were used to compare groups, univariate analysis with multiple regression binary logistic with odds ratio (OR) were used to assess risks factors).

**Results and Discussion:** 83 patients, 60 (83.3%) males and 23 (27.7%) females were included in the study after RT. Mean age was 40±9.89. Mortality after 6 months was 6% (5). Ischemic heart disease (OR:7.3, 95%CI 1.3-41.4, p=0.024) and postoperative respiratory infection (OR:5.0, 95% CI 1.0-24.4, p=0.049) were considered risk factors of mortality after RT. At discharge 30% considered that their general level of health was better than before dialysis; Six months after RT, 75% considered their health better than the beginning of chronic renal disease.

Six months after RT patients had similar scores for SF-36 domains except social function (70.9±26.1 versus 59.5±27.5, p=0.035) compared with discharge scores.

After this time the patient were more independent in ADL than previously.

**Conclusion(s):** The risk factors of mortality after RT were ischemic heart disease and nosocomial pneumonia. After the transplantation the patients had similar scores for SF-36 domains except social function but were more independent in ADL than before.

**References:**

1. Suthantiran M, Strom TB. Renal transplantation. *N Engl J Med* 1994; 331:365

**1AP6-10****A retrospective review of anaesthetic practice and surgical intervention in carotid endarterectomy over 2 years in a tertiary London teaching hospital**

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**Background:** Carotid endarterectomy (CEA) is a preventive surgical treatment to reduce the incidence of stroke. However, the best and safest anaesthetic technique (A) for this procedure has not yet been established.

**Goal:** To review our current anaesthetic practices in King's College Hospital, London.

**Methods:** Retrospective analysis of 144 patients over a 2-year period (2010-11). We collected the following data:

- 1) Demographics
- 2) A either general anaesthetic (GA) or regional anaesthetic (RA)
- 3) Cerebral oximetry (rSO<sub>2</sub>) changes
- 4) Shunt insertions
- 5) Conversion from RA to GA

**Results and discussions:****Demographics**

144 patients, 95 (66%) were men and 49 (34%) were females. Mean age was 71.6 years (41-88).

A

Of the 144 CEA done, 118 (81.9%) were done under RA, 18 (12.5%) under GA and 8 (5.6%) had both GA and RA. Different types of RA were performed, the commonest one being superficial cervical plexus block (SCP) (table 1). Of all the 118 cases done under RA, 97 (82.2%) of them received sedation. RA was converted to GA in 8 cases (6.8%). All due to patient not coping with the long duration of surgery.

RA Type	Number of Patients	Percentage of Patients (%)
SCP	92	73
CCP	22	17.5
Infiltration	12	9.5

[Table 1]

**rSO<sub>2</sub> readings**

rSO<sub>2</sub> was monitored in 98 (68%) of the cases. It was not monitored in 40 cases and in 6 it was unknown if it was used. In 14 (9.7%) patients, the rSO<sub>2</sub> dropped more than 20% from pre-induction baseline readings on clamping. 9 shunts (6.25%) were inserted out of the 144 cases studied. There was 1 case of stroke intraoperatively.

Complications	Percentage (%)
Conversion to GA	6.8
Drops in rSO <sub>2</sub>	9.7
Stroke	0.7
Death	0

[Complications]

**Conclusions:**

1. Regional anaesthesia is the most common anaesthetic technique for carotid endarterectomy in our centre.
2. SCP is the preferred type of RA for this procedure
3. We recommend the standard use of rSO<sub>2</sub> monitoring in order to detect intraoperative events.

**References:**

1. Rerkasem K, et al: Local versus general anaesthesia for carotid endarterectomy. *Cochrane Database of Systematic Reviews* 2008, Issue 4.
2. GALA Trial Collaborative Group. General anaesthesia versus local anaesthesia for carotid surgery (GALA): a multicentre, randomised controlled trial. *Lancet* 2008;372:2132-42

**1AP6-11****Does the anaesthetic procedure depend on experience? A revised approach to the choice of airway management method in general anaesthesia**

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**Introduction/Aim of Study:** Experience seems to be a decisive factor in the choice of the anaesthetic approach. In order to assess this thesis we performed a retrospective analysis of the use of laryngeal mask airways and endotracheal tubes in breast cancer surgery by anaesthesiologists with short

experience (under 6 years /residents/) and specialists in anaesthesiology.

**Materials and Methods:** A retrospective chart review study was conducted on 2334 ASA II-IV patients (23 men, 2311 women aged 21-86 years,) who underwent breast cancer surgery at the same department between January 2010 and November 2011. All patients underwent general anaesthesia: with i.v. atropine, followed by propofol, fentanyl and rocuronium for induction and sevoflurane for maintenance. The assignment of doctors to patients was random. Patients' case histories were unknown during the preparation of the operation schedule, and thus they did not determine the choice of procedure. In view of the initial results we conducted an anonymous poll among specialists in anaesthesiology in order to identify the motives behind their choice.

**Results/Discussions:** 22.19% (518/2334) of all cases were conducted by specialists and 77.81% (1816/2334) by residents. Doctors with short professional experience used the LMA in 35.19% (639/1816) cases and the ETT in 64.81% (1177/1816). Specialists used the LMA in 17.57% (91/518) cases and the ETT in 82.43% (427/518) cases. The differences were statistically significant ( $p < 0.001$ ).

In an anonymous poll only 4/11 (36.3%) of specialists would use the LMA as a first choice method of airway management in a hypothetical simple mastectomy of a young, uncompromised ASA I woman.

**Conclusions:**

1. Residents use more modern airway management techniques twice as often as specialists.
2. Specialists tend to choose the ETT because of their habits or their anxiety about the maintenance effective ventilation.
3. The study should be continued in order to identify the rationale behind the observed differences between the age groups, to analyse the patients' quality of life according to each procedure and to expand the investigation onto other fields of anaesthetic activity.

## 1AP7-1

### Enhancing the safety, quality and productivity of perioperative care: a National Institute for Health Research and Cochrane Collaboration Programme Grant

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**Background and Goal of Study:** Patient safety is paramount within anaesthesia. It has been estimated that two thirds of all hospital inpatients receive care from anaesthetists during their stay. Research findings within this specialty will therefore have a widespread influence on practice across different specialties. Based at the Lancaster Patient Safety Research Unit and working in collaboration with the Anaesthesia Review Group of The Cochrane Collaboration, this programme grant aims to

- identify important clinical questions in perioperative care where there is uncertainty about best practice
- summarise the available evidence
- disseminate results to clinicians and health policy-makers
- highlight topics where further research is needed
- build research capacity in the health service

**Materials and Methods:** To maximise cross-fertilisation between research and practice, we have diverse local and national inputs into the selection of systematic review topics and plan for widespread dissemination of results.

Topics have been contributed by local clinicians and specialist registrars across the UK. Three registrars are now involved in planning and carrying out their suggested reviews. Close synergy with the Lancaster Patient Safety Research Unit and use of national data on errors will inform our choice of new review questions. Our results, particularly when we highlight an adequate evidence base, may help prioritise the research agenda both locally and for national funders. We are developing a patient forum in the local area to suggest topics relevant to patients, comment on results, assist with reviews and help with dissemination. In addition to the core staff of 1.5 FTE systematic reviewers and the investigators, clinicians will contribute as mentors or carrying out reviews.

**Examples of topics:**

- Safety: *Perioperative temperature monitoring for prevention of perioperative hypothermia;*
- Quality: *Anaesthetic techniques for the frail elderly*
- Productivity: *Nurse-led versus physician-led preoperative assessment*

**Progress:** We have secured £420,000 of funding over three years from the UK National Institute for Health Research. Work commenced in August 2011. To date we have 4 new protocols submitted, 1 protocol in preparation, 3 titles submitted and 3 titles under scoping. 2 updates to existing Cochrane titles have been agreed.

## 1AP7-2

### Trainee quality improvement projects: a new paradigm in geographical and temporal integration with the rotating anaesthetic trainee as the core element

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**Background and Goal of Study:** Trainees in anaesthesia participate in audit, for educational purposes as well as to effect improvements in patient care. However, these audits are often of poor quality, as trainees seldom stay in the same hospital for long enough to allow meaningful projects to come to fruition. Projects are rushed, have too little data, and audit cycles remain incomplete. The trainee then moves on to a new hospital and the pattern is repeated. However, this need not be the case. We believe that the pool of rotating anaesthesia trainees is an untapped resource, and we have made an attempt to utilise this resource within our region.

**Materials and Methods:** We have constituted a network of trainees to facilitate geographical and temporal integration of quality improvement projects. The idea is simple: any participating trainee's audit project at a hospital will be maintained by the group, irrespective of where the initiating trainee is currently located. This means that projects are no longer time-limited. Furthermore, trainees throughout the region can rapidly expand successful projects to neighbouring hospitals, giving a larger pool of data and acting as a force multiplier for quality improvement. Indeed, it could be argued that rotating trainees are the ideal medium for transplanting successful quality improvement projects from one hospital to another. This is a win-win situation for the trainee: they can demonstrate involvement in a number of projects, and will be the audit lead for at least one large project, with the same amount of effort expended as previously.

**Results and Discussion:** The project has had some success. We have conducted a region-wide audit of maternal consent in labour, and of emergency laparotomies. We have also created a standard for emergency transfer equipment throughout the region.

Crucially, this entire project is cost-neutral. There is no requirement for additional administrative time or resources, as would be the case were this a traditional model of quality improvement. The project is administered, conducted and led by the trainees themselves.

**Conclusion:** We feel that, by realising the potential of anaesthetic trainees, it is possible to effect a significant positive change in the quality improvement cycle, without a corollary increase in cost.

**Acknowledgements:** We would like to acknowledge the support of Professor John Kinsella in the creation of this project.

## 1AP7-3

### Intrathecal morphine after thoracoabdominal oesophagectomy: a retrospective audit of survival rate and side effects in 81 patients

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**Background:** Oesophageal cancer is the 6<sup>th</sup> leading cause of cancer related mortality worldwide<sup>1</sup>. In Europe, Ireland has one of the highest rates of Oesophageal cancer<sup>1</sup>. Thoracoabdominal oesophagectomy is a major surgical procedure that carries significant postoperative morbidity and mortality<sup>2</sup>. The choice of analgesic technique may influence outcome thus we investigated the impact and outcome of using intrathecal morphine in esophagectomy patients.

**Methods:** Retrospective data collection of clinical parameters post oesophagectomy from 2006 to 2007 inclusive. Two groups of patients were included in this study; patients receiving both pre-operative epidural and intrathecal morphine analgesia (51) versus patients receiving pre-operative epidural analgesia alone (30). Postoperative complications such as increased oxygen requirements, use of noradrenaline and renal dysfunction were recorded on day 0, -1, -2, and 3; and 6 month, 1 and 5- year survival rates were compared in both groups.

**Results:** Noradrenaline requirements were significantly higher in the morphine group- on day 0, 1 & 2 (Day 0:p=0.001, Day 1:p=0.001, Day 2 :p=0.009). There was no significant increase in serum creatinine level except on day 2 post-operative day (p=0.028) and no significant increase in FiO<sub>2</sub> requirement. Survival rate at 6 months was 93% in the non morphine group v 84% in morphine group (p = 0.23), at 1- year was 83% in non morphine group v 69% in morphine group (p= 0.14). Overall 5- year survival rate were 23-57%

in the non morphine group and 35-47% in the morphine group.

**Conclusion:** The use of intrathecal morphine was associated with significant increase in noradrenaline requirement, no significant increase in serum creatinine level except on day 2 post-op., no significant increase in FIO<sub>2</sub> requirement and no significant difference in survival rate between groups. Further prospective, powered studies should be considered to evaluate the major side effects after intrathecal morphine use and acute pain scores and chronic pain development in morphine versus non morphine groups.

**References:**

- 1- Reynolds et al. Modern Oncological and Operative Outcomes for oesophageal cancer treated with curative intent- 5 year experience of 310 patients in a high volume oesophageal centre (March 2010)
- 2- Rudin A et al., Journal of Cardiothoracic and Vascular Anesthesia, Volume 19, Issue 4, August 2005, Page 563

**1AP7-4**

**Implications of increased operation capacity at three surgical departments in a maximum medical care provider**

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**Background and Goal of Study:** Provision of adequate health care can require an extension in various sectors of patient care. In the process a major objective is an economic reasonable utilisation of available resources. An expansion of operative capacity is inter alia dependent on an efficient and dynamic anaesthesia department and it directly puts pressure on its logistics. This study describes the impacts of an increase of 50% in operation capacity at a surgical department of our hospital.

**Materials and Methods:** The number of cases (CN), overall perioperative time (PT), operation time as cumulative incision-to-suture time (OT), median incision-to-suture time (mIST) and anaesthesia time (AT) were surveyed in years 2009 and 2010. Data were collected for the department of neurosurgery. Mann-Whitney-Test was applied to detect statistical significant differences in PM, OM and AM between 2009 and 2010.

**Results and Discussion:** Table A shows CN, PM, OM, mIST and AM for neurosurgical department in both years with percentage increase. Statistical testing revealed significant higher values in 2010 for NS and OS (p=0.05) but not for VS.

	2009	2010	Change
Case number [n]	1885	2212	+ 17%
PT [min]	310664	415649*	+ 34%
OT [min]	225432	303726*	+ 35%
mIST [min]	101	120	+ 19%
AT [min]	34948	43001*	+ 23%

[Table A: Neurosurgical Department (\*p<0,05)]

Increasing operative capacity could aptly be depicted by a raise in CN, PT, OT and AT. Longer mIST most likely resulted from an extended operative spectrum including more complex cases. Thus an increased AT is caused by a higher CN going along with a longer induction and preparation period per case. Increased AM and PM may have severe impacts on anaesthesia human resources planning and logistics, which should be pre-conceived. From an economic point of view expansion should occur in consideration of a future demand for operation capacity [1]. Furthermore the proportions of emergency and ICU patients are known to affect efficiency as well as cost structure [2].

**Conclusions:** In this study, increasing CN, PT and AT illustrate the particular challenge for an anaesthesia department posed by extended operative capacity. These data can be a basic concept for further analysis.

**References:**

- 1. Anesth Analg 2005;100:1425-32
- 2. Anesth Analg 2008;106:215-26

**1AP7-5**

**Occupational exposure to anaesthetic gases: risk perception and reported practices by anaesthesiologists and nurse anaesthetists**

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**Background and Goal of Study:** Nitrous oxide and halogenated agents are commonly used for anaesthesia induction and maintenance. Chronic exposure to these inhaled anaesthetics is one of the occupational hazard related to the practice of anaesthesia. The goal of this survey was to assess the risk perception and reported practices by anaesthesiologists and nurse anaesthetists.

**Materials and Methods:** We carried out a single centre survey in a University Teaching Hospital using a multiple-choice questionnaire sent to all anaesthesiology workers.

**Results and Discussion:** Eighty-three anaesthesiologists and 71 nurse-anaesthetists answered. Response rates were 54% and 40% respectively. Halogenated gases are often if not always used for anaesthesia maintenance by 99%. On the other hand, 54% never use nitrous oxide. Seventy-six percent feel exposed to inhaled anaesthetics. Fifty-four percent of nurse anaesthetists and 19% of anaesthesiologists are therefore worried about their health (p<0,001), without any significant difference between men (32%) and women (38%). They consider that occupational exposure has consequences on pregnancy (72%), liver function (62%), renal function (50%), and is carcinogen (10%). They feel symptoms like tiredness (48%), headache (47%), nausea (8%), irritability (6%) or memory disorders (5%) and impute them to this exposure. Eighty-one percent claim they attempt to reduce their exposure level. However 53% don't systematically use circle breathing system for inhalational induction. Sixty-eight percent sometimes or often administrate anaesthetic gases without airway control device, and 23% use them outside of operating rooms. Ten percent use fresh gas flow upper than 2l/min during anaesthesia maintenance.

Health risks associated with exposure to anaesthetic vapours are controversial. The only evidences concern increased frequency of spontaneous abortion in women exposed to high level of nitrous oxide. Operating room ventilation associated with active scavenging systems enable to sustain occupational exposure below recommended threshold values. A rigorous anaesthetic procedure that avoids inadvertent release of gases into the room also contributes to reduce exposure level.

**Conclusion:** In our study, anaesthetic workers may overestimate risks and symptoms associated with their exposure to waste anaesthetic gases. However they don't systematically apply simple measures that could significantly reduce operating room pollution.

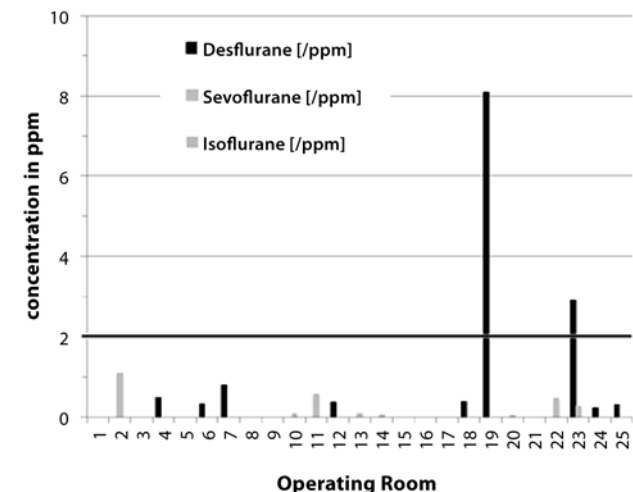
**1AP7-6**

**Exposure of anesthesiologists to halogenated anesthetic vapors in the operating room air**

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**Background and Goal of Study:** Operating room (OR) personnel is regularly exposed to halogenated anesthetic vapors. At present the short and long term effects are discussed controversially. Nevertheless, standards for exposure, measurement, monitoring, scavenging, and work place practices are defined in the US and EU, while work practices in Canada are less defined. The main goal of this initiative was to quantify concentrations of halogenated anesthetic vapors in the operating room air to possibly improve the workplace safety of OR personnel.

**Materials and Methods:** Twenty-five monitoring badges (Assay Technology, Livermore, CA, USA) were worn on the collar of OR personnel (anaesthesiologists, perfusionists) during normal clinical activity in 25 operating rooms at the QE II Health Center in Halifax, NS, Canada. The analysis was performed by Galson Laboratories (East Syracuse, NY, USA, accredited by the American Industrial Hygiene Association) for concentrations of Sevo, Iso and Desflurane. The operating rooms were monitored for airflow rate, temperature and humidity.



[Concentration of Halogenated Anesthetic Vapors]

**Results and Discussion:** Twenty-three of 25 badges showed results below the defined US standard of 2ppm. Specifically, the concentration of desflurane was found to exceed the US standard in two separate ORs.

**Conclusion(s):** The monitored modern operating room ventilation systems keep the concentration of halogenated anesthetic vapors in the room air below the threshold defined in the US standards. Depending on the type of procedure, the arrangement of operating room equipment and the used setup (e.g. vapors on the cardiopulmonary bypass) the concentration might exceed the above mentioned threshold.

## 1AP7-7

### Performance indicators in the management of anesthesia services

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**Background:** Operating theater has a major impact on the performance of hospitals, so managerial aspects are increasingly important in order to make the best use of available resources and ensure appropriate care for patients. Variability in surgical procedure times increases the cost of healthcare delivery by increasing both the underutilization and overutilization of resources. Performance indicators are essential in the management of the surgical facilities.

**Purpose:** Hospital Universitario La Paz is a national referral center which is undergoing important initiatives in the anesthesia department in order to make the provision of care more clinically and cost effective. The main goal is to minimize the rate of cancellations on the day of planned surgery.

**Method:** We have reviewed the recorded information concerning planned surgical procedures from April to October 2010 and 2011 (over 24000 cases). As a result we have performed a descriptive study using a set of performance indicators for the surgical area to monitor the impact of the introduction of an information system(IS) designed to improve the management of the operating room (OR).

**Results and Discussion:** The impact of introducing an IS on accomplishing with the planned care of patients is evaluated. After six months of the implementation of the IS the data shows a decrease in the cancellation rate from 4,32% to 3,65% and an increase in OR utilization that correlates with overutilization in terms of time.

The number of deferred, refused or cancelled patients may evaluate quality of planning. Operating room utilization can have a major impact on hospital professionals and finances as well as operating room management.

Indicators are valuable tools for identifying variation in the performance and play an important role in management of OR. Higher quality information and more timely information lead to improved decision-making.

**Conclusions:** Scheduling of surgery is a problem in every hospital. Coordinating the members of the team and ensure that there is adequate staff and space for each procedure is essential. Low cancellation rate is a good indicator of quality whereas overtime is an indicator of poor coordination.

The indicators based on achieving a low cancellation rate and a high occupancy rate has limitations. OR efficiency could be improved by reducing overutilization; moreover "zero tolerance for overtime" increases surgical per case costs. It is more cost effective to proceed than to postpone surgery.

## 1AP7-8

### Improving the cost-effectiveness of volatile anaesthesia - agent choice or fresh gas flow?

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**Background and Goal of Study:** NHS Greater Glasgow and Clyde spends approximately £600,000 pa on volatile anaesthetic agents. Low fresh gas flow settings (FGF) are an easy way to improve cost-effectiveness and save a considerable amount of money with no impact on clinical care. As part of a health board wide drive to reduce costs, we conducted an audit of FGF settings in our hospital.

**Materials and Methods:** The audit was conducted over 5 days in a large district general hospital. Data collected included: volatile agent used and FGF settings at 10 and 30 min post-induction. To minimise bias, anaesthetic nurses collected the data. We then conducted a paper-based survey of all anaesthetists in our department to ascertain the volatile agents most commonly used and the reasons for this choice.

**Results and Discussion:** 60 cases were included in the audit. Every case used either a mix of O<sub>2</sub>/N<sub>2</sub>O/volatile or O<sub>2</sub>/Air/volatile. Mean FGF at 10 and 30 minutes (Table 1). Volatile agents used were: Sevoflurane 78.3%; Desflurane 15%; Isoflurane 6.7%.

	FGF at 10 min (lmin-1) Mean (range)	FGF at 30 min (lmin-1) Mean (range)
O2	1.1 (0.4-4)	0.9 (0.4-5)
Air	1.0 (0.25-2)	0.9 (0.3-2)
N2O	1.0 (0.4-3.2)	0.9 (0.3-3)

[Table 1 - FGF Settings]

The survey was conducted among 42 anaesthetists, with a response rate of 72% (30/42 replies). Volatile agents most commonly used were: Sevoflurane 80.0%; Desflurane 13.3%; Isoflurane 6.7%.

Reason cited	Number of anaesthetists
Easily available/lack of other agent	9
Familiarity with agent	9
Non-irritant	6
Good recovery profile	5
Low cost	4
Cardiovascular stability	2

[Table 2 - Common reasons for using sevoflurane]

The audit shows that mean FGF in our hospital is  $\leq 2$  lmin<sup>-1</sup>, with Sevoflurane being the most commonly used agent. There is potential to further reduce FGF to  $\leq 1$  lmin<sup>-1</sup>. The cost to the health board of each agent per bottle is: Sevoflurane £86.00; Desflurane £61.41; Isoflurane £9.30. Sevoflurane is present on every anaesthetic machine in our hospital. Increasing the use of Isoflurane as an alternative agent therefore has the potential to save a significant amount of money.

**Conclusion:** Reducing FGF settings in our hospital still has some potential to reduce costs. However, greater savings may be made by choosing a cheaper volatile agent for appropriate cases.

## 1AP7-9

### Providing anaesthesia: what makes it more complicated?

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**Background and Goal of Study:** Patient risk may be increased by unanticipated events that complex anaesthesia. The aim of the study is to identify whether anaesthetic complexity(AC) correlates with ASA score and/or complexity of surgery.

**Materials and Methods:** Anesthesiologists of our department were asked to rate AC after each surgical procedure according to an ordinal scale.

-1	Easier than routine
0	Equivalent to routine
1	Slightly more complex
2	Moderately more complex
3	Markedly more complex

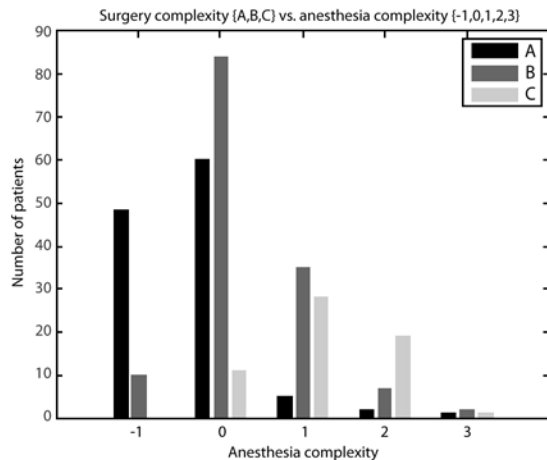
[Scoring of Anesthetic Complexity]

When AC >0 was declared they were asked to justify it. ASA scores were calculated by the same anesthesiologist. Complexity of surgery was estimated according to a previously published graduation.

OPERATION	
TYPE A	surgical procedures without opening of the abdominal cavity (eg hernia repair, thyroid surgery)
TYPE B	abdominal procedures except liver surgery and major surgery in the retroperitoneum (eg stomach, small bowel and colon surgery)
TYPE C	liver surgery, operations on the esophagus pancreas, rectum and retroperitoneum

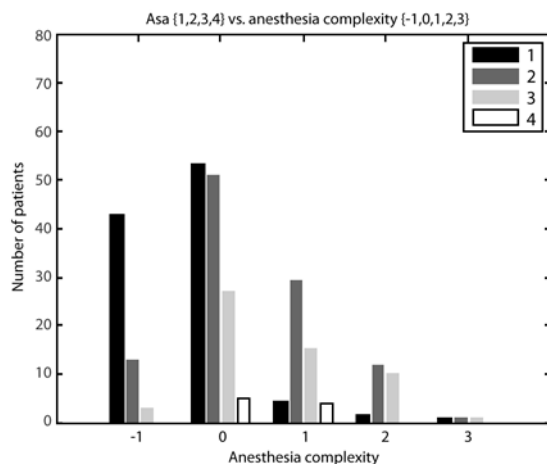
[Table 2 - Complexity of Surgical Procedure]

**Results and Discussion:** 314 cases were included in the study. The more complex the surgical procedure was, the more complicated the management of anaesthesia became.



[Figure 1]

None anesthesiologist found "easier than routine" delivering anesthesia for operations Type C. Furthermore, as the ASA score deteriorates, AC increases



[Figure 2]

For few ASA1 patients anesthesia was more complicated than routine due to technical aspects.

**Conclusion:** Both complexity of surgery and ASA score have an impact on AC.

### 1AP7-10

#### OR capacity increase may reduce the probability of unscheduled overtime for anesthesia department

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**Background and Goal of Study:** Anesthesia time (AT) is a scarce resource, a work-life balance is an important factor in the competition for anesthetists. The most accurate predictability of working hours plays a major role in the attractiveness of an employer for anesthetists. In contrast, university hospitals supply an above-average number of emergencies and perform complex operations with variable length, making precise planning difficult. We have investigated whether an increase in surgical capacity affects the probability of unscheduled overtime. Therefore, we analyzed data from a neurosurgical university department. The hospital increased its capacity for the neurosurgical clinic from two operating rooms (OR) in 2009 to three OR in 2010.

**Materials and Methods:** For both years, the anesthesia minutes (AM) within regular working hours, the AM outside of regular working hours (RWH) and the AM on Saturdays and Sundays have been analyzed. The analysis was performed using SPSS 19.

**Results and Discussion:** By the mentioned capacity expansion of neurosurgical clinic an overall significant increase in AM by 33 % could be achieved from 2009 to 2010. The AM within RWH have increased significantly by 40 %; the AM outside of RWH during weekdays have increased not significantly by 16 %. However, AM on Saturdays and Sundays have declined significantly

by more than 7 %. In 2009, 31 % of AM were outside of RWH and 69 % were within. In 2010 there were 27 % of AM outside of RWH and 73 % within.

The expansion of OR capacity led to an increase of total AT which required more anesthesiologists during RWH. AT outside RWH hours did not drop significantly during the week. Reasons could be that the attitude of the neurosurgical clinic to schedule as much patients as possible did not change. Along with capacity expansion new surgical techniques could be introduced and lead to an increase in patients acquisition and perioperative time. Working time on weekends decreased significantly. Reason could be that during the week there was more capacity available and there was no need to postpone "semi-emergencies" to the weekend.

**Conclusion:** In our study surgical capacity expansion has required more anesthesiologists within RWH. There was a significant trend to reduced AT on weekends whereas during the week AT outside regular hours did not drop.

### 1AP7-11

#### How do we use sugammadex? The experience in a central hospital

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**Background and Goal of Study:** Sugammadex (S) was introduced in our department in 2010, a protocol was established and each administration has been justified by the anaesthesiologist. Published data suggests its safe and well tolerated use, however, efficiency and side effects incidence are lacking due to insufficient reports. This study reflects our experience with S; our purpose was to improve safety practices by sharing this data with our colleagues.

**Materials and Methods:** Data was collected using all form reports of the use of S, from June 2010 to April 2011. We analysed these variables: patient gender, clinical situation justification to S use, dose and complications.

**Results and Discussion:** 210 forms completely reviewed. About 45% were female. Half of S administrations were General Surgery cases, 13% Otorhinolaryngology, 11% Vascular Surgery, 6% Urology and 5% Neurosurgery. Ambulatory procedures represent 1% of the cases.

In 70% of the situations the use of S was related to patient comorbidities: cardiovascular (24%), respiratory disorders (10.5%), obesity (13.3%) or both. Residual neuromuscular block mentioned in 6%. One "Can't intubate, can't ventilate" (CICV) scenario reported. The need to maintain deep neuromuscular block or unexpected ending of the surgical procedure and the need to support operating room efficiency, led to the administration of S in 30% of reported cases (without any morbimortality). Average administered dose was 200 mg/patient. Self-limited supraventricular extrasystoles in one case (reported to INFARME-Drug and Health Products National Authority) that, according to Probability Rates defined by WHO, classified it as "possible". No other morbimortality reported. The main purpose of its use has been the prevention of hazardous hemodynamic and respiratory changes after decarization, the reversal of deep neuromuscular blocks or life-threatening situations such as the CICV scenario.

**Conclusion(s):** Since its introduction in our department, S has confirmed its efficacy and safety. It showed his efficacy in CICV situations without adverse events. A single self-limited cardiac abnormal rhythm was observed, but a straight correlation with drug's administration was not established by the competent authority. We want to point out the opportunity of efficiency of the operating rooms due to S utilization without interfering with patients' safety.

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### 1AP8-1

#### The evolution of regional anaesthesia practice in a general hospital with a regional hand centre

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**Background and Goal of Study:** Regional anaesthesia is becoming more popular since the introduction of ultrasound (U/S) guided block techniques in our hospital in 2006. Indeed, some surgeons are expressing an interest in using ultrasound for wrist blocks as outpatients. This survey hopes to establish the impact on regional block practice among anaesthetists in our hospital following the introduction of ultrasound technology.

**Materials and Methods:** After audit committee approval, in Nov '11, all eligible anaesthetists at our hospital were surveyed. We studied their regional block practice before and after the introduction of U/S. Questions included the total number of blocks done, any change in block practice and improved efficiencies related to ultrasound.

**Results and Discussion:** 64 anaesthetists were eligible for our survey. 50 forms (78%) were returned. 46 anaesthetists (92%) did regional blocks on a regular basis. 19 separate blocks were done both before and after U/S. The commonest blocks done were axillary brachial blocks and femoral blocks (61% each) followed by interscalene blocks (46%).

After the introduction of U/S, more anaesthetists are attempting different blocks than before. The biggest increases in 'new' blocks were forearm blocks (17% vs 0%); supraclavicular (39% vs 15%), popliteal (17% vs 4%) and TAP blocks (43% vs 17%). Femoral (41%) and interscalene (22%) are still popular without U/S; non U/S axillary blocks have fallen out of favour. 26 anaesthetists (57%) thought that their block repertoire increased with the introduction of U/S. A similar number thought that U/S resulted in an improvement in their practice, as represented by increased success rate and improved block quality.

However, only 4 anaesthetists still do not use U/S for their block practice, preferring conventional methods. Importantly, 23 anaesthetists said the time for surgical readiness improved with U/S.

These results represent a developing and changing practice related to the introduction of U/S. 36 anaesthetists have been on training programmes. Prior to U/S, no structured in-house training existed. Now, we have had 3 in-house training days with more scheduled.

**Conclusion(s):** Our survey demonstrates the positive uptake of new technology, enhancing the skill of the anaesthetist and benefitting the patient by allowing better regional anaesthesia. We encourage others to make full use of U/S technology in their hospitals.

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Anaesthesia, 2010, 65 (Suppl.1):1-12.

## 1AP8-2

### Comparison of sugammadex and neostigmine for reversal of rocuronium-induced muscle relaxation in short term elective surgery

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**Background and Goal of Study:** This study compared the efficacy and cost effectiveness of sugammadex and neostigmine for reversal of neuromuscular blockade induced by rocuronium for short term elective surgery.

**Materials and Methods:** This study design was randomised and prospective. Following the approval of hospital ethics committee, 33 patients aged 18-65, ASA I-III, who were undergoing short term surgery (< 90 min) were divided into two groups. Patients with expected difficult intubation, or those receiving medication known to interact with rocuronium or having neuromuscular or significant renal disease, an allergy or other contraindication to medications used during the study, were excluded.

All patients were given 1.5 µg kg<sup>-1</sup> fentanyl, 5-7 mg kg<sup>-1</sup> thiopental, 0.6 mg kg<sup>-1</sup> rocuronium for anaesthesia induction. Anaesthetic maintenance was ensured through 50% O<sub>2</sub>-N<sub>2</sub>O and 1% sevoflurane. Neuromuscular blockade was monitored using acceleromyography and a train-of-four (TOF) mode of stimulation. During surgery maintenance doses of 0.1-0.2 mg kg<sup>-1</sup> rocuronium were administered due to reappearance of the third response of the TOF (T3).

Patients were allocated to receive sugammadex 2 mg kg<sup>-1</sup> (group S=16) or neostigmine 50 µg kg<sup>-1</sup> (with atropine 20 µg kg<sup>-1</sup>) (group N=17) at reappearance of the second response of the TOF (T2) after the last dose of rocuronium. In all patients, neuromuscular monitoring was continued up to recovery of the TOF ratio to 0.9. Thereafter, anaesthesia was discontinued and the patient was extubated. Time to TOF ratio to 0.9, extubation time, haemodynamic parameters and cost were recorded.

SPSS 17.0 (ANOVA, Kruskal Wallis, paired t) were used for statistical analysis. **Results and Discussion:** Intubating and maintenance doses of rocuronium were similar in the two groups. Time to recovery of the TOF ratio of 0.9 and extubation time after sugammadex compared with neostigmine were significantly shorter, being 2.3±0.9 versus 9.4±2.7 min and 6.6±1.6 versus 12.9±2.0 (p< 0.001).

There was no clinical evidence of residual neuromuscular blockade or recurrence of neuromuscular blockade in any patient in either group. The costs were higher in group S (71.2±9.8 \$) than group N (1.7±0.2 \$) per patient (p< 0.001).

**Conclusion(s):** Recovery of neuromuscular function after rocuronium to a TOF ratio of 0.9 was approximately 4 times faster with 2 mg kg<sup>-1</sup> sugammadex when compared with 50 µg kg<sup>-1</sup> neostigmine, while sugammadex was the more expensive than neostigmine.

## 1AP8-3

### Perioperative effect of anaesthetic techniques on lymphocyte subpopulations during colon cancer surgery: balanced general anaesthesia versus opioid-free anaesthesia

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**Background and Goal of Study:** It is well known that surgical stress, anaesthetic technique and drug choice can interact with the immune cells and cancer cells during the perioperative period and affect long-term outcome in oncologic patients. The negative effect of volatile agents and opioids on cancer recurrence has already been reviewed. Nowadays, there is a particular interest in the effect of propofol and regional anaesthesia, which appears to be beneficial. The aim of this study was to analyse the effect of two different anaesthetic protocols on the immune cell population changes.

**Materials and Methods:** Prospective randomised pilot study. We included 16 patients scheduled for elective hemicolectomy for colon cancer, who were allocated into two groups: Group A: balanced general anaesthesia with opioids and volatile agents and Group B: opioid-free anaesthesia with propofol combined with epidural block. Serum levels of immunoglobulins, complement C3, C4 and lymphocyte populations in peripheral blood were measured at 5 different times perioperatively. The anaesthetic management was hemodynamic/entropy guided.

**Results and Discussion:** Demographics and intraoperative data were comparable in both groups. No differences were found in levels of immunoglobulins and complements between groups. In table 1 all the variation percentages of lymphocyte subpopulations from baseline T0 (100%) at T1 (30 minutes after induction), T2 (2 hours after end of surgery), T3 (24 hours after surgery) and T4 (72 hours after surgery) are presented. There was a statistical reduction only in the following subpopulations: CD3+, CD4+, CD8+ and CD19+ at T2, T3 and T4 in group B. Only in group B at T1 CD4+ and CD19+ increased significantly.

	Group A T1	Group A T2	Group A T3	Group A T4	Group B T1	Group B T2	Group B T3	Group B T4
Lymphocytes	101.59 ±19.23	62.08 ±25.85*	68.16 ±18.97*	67.65 ±24.60*	115.74 ±50.89	49.61 ±13.69*	62.23 ±22.61*	60.62 ±18.62*
CD3+	109.06 ±13.34	49.24 ±21.32*	65.09 ±22.61*	66.29 ±25.28*	116.81 ±53.10	40.92 ±9.28*	57.81 ±20.75*	58.58 ±18.64*
CD4+	109.88 ±14.04	48.25 ±15.09*	65.19 ±24.71*	66.31 ±24.99*	122.39 ±73.09*	39.94 ±7.77*	57.51 ±26.20*	60.45 ±26.60*
CD8+	104.13 ±21.25	48.56 ±23.43*	65.54 ±19.54*	66.39 ±29.49*	111.47 ±62.71	44.99 ±10.70*	65.42 ±25.00*	59.03 ±20.90*
CD19+	121.13 ±32.83	46.74 ±16.66*	80.88 ±18.87*	72.33 ±37.02	102.48 ±73.03*	42.13 ±4.53*	73.92 ±47.02	67.40 ±37.57
NK	72.08 ±44.51	123.41 ±92.91	77.82 ±33.51	71.21 ±48.19	119.37 ±104.11	89.02 ±60.24	84.72 ±47.40	65.43 ±26.74*
NKT	88.26 ±29.55	88.26 ±34.48	94.75 ±37.12	112.40 ±35.97	84.56 ±35.91	81.07 ±33.97	131.67 ±76.14	102.31 ±22.83

[Table 1: Cell variation in % from baseline]

**Conclusion(s):** In this study, we observed an immune depression after surgery in terms of global lymphocyte cell numbers affecting mostly B and T cell subpopulations but not NK or NKT cells. We didn't find any statistically significant differences between the two anaesthetic protocols. Analysing a bigger sample size may allow us to confirm our hypothesis.

## 1AP8-4

### Comparison of surgical conditions during propofol or desflurane anaesthesia for endoscopic sinus surgery

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**Background and Goal of Study:** Reduction of intraoperative bleeding is necessary to achieve the ideal surgical field for the endoscopic sinus surgery (ESS). Intraoperative intra nasal bleeding is influenced by various anaesthetics. This study compared surgical field condition between propofol/remifentanyl (PR) based anaesthesia and desflurane/remifentanyl (DR) based anaesthesia.

**Materials and Methods:** American Society of Anesthesiologists physical status class I or II patients undergoing ESS were randomly assigned to group PR (n = 36) or group DR (n = 32). The extent of the preoperative surgical lesion was classified as high (> 12) and low (≤ 12) Lund-Mackay (LM) scores



according to the computed tomography findings. The target mean blood pressure was maintained at 70-80 mmHg. Only one surgeon rated visibility of the surgical field on a numeric rating scale (NRS) every 10 minutes.

**Results and Discussion:** There was a different surgical field grade from PR to DR. The mean (SD) surgical field score of NRS for the PR and DR was 2.3 (0.57) and 2.7 (0.67), respectively ( $P = 0.006$ ). Especially in the high-LM score patients, the mean (SD) of surgical field score for the PR and DR was 2.4 (0.67) and 3.0 (0.63), respectively ( $P = 0.012$ ).

**Conclusion(s):** In the high-LM score patients, PR based anesthesia result in better surgical field condition for ESS than DR based anesthesia. In ESS, PR based anesthesia is considered to give a lot of help.

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## 1AP8-5

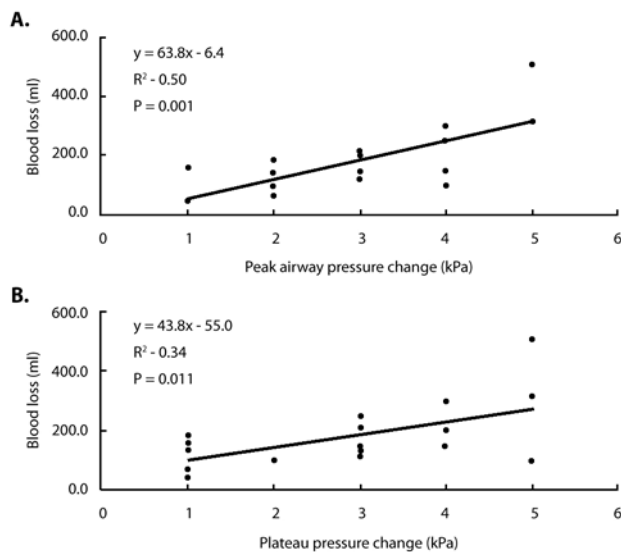
### The effect of airway pressure change after prone positioning on intraoperative blood loss in patients undergoing spine surgery

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**Background and Goal of Study:** Prone positioning of anesthetized patients may increase the abdominal pressure which results in congestion of the intervertebral venous system that leads to increased blood loss during spinal surgery. Since a change in the airway pressure may reflect the abdominal pressure during mechanical ventilation, authors hypothesized that the change in the airway pressure may predict the amount of blood loss during spine surgery in the prone position.

**Materials and Methods:** Eighteen patients were turned to the prone position using the Wilson frame. The peak airway pressure and plateau pressure were measured 5 minutes after anesthesia induction and 15 minutes after the prone positioning. The amount of blood loss was measured at the end of surgery.



[Figure: Correlation of blood loss per vertebra with peak and plateau pressure change during positional change. Blood loss per vertebra was calculated by dividing one-level surgery by two and two-level surgery by three. Blood loss significantly increased as both peak and plateau pressure changes increased.]

**Results and Discussion:** Both peak and plateau airway pressure changes were significantly correlated with intraoperative blood loss but the  $R^2$  was highest with peak airway pressure change ( $R^2 = 0.50$ ,  $p = 0.001$ ). An increase in peak airway pressure by 1 kPa increased intraoperative blood loss by 63.8 ml per vertebra.

**Conclusion:** The increase in the peak airway pressure change after prone positioning increased intraoperative blood loss in anesthetized patients undergoing spine surgery.

#### References:

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## 1AP8-6

### Hypnosis before diagnostic or therapeutic interventions - a systematic review

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**Background and Goal of Study:** There is a controversy if hypnosis is effective when performed before medical procedure. This systematic review of randomised controlled trials (RCTs) aimed to estimate the efficacy of hypnosis before diagnostic or therapeutic medical procedures.

**Materials and Methods:** Medline, Psycinfo, Embase, Cinahl, and the Cochrane Central Registrar of Controlled Trials databases were searched to identify RCTs comparing hypnosis against active or inactive control interventions before medical procedures. All RCTs had to report about pain and anxiety. Three reviewers independently selected RCTs; the quality of the included RCTs was investigated with two different scores.

Characteristics of RCTs were abstracted by 2 investigators and crosschecked by another one. The data were not pooled because heterogeneous outcome measures were observed.

**Results and Discussion:** Nineteen RCTs with 1037 patients were included; study size was 20 to 200 patients (1 RCT >100 patients). These RCTs included 479 patients with hypnosis, 494 with control interventions and 64 without group attribution; 11 RCTs had active controls, 5 RCTs inactive controls and 3 RCTs both.

Fifteen RCTs included 899 adults (mean age 23 to 63 years), 4 RCTs 138 children (mean age 8 to 14 years). Five of 15 RCTs with adults included 410 females only (mean age 25 to 49 years). Ten of 19 RCTs (52.6%) had major quality limitations. Duration of hypnosis was 3 to 30 minutes; 5 RCTs used audiotapes; 6 had more than one session, 3 tested hypnotic susceptibility.

Thirteen RCTs reported on pain and 12 on anxiety. Ten of 13 RCTs on pain reported on quantitative data, eight of 10 RCTs favoured hypnosis; of these 8 RCTs, 5 had large post-interventional pain intensity variability and 3 did not report variability. Six of 8 RCTs reported on significant difference for post-interventional pain. Nine of 12 RCTs on anxiety reported on quantitative data and 6 on post-interventional anxiety; all RCTs favoured hypnosis; of these 6 RCTs 2 had large post-interventional anxiety intensity variability, 1 did not report variability and 3 had low variability. Four of 6 RCTs reported on significant difference for post-interventional anxiety.

**Conclusions:** Hypnosis before medical procedures estimated with post-interventional pain and anxiety may be efficient; however, majority of included RCTs had major methodological limitations.

Large, well-conducted RCTs with a standardised hypnosis and assessments are needed.

## 1AP8-7

### Head position during thyroidectomy, under general anesthesia, reduces regional cerebral oxygen saturation

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**Background and Goal of Study:** The aim of this study was to investigate the effects of positional changes in regional cerebral oxygen saturation values ( $rSO_2$ ) caused by head positioning during thyroidectomy, before and after administration of general anesthesia.

**Materials and Methods:** Thirty physical status ASA I-III patients, undergoing thyroidectomy under general anesthesia were enrolled in this study. Anesthetic technique was standardized for all patients. Recordings of  $rSO_2$  values were performed in each patient of the study in two time intervals. In the first time interval  $rSO_2$  values were measured before anesthesia induction during two phases: at supine position and at 5 min after placing the head of the patient in position for thyroidectomy.

In the second time interval  $rSO_2$  values were measured after anesthesia in-

duction during the following phases: at supine position before intubation, at supine position after intubation, before head positioning, at the end of head positioning and also at the end of anesthesia. At all time intervals, haemodynamic parameters, hemoglobin and SpO<sub>2</sub> were recorded.

Additionally, during the second time interval end-tidal CO<sub>2</sub> and temperature were also measured. Data were analysed with t-paired test and ANOVA followed by Dunnett's post-hoc test.

**Results and Discussion:** Prior to anesthesia induction no significant change of rSO<sub>2</sub> values were noted between supine and position for thyroidectomy. During the second time interval a significant ( $p < 0.05$ ) reduction of the rSO<sub>2</sub> values was measured after placing the patient in the position for thyroidectomy, at the end of head positioning and also at the end of anesthesia. Systolic arterial pressure (SAP) was significantly lower at the end of anesthesia compared to SAP at supine position before intubation. Before head positioning a significant ( $p < 0.05$ ) reduction of ETCO<sub>2</sub> was also noted. The other parameters did not show significant changes.

**Conclusion(s):** The present study shows that placing the patients in position for thyroidectomy after anesthesia induction causes significant decrease in regional cerebral oxygen saturation.

## 1AP8-8

### Anesthesia for robotic radical urological surgery cases: anesthetic challenges, management, and safe clinical discharge criteria from the operating room

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**Background and Objective:** Although robotic surgery for prostatectomy (RP) and cystectomy (RC) offer some advantages to the anaesthetist, the challenges related to this type of procedures and their management have been reported in only small series and case reports (1,2). We aimed to describe the anaesthetic challenges related to high intra-abdominal pressure due to CO<sub>2</sub> insufflation and the deep Trendelenburg position in a series of 69 RP and RC patients.

**Methods:** Data obtained from 69 consecutive patients who underwent RP and RC through routine non invasive and invasive monitoring tools were recorded, and blood gas analysis was performed at every change in position and/or intra-abdominal pressure. Safe extubation was assessed in the operating room according to our discharge criteria for RP and RC cases in combination with Aldrete score.

**Results:** The main challenge for the anaesthetist with these surgeries was respiratory acidosis which might resulted from

- 1) CO<sub>2</sub> insufflation of the pneumoperitoneum,
- 2) the effects of the deep Trendelenburg position on minute ventilation and on upper airway oedema, mainly due to tongue oedema which compromise respiration and the removal of CO<sub>2</sub>, and
- 3) the long surgical duration which could affect the total amount of CO<sub>2</sub> used.

Respiratory problems were determined as

- 1) a decrease in arterial pH and
- 2) upper-airway and tongue oedema, which may have resulted from long-term deep Trendelenburg position and from endotracheal cuff pressure on the tongue base.

These factors led to upper-airway "obstruction-like" clinical symptoms, including a dulled, oedematous and swollen tongue and awake snoring, inspiratory difficulty with loud inspiration, intercostal retraction, and alae nasi participation after the extubation.

**Conclusion:** The appropriate management of respiratory acidosis and obstruction-like clinical symptoms were the main focuses in the management of RP and RC cases. Additionally, using modified discharge criteria from the operating room allowed for safe and successful extubation in this group of patients.

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## 1AP8-9

### Potential influence of intraoperative hypotensive episodes on postoperative recurrence and survival in patients with complete resection of esophageal cancer

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**Background and Goal of Study:** There are several reports that tell us anesthetic technique during operation has an influence on postoperative recurrence of malignancy. The purpose of this study is to define which factors in the anesthetic management affect the recurrence and survival of the esophageal cancer after the surgical resection. For this purpose, we studied the relationship between perioperative variables and the outcomes of patients undergoing esophagectomy with a single center retrospective observational design.

**Materials and Methods:** Fifty three patients who underwent complete resection of esophageal cancer from March 2006 to December 2007 were included. All patients underwent elective surgery without preoperative chemotherapy and radiotherapy. They were given general anesthesia combined with epidural analgesia if possible. We abstracted preoperative factors (age, sex, weight, stage of cancer, ASA PS), intraoperative variables (duration of anesthesia and surgery, blood loss, blood infusion, fluid balance, body temperature, heart rate, blood pressure, biochemical data and maximum dose of dopamine) and outcome variables from clinical records. Hypotensive episodes were defined as the systolic pressure lower than 70mmHg from the introduction of anesthesia to the end of anesthesia.

**Results and Discussion:** By multiple regression analysis, ASA PS, hypotensive episodes and serum creatinine levels significantly affected 1year cancer specific survival. ( $p=0.0015$ ,  $p=0.0002$ ,  $p=0.0096$  for each). Furthermore, Kaplan-Meier analysis defined that patients with hypotensive episodes ( $n=34$ ) showed significantly lower 1year cancer specific survival than patients without hypotensive episodes ( $n=19$ ). There were no differences between those two groups with regard to 1year cancer recurrence. These results were consistent with a previous study showing that the number of intraoperative hypotensive episodes with patients undergoing complete resection of colorectal liver metastases significantly affected disease-free survival 1). Maintaining stable hemodynamics during esophagectomy is very important for long term cancer specific survival.

**Conclusion:** We found that intraoperative hypotension may affect 1year cancer specific survival in patients with complete resection of esophageal carcinoma. Interventions to prevent intraoperative hypotension might improve long term cancer specific survival after esophagectomy.

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## 1AP8-10

### Correlation between the preoperative echocardiographic findings in patients with arteriosclerosis risk factors submitted to bariatric surgery with the appearance of early and late postoperative complications

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**Background and Goal of Study:** Patients with morbid obesity are associated with cardiovascular risk factors which imply a greater surgical risk, for that reason in many preoperative protocols the use of the echocardiography is mandatory. The role of this test to be able to predict cardiovascular complications is on debate. The objective of this study was to ascertain whether the pathological results of test were correlated with the higher number of arteriosclerosis risk factors. Furthermore if the factors that determine this risk imply a greater number of immediate or long term post operative cardiovascular and digestive complications.

**Materials and Methods:** We analyzed retrospective all patients that underwent bariatric surgery at our hospital from 2007 to June 2011, in total 203, were gathered. The main arteriosclerosis risk factors used were: Hypertension, Diabetes, hyperlipidemia, cigarette smoking, alcohol and drug consumption, atrial fibrillation, hypercoagulability syndromes, active inflammatory response syndrome, cardiovascular events diagnosed and the patient functional capacity. We then divided the study in three groups: More than three factors (Group 1), cardiovascular event diagnosed (Group 2) and both at the same time (Group 3). We defined early complication before 6 months and late after 6 months.

**Results and Discussion:** The average age was  $42.5 \pm 10$ , 1 years, IMC  $50.2 \pm 8.14$  kg/m<sup>2</sup>. 51 in group 1, 24 in group 2 and 59 in group 3. There were no cardiovascular complications. 146 (71,9%) there were no pathological findings and 57 (28,1%) -lesser echocardiographic findings, except for left ejection fraction of 35% in one patient. Within the normal echocardiography 26 had were group 1 (17,8%) and 120 no (82,2%)  $P = 0,0001$ ; 7 group 2 (4,8%) and 139 no (95,2%)  $p = 0,0001$ , and 31 group 3 (21,2%)  $p = 0,0001$ . There were no significant differences in the number of pathological echocardiography between patients with good or low functional capacity .No significant differences in digestive complications.

**Conclusion(s):** In our studied population , the echocardiography is not a good test to detect cardiac irregularities in morbid obese patients with more than three risk factors nor to foresee cardiovascular complications. There does not exist a correlation between the presence of arterioesclerotic factors and /or cardiovascular events diagnosed and low functional capacity with the appearance of early or late of digestive complications.

## 1AP8-11

### Prophylactic antibiotic treatment for severe acute necrotizing pancreatitis

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**Background and Goal of Study:** In patients with severe, necrotizing pancreatitis, it is common to administer prophylactic broad-spectrum antibiotics, as imipenem, to reduce the incidence of pancreatic and peripancreatic infections. The aim of this double-blind, placebo-controlled, randomized study was to evaluate the effectiveness of prophylactic intravenous imipenem in preventing pancreatic and / or peripancreatic infection in patients with non infected necrotizing pancreatitis when compared with placebo.

**Materials and Methods:** A prospective, double-blind, placebo-controlled randomized study set in ICU of HUC „Mother Theresa”: There were involved 80 patients with clinically severe, confirmed necrotizing pancreatitis in the study: 40 patients received imipenem (750 mg i.v. every 12 hours) and 40 other patients received placebo. Treatment started within 5 days of the onset of symptoms. Treatment continued for 7 days. Patients were followed for 42 days following randomization, focusing in development of complications (infection, the need of surgery and mortality).

**Results and Discussion:** Pancreatic or peripancreatic infections developed in 15% (6 of 40) of patients in the imipenem group compared with 10% (4 of 40) in the placebo group ( $P = 0.401$ ). Overall mortality rate was 20% (8 of 40) in the imipenem group and 15% (6 of 40) in the placebo group ( $P = 0.799$ ). Surgical intervention was required in 25% (10 of 40) and 20% (8 of 40) of the imipenem and placebo groups, respectively ( $P = 0.476$ ).

**Conclusion(s):** This study demonstrated no statistically significant difference between the treatment groups for pancreatic or peripancreatic infection, mortality, or requirement for surgical intervention. So, it did not support early prophylactic antimicrobial use in patients with severe acute necrotizing pancreatitis.

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## 1AP9-1

### Feasibility of an aggressive postoperative haemoglobin monitoring policy to reduce unrecognised anaemia in postoperative hip fracture patients

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**Introduction:** Postoperative anaemia is associated with morbidity in patients undergoing hip fracture surgery and is avoidable. During review of two adverse cardiac events our hospital identified late recognition of anaemia and poor communication of estimated intra-operative blood loss, as contributing factors.

We designed a clinical audit that included the introduction of an aggressive haemoglobin monitoring policy to improve detection and treatment of post-operative anaemia.

**Methods:** The new policy consisted of: measurement of haemoglobin concentration in venous blood using a blood gas analyser in theatre recovery, a formal haemoglobin sample within 4-6 hours postoperatively and a recording

of surgical blood loss. A transfusion trigger was agreed by consultant trauma anaesthetists and was set at 9g/dL. The policy was implemented with support of the anaesthetic and surgical teams and an educational programme was organised for all stakeholders.

Two cohorts of patients were studied at time points before ( $n=50$ ) and after ( $n=53$ ) implementation of the new policy by case note review and using the hospital clinical information systems. Outcomes were: proportion of patients having a haemoglobin measurement on day or surgery, mean day 1 haemoglobin concentration and policy compliance.

**Results:** Proportion of patients with haemoglobin measurement on day of surgery increased from 24% to 83% ( $p < 0.001$ ). Mean day 1 haemoglobin concentration was similar in both groups (110.1 vs 99.4 g/dL  $p=0.82$ ). Overall, compliance with the new policy was good: 70% of patients had venous blood gas sampling in theatre recovery. 56% of patients had a laboratory haemoglobin measurement within 4-6 hours of surgery. 19% of patients had surgical blood loss recorded.

**Conclusions:** Introduction of an aggressive haemoglobin monitoring policy has increased reliability of postoperative haemoglobin measurement at our institution. We have demonstrated a system that not only improves detection of post-operative anaemia, but one that is easy to integrate into our current clinical practice.

## 1AP9-2

### Cervical plexus block allows sooner hospital discharge after carotid endarterectomy

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**Background and Goal of Study:** Although a trend towards earlier discharge for patients who received cervical block anesthesia rather than general anesthesia was reported previously, the difference did not reach statistical significance (1). In another paper dealing with carotid endarterectomy under general anesthesia, only 50% of patients had one day postoperative stay, the others left the hospital later (2). Since early discharge is multifactorial, we studied risk factors for staying longer than one day, including type of anesthesia.

**Materials and Methods:** Data of 62 patients with atherosclerotic disease of the carotid artery undergoing carotid endarterectomy was retrospectively analyzed. The method was approved by the Ethical Committee of the Hospital. Surgery was performed either under general anesthesia or under cervical block with ropivacaine 0.75%.

The patients were categorized according to the time they spent in the institution. The majority left the hospital around noon the day following surgery (time 11:00 to 13:00 h). Seventeen patients were identified as having spent more than 48 hours in the hospital. Pre-, per-, and postoperative medical factors possibly affecting hospital stay were retrieved from the medical records in each group. The sole peroperative factor considered was the way in which the patient was anesthetized, with general anesthesia as a risk factor for prolonged hospital stay. Preoperative symptoms were also considered. Odds, odds ratios and log odds ratios were calculated. Significance of occurrence was calculated using the chi-square for the odds ratio. Fisher's exact test was used in estimating differences in occurrence for a given pathology between the two groups.

**Results and Discussion:** Predictive factors for discharge at noon the next day were: cervical block (OR: 5 ,CI: 0.61-6.64 ;  $p = 0.006$ ), male sex (OR: 5.31, CI: 0.61-6.99;  $p = 0.005$ ) and tobacco use (OR: 2.6, CI: 0.43 - 5.37, NS). Relative risk for staying more than 48 hours was renal failure (RR: 13.23, CI: 2.19 - 8.1,  $p = 0.0052$ ). The probability of returning home early depending on symptomatology did not reach significance.

**Conclusion(s):** The likelihood of returning home the next day after carotid endarterectomy is greater after cervical plexus block than after general anesthesia.

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## 1AP9-3

### Long-term postoperative quality of sleep after fentanyl- and remifentanyl-based anaesthesia - a randomised controlled trial

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**Background and Goal of the Study:** Opioids are an integral part of anaesthesia, however, there is some evidence that they have a potential to interfere with postoperative quality of sleep. Only sparse data exists with regards to

long-term disturbances of quality of sleep, especially for the different types of opioids available today. We aimed to investigate the long term quality of sleep after fentanyl or remifentanyl-based anaesthesia in a randomised controlled trial.

**Methods:** After approval by the Royal Perth Hospital Ethics Committee (protocol EC2010-019) and registration at the Australian and New Zealand Clinical Trials Registry (protocol ACTRN12610000362099) we performed a prospective double-blinded study. 100 patients undergoing minor orthopaedic or plastic surgery were randomized into two groups.

Patients in group F received a fentanyl-, patients in group R a remifentanyl based anaesthesia. Quality of sleep was assessed preoperatively, as well as three and six months postoperatively using the Pittsburgh Sleep Quality Index (PSQI).

**Results and Discussion:** Fifty patients were allocated to each group. In the investigated population, quality of sleep at three and six months postoperatively did not show significant differences compared to preoperative values. Likewise, we did not find a significant difference in PSQI values between the fentanyl and remifentanyl group at three and six months postoperatively.

However, in a subgroup analysis we found that otherwise healthy patients with a low preoperative total PSQI score ( $< 5$  ("good sleepers")) suffered from a significant long-term deterioration of their sleep architecture postoperatively, when they had received remifentanyl -but not fentanyl- intraoperatively.

**Conclusion:** There is some evidence that remifentanyl may cause long-term sleep disturbances in patients with a normal preoperative sleep architecture. Consequently, remifentanyl should probably be avoided in these patients, whenever possible. However, further randomised trials are necessary to confirm or refute these findings.

## 1AP9-4

### Cervicotomy for thyroid surgery: how long they need to be watched over in the post anesthesia care unit?

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**Background and Goal of Study:** Cervical hematoma (CH) after thyroid surgery is a rare (1%) but potentially life threatening complication in case of compressive cervical hematoma (CCH).

Our purpose was to evaluate in a retrospective observational study if the 2-hour surveillance in the post anesthesia care unit (PACU) cover the risk for compressive cervical hematoma.

**Materials and Methods:** From January 2006 to December 2010, 4235 patients underwent thyroid surgery in the General Surgery unit at Pitié Salpêtrière University Hospital and were postoperatively admitted for 2 hours in PACU before being discharged to a conventional care unit. In 43 patients (1%) 47 CH occurred and required surgical treatment (annual incidence: 7 - 12 cases/year). Their medical files were systematically reviewed.

**Results and Discussion:** Thirty (63,8%) out of 47 CH were CCH and 17 (37,2%) non-compressive hematomas (NCH). In 12 cases (25,5%) CCH occurred in the operating room. During the standard 2 hours surveillance in PACU, 6 CH occurred (12,8%): 4 CH in the first hour (1 CCH and 3 NCH) and 2 CCH in the 2<sup>nd</sup> hour after surgery. Twenty-nine hematomas (61,7%) developed after discharge from PACU: 8 cases (17%; 6 CCH) from 2 to 6 hours after surgery, 7 cases (15%; 5 CCH) from 6 to 24 hours after surgery, and 14 cases (30%) later than 24 hours after surgery, 4 cases (2 CCH) during their stay in hospital and 10 cases (2 CCH) after discharge from hospital. No correlation was found between demographic or clinical data and CH occurrence.

**Conclusion(s):** CH after thyroid surgery occurred in the present study with a random distribution. Two peaks of incidence for CCH were identified: the first one before the PACU admission (12/30) and the second one (11/30) after the PACU discharge, from 2 to 24 hours after surgery, whereas only 3 CCH occurred during the PACU surveillance.

Therefore, the 2-hour postoperative surveillance in PACU of patients with cervicotomy for thyroid surgery does not adequately cover the period at risk for CCH.

However, since they are rare complications, we chose not to extend the length of the PACU care. Further studies are required to identify risk factors in patients who need a longer surveillance in PACU.

## 1AP9-6

### The impact of ondansetron on postoperative cognitive function in elderly patients undergoing surgery under general anaesthesia due to femoral fracture - preliminary data

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**Background and Goal of Study:** Postoperative delirium and cognitive dysfunction are topics of special importance in the geriatric surgical population. Ondansetron is a highly selective serotonin receptor antagonist, which has become available for the control of anesthesia and surgery-induced emesis. It is rapidly absorbed and penetrates the blood-brain barrier easily. Recent studies have revealed that, endogenous serotonin modulates cognitive processes, particularly learning and memory (short- & long-term). The aim of this study was to investigate the impact of ondansetron on postoperative cognitive function in elderly patients undergoing surgery with general anesthesia due to femoral fracture. Statistics: Mean values, standard deviations, Student's t-test.

**Material and Methods:** The hospital ethics committee approved the study protocol and all participants provided their consent. 65 Patients  $70.5 \pm 14.7$  of age, scheduled for a femoral fracture rehabilitation surgery, were randomized on a double-blind protocol to receive postoperatively 4 ml of either placebo (Group A) or ondansetron (8 mg, Group B) daily i.v. for five days. Each patient was evaluated pre- and the 5<sup>th</sup> and 30<sup>th</sup> day postoperatively with the following tests: Confusion Assessment Method, Mini-Mental State Examination, Beck Depression Inventory, Visual Analog Scale of Pain, Instrumental Activities of Daily Living, Trail Making Test A and B, Stroop Neuropsychological Screening Test, Controlled Oral Word Association Test, Three Words Three Shapes Test and Babcock Story Recall Test.

**Results and Discussion:** Patients of both groups did not differ preoperatively significantly in their basic characteristics and predisposing factors associated with postoperative delirium and cognitive dysfunction. Statistical analysis of results showed that postoperative administration of ondansetron was followed by a lower incidence of postoperative delirium and improved postoperative neurocognitive function until the 30<sup>th</sup> postoperative day. This was accompanied by a significant better postoperative functionality.

**Conclusion:** The postoperative ondansetron administration seems to protect and might improve the cognitive function in elderly patients undergoing surgery under general anesthesia. The beneficial effect of ondansetron on postoperative cognitive function needs to be further evaluated.

## 1AP9-7

### Epidural analgesia and fast-track protocols in colorectal surgery: what benefits for the patient?

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**Background and Goal of Study:** Fast-track protocols (FTP) are multimodal perioperative therapy strategies aimed to improve post-operative quality of life and to decrease hospital length of stay. Continuous epidural analgesia (CEA) can be a reasonable supplementation in a modern fast-track setting. The purpose of this study was to identify potential benefits and advantages offered by CEA to FTP in colorectal surgery.

**Materials and Methods:** In this study 60 consecutive patients (ASA I-II) undergoing elective colorectal surgery were prospectively randomized. For postoperative pain control 30 patients (CEA group) received continuous thoracic epidural infusion of ropivacaine 0,1% and sufentanil 1 mcg/ml through an elastomeric pump (flow rate: 5 ml/h). The other 30 patients (IV group) received an intravenous bolus of morphine 0,1mg/kg at the end of operation and then started continuous intravenous solution of ketorolac 90 mg/die and morphine 0,01mg/kg/h (flow rate of 2ml/h). Rescue analgesia with intravenous tramadol 0,15 mg/kg was administered in both groups whenever the VAS score was  $> 3$  at rest. Anesthetic protocol during surgery was standardized.

Primary end points were: postoperative pain, nausea and vomiting, time to postoperative mobilization, Foley catheter removal, time to gastrointestinal recovery, incidence of surgical and medical complications and time to discharge. Postoperative pain scores (evaluated by VAS score) and analgesic requirements were examined and compared between groups at 0, 2, 8, 12, 24 and 48 h. Statistical analysis was performed using a  $\chi^2$ -square test; significance was assumed at  $P < 0.05$ .

**Results and Discussion:** VAS scores were significantly lower in the CEA group (overall mean  $1.53 \pm 0,25$  versus  $2.71 \pm 0.25$ ;  $p < 0.05$ ). Patients with CEA required significantly less analgesics (tramadol median  $120 \pm 80$  mg

versus  $280 \pm 80$  mg ( $p < 0.05$ ), experienced a lower incidence of vomiting and nausea ( $p < 0.05$ ), showed faster gastrointestinal recovery ( $1.8 \pm 0.51$  vs  $3.73 \pm 0.7$  days,  $p < 0.05$ ) and earlier discharge ( $5.76 \pm 0.88$  vs  $6.8 \pm 1.81$  days,  $p < 0.05$ ) than the IV-group. The complication rate, including anastomotic leak rate, was similar between the two groups.

**Conclusion:** Even if further studies are requested, our results suggest that postoperative pain therapy with epidural analgesia seems to offer advantages with regard to the quality of analgesia and the length of hospital stay but does not change the incidence of complications.

## 1AP9-8

### Fast track anaesthesia in patients candidates for bariatric surgery: Xenon vs desflurane

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**Background and Goal of Study:** Fast track anaesthesia is a paradigm applied to elective surgery. The method includes the use of specific drugs that do not act with the respiratory function and conscience and provide optimal pain control. Fast-tracking anaesthesia has assumed increased importance because of the cost-savings potential when patients are transferred directly from the operating room (OR) to the surgical ward. The modified Aldrete score is commonly used for determining when patients can bypass the post-anaesthesia care unit (PACU).

**Materials and Methods:** We conducted a prospective controlled study including 30 ASA II-III obese patients of both genders aged between 18-65 years with BMI  $\geq 40$  Kg/m<sup>2</sup> undergoing sleeve gastrectomy. 15 Patients received anaesthesia with xenon, propofol, remifentanyl and rocuronium, 15 with desflurane, propofol, cisatracurium and fentanyl. Mean duration of the surgical procedure was  $120 \pm 25$  min. All patients were monitored for neuromuscular function (TOF-guard®) and anaesthesia depth (Bispectral Index® (BIS) monitor). Recovery of neuromuscular function was obtained with sugammadex in xenon group, with neostigmine in desflurane group. Level of postoperative sedation was evaluated using modified Aldrete score. All patients received metoclopramide 10mg, tramadol 100mg, paracetamol 1gr half an hour before the end of surgery. Mann-Whitney U-test was used for statistical analysis;  $p < 0,05$  was considered significant.

**Results and Discussion:** This study showed differences between xenon and desflurane groups: time to reach 60 at the BIS (Xe  $73,6 \pm 50,5$  vs Des  $274 \pm 43$  sec;  $p < 0,01$ ), time for eyes opening (Xe  $117 \pm 56,4$  sec vs Des  $324 \pm 67,8$  sec;  $p < 0,01$ ), extubation time (Xe  $156 \pm 44,5$  sec vs Des  $365 \pm 53,5$  sec;  $p < 0,01$ ). In Xenon group Aldrete score (0-12) at 15' has always reached 12, but only 5 patients in desflurane group. VAS value was not significantly different. In the xenon group postoperative BGA values showed PO<sub>2</sub> values significantly greater than in desflurane group (Xe:  $124,14 \pm 26,21$  mmHg, Des:  $85,28 \pm 17,1633$  mmHg;  $p < 0,01$ ). PCO<sub>2</sub> values were comparable.

**Conclusion(s):** According to our results we can assert that the xenon anaesthesia offers a lot of advantages. The shorter awakening time, the fast recovery of respiratory function and the general comfort expressed from each patient allow an early discharge from the OR decreasing the need for PACU.

## 1AP9-9

### Post-operative delirium in a post-anaesthesia care unit

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**Background and Goal of Study:** Post-operative delirium (POD) is a complex syndrome frequent after surgery associated with increased morbidity and mortality rate in the post-operative period. The aim of this study was to access the incidence of delirium and identify risk factors for its development in a post-anaesthesia care unit (PACU).

**Materials and Methods:** Observational prospective study approved by the Centro Hospitalar São João Ethics Committee. Written informed consent was obtained. It was conducted in a PACU during a three-week period. From the 357 patients consecutively admitted in the PACU during this period 340 had inclusion criteria (which included all consecutive adult Portuguese-speaking patients submitted to major elective noncardiac and non-neurological sur-

gery). Each patient was evaluated for diagnosis of POD using the *Nursing Delirium Screening Scale* (NUDESC). Demographic data, perioperative variables, length of hospital and recovery room stay and mortality were recorded. Descriptive analysis of variables was used to summarize data and the Mann-Whitney U test, Fisher's exact test or Chi-square test were used. Multivariate analyses were done with logistic binary regression with calculation of Odds Ratio (OR) and its 95% confidence interval (95% CI).

**Results and Discussion:** The incidence of POD was 10%. POD patients were older, were more likely to have higher ASA physical status (40% versus 16% for ASA III/IV,  $p=0.001$ ), had more frequently ischemic heart disease (14% versus 5%,  $p=0.035$ ), congestive heart failure (29% versus 3%,  $p < 0.001$ ), hypertension (63% versus 39%,  $p=0.007$ ), had a higher Revised Cardiac Risk Index (RCRI) (17% versus 3% at  $RCRI \geq 2$ ,  $p < 0.001$ ) and had a higher amount of intraoperative crystalloids administered (1,782 liters versus 1,350 liters,  $p=0.021$ ). POD patients had more frequently an inadequate postoperative recovery measured by Richmond Assessment Sedation Scale (37% versus 10%,  $p < 0.001$ ). Age (OR 2.7 95% CI 1.2-5.9,  $p=0.017$ ), congestive heart failure (OR 8.0, 95% CI 2.7-23.3,  $p < 0.001$ ) and inadequate postoperative emergence (OR 5.7, 95% CI 2.4-13.6,  $p < 0.001$ ) were considered independent risk factors for POD in the multivariate analyses. POD patients had a longer PACU length of stay (OR 2.1 95% CI 1.6-2.9,  $p < 0.001$ ).

**Conclusion:** POD had a high incidence in PACU patients and was independently associated with age, congestive heart failure and inadequate emergence. POD patients had higher length of PACU stay.

## 1AP9-10

### The efficacy of prewarming on post-induction core temperature and thermoregulatory response under general anesthesia

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**Background and Goals:** Perioperative hypothermia is a common problem. Core hypothermia developing immediately after induction of anesthesia results largely from an internal core-to-peripheral redistribution of body heat.<sup>1)</sup> Some studies have shown that prewarming during procedures lasting <1 hour may prevent redistribution. We therefore evaluated the efficacy of prewarming for 30 minutes compared with warming while induction through thermoregulatory response under general anesthesia.

**Material and method:** Following IRB approval and written informed consent, sixteen patients with ASA 1-2 undergoing the laparoscopic surgery were studied. The patients were not received any premedications and randomly assigned to three groups:

- 1) Prewarming for 30 minutes with forced-air at 38-43°C. (PWgroup),
- 2) Warming started while induction of anesthesia using underbody blanket at 43°C. (W group) and
- 3) Warming started with forced-air below 36°C intraoperatively (C group).

General anesthesia was induced with propofol 2mg/kg, fentanyl 2µg/kg and remifentanyl. After intubation with rocuronium, anesthesia maintained sevoflurane and remifentanyl 0.1-0.3µg/kg/hr. Intravenous fluids were warmed to 41°C (Ranger, Arizant Healthcare), and ambient temperature was kept 21-23°C. Core temperature was recorded at the tympanic membrane. Mean skin temperature (MST) was calculated from measurements at 4 area-weighted sites. Differences among the groups were compared by using one-way analysis of variance and Scheffe' F tests.

**Results:** The demographic data of patients on each group were not significantly difference. Initial core temperature of PW group was higher than W and C group. After 1 h of anesthesia, core temperature in PW group was still  $37.2 \pm 0.3^\circ\text{C}$ , in W group and C group was  $36.5 \pm 0.5^\circ\text{C}$ ,  $36.0 \pm 0.1^\circ\text{C}$ , respectively. MST changes in W and C group were similar.

**Conclusions:** After prewarming for 30 minutes, core temperature was not significantly reduced intraoperatively. This will be one of strategy as effective treatment for preventing intraoperative hypothermia, and consequently could be reduction of risk for postoperative hypothermia.

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## Ambulatory Anaesthesia

### 2AP1-1

#### Health care consumption during the first four days after outpatient surgery

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**Background and Goal of Study:** In the Netherlands, 52% of all surgery is performed on ambulatory basis. Previous studies have shown an incidence of acute postoperative pain of 20-40% after outpatient surgery. However, little is known about health care consumption due to acute postoperative pain in this setting. This study evaluates health care consumption during the first four days after outpatient surgery.

**Materials and Methods:** Over a period of eighteen months, 1275 patients undergoing outpatient surgery were prospectively included in this study. They were asked to complete a questionnaire one week before surgery.

Another questionnaire was completed at the fourth day after surgery to determine health care use, including visits to a general practitioner, specialist, emergency unit or other health care professionals (e.g. physical therapist, or chiropractor). Acute postoperative pain was measured by an 11-point numeric rating scale (NRS). Moderate to severe postoperative pain was defined as an NRS >4.

**Results and Discussion:** Of all included patients, 251 (19.7%) experienced moderate to severe postoperative pain, of whom 53 patients (21.3%) visited the general practitioner, specialist or emergency unit, and 11 patients (4.4%) visited other health care professionals.

A total of 1024 patients experienced an NRS ≤ 4, of whom 63 patients (6.1%) visited a general practitioner, specialist or emergency unit, and 12 patients (1.1%) visited other health care professionals. These differences are statistically significant ( $p < 0.001$ ).

**Conclusion(s):** Our study showed that acute postoperative pain was associated with a significant increase of health care consumption after outpatient surgery during the first four postoperative days.

### 2AP1-2

#### Comparison of propofol versus propofol and ketamine for deep sedation during endoscopic retrograde cholangiopancreatography in elderly patients

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**Background and Goal of Study:** Propofol is frequently used in anesthesiologist-administered deep sedation for endoscopic retrograde cholangiopancreatography (ERCP). Sedation-related adverse events (SRAEs), associated with propofol administration, include hypotension, arrhythmia, O<sub>2</sub> desaturation (< 85%), unplanned intubation and procedure termination (1). The aim of this study was to evaluate the efficacy of synergistic effect of small dose of ketamine (25 mg) and propofol in comparison with propofol alone on propofol consumption and SRAEs during target-controlled propofol infusion (TCI) for deep sedation in elderly patients (>65 years) undergoing ERCP.

**Materials and Methods:** In this prospective, double blind study of 40 unpremedicated elderly patients (> 65 years) undergoing ERCP, induction and maintenance was established by TCI pump (Schnider model) for propofol alone in Group P (N=20) or by propofol and bolus dose of 25 mg of ketamine administered after losing ciliary reflex in Group PK (N=20). Propofol target blood concentration of 5.0 µg/mL was used for induction and 2-4 µg/ml for maintenance of deep sedation in both groups. SRAEs, the total dose of administered propofol (mg) and the mean duration of ERCP (min) were recorded. Data are expressed as means ± SD or frequencies as appropriate. Student's t-test and Chi-square with Yates' correction were used.

**Results and Discussion:** Patients in both groups were comparable in terms of BMI, ASA status and duration of ERCP. The mean age in Group P was 74.65±4.3 and in Group PK 75±4.5.

There was statistically significant difference in propofol consumption (Group P 380.1 ± 135.4; Group PK 352.65 ± 109.44,  $p=0.0004$ ). Incidence of hypotension was 30% in Group P and none in Group PK and difference reached statistical significance ( $p=0.0268$ ). There was no significant difference among other SRAEs between groups.

**Conclusion(s):** There is efficacy of synergistic effect of small dose of ketamine and propofol on lower propofol consumption and lower incidence of hypotension whereas incidence of other SRAEs was not observed between the groups.

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### 2AP1-4

#### Hyperglycaemia and ambulatory surgery (the H2A study)

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**Background and Goal of Study:** Mounting evidence indicates that perioperative hyperglycaemia is associated with postoperative complications in major surgery. However, over 50% of the operations are performed in an ambulatory setting when glucose is not routinely measured. Except for patients with diabetes mellitus (DM), it is unknown which patients are at risk for hyperglycaemia during ambulatory surgery and whether this has clinical consequences. The objective of this study was to investigate the glucose change during ambulatory surgery and to identify risk factors for hyperglycaemia (glucose > 7.8 mmol/l).

**Materials and Methods:** In an observational cohort study, patients scheduled for ambulatory surgery between Oct 1<sup>st</sup> and Dec 1<sup>st</sup> 2011, aged 18-85 years, were included. Capillary blood glucose was measured one hour before- and after surgery. The Wilcoxon signed ranks, the Mann Whitney-U test and multivariate binary logistic regression (including age, sex, dexamethasone use, DM, operating time and BMI) were used to compare median glucose values and identify risk factors for hyperglycaemia.

**Results and Discussion:** We included 225 patients in the study (Table 1). Median glucose increased significantly from 5.4 to 5.7 mmol/l,  $P=0.001$ . In the perioperative period 9.8% of patients reached a glucose value above 7.8 mmol/l. Age >56 years (OR 15.8 95% CI 2.1-120.2) and DM (OR 66.9 95% CI 11.0-408.0) were independent risk factors for hyperglycaemia. Duration of surgery >50 minutes reached borderline significance as a risk factor for hyperglycaemia (OR 4.0 95% CI 0.8-19.9).

Sex (% male)	47.6
Mean age (years)(SD)	45.9 (15.3)
Mean BMI (SD)	25.7 (4.5)
Median operating time (min) (IQR)	31.5 (22.0 - 50.0)
Diabetes (%)	5.8
Median glucose pre-surgery (mmol/l) (IQR)	5.4 (5.0 - 5.9)
Median glucose post-surgery (mmol/l) (IQR)	5.7 (5.1 - 6.4)
Median glucose difference (mmol/l) (IQR)	0.2 (-0.4 - 0.7)
Locoregional anesthesia (%)	25.5
General anesthesia (%)	74.5

[Table 1: Patient Characteristics (n=225)]

**Conclusion(s):** Although glucose increases significantly during ambulatory surgery, it is unclear whether overall median increase of 0.2 mmol/l is clinically relevant. However, DM, age > 56 years and possibly duration of surgery > 50 minutes are risk factors for perioperative hyperglycaemia in the ambulatory setting. The clinical consequences of hyperglycaemia during ambulatory surgery are now further investigated.

### 2AP1-5

#### Anaesthetic considerations for 23 hour discharge pathway for breast cancer surgery at WWL NHS Foundation Trust UK

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**Background and Goal of Study:** The 23 hour breast surgery scheme was recently introduced at WWL NHS Foundation Trust UK following piloting in Kings College Hospital.<sup>1</sup> The aim of the study is to check the feasibility of the scheme and demonstrate the role of anaesthetic considerations in enhancing patients recovery and implementation of a successful scheme.

**Materials and Methods:** The 23 hour discharge pathway was implemented in January 2011 and 2 audits were performed to assess its success.

The two audits, each with a sample size of 100, were performed to identify

- 1) the length of stay
- 2) reasons of prolonged stay
- 3) post operative complications or readmissions for wide local excision and mastectomy cases.

Breast reconstruction cases were excluded. The first audit was done retrospectively via case notes review between July to December 2009 and the re-audit was done prospectively between January to June 2011 using the same method.

**Results and Discussion:** The audited outcomes have shown a statistically significant decrease ( $p < 0.01$ , student t test 99% confidence intervals) in length of stay for both wide local excision and mastectomy cohorts. The audit showed no significant difference in readmission rates or complication rates for both cohorts.

On the back of this success funds were secured to hire a '23 hour enhanced recovery breast care nurse' to co-ordinate the service. Currently and in the future re-audit will measure discharge time in hours rather than in days.

**Conclusion(s):** 23 hour breast care surgery has been successfully implemented in WWL NHS Foundation Trust UK due to good planning and good multi-disciplinary team work.

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**Acknowledgements:** Many thanks to all the members of the 23 hour breast surgery committee at WWL.

Thanks to all the doctors, nurses and managers who contributed to development of the pathway and audit process.

## 2AP1-6

### Analgo-sedation for colonoscopy: remifentanil vs propofol

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**Background and Goal of Study:** Unlike propofol, administration of remifentanil for sedation in gastrointestinal endoscopy has never been formally evaluated. Aim of this study is to assess the efficacy and tolerance of the administration of remifentanil compared with propofol during gastrointestinal endoscopy (GE) NORA environments.

**Materials and Methods:** 154 patients undergoing GE were randomized into group R (n=78) received midazolam 2 mg iv, remifentanil 0.5 mcg/Kg bolus plus 0.07 to 0.1 mcg/Kg/min by continuous infusion; Group P (n=76) received midazolam 1 mg iv, propofol 0.5 mg/Kg bolus and 1 mg/Kg/h by continuous infusion. During the procedure 2L/min oxygen via face mask was supplemented in all patients; all were monitored for heart rate (HR), oxygen saturation SpO<sub>2</sub> (pulse oximetry), blood pressure, respiratory rate (RR), Bispectral Index (BIS) and end tidal carbon dioxide (ETCO<sub>2</sub>) at 1,3,6,9,30 minutes. The degree of sedation (or sleepiness) was assessed using the observer's assessment of the scale supervisory/sedation (OAA/S) every three minutes. Patient satisfaction was analyzed by mean of a satisfaction score of 10 points. Recovery of the patient was evaluated at 30 minutes after the end of the procedure with the modified Aldrete Scoring System.

**Results and Discussion:** In group P in five patients was necessary to provide respiratory support with SpO<sub>2</sub> < 90%. In group R SpO<sub>2</sub> was remained fairly stable. Hemodynamic parameters and ETCO<sub>2</sub> remained stable during the procedure in both groups. Lowest values of OAA/S and BIS were found in the group P than in group R. BIS at 3,6 and 9 minutes was group P 70±8, 61±7.8, 60±9.8; group R 91±4, 90±6.4, 89±4.4;  $p < 0.01$ . OAA/S at 3,6 and 9 minutes were: group P 2.6±0.66, 2.3±0.59, 6.59±0.58; group R 4.67±0.49, 4.5±0.48;  $p < 0.01$  respectively. Recovery time was faster in the group R (0 minutes) than in group P (time 2.59±0.94 minutes). Aldrete Scoring System did not show significant differences in the two groups. Side effects reported were: nausea (6 patients, group P; 4 patients, group R) and abdominal pain (4 patients, group P). Both groups were satisfied dell'analgo-sedation.

**Conclusion(s):** The study suggests that analgo-sedation with low dose of remifentanil is a valid alternative to sedo-analgesia with propofol. Indeed, administration of an opioid so fast is just as effective, especially when loss of consciousness of the patient is not required under in environments NORA.

## 2AP1-7

### Propofol versus dexmedetomidine for sedation in colonoscopy: a prospective, randomized study

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**Background and Goal of Study:** Since 2008 dexmedetomidine is approved for sedation purpose in colonoscopy procedures in nonintubated patients. We compared the efficacy and side effects of the standard regimen of propofol versus dexmedetomidine.

**Materials and Methods:** We prospectively studied 231 patients (ASA1-3) undergoing to colonoscopy during the period January 2009- June 2011, randomly assigned to Propofol (P) and Dexmedetomidine (D) groups. Conscious sedation was performed with Propofol 1,5mg/kg and on demand bolus 0,4-0,5mg/kg (group P =119 pts) and Dexmedetomidine 1mcg/kg (group D = 112 pts). The HR, BP, RR, pulse oximetry values, as well as patients' satisfaction (amnesia) and the endoscopist' one (his verbal pronunciation) were recorded.

We considered hypotension as systolic BP less than 100 mmHg, bradycardia as HR under 50 beats a minute, and hypoxemia an oximetry value (SpO<sub>2</sub>) fewer than 90%.

**Results and Discussion:** The mean procedure duration, time for sedation induction, and post procedure recovery time were: 37 ± 11 min, 4.5 ± 1.5 min, and 25 ± 11 min, respectively. A decline in SBP occurred in 29 patients (12.5 %), 17 (58.6 %) in the patients receiving dexmedetomidine and 12 (41.4 %) in gr. P. 11 patients (4.7 %) had a decline in oxygen saturation, predominantly in gr. P (10 pts) and only one patient in gr. D. All of the complications were not clinically significant, and without major consequences. No severe bradycardia, and unpleasant situation related to the patients and endoscopists were recorded. Dexmedetomidine seems to be safe related to respiratory complications, but causes more hypotension. Probably the combination of a  $\alpha_2$ -agonist (leading to vasodilatation) with special preparation before colonoscopy (leading to hypovolemia), can explain the hypotension encountered in gr. D. Satisfaction was the same in both groups.

**Conclusion(s):** We found both regimens suitable for safe sedation during colonoscopy procedure. The use of propofol caused more desaturation, whereas dexmedetomidine caused more hypotension. The anesthesiologist must be aware to choose the correct sedation regimen, respecting the patient's physical status and medical history.

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## 2AP1-8

### Variability in early and protracted recovery after intravenous and inhaled anaesthesia

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**Background and Goal of Study:** The anaesthetics used today are all safe and efficient. The effects wear off rapidly after cessation of administration. The short term recovery (0-24 hrs) has been extensively studied but the protracted recovery (24 hrs -1 week) is less well defined. This aim of the present study was to assess recovery in females undergoing elective breast surgery under general anaesthesia (propofol or desflurane) with a focus on the more protracted recovery.

**Materials and Methods:** 60 ASA I-II women between 20 and 65 years undergoing elective short time breast surgery are included in the study. All patients follow a standardised protocol but are randomly allocated to inhalation anaesthesia with desflurane or iv. anaesthesia with propofol (TIVA). The patients complete cognitive questionnaires (baseline-test) preoperatively using three different tools (PQRS-Postoperative Quality Recovery Score<sup>1</sup>, CFQ - Cognitive Failure Questionnaire<sup>2</sup> and FRI-Functional Recovery Index<sup>3</sup>) and at 2, 24, 48, 72 hrs and one week after the anaesthesia.

**Results and Discussion:** 27 patients are included so far, mean duration of anaesthesia is 86 min.(SD 31) and 91 min. (SD 26), in desflurane and TIVA group respectively. Emergence is somewhat faster after desflurane (median 4.6 min, range 1-13) as compared to TIVA (median 5.6 min, range 2-18). At 48 hrs. in both groups around half the patients still show deficits in the two cognitive tests PQRS and CFQ (see table). At this time the emotional PQRS recovery is as high as 90 % while nociceptive recovery is still low (20-25%). The FRI results show that 87 % in the desflurane group and 92 % in the TIVA group still not feel physically recovered after one week.

	POQRs Cogn. 20h	POQRs Cogn. 48h	CFQ 48h	CFQ 1w
TIVA (n=15)	7/8 (47)	6/7 (46)	6/9 (40)	6/6 (50)
Des (n=12)	4/8 (33)	7/5 (58)	6/6 (50)	6/4 (60)

[Recovery assessed by PQRS and CFQ]

**Conclusion(s):**

- About 50 % of the patients still haven't cognitively fully recovered 48 hours after anaesthesia according to the scales PQRS and CFQ.
- According to the FRI scale, only around 10 % of the patients have resumed their normal level of activities of daily living one week after anaesthesia and surgery.

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**2AP1-9**

**The optimal effect site concentration of propofol for conscious sedation in elderly male patients undergoing urologic surgery under spinal anesthesia with or without intrathecal fentanyl**

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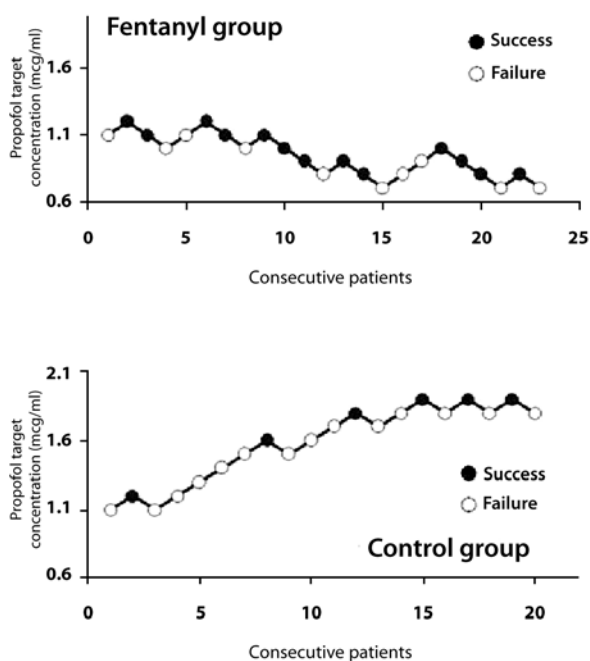
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**Background and Goal of Study:** Spinal anesthesia is a preferred anesthesia to elderly patients undergoing urologic surgery. However, causing conscious patients fear and boredom, sedative agent is needed to reduce patient's anxiety about surgery.

The purpose of this study was to calculate the optimal effect site concentration of propofol for conscious sedation in elderly male patients undergoing urologic surgery under spinal anesthesia with or without intrathecal fentanyl guided by CSI monitoring.

**Materials and Methods:** Forty-three patients were randomly assigned to receive either fentanyl 25 mcg (n = 23) or normal saline (n = 20) with hyperbaric bupivacaine 10 mg for spinal anesthesia. Intravenous propofol infusion was started 15 min after the spinal injection at a dose determined by a modified Dixon's up-and-down method. When target effect site concentration was reached, CSI value was measured every 1 min during 10 min and averaged over the period.

**Results and Discussion:** The EC50 of the effect-site concentration of propofol for sedation was 1.67 ± 0.28 mcg/ml in the control group. However, in the fentanyl group, and 0.87 ± 0.15 mcg/ml (p = 0.02). Sensory deafferentation effect and rostral spread of fentanyl seem to be the most likely causes of reduced propofol dose for sedation. The limitation is that the sensory block levels of the two groups were different in this study.



[Patient responses to conscious sedation under spin]

**Conclusion(s):** Intrathecal fentanyl 25 mcg added to local anesthetic during spinal anesthesia reduced the dose of propofol for sedation by 48% compared to local anesthetic alone in elderly patients undergoing urologic surgery.

**2AP1-11**

**Ambulatory anesthesia in a patient with anorexia nervosa**

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**Background:** Anorexia nervosa is a psychiatric disorder characterized by abnormal eating behavior with an estimated mean yearly incidence of 10 per 100,000 population and its prevalence has increased over the last years. We present a case report in order to consider the possibility and safety to provide anaesthesia in such cases for day surgery.

**Case report:** We report a 35 year old female in 14 weeks of gestation who presented in order to have a termination of unwanted pregnancy as a day case surgery. Physical examination revealed a BMI of 14, nonsmoker with reduced breath sounds and widespread expiratory wheeze. The patient underwent spirometry that showed mild restrictive pattern of breathing with moderate airway obstruction. Before anesthesia induction the patient received salbutamol/ ipratropium neb, budesonide neb, hydrocortisone 500mg iv. and ranitidine 50 mg iv, metoclopramide 10 mg iv. For sedation alfentanil 15 µg/kg (total 500 µg) and propofol 2.5 mg/kg followed by infusion were given. Her ventilation was supported by bag and mask with O2 100%.The patient retained good SpO2 and was haemodynamically stable. After surgery the patient recovered within 5 min and auscultation revealed an improvement of breath sounds:

**Discussion:** Anorexia nervosa leads to multisystem abnormalities with the perioperative mortality ranging from 10-20%. Prolonged anorexia can cause loss of lung elasticity, reduction of pulmonary compliance and obstructive pulmonary disease. Total intravenous anesthesia with short acting drugs was uneventful while perioperative inhaled β2 agonists, anticholinergics, glucocorticoids and hydrocortisone may be needed in day case surgery in such patients.

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**Learning points:** Anorexia nervosa can produce a wide array of physiological derangement. The impact of prolonged anorexia on lung physiology and respiratory muscle performance is still incompletely investigated. Correction of such derangements is vital in optimizing patient safety and conducting appropriate ambulatory anaesthesia in this population.

**2AP2-1**

**Quantitative measurement of motor blockade is superior to Bromage score as a predictor of patient ambulation after spinal anesthesia in ambulatory surgeries**

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**Background and Goal of Study:** Patient ability to ambulate unassisted is routinely predicted by Bromage scale which is qualitative and does not have sensitivity to lower degree of motor weakness. The aim of our study is to use a quantitative measure of the muscle strength to find out the muscle power at which the patient can ambulate unassisted safely after spinal anesthesia

**Materials and Methods:** After approval of the local ethics and research committee, 20 adult males scheduled for ambulatory perianal surgeries were enrolled in this study. Spinal anesthesia was conducted using 10mg heavy bupivacaine. The regression of motor block was assessed both qualitatively using Bromage scales and quantitatively by measuring the isometric contraction of Knee, Hip and Ankle flexors every 15 min. The muscle strengths at which patients safely ambulated unassisted was recorded and their correlations with Bromage scale were analyzed using, correlation coefficient, ROC curves, and prediction probability

**Results and Discussion:** Regression of Bromage score was faster than regression of the isometric forces at all tested joints. As the change of the median Bromage score from grade 1 to 0 (no motor block), the motor power recoveries at knee, hip and ankle were 39.0 ± 18.1%, 56.7 ± 28.3%, 67.1 ± 31.2 % respectively and only 6/20 (30%) of the patients were able to walk unassisted. 120 min later all the patients were able to mobilize unassisted with power recovery of 80.0 ± 14.9%, 92.4 ± 16.9%, and 95.7 ± 10.6 % at knee, hip and ankle respectively. Quantitative motor power was specific in predicting the patients'



ability to walk unassisted. ROC curves showed specificity of 88%, 90%, 92% and 50% for, Knee, Hip, Ankle and Bromage respectively and Prediction probabilities of 0.901, 0.948, 0.958 and 0.752 in the same order  $P < 0.001$ . The possible explanation is the fact that lower degree of muscle weakness could not be fully detected by the Bromage test.

**Conclusion(s):** Quantitative measurements of the degree of recovery of the motor power of the Knee, Hip, or Ankle flexors are more accurate and superior to Bromage score, as predictors of patient ability to safely ambulate after spinal anaesthesia.

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## 2AP2-2

### Premedication with controlled-release oxycodone in management of postoperative pain after ambulatory laparoscopic gynaecological surgery

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**Background:** Oxycodone controlled release (CR) (OxyContin™, Mundipharma Pharmaceutical, United Kingdom) is a potent opioid analgesic. Current studies about its efficacy in ambulatory surgical patients yield conflicting results. We aim to assess the analgesic effect of oral oxycodone CR when used as a premedication in patients undergoing ambulatory laparoscopic gynaecological surgery.

**Methods:** With the approval of Hospital Ethics Committee, a randomised, double blind, placebo-controlled trial was performed in 60 patients undergoing uncomplicated ambulatory laparoscopic gynaecological surgery. They were randomised into two groups to receive either oral oxycodone CR 10 mg (Group C, n=30) or placebo (Group P, n= 30) 1hr preoperatively. Post operative pain score and side effects of oxycodone CR were assessed. If necessary, rescue analgesia of intravenous fentanyl 25mcg every 15 min was given in recovery room until the numerical rating pain score  $\leq 5$ . These patients were followed up for 24hrs postoperatively via telephone interview.

**Results:** We found no difference in pain scores at rest or on exertion at 15 minutes, 1 hour, 2 hours or 24 hours after surgery between the 2 groups of patients. In addition, fentanyl usage, discharge time and satisfaction score were not significantly different. The side effects profile were similar between the 2 groups except an increased incidence of headache at 24 hours after surgery in the oxycodone CR group. ( $p < 0.05$ )

**Conclusion:** There is no difference in post operative pain scores in patients who are premedicated with oral oxycodone CR when compared with placebo. No conflict of interest declared.

This study was approved by local IRB.

## 2AP2-3

### Flexible laryngeal mask airway for ambulatory hemithyroidectomy - an efficient and safe option

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**Background and Goal:** Thyroid surgery has traditionally been done as an inpatient procedure. With the advent of minimal access techniques, drains are frequently not required and ambulatory thyroidectomy is possible.<sup>1</sup> There are few published studies about anaesthesia for ambulatory thyroid surgery. We compare the use of Flexible Laryngeal Mask Airway (LMA) with Orotracheal Intubation (OIT) in ambulatory hemithyroidectomy (AH), particularly in concerning to the intraoperative use of fentanyl and rocuronium.

**Material and Methods:** Retrospective study of AH performed during 1 year at our hospital. Data were collected from the database of the software *CareSuite 8.2* (Siemens) and the statistical analysis made with the *GraphPad Prism 5.0* (GraphPad Software, EUA). Data for age, sex, ASA physical status and need for re-intervention were analysed. Using the *Student's t-test* we compared fentanyl and rocuronium intake as well as the duration of surgery and anaesthesia between patients LMA and OIT.

**Results and Discussion:** There were performed 60 AH, 50 patients were in the OIT group and 10 in the LMA. 88% were female patients and 12% male patients. Their average age was 37,2 years old (SD 12,8), 70% were ASA I and 30% ASA II. The mean duration of surgery was 50,1min (SD 10,7) and the mean duration of anaesthesia was 63,7min (SD 14,6). One patient, in the OIT group, needed re-intervention due to cervical hematoma. Although the num-

ber of patients in the LMA group was much smaller, there was a statistically significant decrease in the consumption of fentanyl (0,125mg vs 0,152mg;  $p=0,0068$ ) and rocuronium (21,0mg vs 37,3mg;  $p < 0.0001$ ) in this group. Likewise there was a statistically significant decrease in the mean duration of anaesthesia in LMA group (51,30min vs 66,16min;  $p=0,0028$ ) with no differences in the duration of surgery (45,20min vs 51,06min;  $p=0,1548$ ).

**Conclusion(s):** The lower mean dosage of fentanyl and rocuronium used in LMA group probably explains the significant decrease in the duration of anaesthesia. The use of LMA did not imply an increase in surgical duration, so we assume that didn't impair the surgical technique. We conclude that LMA is an advantageous option addressing the airway in AH and may increase the efficiency and safety, being advantageous in a program of ambulatory surgery.

#### References:

<sup>1</sup>Otolaryng-Head&Neck Surg 2007;136:556-559

**Acknowledgements:** Group of Head and Neck Surgery of Braga Hospital

## 2AP2-4

### Spinal anaesthesia with low dose bupivacaine-fentanyl combination: a good alternative for day case TURP surgery in geriatric patients

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**Background and Goal of Study:** We evaluated the effectiveness, block duration, postanesthetics care unit stay and adverse effects of using intrathecal low dose bupivacaine and fentanyl combination and compared with conventional dose prilocaine and fentanyl combination usage for day case transurethral resection of prostate surgery in geriatric patient population.

**Materials and Methods:** 60 patients were randomized into two groups as Group B, receiving 4 mg bupivacaine 0.5% + 25 µg fentanyl and Group P, receiving 50 mg prilocaine 2% + 25 µg fentanyl intrathecally. Block qualities, duration of block, postanesthesia care unit stay and adverse effects were compared.

**Results and Discussion:** Block durations and postanesthesia care unit stays were shorter in Group B than in Group P ( $p < 0.001$  in both). Block properties were shown in table in which \*  $p < 0.05$ . Hypotension and bradycardia were not seen in Group B which was significantly different than in Group P ( $p=0.024$  and  $p=0.011$  respectively).

	Group B (n=30)	Group P (n=30)
Highest sensorial block level	T10 (T8-T10)	T8 (T6-T10)*
Time to reach highest sensorial block level (min)	7.6 ± 1.3	7.1 ± 1.9
Motor block	1 (0-3)	2 (1-3)*
Block duration (min)	110.8 ± 14.7	158.5 ± 12.7*
Duration of stay in PACU (min)	168.3 ± 19	168.3 ± 19

[Block properties in groups]

**Conclusion(s):** Intrathecal 4 mg bupivacaine + 25 µg fentanyl provided adequate spinal anaesthesia with shorter block duration and postanesthesia care unit stay with stable hemodynamic profile than intrathecal 50 mg prilocaine + 25 µg fentanyl for day case transurethral resection of prostate surgery in geriatric patients.

## 2AP2-5

### Radiological verification of an I-gel mask placement in children

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**Background and Goal of Study:** Since recently, an I-gel mask has been used as a routine airway device in both children and adults. The purpose of this study was to evaluate the blind placement of an I-gel mask airway in children and infants scheduled for magnetic resonance imaging (MRI) under general anaesthesia.

**Materials and Methods:** 99 children and infants fasted for a scheduled MRI under general anaesthesia. All of the children were given an inhalational anaesthesia with sevoflurane with 40% oxygen (O<sub>2</sub>/N<sub>2</sub>O mixture). After an induction, an iv route was established and an I-gel mask appropriate to age and weight was placed by one of two anaesthesiologists. General anaesthesia was maintained with sevoflurane with 40% oxygen only. All children were monitored for an end-tidal CO<sub>2</sub>, peripheral oxygen saturation, an electrocardiography (ECG) and non-invasive blood pressure (NIBP) according to the ASA status. After the procedure was commenced, the exact position of the tip of

the I-gel mask and a laryngeal opening (vocal cords) at the depending cervical vertebra (C level) were recorded both by one of the anaesthesiologists and by one of two radiologists on the coronary section of the image.

**Results and Discussion:** Our study group included 65 boys and 34 girls of various ages. The youngest participant was a newborn 30 days of age and the eldest were two 16-year old boys. Most of the children were in the age group from 3 to 5 years of age (51 children), whilst approximately the same number of children were in the youngest age group up to 2 years of age (23 children) and in the eldest group, older than 6 years of age (25 children). The median cervical level of the tip of an I-gel mask was C5 level regardless of gender or age. The youngest and the oldest age group had their vocal cords anatomically positioned more cranial, median at C4 level. In the most numerous group (from 3 to 5 years of age) we registered the vocal cords median at C3 level, but the difference between the groups was found not to be significant. An airway complication was registered (low etCO<sub>2</sub>, intercostal retractions and low SpO<sub>2</sub> measurement) in three children and was corrected before the imaging procedure was commenced.

**Conclusion(s):** Regardless of age and gender specific anatomy, a blind placement of an I-gel mask airway is a safe and uneventful procedure for magnetic resonance imaging under general anaesthesia in infants and children.

## 2AP2-6

### Comparison of sevoflurane-parecoxib and sevoflurane-sulfentanil anesthesia for patients undergoing day case breast surgery with laryngeal mask airway under spontaneous breath

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**Background and Goal of Study:** This study was designed to compare the clinical characteristics of sevoflurane-parecoxib and sevoflurane-sulfentanil anesthesia for patients undergoing day case breast surgery.

**Methods:** Fifty-six patients undergoing day case breast surgery were allocated randomly to receive sevoflurane-parecoxib (Group P) or sevoflurane-sulfentanil (Group S) with laryngeal mask airway (LMA) under spontaneous breath. Respiratory rate (RR), heart rate (HR), and mean blood pressure (MBP) were compared during anesthetic induction, maintenance, and recovery at different time points. The incidence rates of adverse effects and consumption of fentanyl during and after operation were compared.

**Results:** Respiratory rate, heart rate, and mean blood pressure did not differ significantly in two groups. The incidence rates of bradypnea, breath holding, desaturation, and bradycardia in Group P were significantly lower than those in Group S, and the incidence of excitement in Group P was higher than Group S. The incidence of postoperative nausea or vomiting did not differ significantly in two groups.

	Group P	Group S	p value
Bradypnea	2(7.14%)	8(28.57%)*	0.036
Breath holding	1(3.57%)	7(25.00%)*	0.026
Desaturation (<93%)	1(3.57%)	6(21.42%)*	0.043
Bradycardia	2(7.14%)	9(32.14%)*	0.028
Nausea and vomiting	2(7.14%)	3(10.71%)	0.639
Excitement	8(28.57%)	2(7.14%)*	0.036

[Table 1. Comparison of adverse events]

The consumption of fentanyl did not differ significantly in two groups during and after operation.

**Conclusion:** Both sevoflurane-parecoxib and sevoflurane-sulfentanil provide satisfactory anesthesia for patients undergoing day case surgery with LMA under spontaneous breath. Sevoflurane-parecoxib was associated with more stable respiration but higher incidence of emergence agitation when compared with sevoflurane-sulfentanil.

## 2AP2-7

### Comparison of local anaesthetic wound infiltration and bilateral superficial cervical plexus block for thyroid and parathyroid surgery

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**Background and Goal of Study:** Thyroid and parathyroid surgery in the UK are now routinely performed on a 23 hour basis. Post operative pain relief may consist of oral analgesia with either, local anaesthetic wound infiltration (LAI) after skin closure, or bilateral superficial cervical plexus block (BSCP)

prior to incision. To date, studies on the superiority of either technique have been inconclusive.

The aim of this study was to compare post-operative pain scores, anaesthetic recovery time and analgesia intake for patients undergoing thyroid and parathyroid surgery when treated by two consultants using either of these regimes.

**Materials and Methods:** This was a prospective, non-randomised study of consecutive patients treated from February to July 2011. Details on operation, type of block (LAI: 20mls of 0.5% Levobupivacaine or BSCP: 20mls 0.25% Levobupivacaine each side) and pain score (0 - no pain to 10 - most severe pain) on first post-operative day were collected during hospital stay. Information on complications and pain score at day 5 were obtained via telephone. Students' t-test was used for statistical analysis and deemed significant if P < 0.05.

**Results and Discussion:** Sixty-eight patients were included (58 women, median age 51 years, 19-86). Forty patients underwent thyroidectomy (12 total thyroidectomy, 28 thyroid lobectomy) while 28 patients had parathyroidectomy (18 open parathyroidectomy, 10 minimally invasive parathyroidectomy (MIP)). Of the thyroidectomy patients 26 had BSCP (8 total, 18 lobectomy) and 14 had wound LAI (4 total, 10 lobectomy). Patients in the LAI group had significantly higher pain scores on day 1 (P=0.0048) and spent significantly longer in recovery (P=0.016) compared with patients receiving BSCP. By day 5 pain scores were similar.

There was no significant difference in the total amount of analgesia consumed between groups on day 1 or by day 5. Of those that had parathyroidectomy, 18 had BSCP (8 open, 10 MIP) and 10 had LAI infiltration (all open). Only patients who had MIP had significantly less pain at 24 hours (P=0.045) and spent significantly less time in recovery P=0.008). Analgesia intake was similar between groups.

**Conclusion(s):** When used in thyroid surgery, compared with LAI, BSCP reduces time in recovery and 24 hour pain scores but does not alter analgesia intake. BSCP therefore enhances recovery and reduces immediate post-operative pain after thyroidectomy.

## 2AP2-10

### Postoperative discomfort due to residual peripheral nerve blocks in outpatients operated from for carpal tunnel release

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**Background and Goal of Study:** For hand surgery, peripheral nerve blocks (PNBs) can be performed at the wrist or more proximally at the brachial level. No data are available concerning the potential discomfort due to the residual block in the early postoperative period.

The aim of our study was to assess the discomfort due to residual distal and proximal blocks in outpatients operated from carpal tunnel release.

**Materials and Methods:** Cohort of outpatients undergoing open carpal tunnel release under PNBs. Median and ulnar nerves were always blocked with mepivacaine 1.5%. Musculocutaneous nerve block and PNB choice depended on the attending anaesthesiologist routine. Five anaesthesiologists performed distal PNBs (at the wrist, with nerve stimulation). Two anaesthesiologists performed proximal PNBs : at the brachial canal with nerve stimulation, or at the axillary crease with ultrasound guidance. Patients went home 2-3 hours after surgery. They were phoned 3 days later for our routine follow up, and were invited to graduate the discomfort due to the residual block after hospital discharge on a verbal scale (absence, minor, mild, quite important and very important).

This was our primary end point. Both groups were compared with Fisher exact tests and student t tests when appropriate.

**Results and Discussion:** Between november 2006 and january 2008, 185 of 217 consecutive patients were contacted at Day3 and analysed (105 distal PNBs and 80 proximal PNBs). Age, gender, body mass index, ASA score, postoperative pain scores were not different between groups. The musculocutaneous nerve was blocked in 23% of distal PNBs and in 81% of proximal ones (p < 0.001). Overall, distal PNBs induced less discomfort than proximal PNBs (p=0.041).

Nevertheless, 20% of patients with distal PNBs express mild to very important discomfort, versus 30% of patients with proximal PNBs (p=0.124).

**Conclusion(s):** Despite dramatic differences in anaesthetised and paralysed territories between the two groups, wrist PNBs induce only slightly less post-operative discomfort due to residual block than proximal PNBs. Therefore, the clinical impact of this discomfort seems limited since in both groups, 70 to 80% of patients reported no or minor discomfort.

## Monitoring: Equipment and Computers

### 3AP1-1

#### A comparison of bioreactance with oesophageal Doppler for cardiac output monitoring during open abdominal surgery

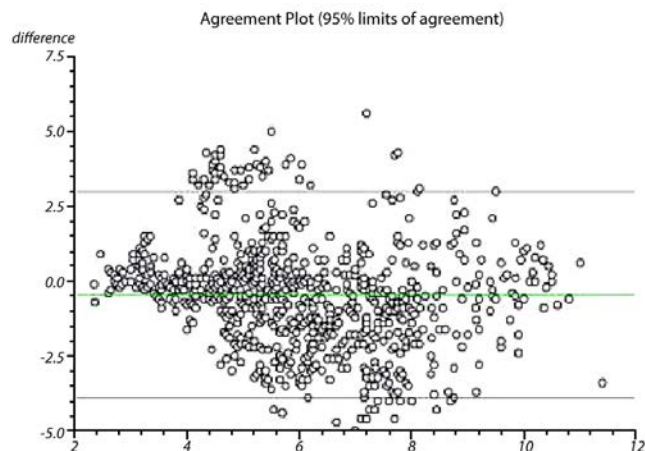
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**Background and Goal of Study:** Less invasive cardiac output (CO) monitoring can facilitate fluid administration; optimize blood volume and reduce post-op complications. Oesophageal Doppler ODM (Deltex Medical, UK) is recommended by NICE, a UK governmental body (1). ODM has limitations: it is difficult to use in head/ neck surgery; in awake patients and with patient movement. A new non-invasive CO monitor utilising Bioreactance (NICOM Cheetah Medical, Portland, Oregon) has the potential to overcome these problems (2). The aim of this study was to compare CO of ODM & NICOM during surgery.

**Materials and Methods:** The protocol was approved by the Local Research Ethics Committee (REC Ref: 11/NW/0046) & we received written, informed consent from abdominal surgery patients. Exclusion criteria: AF; valvular disease; heart failure; oesophageal disease; allergy to starch/ECG sticker. The researchers placed & calibrated 4 NICOM dual electrodes on the anterior thoracic wall 'boxing-in' the heart. Following induction of anaesthesia & intubation, the anaesthetist set up ODM. We took snapshots of CO every 30s. Bland-Altman plots and bias, limits of agreement and percentage error, as described by Critchley, was calculated. The precision for each device was obtained during 10mins of haemodynamic stability.

**Results and Discussion:** 788 acceptable CO measurements from each device were recorded from 22 patients. Bland Altman analysis for CO demonstrated bias of  $-0.46 \text{ litre min}^{-1}$  and limits of agreement of  $3.4 \text{ litre min}^{-1}$ . The percentage error was 59.6%. Average precision for both the CardioQ and NICOM were similar, 8.5% (SD 5.4%) and 8.7% (SD 3.2%) respectively. Both devices had poor readings with diathermy.



[Bland-Altman analysis for CO Measurements]

**Conclusion:** NICOM Cheetah produces robust CO readings during abdominal surgery with minimal bias, but with a relatively high percentage error.

**References:**

1. <http://guidance.nice.org.uk/MTG3>
2. Squara P et al Intensive Care Medicine 2007;33:1191-4

**Acknowledgements:** NIAA Small Project Grant.

### 3AP1-2

#### Bioreactance and oesophageal Doppler for stroke volume monitoring: correlation with arterial pressure measurements during open abdominal surgery

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**Background and Goal of Study:** Less invasive cardiac output monitoring can facilitate fluid administration during surgery helping the anaesthetist to optimize blood volume and reduce post-operative complications. The oesophageal Doppler (CardioQ ODM, Deltex Medical, UK) is recommended by NICE, a UK governmental body, for use during major surgery (1). Unfortunately ODM

has a number of limitations: it is difficult to use in head and neck surgery; in awake patients and following patient movement. Alternatives such as pulse contour analysis or a new non-invasive cardiac output monitor utilising Bioreactance technology (NICOM, Cheetah Medical, Portland, Oregon) have the potential to overcome these problems(2). Pulse contour analysis devices will correlate CO estimates with arterial pressure (3).

**Aim of study:** To evaluate whether cardiac output estimates by ODM or NICOM correlate with mean arterial pressure during surgery

**Materials and Methods:** The protocol was approved by the Local Research Ethics Committee (REC Ref:11/NW/0046) & we received written, informed consent from abdominal surgery patients. Exclusion criteria: AF; heart failure; valvular disease; oesophageal disease; Allergy to starch/ ECG sticker. The researchers placed & calibrated 4 NICOM dual electrodes on the anterior thoracic wall 'boxing in' the heart. Following induction & intubation, ODM was set up by the anaesthetist in charge of the case. We recorded snapshots of stroke volume (SV) and mean arterial pressure (mAP) every 30s. We calculated simple linear regression & Pearsons' correlation of mAP v SV for both devices

**Results and Discussion:** 788 acceptable stroke volume & blood pressure measurements from each device were recorded from 22 patients. There was no correlation between SV and mAP for either device : ODM SV v mAP ( $r = 0.062$  ( $r^2 = 0.0039$ ); NICOM SV v mAP ( $r = -0.008$  ( $r^2 = 0.000064$ )). ODM and NICOM SV correlated significantly with an R value of 0.57 ( $r^2 = 0.35$ ).

In this preliminary analysis, there was a good correlation of SV estimation between NICOM & ODM. Neither monitor correlated with mAP suggesting that signal received by each monitor may be related to flow rather than pressure.

**Conclusion(s):** Both NICOM and ODM stroke volume estimates appear to be independent of arterial pressure

**References:**

1. <http://guidance.nice.org.uk/MTG3>
2. Squara P et al Intensive Care Medicine 2007;33:1191-4
3. Camporota L Beale R. Crit Care 2010;14:124

**Acknowledgements:** NIAA Small Project Grant.

### 3AP1-3

#### Transoesophageal doppler as a haemodynamic monitor during and after liver resection for cirrhotic patients.

##### An observational study

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**Goal of Study:** To monitor haemodynamic changes with Transoesophageal Doppler (TED) a minimal invasive method during and after hepatic resection in cirrhotic patients and study the effect on both colloid consumption and complications.

**Patients and Methods:** After Ethic committee approval and written informed consent, fifty nine cirrhotic patients (Child A) were studied prospectively and randomized into two groups. Central venous pressure (CVP), (Control group), ( $n=30$ ) and another group monitored with TED (Doppler group), ( $n=29$ ) and CVP. During resection CVP was kept  $< 5 \text{ mmHg}$  in both groups with colloid restriction and nitroglycerine.

Post resection colloids infusion were CVP guided in CVP group (5-10 mmHg) and corrected aortic flow time (FTc) guided in Doppler group (CVP Kept blind to Anaesthetist in Doppler group). Crystalloids  $6\text{ml/kg/hr}$  were given as a background for both groups throughout surgery. Blood products given according to laboratory data.

**Results and Discussion:** A significant increase in heart rate in both groups after resection compared to base line ( $P < 0.05$ ). Cardiac Index (CI) and stroke volume (SV) of the Doppler group increased immediately after hepatic resection compared to baseline, ( $3.0 \pm 0.9$  v  $3.6 \pm 0.9 \text{ L/min/m}^2$ ;  $P < 0.05$ ;  $67.1 \pm 14.5$  v  $76 \pm 13.2$ ;  $P < 0.05$ ) and was associated with a decrease in systemic vascular resistance (SVR) ( $1142.7 + 511$  v  $835.4 + 190.9 \text{ dynes.sec/cm}^3$ ,  $P < 0.05$ ). No significant difference between arterial pressure and CVP between both groups ( $P > 0.05$ ). Using the FTc parameter to guide Hydroxyethyl starch (HES) 130/0.4 administration lead to a significant decreased in consumption for Doppler vs CVP group post-resection ( $1.03 \pm 0.49$  vs  $1.74 \pm 0.41 \text{ Liter}$ ;  $P < 0.05$ ).

No significant correlation was found between FTc and CVP ( $r = 0.24$ ,  $P > 0.05$ ). Insignificant difference in blood products transfusion reported between the two groups, only plasma transfused (mean 4 units), no packed red cells ( $P > 0.05$ ). Nausea, vomiting and chest infection were significantly less in the Doppler group leading to a shorter hospital stay. ( $P < 0.05$ )

**Conclusion:** TED as a sole monitor was able to present significant haemodynamic changes immediately post-resection. FTc guide lead to a reduction in

colloids administration post-resection, reduced both morbidity and shortened hospital stay. Future research is recommended to investigate the interrelationship between CVP and FfC.

#### References:

1. Sinclair S, James S, Singer M: *BMJ* 1997, 315:909-912

### 3AP1-4

#### Monitoring of myocardial CO<sub>2</sub> tension detects cardiac metabolism and function impairment during low grade coronary flow reduction: a study in pigs

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**Background and Goal of Study:** Myocardial PCO<sub>2</sub> monitoring detects acute ischemia (1). Coronary stenosis may lead to myocardial hypoxia but the impact on metabolism and the ability of PCO<sub>2</sub> monitoring to detect partial occlusion is unknown. We hypothesized that minor coronary flow reduction leads to anaerobic metabolism, is correlated to regional ventricular function and is detectable by myocardial PCO<sub>2</sub> measurement.

**Materials and Methods:** Off-pump coronary artery bypass grafting was performed from left internal mammary artery (LIMA) to left anterior descending artery (LAD) in 8 pigs. LIMA blood flow, measured with a transit time ultrasound probe, was reduced for 18 min intervals to 75%, 50%, 25% and 0% flow with reperfusion between each flow reduction. Myocardial PCO<sub>2</sub> (Neutrend) and lactate (microdialysis) from the LAD- and left circumflex artery (LCx)-region were obtained. Regional ventricular function was assessed as radial strain by 2D-echocardiography and global function as cardiac index by thermodilution.

**Results and Discussion:** LIMA flow reduction did not affect global cardiac function. Myocardial PCO<sub>2</sub> increased significantly and flow dependently in the LAD-region during each flow reduction, returned to baseline values between ischemic periods and completion of the experiment (table 1).

Intervention	Cardiac PCO <sub>2</sub> (mmHg)		Cardiac Lactate (mM)		Radial Strain (%)	
	Mean	SD	Mean	SD	Mean	SD
Baseline (after surgery)	66.9	13.5	1.9	0.2	43.4	14.6
75% bloodflow	101.1	37.5 * #	4.5	1.1 * # □	22.8	17.8 *
50% bloodflow	124.8	52.5 * #	6.5	1.6 * # □	13.3	15.2 * □
25% bloodflow	163.3	51.6 * #	8.2	1.2 * # □	3.1	6.5 * □
0% bloodflow	253.7	98.4 * #	8.9	2.5 * # □	-9.8	4.6 * □
Reperfusion	67.2	9.8	3.2	1.9	Not assessed	

Data from LAD region. p < .05; \* compared to baseline, # compared to reperfusion, □ compared to LCx-control area

[Table 1]

Similarly, lactate increased significantly but remained constant low in the LCx region throughout the experiment (1.8 ± 0.3 mM). PCO<sub>2</sub> correlated with lactate (R = .97, p < .05). Regional ventricular function declined significantly in the LAD region and correlated to PCO<sub>2</sub> and lactate (R = -.99 and -.99, respectively, both p < .05).

**Conclusion(s):** Early detection of decreased coronary flow is necessary as myocardial metabolism and function gets impaired before complete ischemia is achieved. Myocardial PCO<sub>2</sub> monitoring can quantify the degree of regional tissue hypoperfusion, is correlated with metabolism and function and might thus serve as a monitoring tool in cardiac anaesthesia.

#### References:

1. Pischke SE et al, *EJCTS* (2012) accepted

### 3AP1-5

#### Endotracheal bioimpedance cardiography and calibrated pulse contour analysis: a comparative study following cardiac surgery

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**Background and Goal of Study:** Validation studies of bioimpedance cardiography measured by the Endotracheal Cardiac Output Monitor (ECOM) have been scarcely reported. We tested the hypothesis that the ECOM device would be a convenient and reliable tool for both continuous cardiac index measurement and prediction in fluid responsiveness.

**Materials and Methods:** Twenty-five adult patients were admitted to the surgical intensive care unit of a teaching university hospital following conventional cardiac surgery, and investigated at baseline, during passive leg raising and after fluid challenge. Simultaneous comparative cardiac index data points were collected from calibrated pulse contour analysis (CI<sub>PC</sub>) and ECOM (CI<sub>ECOM</sub>). Correlations were determined by linear regression. Bland-Altman analysis was used to compare the bias, precision and limits of agreement. The percentage error was calculated. Pulse pressure variations (PPV) and stroke volume variations (SVV) before fluid challenge as well as changes in CI<sub>PC</sub> (ΔCI<sub>PC</sub>) and CI<sub>ECOM</sub> (ΔCI<sub>ECOM</sub>) during passive leg raising were collected to assess their discrimination in predicting fluid responsiveness.

**Results and Discussion:** A weak but statistically significant relationship was found between CI<sub>PC</sub> and CI<sub>ECOM</sub> (r = 0.45; P < 0.001). Bias, precision, and limits of agreement between CI<sub>PC</sub> and CI<sub>ECOM</sub> were 0.44 L.min<sup>-1</sup>.m<sup>-2</sup>, [95% confidence interval(CI):0.33-0.56], 0.59 L.min<sup>-1</sup>.m<sup>-2</sup> and -0.73 to 1.62 L.min<sup>-1</sup>.m<sup>-2</sup>, respectively. The percentage error was 45%. A weak but statistically significant relationship was found between percent changes in CI<sub>PC</sub> and CI<sub>ECOM</sub> after fluid challenge (r = 0.42, P = 0.035). Areas under the ROC curves for PPV, SVV, ΔCI<sub>PC</sub> and ΔCI<sub>ECOM</sub> to predict fluid responsiveness were 0.65 [95% CI:0.43-0.83], 0.69 [95% CI:0.47-0.86], 0.63 [95% CI:0.41-0.81] and 0.83 [95% CI:0.63-0.95] respectively.

**Conclusions:** The ECOM device, while not interchangeable with pulse contour analysis, seems convenient and consistent to continuously monitor cardiac index and could track the direction of its changes under dynamic loading conditions. The ability to predict fluid responsiveness with a good discrimination by using changes in cardiac index during passive leg raising could help to conduct perioperative hemodynamic goal-oriented therapy after cardiac surgery.

### 3AP1-6

#### Comparison of pulse contour versus pulmonary artery thermodilution cardiac output in patients undergoing elective open abdominal aortic aneurysm repair

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**Background and Goal of Study:** The FloTrac system provides cardiac output (CO) measurement by analysis of the arterial waveform. The system has been validated in a variety of clinical settings, but the reliability during major hemodynamic changes is unclear. We therefore investigated the FloTrac system (software version 3.02) versus pulmonary artery thermodilution CO in patients undergoing open abdominal aortic aneurysm (AAA) repair.

**Materials and Methods:** Twenty-one patients undergoing elective open AAA repair were included. CO was determined with FloTrac (CO<sub>FT</sub>) after induction (T1), after aortic cross-clamping (T2), after clamp release (T3) and after closure (T4). At the same time points, CO was measured using pulmonary artery thermodilution (CO<sub>TD</sub>) by averaging five consecutive measurements. Agreement was assessed using Bland-Altman analysis. Trending ability was studied with concordance and polar plot analysis.

**Results and Discussion:** We observed a significant difference between CO<sub>FT</sub> and CO<sub>TD</sub>, especially during aortic cross-clamping and clamp release (table 1). Trending ability was studied by determining concordance of ΔCO<sub>FT</sub> versus ΔCO<sub>TD</sub> between the time points T1-2, T2-3 and T3-4 (table 2). The concordance rates are lower than 90-95%, demonstrating insufficient trending ability. In addition, angular biases and angular LOA were determined (table 2). The values obtained do not meet the criterion for acceptable trending ability (angular LOA < +/- 30°). High standard deviations in CO<sub>TD</sub> as well as in CO<sub>FT</sub> measurements is one possible explanation for the non-interchangeability of methods. Furthermore, unstable hemodynamic conditions after aortic cross-clamping and clamp release may play a role in the large differences between the techniques.

time point	Bland-Altman		
	bias (L)	LOA (L)	% error
T1	0.27	-1.75;2.29	38.6
T2	-0.62	-3.07;1.82	50.7
T3	0.90	-2.58;4.38	53.3
T4	0.97	-1.66;3.60	39.7

[Table 1]

time interval	concordance (%)	polar statistics	
		angular bias (degrees)	angular LOA (degrees)
T1-2	77	-3	56;-62
T2-3	71	-22	37;-80
T3-4	89	-6	52;-63

[Table 2]

**Conclusion:** In this study, we found that FloTrac / Vigileo and pulmonary artery thermodilution CO measurements are not interchangeable in patients undergoing open AAA repair.

### 3AP1-7

#### Agreement of cardiac output determination obtained simultaneously using three different techniques during elective coronary by-pass

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**Background and Goal of Study:** Reliable cardiac output (CO) determination remains fundamental in the critically ill. Two less invasive techniques of CO determination were recently introduced. NEXFIN uses infrared plethysmography to estimate beat to beat stroke volume, systemic vascular resistance and dP/dt (1). ECOM uses bio-impedance via electrodes on the cuff of an endotracheal tube and an arterial pressure tracing to deliver CO (2). We studied the level of agreement with thermodilution cardiac output (TDCO) in patients undergoing elective coronary by-pass.

**Materials and Methods:** Nineteen patients agreed in writing to take part in the study. The method was approved by the Ethical Committee of the hospital. A pulmonary catheter and a radial arterial line were inserted after the induction. CO was determined simultaneously using TDCO, Nexfin and ECOM at fixed times throughout the procedure:  $T_0$  = after induction,  $T_1$  = 3 minutes after sternotomy,  $T_2$  = after heparine administration,  $T_3$  = 10 minutes after protamine,  $T_4$  = after closure of the sternum,  $T_5$  = after the intervention, before transport. Level of agreement in cardiac output was evaluated using Bland-Altman plots, trend performance and correlation. Accuracy, bias and precision were also calculated.

**Results and Discussion:** TDCO is significantly higher as compared to NEXFIN at  $T_3$ , while ECOM is higher than TDCO at  $T_1$ . Bland-Altman plot revealed a bias of -0.59 L/min for the NEXFIN and -0.20 L/min for the ECOM. ECOM underestimates all values above 7 L/min. Accuracy is 0.94 and 0.96 for the ECOM and NEXFIN respectively, while precision is similar. Correlation R is 0.73 for the ECOM and 0.64 for the NEXFIN. Total error rate was 3.2 % with NEXFIN and 5.3 % with ECOM.

**Conclusion:** Both devices seem to be valuable in situations where TDCO is not possible or is simply not wanted. ECOM's consumables and NEXFIN's hardware remain expensive.

**References:**

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2. Wallace AW et al. *Anesthesiology* 92: 178-89, 2000.

### 3AP1-8

#### A comparison between LiDCO rapid and vigileo in early goal-directed therapy: do they walk to the same direction?

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**Background and Goal of Study:** Cardiac Output (CO) monitors are often employed in Early Goal-Directed Therapy. The present study was designed to examine the degree of agreement between two of them. Preliminary data are presented.

**Materials and Methods:** After ethic committee approval, patients submitted to microvascular flap reconstruction were contemporaneously monitored with LiDCO Rapid (LiDCOr) and Vigileo, both uncalibrated, pulse contour-based devices. A haemodynamic optimization protocol was applied. Measurements were registered before and after an intervention (volume loading, vasoconstrictor or vasodilator drug infusion).

Pairs of measurements were evaluated by Bland-Altman analysis<sup>1,2</sup> and percentage error (PE) was calculated. Polar plot method<sup>3</sup> was applied as well; the central zone limit was set to 0,3 l/min/m<sup>2</sup> because Cardiac Index (CI) instead of CO was considered. CI and  $\theta$  angle ( $\theta$ ) are expressed as mean ( $\pm$ standard deviation(95%limits of agreement)).

**Results and Discussion:** 6 consenting patients were included in the analysis. The number of recorded measurements was 36. Mean CI was 3,0( $\pm$ 0,7(2,7-3,2)) l/min/m<sup>2</sup> for LiDCOr and 2,8( $\pm$ 0,8(2,5-3)) l/min/m<sup>2</sup> for Vigileo. Mean bias was 0,21( $\pm$ 0,53(0,04-0,38)) l/min/m<sup>2</sup>. PE was 20% for LiDCOr and 30% for Vigileo. PE between monitors was 36,8%. A total of 18  $\Delta$ CI was calculated for each monitor. After building the polar plot, 10 pairs of  $\Delta$ CI were discarded, being the correspondent mean value  $\leq$ 0,3 l/min/m<sup>2</sup>. 7 of the remaining 8 pairs presented  $\theta < 30^\circ$  from the line of identify. Mean  $\theta$  was 21,09( $\pm$ 12,4(12,5-29,7))<sup>o</sup>.

**Conclusion(s):** According to Bland-Altman analysis, the PE between LiDCOr and Vigileo is far from being acceptable, mainly due to a high PE internal to Vigileo. However, the agreement in terms of  $\Delta$ CI was tolerable, according to polar plot method. Further enrollments are needed to confirm these preliminary data.

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### 3AP1-9

#### Late evaluation of complications and Doppler upper limb flow in patients with advanced hemodynamic monitoring (Picco system) with radial artery catheter placement

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**Background:** Advanced hemodynamic monitoring systems in critically ill patients like PICCO<sup>tm</sup> (Pulsion Medical System, Munich, Germany) are very useful devices for hemodynamic management. This system can be used with long radial catheters (50 cm). There are few literature about safety and complications of this alternative to the femoral path.

**Objectives:** To evaluate arterial blood flow with Doppler on arm arteries 40 days after long arterial catheter placement compared with the arteries of the other arm.

**Methods:** This is an observational prospective study of 16 patients who underwent radial artery cannulation with long catheter. 40 days after cannulation Doppler examination was realized by the radiologist who didn't know where was the long catheter placed. Clinical ischemic symptoms and Doppler flow data were obtained and analyzed with SPPS.

**Results:** 40 days After radial cannulation with long catheter, the most significant flow reduction (47,84%) was observed at distal segment of radial artery (p=0,007). Subclavia and Axillar artery had a 9,68%(p=0,575) and 29,99%(p=0,173) flow reduction respectively compared with the other limb (no statistically significant). Ulnar artery had an increased flow of 22% . Humeral artery only increased 3%.

No acute ischemic complications were observed in any of these patients. Despite 3 patients without radial flow detected and 1 patient without cubital flow.

Artery Name (n)	Media (mL/min.) $\pm$ SD	Flow % respect No PICCO artery flow.	Number of none doppler flow arteries.
Subclavian (9)	79,89 $\pm$ 43,92	90,32% (-9,68%)	0
Axillary (9)	56,56 $\pm$ 30,81	70,01% (-29,99%)	0
Humeral (16)	43,50 $\pm$ 21,18	103,15% (+3,15%)	0
Radial (16)	5,18 $\pm$ 6,08	52,16% (-47,84%)	3
Ulnar (15)	10,00 $\pm$ 9,00	122,02% (+22,02%)	1

[Post Picco artery flow evaluation]

Artery Name (n)	Media (mL/min.) $\pm$ SD	Number of none doppler flow arteries.
Subclavian (9)	88,44 $\pm$ 31,30	0
Humeral (16)	42,20 $\pm$ 25,16	0
Axillary (9)	80,78 $\pm$ 44,33	0
Radial (16)	9,94 $\pm$ 7,30	0
Ulnar (14)	9,18 $\pm$ 7,49	0

[No PICCO artery flow evaluation]

**Conclusions:** In these patients radial artery cannulation with PICCO radial system catheters was a safe procedure with no upper limb acute ischemic or long term complications.

Radial artery shows statistical significant flow reduction of 47,84% (p=0,007) in evaluated patients 30 days after the cannulation, this findings were not associated with clinical hand ischemia.

### 3AP1-10

#### Estimation of cardiac output by a new semi-invasive monitoring system

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Several studies could demonstrate that goal-directed perioperative optimization of cardiac index (CI) is associated with beneficial effects on both morbidity and the length of stay on the intensive care unit [1]. With respect to risk-benefit ratio, invasive procedures like right heart catheterization are not always justified or practicable. Therefore, less-invasive, simple to interpret and quickly available continuous monitoring of CI has gained increasing interest. The recently introduced Pulsioflex monitoring system (Pulsion® Medical Systems; Munich, Germany) is based on the calculation of CI by arterial waveform analysis without the need for calibration. The aim of our study was to investigate the accuracy of CI generated by arterial waveform analysis in patients undergoing coronary artery bypass grafting (CABG).

**Methods:** 18 patients scheduled for elective CABG operation were studied before and after cardiopulmonary bypass (CPB). Each patient was monitored with the PiCCO system (Pulsion® Medical System, Munich, Germany), a central venous line and the recently introduced Pulsioflex monitoring system. Haemodynamic variables included measurement of CI derived by TPTD ( $CI_{TPTD}$ ) and CI derived by Pulsioflex ( $CI_{PFX}$ ).

**Results:** There was a significant correlation between  $CI_{PFX}$  and  $CI_{TPTD}$  before ( $r^2=0.71$ ,  $p < 0.0001$ ) and after ( $r^2=0.77$ ,  $p < 0.0001$ ) CPB. Bland-Altman analysis showed a mean bias of 0.19 L/min (95% limits of agreement: -0.31 L/min to +0.71 L/min) with a percentage error (PE) of 24% before CPB. After CPB,  $CI_{PFX}$  showed a mean bias of 0.48 L/min (95% limits of agreement: -0.95 L/min to +0.94 L/min) with a percentage error (PE) of 30% [Figure 1]. With respect to percentage changes in CI, uncalibrated  $CI_{PFX}$  was able to track haemodynamic changes both, before and after CPB.

**Conclusion:** CI measurement by semi-invasive pulse contour analysis was able to reliably provide CI and track haemodynamic changes and trends compared with TPTD.

**Summary:** Measurement of cardiac index derived by semi-invasive Pulsioflex monitoring system showed a sufficient accuracy compared with transpulmonary thermodilution.

#### References:

1. Rhodes A. Intensive Care Med, 2010; 36:1327-32.

Figure 1: Correlation and Bland-Altman analysis between uncalibrated cardiac index measured by Pulsioflex ( $CI_{PFX}$ ) and cardiac index measured by transpulmonary thermodilution ( $CI_{TPTD}$ ) before and after cardiopulmonary bypass.

### 3AP1-11

#### Validation of cardiac output monitoring based on uncalibrated pulse contour analysis during off-pump coronary artery bypass grafting

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**Background and Goal of Study:** Cardiac index (CI) is one of the most important variables to monitor during cardiac surgery. Traditionally CI is monitored either by means of the pre-pulmonary or the transpulmonary thermodilution (TPTD) techniques. Recently, a novel system for CI monitoring (ProAQT, Pulsion Medical Systems, Germany) based on uncalibrated pulse contour analysis was made available for clinical practice. Our aim was to evaluate the accuracy of uncalibrated CI monitoring based on arterial waveform analysis in patients undergoing off-pump coronary artery bypass grafting (OPCAB).

**Materials and Methods:** Seven patients scheduled for elective OPCAB were enrolled into a prospective ongoing study. The patients were cannulated with femoral artery and central venous catheters and monitored using uncalibrated pulse contour analysis (ProAQT) in comparison with the TPTD technique (PiCCOplus, Pulsion Medical Systems). Hemodynamic parameters included CI determined by TPTD ( $CI_{TPTD}$ ) and ProAQT ( $CI_{uncalPCA}$ ), respectively. Parallel measurements were performed after induction of anesthesia, after sternotomy, at the restraint of the heart, after restoration of blood flow via the grafts, at the end of surgery, and at 2, 4, 6 and 24 hrs postoperatively. After checking the data distribution, the agreement between  $CI_{TPTD}$  and  $CI_{uncalPCA}$  and hemodynamic trends ( $\Delta CI_{TPTD}$  and  $\Delta CI_{uncalPCA}$ ) were assessed using Pearson's correlation, Bland-Altman and linear regression analysis.

**Results and Discussion:** Totally, 63 pairs of data were obtained. There was a significant correlation between  $CI_{TPTD}$  and  $CI_{uncalPCA}$  ( $r^2 = 0.81$ ,  $p < 0.0001$ ) with the following regression equation:  $CI_{uncalPCA} = 0.08 + 0.85 \times CI_{TPTD}$ . According to Bland-Altman analysis, the mean bias between  $CI_{uncalPCA}$  and  $CI_{TPTD}$

(+1.96SD - -1.96SD) was -0.32 (+0.26 - -0.91) L/min. Trends of absolute changes in CI measured by uncalibrated pulse contour analysis ( $\Delta CI_{uncalPCA}$ ) and transpulmonary thermodilution ( $\Delta CI_{TPTD}$ ) displayed a significant correlation as well ( $r^2 = 0.69$ ,  $p < 0.0001$ ).

**Conclusions:** In OPCAB, CI measured by uncalibrated pulse contour analysis correlated significantly with CI, as determined with the transpulmonary thermodilution technique.  $CI_{uncalPCA}$  slightly underestimates  $CI_{TPTD}$ . Thus, CI based on uncalibrated arterial waveform analysis might be a useful alternative to transpulmonary thermodilution technique during off-pump coronary surgery.

### 3AP2-1

#### Accuracy of end-tidal CO<sub>2</sub> measurements via nose and pharynx in nonintubated patients during digital subtraction cerebral angiography

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**Background and Goal of Study:** The purpose of this study is to determine the accuracy of end-tidal carbon dioxide (PETCO<sub>2</sub>) obtained at nose through the smart capnoline O<sub>2</sub>™ and at pharynx through the smart capnoline H with supplemental oxygen by five liters per minute in nonintubated patients undergoing digital subtraction cerebral angiography (DSA).

**Materials and Methods:** This is a prospective, observational study. Twenty unconscious patients undergoing DSA were included. PETCO<sub>2</sub> was measured at nose sampled via the smart capnoline O<sub>2</sub>™ and at pharynx via the smart capnoline H which was placed at pharynx through nasopharynx airway. Oxygen was administered through smart capnoline O<sub>2</sub>™ at a rate of five liters per minute.

After PETCO<sub>2</sub> stable for five minutes, arterial blood sample was drawn from an indwelling femoral catheter for analyzing arterial carbon dioxide partial pressure (PaCO<sub>2</sub>) and PETCO<sub>2</sub> measured via nose and pharynx were simultaneously recorded. When DSA procedure was over, PaCO<sub>2</sub> was analyzed again. Data were analyzed by Pearson correlation and Bland-Altman analysis.

**Results and Discussion:** Both PETCO<sub>2</sub> sampled from the nose and the pharynx were highly correlated with PaCO<sub>2</sub>, and the correlation coefficients were approximate values, 0.832 ( $p < 0.0001$ ) for PaCO<sub>2</sub> with PETCO<sub>2</sub> via nose and 0.836 ( $p < 0.0001$ ) for PaCO<sub>2</sub> with PETCO<sub>2</sub> via pharynx. The mean bias ± SD between PETCO<sub>2</sub> and PaCO<sub>2</sub> was 4.53±2.76 mmHg (nose) and 3.22±2.86 mmHg (pharynx). The 95% limits of agreement between PETCO<sub>2</sub> and PaCO<sub>2</sub> ranged from -0.90 mmHg to 9.95 mmHg (nose), and ranged from -2.39 mmHg to 8.82 mmHg (pharynx). End tidal CO<sub>2</sub> measurements via nose and pharynx had comparable performance. The correlation between PETCO<sub>2</sub> measured via nose and pharynx was 0.971 ( $p < 0.001$ ). The difference between PETCO<sub>2</sub> measured via nose and pharynx was 1.31 ± 1.25 mmHg.

**Conclusion(s):** This study demonstrated that a high correlation and good agreement between PETCO<sub>2</sub> measured via nose and pharynx and PaCO<sub>2</sub> was obtained. Therefore, PETCO<sub>2</sub> derived from nose and pharynx was accurate and reliable in nonintubated patients during DSA.

### 3AP2-2

#### End-tidal control effectiveness: General Electric Aisys vs General Electric Avance washin and washout comparison

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**Background and Goal of Study:** Gas washin and washout depend on fresh gas flow (FGF) and the ventilator manufacturer. A new technology has been introduced in the market: end-tidal (ET) control by General Electric (GE), in which an algorithm is used to achieve the desired gas concentration as fast as possible.

Our aim is to compare 2% sevoflurane washin and washout time between two ventilators with the same circuit (GE Aisys™ with ET control vs GE Avance™) and different FGF within the same ventilator (GE Avance).

**Materials and Methods:** Six ventilators (3 Avance and 3 Aisys) were compared using a 1L mock lung. After ventilator autocheck, mechanical ventilation was started at a tidal volume of 500 mL, 12 breaths/minute. No local committee approval was needed.

After 5 minutes, 2% sevoflurane was set and sampled from the Y piece by the same gas analyzer (GE CareScape B650, GE, Finland) until no change in ET Sevoflurane was observed (at least 10 minutes).

ET control was used for the Aisys and FGF = 6, 9 and 12 L/min were used for the Avance. Each run was repeated five times for each ventilator and each FGF

Maximum ET sevoflurane (maxETSevo) and 95% of maxETSevo (3 time constant) were recorded. Then, the vaporizer was closed and the time to 3 time constant washout and full washout (no ETSevo recorded) were recorded. ETControl was compared to each FGF of the Avance. FGF from the Avance were compared to each other. Student's t test or ANOVA with Bonferroni's post hoc correction were used as appropriate. A  $p < 0.05$  was considered significant.

**Results and Discussion:** Six ventilators were analyzed. A total of 60 runs were analyzed (15 for the Aisys and 15 for each FGF for the Avance). Time results are shown in the table 1

	maxETSevo	Washin (3 TC)	Washout (3 TC) (*)	Full Washout (*)
ET Control	2,04 ± 0,07(*)	41,3 ± 5,8(*)	52,2 ± 12,7	65,8 ± 9,5
6 L/min	2,08 ± 0,16	41,0 ± 16,9(**)	155,1 ± 55,5(**)	165,1 ± 54,0(**)
9 L/min	2,17 ± 0,11(*)	30,1 ± 1,3(*)	28,8 ± 1,5	36,3 ± 2,5
12 L/min	2,19 ± 0,17(*)	31,2 ± 4,2(*)	31,5 ± 7,6	41,1 ± 11,1

(\*) $p < 0,05$  between ETControl and different FGF (\*\*)  $p < 0,05$  between the different FGF  
 [Table 1. Data show mean (seconds) ± SD.]

**Conclusion(s):** ETControl feature is faster than setting a FGF=6L/min, but slower than 9 and 12 L/min. There's no time improvement setting a FGF higher than 9 L/min.

### 3AP2-3

#### The influence of ventilator settings on heart rate variability during general anesthesia

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**Background:** Heart rate variability (HRV) is commonly used to evaluate autonomic nerve activities. Recent studies suggested that the monitoring of HRV may be useful for the weaning of mechanical ventilation. However, in most studies using HRV, the subjects breathed spontaneously without general anesthesia. The effects of ventilator settings for the change of HRV during general anesthesia is unknown.

The aim of this study is to investigate the effect between respiratory status and HRV during general anesthesia.

**Patients:** After the institute ethics and informed consent, 15 patients undergoing brachytherapy for prostate cancer were enrolled. The patients with history of arrhythmia and diabetes were excluded.

**Methods:** Each patient received general anesthesia following subarachnoid nerve block. General anesthesia was induced with 2mg/kg of propofol. After insertion of the laryngeal mask airway, anesthesia was maintained with 1.5%sevoflurane.

The following 4 ventilation modes were applied sequentially, each lasting for 15min; spontaneous breathing (SP), pressure support of 10 cm H<sub>2</sub>O (PS), volume control ventilation with the tidal volume of 5ml/kg and the frequency of 20 bpm (VCV5). And the tidal volume of 10ml/kg and the frequency of 10 bpm (VCV10). We recorded the low and high frequency components of HRV (LF and HF). The measured values were normalized with those during SP in each patient as a standard. Study 1 was a comparison between SP and VCV5. These setting were similar with respect to TV and frequency. Study 2 was a comparison between the changes of HRV from SP to PS and from VCV5 to VCV10.

**Results:** All components of HRV greatly reduced after induction of general anesthesia compared to those before induction. After the spontaneous breathing resumed, HF components alone increased in all patients.

In study 1, HF components during VCV5 were significantly lower than those during SP

In study 2, HF components during PS were significantly decreased from those during SP

On the other hand, the HRV were similar during VCV10 and VCV5.

**Conclusion:** During general anesthesia, although autonomic nerve activity is reduced, parasympathetic nerve activity alone may increase without the change of sympathetic nerve activity during spontaneous ventilation. In addition, TV and respiratory frequency do not affect HRV during mechanical ventilation.

### 3AP2-4

#### Accuracy of manual data entry into computerized anesthesia information management system (AIMS)

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**Background and Goal of Study:** AIMS are becoming a routine in anesthesia practice. This study examined the accuracy of data on drug administration entered manually by the anesthesiologist into an AIMS in order to determine whether AIMS records reflect actual practice.

**Materials and Methods:** A trained independent observer recorded all drugs administered (name of drug, dose, time of administration) during anesthesia. These data were compared to the information entered by the anesthesiologist into the AIMS (Metavision, iMDSofT, Tel-Aviv, Israel). Accurate data entry by the anesthesiologist was defined as correlation with the observer for drug name, dosage (within 10%) and administration time recorded (within ±10 minutes) of drug administration.

**Results and Discussion:** Data were collected on 598 drug administrations in 58 patients including 151 (25%) opiates, 136 (23%) induction agents, 94 (16%) cardio-vascular drugs, 76 (13%), 60 (10%) muscle relaxants, 60 (10%) antibiotics, 36 (6%) analgesics, 23 (4%) local anesthetics, 20 (3%) antiemetics and 1 other. Matching datapoints were found for data in the AIMS entered by the anesthesiologists and for the observer data on 502/598 (84%) occasions. There was agreement for drug name (502/502, 100%), dose (468/502, 93%) and administration time (479/502, 95%). No AIMS records were found for 96 (16%) drugs that were administered by the anesthesiologists as per observation. The majority of these were cardio-vascular drugs (37/96, 39%) and induction drugs (30/96, 31%). With induction agents, the non-recorded doses were much lower than where the anesthesiologists correctly entered agents into the AIMS (for example mean propofol doses: non-recorded 42±21mg versus AIMS 135±72mg,  $p < 0.001$ ), whereas there was no difference in doses of the cardio-vascular drugs in the AIMS versus the non-recorded ones (e.g. mean phenylephrine doses: AIMS 136±93µg, non-recorded 147±53µg,  $p=0.677$ ). On only 23 (4.7%) occasions did the time difference for drug administration between the observer and anesthesiologists exceed 10 minutes.

**Conclusion(s):** Manually entered data on drug administration into AIMS were very accurate in respect to drug name, dose and time. On the other hand, a fairly large number of drug administrations were not entered into the AIMS. The majority of these are small doses of inductions agents and bolus doses of cardiovascular drugs.

### 3AP2-5

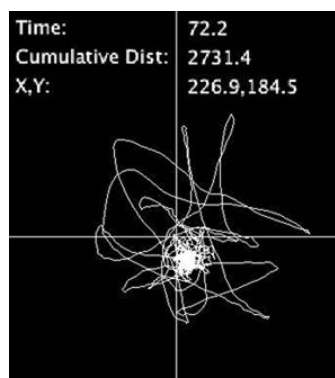
#### Evaluation of a wireless gaming force platform as a portable device for assessing the residual effects of anaesthetics and neuraxial blockade

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**Background and Goal of Study:** Force platforms are laboratory tools to assess postural stability or sway.<sup>1</sup> A low cost platform now exists as part of a gaming system, containing 4 high quality force sensors transmitting data wirelessly. We compared this with a laboratory platform to investigate its potential as a portable objective method of assessing sway, particularly for example after neuraxial blockade.

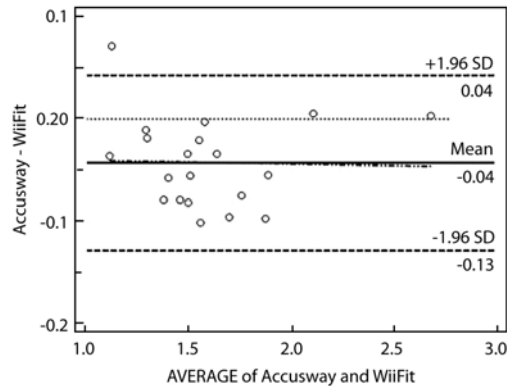
**Materials and Methods:**



[Figure 1. Example of gaming force plate trace]

A WiiFit™ gaming platform was placed on top of an AccuSway™ platform. Custom software allowed a laptop computer to intercept raw wireless force sensor data. 10 volunteers stood in turn on the stacked devices allowing comparison of their outputs. The path length of a line following the centre of gravity was calculated simultaneously for both, as an index of „sway“ (Fig 1). Volunteers in random order:

- Stood 1 minute, feet together, eyes closed (simulating residual anaesthesia - increased sway)
- Stood 1 minute, eyes open (baseline, simulating no anaesthesia - reduced sway) For each system, ratio a/b was calculated as an index of performance reduction. The ratios from each system were compared (Fig 2).



[Fig 2. Bland and Altman comparison of both systems]

**Results and Discussion:** Values ranged from 1.09 - 2.67, were in close agreement with fixed error of -0.04 (WiiFit>AccuSway) and 95% confidence limits of -0.13 to +0.04.

**Conclusion(s):** The gaming force plate may have potential as an objective, wireless bedside evaluation technique for residual anaesthesia/neuraxial blockade.

#### References:

- A&A2002;94(1):60-4

### 3AP2-6

#### Evaluation of perception of operating table orientation using a novel clinometer

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**Background and Goal of Study:** Correct operating table orientation is essential for patient positioning for specific procedures (e.g. orthopaedic surgery) and emergencies<sup>1</sup>; however the angles of head up/down ( $\rho$ , "pitch") and lateral ( $\phi$ , "roll") tilt are not routinely measured, and subjective estimation is highly variable<sup>2</sup>. We therefore developed a novel battery operated 2-axis clinometer to measure  $\rho$  and  $\phi$  using a 3-axis accelerometer, Arduino micro-controller (SparkFun, Boulder, CO) and LCD display (Fig. 1); and calibrated and validated it using a spirit level, plumb line and protractor.



[Clinometer]

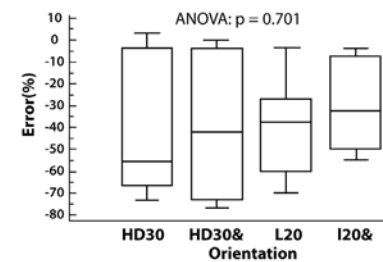
**Materials and Methods:** Ten volunteers performed a double blinded pilot study in which they were asked to orientate an operating table in 3 orientations, returning to the neutral position between readings: 20° left lateral (L20), 30° head down (HD30), and 20° left lateral(L20&) combined with 30° head down(HD30&) tilt. Clinometer measurements, differences from target angles, and % error were recorded in each case.

**Results and Discussion:** All data and errors were normally distributed (K-S test). 1 way ANOVA of error showed no significant difference between or within tasks ( $p = 0.176$ ) (Fig. 2).

#### a) Estimated Angle (degrees)

	Orientation			
	HD30	HD30&	L20	L20&
Mean	17.3	18.2	11.9	14.1
SD	9.4	9.4	4.1	4.1
Range	8 - 31	7 - 30	9 - 13	9 - 19
n	10	10	10	10

#### b) Percentage Error



[Results from Clinometer]

**Conclusion(s):** Subjective measurement of operating table orientation is unreliable. Subjects tended to consistently underestimate angles in all planes, whether singly or in combination. Our clinometer offers a simple low-cost solution.

#### References:

- Resuscitation (2010);81:1400-33
- Anaesthesia (1988);43:347-9

### 3AP2-7

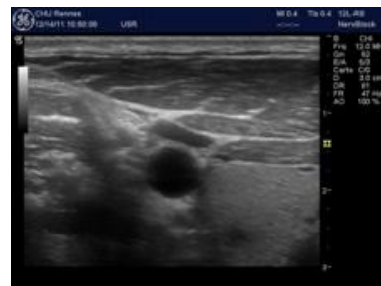
#### Use of Biseptine as liquid interface for ultrasound procedure in internal jugular catheterisation

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**Background and Goal of Study:** Incidentally we have found that Biseptine possess a good interface property for echographic visualization. We have decided to compare the echographic characteristics in terms of quality of the picture and the success rate of internal jugular vein (IJV) catheterisation between Biseptine (B) and Aquasonic gel (A) when used as a liquid interface in echographic visualisation.

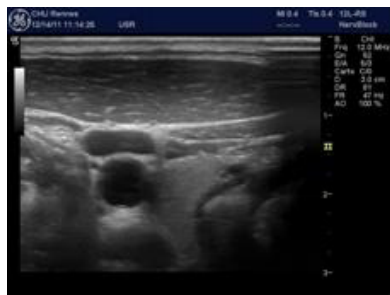
**Materials and Methods:** After informed consent, 60 patients were included in this study and were randomly divided in two equal groups. They received either Biseptine or Aquasonic gel as skin interface. Visualisation and depth of the IJV and its position around the internal carotid was determined. Quality of echographic pictures and intervals of time between localization of the site puncture, skin anesthesia and insertion of catheter were noted.

**Results and Discussion:** In both groups, the quality of visualisation of the IJV was similar and the duration of the procedure was rapid:  $7 \pm 3$  min in group B versus  $5 \pm 3$  min for group A. The rate of success catheterisation was 95% in two groups. Our results have shown that Aquasonic gel and Biseptine used in screening echography seem to have the similar efficiency.



[Aquasonic gel]





[Biseptine]

**Conclusion(s):** We are not able to respond why Biseptine has the same property as the Aquasonic gel. A comparison between the compositions of these two products may respond, a part, to this question?

### 3AP2-8

#### Agreement of four different methods of temperature measurement in laparoscopic cholecystectomy

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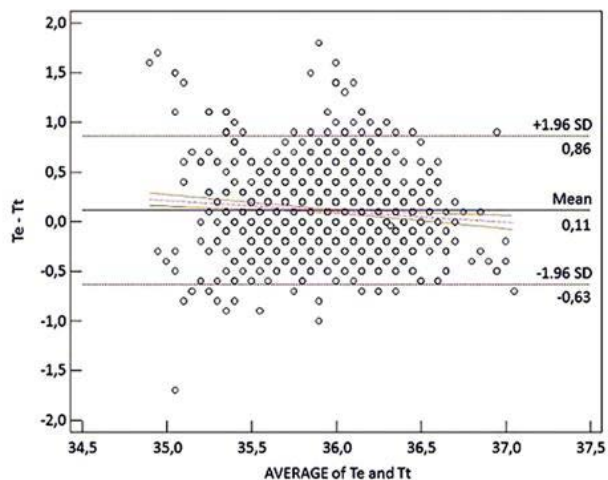
**Background and Goal of Study:** Temperature measurement is important for some surgical procedures. The gold standard is considered the esophageal (Te) or bladder invasive temperature measurement. Tympanic (Tt), cutaneous (Tc) and axilar (Ta) temperature measurements are also available, are non-invasive and easy to perform. Our aim is to compare those measurement methods to the gold standard.

**Materials and Methods:** After local ethics committee approval, for this open-label study, written informed consent was obtained from 40 adult patients scheduled for laparoscopic cholecystectomy under general anaesthesia. All patients were monitored at the same time with Te (Reusable Temperatura Probe, General Electrics, Sweden), Tt (GentleTemp 510, OMRON, USA), Tc (ThermoFlash LX-26, JXB CO. LTD, Guangzhou, China) and Ta (Skin Temperature Probe, General Electrics, Sweden).

To compare methods, the Bland-Altman approach was used. Bias (mean of the difference between two methods), is plotted against 1,96 times the standard deviation of those differences (limit of agreement, LoA). If bias and LoA fall within acceptable values, both methods can be considered interchangeable. In our case, if bias was lower than 0,5°C and LoA lower than 1°C, we considered both methods interchangeable.

	Te vs Tt (287 pairs)(°C)	Te vs Ta (349 pairs)(°C)	Te vs Tc (304 pairs)(°C)
BIAS	0,02	1,18	-0,02
PRECISION(SD)	0,38	1,17	0,4
LoA	0,7448	2,2932	0,784

[Table 1]



[Figure 1]

**Results and Discussion:** Data were recorded from 39 patients (in one of them, Te was not recorded due to technical problems). A mean of 9,9 (SD=3,2) determinations were recorded for each patient. Surgery time was 100.2 (SD=26.2) minutes. Bland-Altman approach for bias and precision are shown in table 1. Bland-Altman plot analysis between Te and Tt is shown in the figure 1.

**Conclusion(s):** Both Tt and Tc can be used interchangeably, while Ta should not be used for temperature monitoring for this kind of patients.

### 3AP2-9

#### Near-real time pulmonary shunt measurement with Multiple Inert Gas Elimination Technique (MIGET) by Micropore Membrane Inlet Mass Spectrometry (MMIMS) in a porcine lavage lung model

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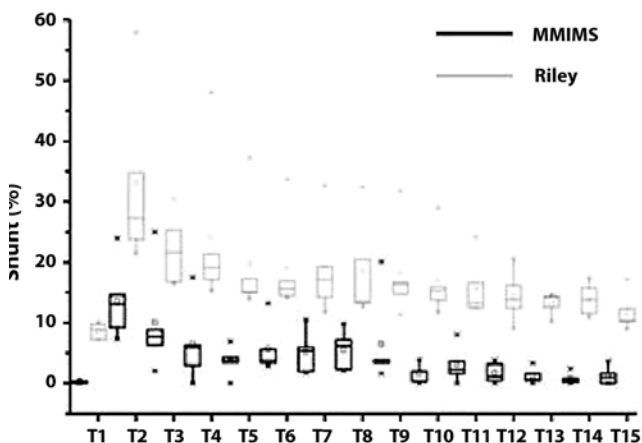
**Background:** MIGET using gas chromatography (GC) is a well-established, but time-consuming method to determine ventilation/perfusion ( $V_A/Q$ ) distributions. MMIMS however reduces analysis cost substantially compared to GC<sup>1,2</sup>. In porcine lung injury MMIMS-MIGET shunt (MS) has been shown to correlate well with Riley shunt (RS)<sup>2</sup>. This study aimed to evaluate MMIMS-MIGET derived pulmonary shunt in porcine lavage ALI, however with enhanced temporal resolution.

**Methods:** With Bern animal care committee approval, 5 anaesthetized pigs (24 ± 1 kg) were studied. After induction and instrumentation, a dissolved inert gas mixture (IG) (SF<sub>6</sub>, krypton, desflurane, enflurane, diethyl ether, acetone) was infused at a rate of 8 ml kg<sup>-1</sup> h<sup>-1</sup>.

Arterial, mixed venous and mixed expired samples were taken at baseline (T1) and after lung injury in 15 minutes intervals (T2-T15). Samples were analyzed for IG partial pressures using a micropore MMIMS system (Oscillology LLC, Folsom PA).

The resulting retention data were transformed to  $V_A/Q$  distributions. As compartments of interest (Fig 1), MS fraction was determined as  $V_A/Q < 0.005^3$ , and RS by using conventional blood gas analysis.

**Results:** MS ( $P=0.009$ ) and RS ( $P=0.02$ ) increased after ALI (Fig 1) and decreased after 90 min towards T15 ( $P > 0.05$  compared to baseline). Time course of RS fraction was consistently reflected by MS. Correlation between RS and MS yielded  $r^2 = 0.72$  ( $P < 0.0001$ ). MS underestimated RS (mean bias ± 2SD = -14.0% ± 13.8%).



[Figure 1]

**Conclusion:** MMIMS enhances temporal resolution of the MIGET methodology to a near-real time  $V_A/Q$  distribution analysis technique. This provides new insights into short-term changes of  $V_A/Q$  mismatch during acute lung injury. This may become useful in the future for clinical decision making.

#### References:

1 Baumgardner et al. J Appl Physiol 2000;89:1699-708; 2 Duenges B et al. A & A 2009; 109:1831-5; 3 Wagner PD et al. J Clin Invest 1977;59:203-16.

**Acknowledgements:** Funded by SNF POIB320030\_133046

### 3AP2-10

#### Comparison of the heating capabilities of three fluid warmers at different temperatures and flows

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**Background and Goal of Study:** Perioperative hypothermia is a multifactorial consequence of general anesthesia and surgery associated with numerous adverse outcomes. The objective of this study is to evaluate and compare the performance of three fluid warmers representative of the commercially available systems and to address the influence of infusion rate and fluid temperature in outflow fluid temperature (OT).

**Materials and Methods:** In this laboratory investigation a water bath coaxial fluid warming system (HotLine®), a far from patient dry-heat plate warmer (pediatric and standard Ranger® sets) and a next to patient dry-heat plate warmer (enFlow®) were studied using room temperature (20°C) and cold (4°C) normal saline (NS). The OT was measured with a rapid response thermometer probe at the distal end of the disposable tubing of each fluid-warming device, that was connected to a roller head pump (HemoCare® TGV 600) and to a countercurrent cooler (Sarns TCM II®) in a closed circuit. Forty measurements per set/device were made in a range of low to high flow rates, from 1 to 333 mL/min (0.06 to 20 L/h).

The cut-off temperature to define the efficiency of a fluid warmer in order to prevent hypothermia was set in 36 °C.

**Results and Discussion:** Ranger® with standard set for adults warms fluid above 36 °C from flows of 1.2 and 1.4 L/h with NS at 20 °C and 4 °C respectively, maintaining outflow fluid temperature above 36 °C throughout the flow range studied with 20 °C NS and until a flow of 11 L/h with 4 °C NS. The pediatric-neonatal Ranger® set achieves the cut-off temperature at a flow of 0.48 L/h, maintaining it until 8.5 and 17 L/h for cold and room temperature NS respectively.

HotLine® exceeds 36 °C OT from a flow of 0.12 L/h, but the temperature declines below the cut-off point at flows greater than 3 and 4 L/h, with 4 and 20°C NS respectively.

enFlow® reaches outflow temperatures above 36 °C from a flow range of 0.18 L/h, until 7 and 14 L/h with 4 and 20°C respectively.

#### Conclusion(s):

- The most suitable fluid warmers for situations where very low flows (< 500 ml/h) are needed (E.g. pediatric anesthesia), are HotLine® and enFlow®.
- HotLine® however, is not adequate for high flow demand situations in the adult patient, where Ranger® or enFlow® would be more appropriate.
- enFlow® is the most versatile, covering a wider range of flows, being suitable for both adult and pediatric patients.

### 3AP2-11

#### Ultrasound-guided catheterisation of the internal jugular vein in morbid obesity patients

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**Background and Goal of Study:** Catheterisation of the internal jugular vein (IJV) is commonly attempted by using anatomical landmarks. It may be difficult and cause serious complications in morbid obesity patients. In prospective study we have evaluated the efficiency of the ultrasound-guided (US) visualisation versus standard landmark (LM) method during catheterisation of the IJV in 40 patients with body mass index (BMI) > 30 kg/m<sup>2</sup>.

**Materials and Methods:** After randomisation patients were determined to the US-group (n=20) or to the LM-group (n=20). The end points of study: the access time, the average number of attempts, successful placement, the rate of mechanical complications. Statistical processing of results were organized using the Student *t* test,  $\chi^2$ -test and Fisher's exact test.

**Results and Discussion:** There were no significant differences in gender, age, BMI between groups. Catheterisation of the IJV was achieved in all US-group patients and in 16 (80%) of the LM-group patients ( $p < 0.01$ ). Average access time (skin to vein) and number of attempts were significantly reduced in the US-group patients compared with the LM-group ( $27.1 \pm 26.5$  sec (21.5 - 51.4) vs  $54 \pm 99.4$  sec (43.2 - 97.5),  $p < 0.01$ , and  $1.1 \pm 0.6$  (1.1 - 1.9) vs  $2.6 \pm 2.9$  (1.5 - 6.3),  $p < 0.01$ , respectively). In the LM-group puncture of the carotid artery occurred in 3 (15%) of patients, haematoma in 2 (10%), haemothorax in 1 (5%), pneumothorax in 2 (10%), that haven't been occurred in the US-group ( $p < 0.01$ ).

During central vein catheterisation mechanical complications are reported in 5% - 19% of patients, infectious - in 5% - 26%, thrombotic - in 2% - 26%. Their quantity increases in morbid obesity and other risk factors. Real-time

US-guided IJV catheterisation helps to visualize vein and surrounding anatomic structures. Visualisation of the IJV on the transverse axis is useful for catheterization when the vein diameter is small, whereas visualization of the vein on the longitudinal axis provides a clear image of both walls of the vessel, and so a single-wall puncture can be made. In our study single-wall punctures were achieved in all US-group patients.

**Conclusion(s):** The present data suggest that ultrasound-guided catheterisation of the internal jugular vein in morbid obesity patients is superior to the landmark technique because of shorter access time, reduced number of successful attempts, lower mechanical complication rates.

### 3AP3-1

#### Optimising postoperative fluid administration

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**Background:** Large volumes of fluid increases surgical morbidity and hospital stay.<sup>1</sup> Recent emphases, on goal-directed therapy and enhanced recovery highlight the importance of accurate fluid management. Despite focus on careful intra-operative fluid balance and cardiac output monitoring, we believe post-operative fluid balance is less well managed. This study reports on: 1.The use of volumetric fluid pumps in surgical patients across Greater Glasgow & Clyde (GG&C); 2.The accuracy of gravity-fed IV fluids at the Southern General Hospital (SGH).

**Method:** 1. Using a self-reported questionnaire, 182 staff nurses in general medical and surgical wards throughout GG&C were surveyed on pump availability, pump training and indications for volumetric pump use (renal/cardiac failure/administration of IV potassium/IV antibiotics and Dextrose for Insulin Sliding Scales). We also asked nursing staff about their confidence in using gravity-fed infusions. 2. Secondly, a 'snap-shot' audit compared the prescribed rate of gravity-fed IV fluid infusions with the actual rate, by counting the drops-per-minute.

**Results:** 1. We identified all wards used volumetric pumps. Up to 37% of nurses self-reported they were not trained in the use of pumps, depending on hospital and speciality. Dextrose for Insulin Sliding Scales was not exclusively delivered by pumps, as shown in the table below.

	Gartnavel General, Glasgow	Southern General, Glasgow	Glasgow Royal Infirmary, Glasgow	Victoria Hospital, Glasgow	Royal Alexandra Hospital, Paisley
Renal Failure	100	55	100	63	80
Cardiac Failure	100	55	100	63	100
IV Potassium	100	100	100	100	100
IV Antibiotics	100	100	75	100	100
Insulin Sliding Scale	100	81	100	63	100

[Table 1: % Pump Use in GG&C]

2. The majority of nurses (100% in GGH/SGH/GRI/Victoria) felt confident in the count-the-drop method. However, only one patient received fluids at the prescribed rate. Twenty percent of patients received fluids at an excessive rate and in 27% of patients, fluid administration was Omls/hr.

**Conclusions:** Postoperative fluid care is important. Pump use is not universal even in high risk areas. Despite nursing confidence in gravity-fed infusions, evidence suggests they provide inaccurate fluid administration. We advocate increased pump use to provide accurate IV fluid administration.

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1. Patterns and clinical outcomes associated with routine intravenous sodium and fluid administration after colorectal resection. Tambyraja AL et al, J Surg, 2004

### 3AP3-2

#### External pressure applied on the caval vein and its effects on difference in Pulse Pressure (dPP) and Pleth Variability Index (PVI)

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**Background and Goal of Study:** Fluid therapy optimization in the perioperative period has been considered as major contributor to improve oxygen delivery. Intraoperative fluid management by difference in pulse pressure (dPP) is a goal-directed fluid management approach to avoid both hypervolemia and hypovolemia (1). However, several clinical factors may impede dPP measurements, e.g. surgical manipulations.

**Materials and Methods:** Following IRB approval and written informed consent, 20 patients, ASA 2-3, undergoing elective hepatic surgery were enrolled. Anesthesia was standardized. Hemodynamic monitoring for cardiac index (CI), stroke volume (SV), and corrected flow time (fTc) was obtained by esophageal doppler. Pleth variability index (PVI) was monitored by Radical 7<sup>©</sup> (Masimo Inc., Irvine, Ca.), dPP was assessed continuously at the bedside as described previously (2). Fluid management consisted of a crystalloid solution for baseline fluid maintenance and additional boluses of HES 6% 130/0.4 in case of fTc < 330 msec. After hepatic resection, baseline measurements of CI, SV, fTc, dPP, and PVI were taken. Thereafter, the attending surgeon applied three different pressure levels (2 N, 5 N, 10 N) at random with a pressure application device (Fa. ATP Messtechnik, Ettenheim, Germany). Two minutes after starting pressure application, CI, SV, fTc, dPP and PVI was measured by a blinded investigator. After each pressure application a stabilization period of at least 5 minutes was given for hemodynamic recovery. Comparisons were made using a paired t-test.  $P < 0.05$  was considered statistically significant.

**Results and Discussion:** Data are shown in Table 1:

Hemodynamic parameters	2N		5N		10N	
	baseline		baseline		baseline	
CI	3,5 ±0,86	3,22±0,91 p<0,0122	3,36 ±0,91	3,09±1,12	3,65 ±1,62	2,63±1,05 p<0,024
SV	87,65 ±22,96	82,15±23,49 p<0,018	85,45 ±24,95	77,70±25,10 p<0,006	86,95 ±21,81	66,55±25,53 p<0,0004
fTc	370,85 ±36,74	357±56,29 p<0,112	370,9 ±29,05	347,05±54,62 p<0,042	373,8 ±34,52	328,5±60,69 p<0,009
dPP	6,82 ±3,49	9,21±5,05 p<0,013	7,31 ±2,51	10,8±8,16 p<0,049	8,09 ±3,45	14,32±9,22 p<0,008
PVI	10,85 ±7,37	9,35±5,53	10,7 ±5,18	10,4±5,5	9,9 ±6,97	12,85±8,38 p<0,034

[Table 1]

**Conclusion(s):** Surgical manipulation, as modeled by external pressure application, may impede dPP measurements. A pressure application of 10 N might have led to therapeutic consequences. Therefore, a vigilant anesthesiologist is mandatory to interpret displayed dPP numbers correctly.

#### References:

<sup>1</sup> Marik PE et al: Crit Care Med 2009; 37(9): 2642-2647.

<sup>2</sup> Pestel G Fukui K Hartwich V et al: Anesth Analg 2009; 108: 1823-1829.

### 3AP3-3

#### Accuracy of Nexfin for non-invasive continuous cardiac output measurement: comparison with thermodilution method using a pulmonary artery catheter

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**Background and Goal of Study:** Cardiac output (CO) monitoring has traditionally used invasive techniques with a pulmonary artery catheter (PAC). However, invasive methods have the risk of complications such as pulmonary artery rupture, catheter infection and pulmonary infarction. Nexfin(TM) (Bmeeye B.V., Amsterdam) is a non-invasive hemodynamic monitor that provides continuous blood pressure and CO by measuring finger arterial pressure with an inflatable finger cuff. The finger arterial pressure is converted to a reconstructed brachial artery pressure, and CO is calculated with pulse contour analysis. We compared the CO measurement accuracy of Nexfin and intermittent thermodilution method with a PAC.

**Materials and Methods:** We studied patients (ASA I-III) undergoing cardiac surgery in our hospital following written consent. Cardiac output was measured with Nexfin (Nexfin CO) from induction of general anesthesia until establishment of cardiopulmonary bypass. The 30-second averages of beat-to-beat Nexfin CO were used as the representative Nexfin results. At the same time, a pulmonary artery catheter (Edwards Lifesciences, USA) was inserted via the right internal jugular vein and connected to a Vigilance(TM) cardiac monitor (Edwards Lifesciences, USA). Three intermittent bolus thermodilution measurements with 10 mL iced 5% glucose were performed manually and the results were averaged. Data were evaluated with Bland-Altman analysis.

**Results:** We obtained a total of 13 data points from eight patients (7 male, 1 female). The mean age of the patients was 65 (54-76). Six of the patients had sinus rhythm and two had chronic atrial fibrillation. The mean difference in CO between the two methods (bias) was 0.08L/min and a standard deviation from the mean (precision) was 0.74L/min.

**Conclusion(s):** Results from Nexfin CO agreed well with results from intermittent thermodilution method in anesthetized patients during cardiac surgery. This suggests that Nexfin is clinically useful.

### 3AP3-4

#### The use of digital photoplethysmography for continuous non-invasive blood pressure and cardiac index monitoring in cardiac surgery patients

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**Background and Goal of Study:** This study was designed to evaluate the reliability and precision of a new digital photoplethysmographic device (<sup>©</sup>Nexfin, BMEYE B.V., Amsterdam, Netherlands) for continuous and non-invasive assessment of arterial blood pressure and cardiac output.

**Materials and Methods:** Fifty consecutive adult patients were prospectively included at the admission to the intensive care unit following conventional cardiac surgery and investigated hourly from H0 to H4. At each step, simultaneous comparative systolic, diastolic and mean blood pressures and cardiac index (CI) data points were collected from invasive radial artery catheter and transpulmonary thermodilution and from the <sup>©</sup>Nexfin device. Correlations were determined by linear regression. Bland-Altman analysis was used to compare the bias, precision and limits of agreement. The percentage error was calculated.

**Results and Discussion:** Six (12%) patients were excluded from the analysis because of the impossibility to obtain a reliable photoplethysmographic signal. No complication related to the use of the new device was observed. Thirty three (75%) patients presented hypertension history. Fifteen (34%) patients received norepinephrine. A good relationship was found between absolute values of photoplethysmographic and radial systolic ( $r=0.75, p < 0.001$ ), diastolic ( $r=0.78, p < 0.001$ ) and mean ( $r=0.88, p < 0.001$ ) blood pressures. A positive significant relationship was also found between transpulmonary thermodilution and <sup>©</sup>Nexfin cardiac index absolute values ( $r=0.57, p < 0.001$ ). Bias, precision and limits of agreement between mean photoplethysmographic and radial blood pressures were 4.6 mmHg (95% confidence interval: 3.7 to 5.5), 6.5 mmHg, and -17.3 to 8.1 mmHg, respectively. The percentage error between transpulmonary thermodilution and the <sup>©</sup>Nexfin for CI measurement was 50%.

**Conclusions:** The <sup>©</sup>Nexfin device is safe, convenient and reliable in measuring continuous non-invasive blood pressure but not interchangeable with transpulmonary thermodilution to monitor CI.

**Acknowledgements:** The authors thank Sylvain Thuaudet, M.D., (IST Cardiology, Saint-Contest, France) and BMEYE B.V. (Amsterdam, Netherlands) for kindly providing all the facilities necessary for hemodynamic monitoring with the CC Nexfin device.

### 3AP3-5

#### Plethysmographic variability index does not predict fluid responsiveness in cardiac surgery patients

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**Background and Goal of Study:** Plethysmographic variability index (PVI) has been proposed as a novel tool to predict fluid responsiveness in mechanically ventilated patients.

Because of abrupt changes in vasomotor tone, the use of PVI in critically ill patients remains controversial. We hypothesized that PVI would be reliable in predicting fluid responsiveness in patients having undergone cardiac surgery.

**Materials and Methods:** Thirty-two consecutive adult patients were prospectively enrolled at the admission to the intensive care unit following conventional cardiac surgery. Four sets of measurements were recorded for each patient: at baseline; after passive leg raising; at return to baseline; and after fluid challenge.

Transpulmonary thermodilution was used to define the positive response to fluid challenge as an increase in cardiac index of at least 15%. The correlation between PVI and arterial pulse pressure variation (PPV) was determined by linear regression.

To assess the discrimination of PVI and PPV in predicting fluid responsiveness, ROC curves were computed with  $ROC_{AUC}$  and their 95% confidence interval (CI) and used to describe the gray zones for both PPV and PVI by defining three classes of response: negative, inconclusive and positive.

**Results and Discussion:** Nine (30%) patients received a continuous infusion of norepinephrine and 18 (60%) patients were responders to fluid challenge. We found a significant moderate relationship between absolute values of PPV and PVI ( $r = 0.60; P < 0.001$ ) which increased after removal of patients receiving norepinephrine ( $r = 0.73; P < 0.001$ ).  $ROC_{AUC}$  for both PVI and PPV to predict fluid responsiveness were 0.61 [95% CI: 0.40-0.82] and 0.71 [95% CI: 0.51-0.91];  $P=0.356$ , respectively. The PVI gray zone ranged from 12 to 24%,

including 70% of the study population while the PPV gray zone ranged from 9 to 20%, including 67% of the study population.

**Conclusions:** PVI cannot predict fluid responsiveness in patients having undergone conventional cardiac surgery.

### 3AP3-6

#### Continuous and non-invasive estimation of mean arterial blood pressure using photoplethysmograph waveform

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**Background and Goal of Study:** Mean Arterial Pressure maintenance within a predefined range is an important hemodynamic goal to ensure appropriate perfusion. Photoplethysmographic (PPG) Pulseoxymetry (PO) is commonly used to infer SpO<sub>2</sub>, heart rate and more recently cardiac output and fluid responsiveness.

Because PO and arterial blood pressure waveforms are morphologically related, it is sensible to extract enough information from the former to infer the latter.

The objective of this study was to validate a continuous and non-invasive estimation of mean arterial blood pressure (MAP) using PPG waveform.

**Patients and methods:** After Ethical Clinical Research Committee's approval, from Jan 2010 to Nov 2011, patients admitted in ICU and PACU of a University Hospital and monitored with PO and invasive arterial blood pressure were included in a prospective observational study. Exclusion criteria: arrhythmias, pulse wave morphological alterations, immediate death condition. Both waveforms were continuously registered during a minimum of 30-minute interval and manually revised thereafter to ensure quality compliance. Clinical and demographic data were also registered. Intrinsic pattern analysis of both waveforms from a first cohort of patients (Development Group; DG) was modelled in a stochastic neuronal network (SNN). A random and representative sample of a second independent cohort (Validation Group; VG) served to infer the results. Mean squared error (MSE) and Bland-Altman concordance between inferred and obtained values were analyzed. Values were expressed as mean( $\pm$ SD).

**Results and Discussion:** 619 patients were recorded, 74% were accepted for analysis: 352 DG and 105 VG within a MAP range of 61-110 mmHg. For the validation sample (n=22, 2271 measures): age was 61( $\pm$ 12) years, arterial catheter were 2.4 ( $\pm$ 1.6) days long before inclusion. Monitoring was mainly during post-surgery (27%), on neurologically impaired patients (18%) and after transplantation (18%). None of the statistical differences between DG and the VG sample were considered clinically relevant except for the latter having more norepinephrine and less catheter days than the former. MSE was -5.01 ( $\pm$ 8.28) mmHg.

**Conclusions:** Artificial intelligence and machine learning can be of great help if applied to current non invasive monitoring. Under the described conditions, these techniques can be used to infer MAP, though more research is needed on the clinical applicability and validity of these results.

### 3AP3-7

#### Noninvasive continuous beat-to-beat radial artery pressure via TL-200 applanation tonometry

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**Background and Goal of Study:** Continuous beat-to-beat arterial blood pressure (BP) monitoring is most valuable during acute hemodynamic instability such as those observed with anesthesia induction, high risk surgical procedures and critical ill patients. Until recently, beat-to-beat BP monitoring for such acute events required an invasive artery catheter. The TL-200 is a noninvasive radial artery blood pressure monitor that offers continuous BP signals through applanation tonometry.

Our goal was to test the accuracy of the TL-200 device in terms of correlation and agreement with arterial line values from in critical ill patients who needed beat-to-beat blood pressure monitoring.

**Materials and Methods:** The TL-200 components are: disposable wrist splint, disposable adhesive pressure sensor, a sensor positioning bracelet, and interface monitor. The adhesive sensor is applied over the distal radial artery pulse.

We performed a cross-sectional study of TL-200 noninvasive BP measurement comparisons with contralateral invasive radial artery (A-Line) BP measurements in 28 patients under general anesthesia and paralysis during an av-

erage 2.5 hours. Two-hundred and fifty random sample points were selected per patient resulting in 6,966 systolic, mean and diastolic BP pairs for analysis.

**Results and Discussion:** Bland Altman analysis showed an average -4.40 mm Hg TL-200 versus A-Line systolic BP bias and limits of agreement (1.96 SD) were  $\pm$  21.13 mm Hg. Mean BP showed a 5.31 mm Hg TL-200 bias and  $\pm$  14.09 mm Hg limits of agreement, while diastolic BP showed a 9.31 mm Hg bias and  $\pm$  14.13 mm Hg limits of agreement. Coefficients of determination for TL-200 and A-Line BP regression were  $r^2=0.39$  for systolic,  $r^2=0.41$  for mean, and  $r^2=0.26$  diastolic BP, respectively.

Our findings demonstrate a good clinical agreement of TL-200 with A-Line values over a wide dynamic range of BP

**Conclusion(s):** TL-200 arterial blood pressure monitor is a valuable new noninvasive beat-to-beat device for patients during general anesthesia and surgery, and many other potential indications in which acute BP changes are expected.

### 3AP3-8

#### Goal directed therapy using PulsioFlex monitoring in general surgery

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**Background:** Major surgery bares the risk of hypoperfusion and possible mismatch of oxygen supply. The recently introduced PulsioFlex monitoring system offers a less invasive approach to estimate cardiac index (CI) and pulse pressure variation (PPV) on the basis of pulse contour analysis using simply a radial artery cannula instead of a pulmonary artery catheter or a femoral artery line in combination with a central venous line.

The aim of this study was to compare the clinical outcome of patients undergoing major surgery with standard intraoperative care (Standard-Group) with those, who were treated in accordance to a goal directed therapy algorithm (ProAQT-Group), monitored with the PulsioFlex system.

**Materials and Methods:** 30 Patients (ASA1-3) were randomized into a standard or ProAQT study group. Before the induction of the general anaesthesia the radial artery was cannulated and connected to the PulsioFlex monitor. After saving the patient's age, sex, height and weight the PulsioFlex device calculated CI and PPV beat-to-beat: based on pulse contour analysis at baseline, after 60 min and 120 min of surgery. After induction of general anaesthesia a central venous catheter was placed and central venous pressure was detected.

The goal directed therapy firstly aimed to maintain the PPV below 10% by volume substitution as long as CI increased and reached  $\geq 2.5$  l\*min<sup>-1</sup>\*m<sup>2</sup>. Secondly the mean arterial blood pressure (MAP) was maintained above 65 mmHg using vasopressors after PPV  $\leq 10\%$ . Inotropic agents were administered to stabilize CI and MAP. After surgery the patient's follow up was assessed in the recovery unit for another 3 hours.

**Results:** There were no differences found between the groups regarding demographics and initial haemodynamic variables. With respect to CI the only significant difference between the groups was seen intraoperatively after 60 min, whereas we have seen no differences in PPV and MAP. The amounts of fluids administered were comparable between groups, trending to be lower in the ProAQT-Group. Lactate levels at the end of stay in the recovery unit also showed no differences.

**Conclusion:** These preliminary data suggest that defining and implementing a goal directed protocol guided by variables as PPV and CI, obtained semi-invasiv using the PulsioFlex monitoring system, seems to be useful and decisive in daily clinical routine. However, we have seen no differences regarding the defined primary endpoints.

### 3AP3-9

#### Plasma dilution efficacy as target parameter for evaluation of fluid responsiveness in goal directed fluid therapy

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**Background and Goal of Study:** Goal directed fluid therapy aims for maximization of target parameters by consecutive fluid challenges. Attractive approach would be the use of plasmadilution efficacy (PDE), and especially its noninvasive estimate, as target parameter. Significant decrease of PDE in consecutive fluid challenges could be a marker of decreasing fluid responsiveness.

Objective was to investigate if significant decrease of PDE in consecutive fluid challenges can be detected by evaluating it after 5 min. following each bolus.

**Materials and Methods:** Our prospective clinical trial was conducted in 36 ASA-II elective orthopaedic surgery patients. After overnight fast 36 subjects received three 5 ml kg<sup>-1</sup> boluses of acetated Ringer's solution separated by periods of 5min. without fluid. Radial arterial (aHb) blood samples were drawn and noninvasive SpHb™ (Radical-7, Masimo Corp., Irvine, USA) measures were recorded simultaneously at 4 data points - before the 1<sup>st</sup> bolus and after each 5 min. period following the 3 boluses. Arterial blood was analyzed in a laboratory (COULTER® LH750; Beckman Coulter, Inc. USA). Arterial and capillary plasma dilutions were calculated from fractional changes of aHb and SpHb, respectively. Arterial (aPDE) and capillary (cPDE) plasma dilution efficiencies were then calculated for every fluid challenge from deviation of dilutions.

**Results and Discussion:** The 108 arterial and 108 capillary PDE estimates were calculated at 3 data points from 144 simultaneous measurements of SpHb and aHb at 4 data points. Mean arterial PDE was significantly decreasing in all fluid challenges - step 1 vs. 2 (0.091 ± 0.008 vs. 0.047 ± 0.008,  $p = 0.0002$ ) and 2 vs. 3 (0.047 ± 0.008 vs. 0.019 ± 0.005,  $p = 0.0049$ ).

However, decrease of noninvasive PDE estimates was not significant. Increase of fluid elimination was previously reported in consecutive infusions<sup>1-3</sup>. It is explained by increasing fluid extravasation which is the sum of fluid elimination and translocation into interstitium provided that it is lower than the increase of lymphatic inflow.

**Conclusion(s):** Significant decrease of invasive arterial plasma dilution efficacy in consecutive fluid challenges was detected from dilution at 5 min. following each bolus.

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### 3AP3-10

#### Superiority of central venous oxygen saturation over central venous pressure to detect volume responder patients

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**Background and Goal of the Study:** A positive fluid balance in intensive care units has been associated with a worse outcome.

The fluid challenge test allows the clinician to give fluids and at the same time, to test the preload reserve of the patient. This small amount of fluid helps to assess the volume responsiveness and reduces the risk of a too liberal fluid strategy.

The aim of our study was to compare central venous oxygen saturation (SvcO<sub>2</sub>) with central venous pressure (CVP) as a marker of volume responsiveness.

**Materials and Methods:** We used the infusion 250 ml of colloids in 5 minutes to make a fluid challenge test in 24 patients.

These 24 patients had undergone major non cardiac surgery and didn't have mechanical ventilation.

We monitored their cardiac output using Vigileo system (Edwards).

Cardiac output, SvcO<sub>2</sub> were measured before and after the fluid challenge. We also pointed out their CVP before the test.

We assumed that the patients were volume responders if their cardiac output raised more than 10% after the fluid test.

We also considered that our patients were possibly responders if they had, previously to fluid test, CVP < 5 mmH<sub>2</sub>O or their SvcO<sub>2</sub> raised more than a 3% after the test.

#### Results and Discussion:

- The 65,21% of our patients had a positive test (they were responders).
- The 81% of these responders had an augmentation in their SvcO<sub>2</sub> of more of 3%.
- However, only the 38,45% of responders had a CVP < 5 before the test.

#### Conclusions:

1. Central venous saturation may be better to detect fluid responder patients than central venous pressure.
2. This fact can help us to estimate volume responsiveness in case we are not able to measure patients' cardiac output.
3. To corroborate these findings further studies must be made.

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### 3AP4-1

#### Validation of a "Plug-and-play" near infrared spectroscopy system for monitoring cerebral autoregulation during cardiac surgery

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**Background and Goal of Study:** Maintaining mean arterial pressure (MAP) within the limits of cerebral blood flow (CBF) autoregulation may be a more rational approach for optimizing blood pressure during cardiopulmonary bypass (CPB) than the current empiric standard of care.<sup>1</sup> Near infrared spectroscopy (NIRS) provides a suitable surrogate of CBF for clinical autoregulation monitoring.<sup>2,3</sup>

The purpose of this study was to compare the accuracy of a self-contained, "plug-and-play" autoregulation monitor that uses a commercially available NIRS system with transcranial Doppler (TCD) autoregulation monitoring methods.

**Materials and Methods:** TCD monitoring of CBF velocity and NIRS monitoring (Somanetics/Covidien, Boulder, CO) were performed in 59 patients during CPB. Analog blood pressure signals from the operating room hemodynamic monitor were directly connected to a prototype NIRS monitor containing additional hardware/software to measure CBF autoregulation. A moving linear correlation coefficient was calculated between slow waves of MAP and CBF velocity generating mean velocity index (Mx) using a personal computer-based system.<sup>2,3</sup> A similar continuous correlation was performed between MAP and slow waves of cerebral oximetry to yield cerebral oximetry index (COx) using the prototype NIRS monitor. When MAP is below the lower limit of autoregulation (LLA), Mx and COx approach 1 (i.e., CBF is pressure passive). Linear regression and bias analysis was performed between time-averaged values of Mx and COx. Values for Mx and COx were categorized in 5 mmHg bins of MAP for each patient. The LLA was defined as the MAP where Mx increased from < 0.4 to ≥ 0.4.<sup>2,3</sup>

**Results and Discussion:** Mx and COx were correlated ( $r=0.482$ ,  $p < 0.0001$ ) and had good agreement (mean±SD, bias -0.082± 0.195). The MAP at the LLA based on Mx was 67±9 mmHg (range, 30 to 84 mmHg). The average COx at this MAP was 0.40±0.45. Based on this cut-off, the MAP at the COx determined LLA (65±11 mmHg) was equivalent to that determined with Mx.

**Conclusions:** Monitoring CBF autoregulation with a modified, stand-alone NIRS monitor is correlated and in good agreement with TCD based methods. Availability of such a device would allow wide-spread autoregulation monitoring as a means of individualizing MAP targets during CPB.

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### 3AP4-2

#### ScvO<sub>2</sub> and multi-site near-infrared spectroscopy measurements during fluid challenge in cardiac surgery patients

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**Background and Goal of Study:** The present study aimed to compare the relationships between central venous oxygen saturation (ScvO<sub>2</sub>) and NIRS-derived cerebral (rSO<sub>2</sub>b) and somatic (rSO<sub>2</sub>s) regional oxygen saturations (1) during fluid challenge (2) and to compare their diagnostic value in predicting fluid responsiveness according two clinical definitions: an increase of at least 15% in cardiac index and an increase of at least 15% in systemic oxygen delivery (DO<sub>2</sub>).

**Materials and Methods:** Fifty adult patients were admitted to the surgical intensive care unit of a teaching university hospital following conventional cardiac surgery, and investigated before and after fluid challenge. Simultaneous comparative ScvO<sub>2</sub>, rSO<sub>2</sub>b and rSO<sub>2</sub>s data points were collected from a blood-gas analyzer and the EQUANOX monitor. Correlations were determined by linear regression. ScvO<sub>2</sub>, rSO<sub>2</sub>b and rSO<sub>2</sub>s before fluid challenge were collected to assess their discrimination in predicting fluid responsiveness according to both definitions.

**Results and Discussion:** A statistically significant relationship was found between absolute values of ScvO<sub>2</sub> and rSO<sub>2</sub>b ( $r=0.42$ ;  $P < 0.001$ ) but not between absolute values of ScvO<sub>2</sub> and rSO<sub>2</sub>s ( $r=0.17$ ;  $P=0.066$ ). No relationship was found between percent changes in ScvO<sub>2</sub> and rSO<sub>2</sub>b ( $r=0.00$ ;  $P=0.714$ ) and between percent changes in ScvO<sub>2</sub> and rSO<sub>2</sub>s ( $r=0.00$ ;  $P=0.886$ ) following fluid challenge. Whatever the definition, ScvO<sub>2</sub>, rSO<sub>2</sub>b and rSO<sub>2</sub>s were of poor diagnostic value in predicting fluid responsiveness. No significant dif-

ference was found among areas under the ROC curves for  $ScvO_2$ ,  $rSO_2b$  and  $rSO_2s$ .

**Conclusion(s):**  $rSO_2b$  and  $rSO_2s$  cannot be used to provide rapid and non invasive estimation of  $ScvO_2$  and trends in  $rSO_2b$  and  $rSO_2s$  cannot be considered as a non invasive surrogate for the trend in  $ScvO_2$  following cardiac surgery.  $ScvO_2$ ,  $rSO_2b$  and  $rSO_2s$  are of poor diagnostic value to predict fluid responsiveness in that setting.

**References:**

1. Crit Care 2007;11:R6
2. J Appl Physiol 2008;104:475-481

### 3AP4-3

#### Masimo Radical 7 continuous hemoglobin measurement error grid approach results

Gomez Diago L., Soliveres J., Balaguer J., Hernández M.J., Sánchez A., Solaz C.

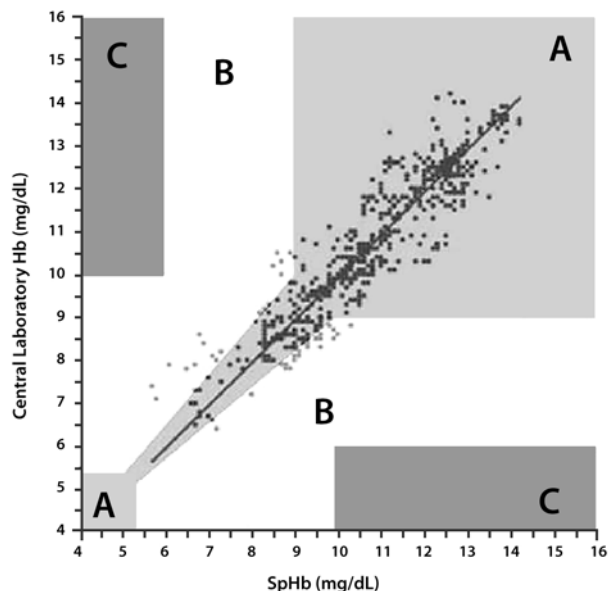
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**Background and Goal of Study:** Pulse CO-Oximetry™ (SpHb) (Radical 7, Masimo Corp) is a noninvasive, continuous hemoglobin monitor, and in vivo calibration has been recently introduced. Our aim is to determine the bias and precision of the in vivo calibration feature.

**Materials and Methods:** After local ethics committee approval, written informed consent was obtained from 36 older than 18 years ASA I-III patients scheduled for surgery under general anesthesia monitored with a radial artery catheter. The Rad7 probe was placed at the extremity of the second finger on the same side as the arterial catheter. The results from the Rad7 were compared with the arterial Hb from the central hematology analyzer used in our hospital (Coulter). A grid error similar to the one described for blood glucose measurement is used (1) showing concentrations between 0 and 16 g/dL. Hb from the laboratory reference value (LabHb) and SpHb are ordered in pairs. Ideally, all points would be on a line of unity (shown in the figure 1). Zone A means deviation of  $\pm 10\%$  from the reference (95% of the values should be here); in zone B, significant errors occur (less than 5% of the values should be here) but not as significant as zone C, in which major therapeutic errors may occur (no values should be here). We applied the hemoglobin in vivo calibration to raw data collected previously to draw the hemoglobin error grid. Calibration consisted in adding or subtracting the difference between LabHb (analyzed at the beginning of the surgery) and SpHb to the SpHb value observed from that moment until the end of the surgery. Each pair of values was taken every 15 minutes.

**Results and Discussion:** No patients were excluded. 592 samples were analyzed from 36 patients, 31 had an error greater than 10 % (5.2%, zone B). No value fell in zone C.

Figure 1 shows the hemoglobin error grid with the tree zones.



[Figure 1]

**Conclusion:** Both methods can be considered to be exchangeable.

**References:**

1. Anesth Analg, 2011;113:89-90

### 3AP4-4

#### Noninvasive monitoring of hemoglobin (SpHb™) during preoperative stepwise infusion of Ringer's acetate: accuracy for the evaluation of arterial plasma dilution

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**Background and Goal of Study:** In goal directed fluid therapy, intravenous fluid administration is targeted to maximize cardiovascular performance. This can be done by infusing consecutive fluid boluses targeting plasma dilution. Noninvasive monitoring of plasma dilution is available using a SpHb™ monitor Radical-7 (Masimo Corp., Irvine, USA). Correlation between noninvasive and invasive estimation of plasmadilution has not been reported.

The objective of this study was to evaluate the accuracy of SpHb for the evaluation of plasma dilution during 3 consecutive crystalloid fluid challenges.

**Materials and Methods:** A prospective clinical trial was conducted with 36 ASA -II patients scheduled for elective orthopaedic surgery. The patients received three 5 ml kg<sup>-1</sup> boluses of acetated Ringer's solution separated by periods of 5 minutes without fluid. Radial arterial blood samples (aHb) were analyzed and SpHb measurements were recorded simultaneously - before the 1<sup>st</sup> bolus, and after each 5 minute period following the 3 boluses. Blood was analyzed in a laboratory (COULTER® LH750; Beckman Coulter, Inc. USA). Arterial and capillary plasma dilutions (aPD and cPD) were calculated from fractional changes of aHb and SpHb, respectively. Agreements between aHb and SpHb and also aPD and cPD were evaluated by linear regression and Bland-Altman analysis.

**Results and Discussion:** The 108 arterial and capillary estimates of stepwise plasma dilution in 36 patients were calculated from 144 simultaneous measurements of SpHb and arterial Hb. There was no difference between the pooled means of 108 arterial and 108 capillary plasma dilution estimates, also between 108 paired estimates. Bland-Altman analysis showed 0.009  $\pm$  0.012 bias and linear regression analysis found weak correlation ( $r = 0.21$ ,  $p = 0.025$ ). Clinical interpretation of SpHb may need revision. Are we really looking at arterial/venous Hb?

**Conclusion(s):** Noninvasive monitoring of hemoglobin (SpHb™) is not sufficiently accurate for evaluation of arterial plasma dilution during stepwise plasma dilution.

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### 3AP4-5

#### Clinical interpretation of noninvasive hemoglobin (SpHb™) revised: single-capillary-bed rather than arterial hemoglobin

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**Background and Goal of Study:** Introduction of noninvasive monitoring of hemoglobin, SpHb™ (Radical-7, Masimo Corp., Irvine, USA) was followed by controversial reports of accuracy. The reference method was laboratory analysis of venous or arterial blood. Radical 7 has arterial and venous SpHb modes, where venous is mathematically derived from arterial.

However, in previous study, arterio-venous dilution difference was found positive at the end of 15 ml/kg crystalloid bolus, but progressively negative during next 20 minutes<sup>1</sup>. This is attributable to reflux of excess interstitial fluid which diluted venous blood.

Our objective was to evaluate arterio-capillary dilution difference (acDD) in a stepwise 15 ml/kg net crystalloid infusion. Hypothetically, if SpHb is affected by transcapillary fluid shift, acDD will be negative after 20min. following last bolus.

**Materials and Methods:** Prospective clinical trial was conducted preoperatively in 36 ASA-II elective orthopedic surgery patients. After an overnight fast they received three 5 ml kg<sup>-1</sup> boluses of acetated Ringer's solution separated by periods of 5min. without fluid. Radial arterial blood samples were drawn and SpHb was recorded simultaneously at 5 data points - before 1<sup>st</sup> bolus, after each 5 min. period following 3 boluses, and after 20min. following 3<sup>rd</sup> bolus. Blood was analyzed in laboratory (COULTER® LH750; Beckman Coulter, Inc. USA). Arterial and capillary plasma dilutions were calculated from fractional change of arterial hemoglobin and SpHb, respectively.

**Results and Discussion:** 144 arterial and capillary estimates of stepwise plasma dilutions were calculated from 180 simultaneous measurements of arterial Hb and SpHb at 5 data points. The acDD was negative after 20min.

following last bolus. Noninvasive Hb could have been affected by transcapillary fluid shift because acDD was positive in 1<sup>st</sup> step (rehydration?), negative in 3<sup>rd</sup> (overhydration?) and most negative after next 20 min. (redistribution?). Anatomy of noninvasive measuring site (derma) suggests that measurements are made in the vicinity of a single capillary bed. Theoretically, SpHb can be a surrogate of metarteriolar (arterial) and capillary Hb since capillaries are also pulsating due to vasomotion.

**Conclusion(s):** Noninvasive hemoglobin (SpHb) was probably affected by transcapillary fluid shifts in capillaries under the probe.

**References:**

1. Svensen et al. *Anesth Analg* 2009;108:128-33.

**Acknowledgements:** Study sponsored by ESA Research grant 2009.

### 3AP4-6

#### A comparison of two different near-infrared spectrophotometers in pediatric and adult cardiac surgeries

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**Background and Goal of Study:** Cerebral oximetry by near-infrared spectroscopy (NIRS) is non-invasive method to measure cerebral tissue oxygen saturation and nowadays widely used in several clinical situations. There are two common NIRS instruments; the NIRO 200NX and the INVOS 5100. TOI (tissue oxygenation index) by NIRO and rSO<sub>2</sub> (regional cerebral oxygenation index) by INVOS were obtained through different measurement principles. Moreover, there have been few reports to compare two indices in cardiac surgery. Accordingly, we compared the changes of TOI and rSO<sub>2</sub> during pediatric and adult cardiac surgeries with cardiopulmonary bypass (CPB).

**Materials and Methods:** With IRB approval and informed consent, 5 little children less than 10 kg and 5 adult patients who underwent elective cardiac surgery with CPB were evaluated. After induction of anesthesia, the probes of INVOS were placed above the supraorbital ridge and the probes of NIRO were placed just above the INVOS probes. TOI and rSO<sub>2</sub> values were obtained every one minute simultaneously and collected in our automated anesthesia recording system. Data were analyzed by dividing the surgical periods into 3 terms; pre-CPB, during-CPB, and post-CPB. A linear regression analysis and Pearson's correlation coefficient were calculated. Bland-Altman analyses were also performed.

**Results and Discussion:** 4753 pairs of data were obtained by adult patients, and 2317 pairs by pediatric patients. In adult patients there were little correlation between TOI and rSO<sub>2</sub> throughout the surgery (Even a highest correlation coefficient was -0.21 at post-CPB.).

However, in pediatric patients, TOI and rSO<sub>2</sub> showed significant correlation (Correlation coefficients at pre-CPB/during-CPB/ post-CPB were 0.640/ 0.780/ 0.332, respectively.). Bland-Altman analysis in pediatric patients showed a mean bias of 6.17with limits of agreement (LOA) of -10.13 to 22.48 for TOI and rSO<sub>2</sub>.

In the adult patients, little correlation was seen between TOI and rSO<sub>2</sub>. One of the possible reasons of this result may be influences by more thick extracranial blood flow or intracranial arterial sclerosis in adult patients. In contrast, in the pediatric patients, better correlation was seen between TOI and rSO<sub>2</sub>. However, Bland-Altman analysis revealed relatively wide LOA.

**Conclusion:** NIRS values seem to be useful to evaluate changes from the baseline, however, careful consideration is required to estimate the absolute values.

### 3AP4-8

#### Arterial sample analysis agreement between two blood gas analysers: Radiometer ABL 700 and Radiometer ABL 80

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**Background and Goal of Study:** Arterial blood pO<sub>2</sub>, pCO<sub>2</sub>, pH, sodium, potassium, chlorine, calcium, glucose and hemoglobin values are measured by point of care blood gas analysers(POC-BGA) in some areas in the hospital, like surgical facilities or critical care units. Depending on the load of work, smaller, more cost-effective devices can be used.

Our aim is to evaluate the agreement between two POC-BGA (Radiometer ABL™ 700 and ABL FLEX™ 80).

**Materials and Methods:** After local ethics committee approval, written informed consent was obtained from 11 ASA I-III adult patients scheduled for surgery under general anesthesia and radial artery catheter placement. Blood samples were collected with arterial blood gas syringes (1,5 mL blood gas

syringe, BD Preset™) and were analyzed by two blood gas analyzers: one at our critical care unit (Radiometer ABL™ 700), and the other one at our surgical site (Radiometer ABL FLEX™ 80). The Bland-Altman approach was used, the CLIA (clinical laboratory improvement amendments) allowable error was used as acceptable limits of agreement, except for hemoglobin, in which a maximum bias of 0.5 g/dl and precision lower than 0.75 mg/dL were considered acceptable. Bias (systematic error) was constructed as the mean of the differences between the two POC-BGA, and the precision (random error) as its standard difference.

**Results and Discussion:** One patient was excluded (due to technical problems with the arterial system). 99 blood arterial samples were analyzed. Bias and precision are shown in the table 1.

	pH	pO <sub>2</sub> (mmHg)	pCO <sub>2</sub> (mmHg)	Hb (g/dL)	Na <sup>+</sup> (mEq/L)	K <sup>+</sup> (mEq/L)	Ca <sup>2+</sup> (mg/dL)	Cl <sup>-</sup> (mEq/L)	Glucose (mg/dL)
	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80	ABL 700 / ABL 80
<b>Mean (SD)</b>	7,39 (0,06) / 7,42 (0,07)	243,2 (96,7) / 206,1 (61,7)	39,6 (4,8) / 37,6 (5,2)	11,9 (1,9) / 11,9 (2,0)	138,18 (2,07) / 142,88 (6,30)	3,84 (0,54) / 3,87 (0,5)	4,50 (0,15) / 4,60 (0,19)	108,4 (2,8) / 108,7 (2,2)	138,9 (26,9) / 130,8 (30,2)
<b>BIAS (Precision)</b>	-0,02 (0,03)	37,07 (49,41)	2,04 (3,48)	-0,02 (1,02)	-4,70 (6,40)	-0,03 (0,11)	-0,11 (0,13)	-0,30 (1,97)	8,11 (18,40)
<b>CLIA<sup>1)</sup></b>	± 0,04	±3SD	± 5 mm Hg	Maximum allowable error (Not CLIA) Bias <0,5 g/dL Precision < 0,75 g/dL	±4 mEq/L	±0,5 mEq/L	±1,0 mg/ dL	±5%	±6mg/dL

[Table 1]

<sup>(\*)</sup> CLIA proficiency testing criteria for acceptable analytical performance

**Conclusion(s):** Both POC-BGA can be used interchangeably except for hemoglobin and glucose determinations.

### 3AP4-9

#### Four leads holter monitoring does not allow an early detection of postoperative myocardial ischemia

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**Background and Goal of Study:** Postoperative myocardial ischemia (POMI) is a live-threatening complication mostly asymptomatic <sup>1</sup>. Serial TnIc measurements are one of the simplest diagnosis tools and is well correlated with a bad long-term outcome <sup>2</sup>. Nonetheless such a policy allows only a late diagnosis (ie several hours after the onset of POMI). The aim of our study was to test the ability of EKG monitoring to detect POMI earlier.

**Materials and Methods:** POMI were detected after moderate or high-risk surgery on 64 patients with a revised cardiac risk index (RCRI) > 1 using both serial TnIc measurements in the recovery room and on the morning of postoperative days 1 to 3 and 4 leads EKG monitoring started on the arrival of the recovery room and pursued during the first three postoperative days. Patients were considered having a POMI when exhibiting at least one TnIc measurement above the 99<sup>th</sup> percentile of a normal population. The data recorded on holter monitoring were the heart rate and the time of ischemia with ST depression > 2 mm.

**Results and Discussion:** 17/64 patients (26%) presented a POMI and only 58 holter monitoring were interpretable. There was no difference between the group with and without POMI neither concerning the mean heart rate (respectively 77 ± 16 and 79 ± 10 mn - p=0.6213) nor concerning the mean time of ischemia on holter monitoring (respectively 6.5 ± 21 and 6.5 ± 38- p=0.9966) Conclusion : Neither heart rate nor ST monitoring through 4 leads EKG monitoring are able to predict POMI.

**References:**

1. Devereaux RJ, et al. *Ann Intern Med* 2011;154:523-8.  
2. Levy M, et al. *Anesthesiology* 2011;114:796-806.

### 3AP4-10

#### Is there a relation between cerebral oxygenation after cardiac arrest and outcome?

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**Background:** After cardiac arrest (CA), neurological outcome might be influenced by cerebral perfusion. Near-infrared spectroscopy (NIRS) makes it possible to continuously monitor the absolute cerebral tissue oxygen saturation (SctO<sub>2</sub>). Using four wavelengths of laser light, absolute determination of oxygenated and deoxygenated hemoglobin in the cerebral microvasculature is provided. Validated by correlation between SctO<sub>2</sub> and jugular bulb saturation, threshold for cerebral ischemia is estimated at SctO<sub>2</sub>-values of 55%. In this study, cerebral tissue oxygen saturation (SctO<sub>2</sub>) was measured during the first 24 hours after cardiac arrest (CA).

**Patients and methods:** After IRB approval, 23 patients were monitored during the first hours after cardiac arrest (induction, maintenance and recovery of therapeutic hypothermia). Cold saline (30 ml/kg) was administered as soon as possible after hospital admission. Therapeutic hypothermia (TH) (33°C) was induced by endovascular or surface cooling. All patients were sedated (propofol/remifentanyl) for the duration of hypothermia. SctO<sub>2</sub>-monitoring was applied before start of TH.

**Results:** Of the 23 patients, 12 (52%) patients survived the hospital stay. Eight of these survivors were discharged without any neurological deficit (CPC1). Two (9%) patients died within the first day after admission due to hemodynamic shock. Nine (39%) patients died during admission as a consequence of post-ischemic brain damage.

Values for cerebral oxygenation in non-survivors started at 66% (± 7). Within three hours, SctO<sub>2</sub> gradually declined to 55% (± 4) and remained below this critical value for cerebral ischemia for one hour. Thereafter, SctO<sub>2</sub> started to increase to reach baseline values at 12 hours after start of monitoring. The decrease in SctO<sub>2</sub> was not correlated with a change in hemodynamic parameters (MAP start: 76 mmHg; 3u: 91 mmHg) or systemic oxygenation (SpO<sub>2</sub> start: 96%; 3h: 100%).

Patients who survived the hospital stay, started at SctO<sub>2</sub> values of 68% (± 4). SctO<sub>2</sub> decreased to 59% (± 5) within two hours, but increased again to baseline values within four hours after the start of monitoring. In the following hours, SctO<sub>2</sub> further increased up to 70% (± 3).

**Conclusion:** In the first hours after CA cerebral oxygenation showed a decrease in SctO<sub>2</sub>. A significant difference in start values between survivors and non-survivors was not observed. But, SctO<sub>2</sub>-values decreased below the critical limit of 55% in non-survivors.

### 3AP4-11

#### Comparison of three methods of hemoglobin measures during major surgery

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**Background:** During surgery, an acute hemorrhage can occur. Hemoglobin concentration (Hb) is essential to manage the transfusional therapy. In our centre, hemoglobin values can be obtained from a blood sample and measured using the automated hemoglobin analyzer in the central laboratory (tHb)(Beckman-Coulter), or, using a "point-of-care" device as *Co-Oximeter* (cHb) (ABL 800 FLEX).

Recently, a non-invasive and continuous monitor (*Masimo Rainbow SET*) is present in surgical theatre: hemoglobin (SpHb) is measured by a spectrophotometric sensor placed in a finger's patient.

We evaluated the accuracy of *SpHb* and *cHb* compared with central laboratory hemoglobin (*tHb*).

**Material and Methods:** We performed a prospective study of 23 patients (73 data points) who underwent major surgery and requiring arterial catheter. General anesthesia was performed with sevoflurane and remifentanyl. Rocuronium was used as non-depolarizing muscle relaxation. All blood samples were obtained from radial artery catheter. First measure was obtained before surgical incision. Following measures were obtained according to anesthesiologist criteria. Each blood sample was analyzed in both central laboratory (tHb) and "point of care" device (cHb). Simultaneously, a value from the SpHb monitor display was collected.

**Results:** 55% of patients (12/23) were men. The mean patient age was 57 years old. R: (19-80). Abdominal surgery was performed in 47.9% (35/73). Head and Neck surgery in 16.4% (12/73). Orthopedic surgery in 13.6% (10/73). Neurosurgery in 12.3% (9/73). Laparoscopic surgery in 5.4% (4/73). Vascular surgery in 4.1% (3/73).

The mean value for different Hb was: tHb 10.91 g/dL, cHb 11.38 g/dL, SpHb 11.96 g/dL.

Difference between SpHb-tHb was < 0.5 g/dL for 17.8% of samples, 0.5-1g/dL for 20% of samples and higher to 2.0 g/dL for 20% of samples. The absolute difference between cHb-tHb was < 0.5 g/dL for 50.7% of samples.

Correlation Coefficient (CC) when compared cHb and tHb was 0.97, considered as excellent. CC when compared SpHb and tHb was 0.77, considered as good.

**Conclusions:** We showed better results in *Co-oximeter* results than in *Masimo*. Absolute difference between *Masimo* and central laboratory is well correlated but it is not as accuracy as *Co-oximeter*. Both of them showed an overestimation of tHb values. *Masimo* provide information about hemoglobin's trend but further improvement is required for guarantee a good clinical management.

### 3AP5-1

#### Which muscle among the orbicularis oculi, corrugator supercilii, masseter and mylohyoid is the best predictor of successful endotracheal intubation?

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**Background and Goal of Study:** The neuromuscular blocking effects of rocuronium on the orbicularis oculi (OO), corrugator supercilii (CS), masseter (MA), and mylohyoid (MH) were compared as a predictor of successful intubating conditions.

**Materials and Methods:** We studied 288 patients undergoing elective surgery requiring general anaesthesia with remifentanyl, propofol and nitrous oxide. Patients were allocated randomly into 8 groups to receive intubation dose of either 0.6 or 1.2 mg kg<sup>-1</sup> of rocuronium. Endotracheal intubation was performed after maximal neuromuscular block by acceleromyography at the eyelid (OO), the superciliary arch (CS), the cheek (MA), and the submental triangle (MH). The onset time after rocuronium and intubating conditions were assessed.

**Results and Discussion:** The onset time in the OO, CS, and MA was significantly shorter than that in the MH (P < 0.05). Excellent intubating conditions were significantly enhanced in the CS (53%) and MH (58%) compared with the OO (19%) and MA (17%) after rocuronium 0.6 mg kg<sup>-1</sup> (P < 0.05). However, the onset time and intubating conditions after rocuronium 1.2 mg kg<sup>-1</sup> were similar for four facial muscles.

**Conclusion(s):** Following rocuronium administration at similar anaesthesia depths, the CS provided the best balance of shorter onset time while maintaining excellent intubating conditions.

#### References:

Lee HJ, Kim KS, Jeong JS, Cheong MA, Shim JC. Comparison of the adductor pollicis, orbicularis oculi, and corrugator supercilii as indicators of adequacy of muscle relaxation for tracheal intubation. *Br J Anaesth* 2009; 102: 869-74.

### 3AP5-2

#### Agreement between subjective and objective method of neuromuscular monitoring using train of four responses to indicate adequacy of muscle relaxation for tracheal intubation following vecuronium induced neuromuscular block

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**Background and Goal of Study:** Monitoring train of four (TOF) stimulations objectively (TOFobj) using acceleromyograph is recommended for research purpose. However visual estimation of TOF (TOFvis) using a peripheral nerve stimulator (PNS) is still widely used in developing countries. The aim of this study was to define the degree of agreement between TOFobj and TOFvis using TOF watch in determining the intubation time (IT).

**Materials and Methods:** In this prospective study, 60 ASA I-II patients undergoing elective surgery were enrolled. After induction of general anaesthesia, vecuronium 0.1 mg/kg was administered. TOF stimulation (0.2 ms duration, frequency 2 Hz, 2 s duration with supra maximal current every 12s) using a TOF-Watch SX<sup>®</sup> or PNS were applied simultaneously to both hand through surface electrode over ulnar nerve. IT was defined as the time period from the start of injection vecuronium until zero reading on TOF-Watch SX<sup>®</sup> (TOFobj IT) or complete disappearance of TOF responses (TOFvis IT). The patients were studied in two groups. In the first group (TOFobj, n=30), endotracheal intubation (ETI) was attempted after documenting a zero on the display of TOF-Watch SX<sup>®</sup>. A Bland-Altman plot was created to define the degree of agreement and mean bias. In the second group (TOFvis, n=30) ETI was done



after adding mean bias from TOFobj to TOFvis IT. Blinded investigator evaluated the quality of intubating conditions (IC) <sup>1</sup> in both the groups.

**Results:** The TOFobj IT was consistently longer than TOFvis IT in all patients from first group. In the first group, TOFobj IT exhibited a moderate correlation ( $r=0.79$ ) and bias of  $47 \pm 18.8$ s relative to the TOFvis IT with wide limits of agreement (10.2-84.2s). IC was clinically acceptable in all patients from TOFobj group compared to TOFvis group (24/30), ( $p < 0.05$ ). Furthermore, excellent IC were more frequently found in TOFobj (26/30) compared to TOFvis (17/30,  $p < 0.05$ ).

**Conclusions:** The results of the study suggest that the IT difference between TOFobj and TOFvis has a good correlation but exhibit a strong disagreement making it difficult to arrive at a single value for all patients that allow prediction of TOFobj IT, from a TOFvis IT using a PNS.

**Reference:**

1. Fuchs-Buder T, Claudius C, Skovgaard LT et al. 8th International Neuromuscular Meeting. Good clinical research practice in pharmacodynamics studies of neuromuscular blocking agents II: the Stockholm revision. *Acta Anaesthesiol Scand* 2007; 51: 789-808.

### 3AP5-3

#### A new multimodal indicator for assessment of the hypnotic component of anaesthesia

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**Background and Goal of Study:** Electroencephalographic (EEG) monitoring of the hypnotic component of anaesthesia has been suggested as a supplement technique to standard monitoring. While the EEG reflects brain activity, standard monitoring provides indirect information on the anaesthetic effects. The investigation evaluates the ability of a new multimodal indicator integrating EEG and standard monitoring parameters to quantify anaesthetic depth from wakefulness to deep anaesthesia for different anaesthetic regimen.

**Materials and Methods:** 263 adult patients undergoing surgery under general anaesthesia were included in a study conducted in 6 European centres. Patients were randomly assigned to one of 11 anaesthetic groups, consisting of opioids, hypnotic drugs for induction and maintenance. Standard parameters and EEG were continuously recorded and stored together with relevant patient data. During anaesthesia induction, Tunstall's isolated forearm technique was performed to detect loss of consciousness. After skin incision, anaesthetic doses were increased until EEG burst suppression (BS) occurred. Subsequently, anaesthesia was performed according to standard clinical practice. At the end of surgery, drugs were discontinued and commands to squeeze hand were given until return of consciousness. The anaesthesia multimodal indicator (AMI) was developed through a data driven adaptive neuro fuzzy inference system, which maps EEG parameters, standard monitoring parameters, patient data and drug protocol into an output indicator (threefold cross validation). AMI and BIS (calculated offline) were analyzed during consciousness, general anaesthesia and BS in three different anaesthetic groups: (A) intravenous, (B) volatile and (C) intravenous & volatile anaesthetics. Prediction probability ( $P_k$ ) including 95% confidence intervals (CI) shows the indicators ability to separate anaesthetic levels.

**Results and Discussion:** The AMI showed an overall  $P_k$  of 0.94 (CI: 0.93-0.95) for separation of different anaesthetic levels for all anaesthetic combinations, whereas BIS has a significantly lower  $P_k$  of 0.75 (0.73-0.78). In the three anaesthetic groups (A/B/C), the  $P_k$  value of AMI remains stable (0.95/0.93/0.92), while  $P_k$  of BIS shows variation (0.87/0.78/0.66).

**Conclusion:** A multimodal integration of standard and EEG parameters exceeds the performance of the current anaesthetic depth monitoring. In particular, AMI yields steady performance for different anaesthetic regimens.

### 3AP5-4

#### Is there an additional benefit of using repetitive post-tetanic count to provide more optimal surgical conditions during minor abdominal surgery?

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**Background and Goal of Study:** Both, train of four (TOF) and post-tetanic count (PTC) technique might be used to assess profound neuromuscular blockade (NMB) and therefore to facilitate optimal surgical conditions. Subsequent responses to frequent, repetitive tetanic stimulations might be altered due to phenomenon known as post tetanic facilitation (PTF).

The objective of this study was to determine which of these NMB monitoring

techniques is more suitable in establishing optimal surgical conditions during minor abdominal surgery.

**Materials and Methods:** Study involved 40 patients, underwent elective abdominal surgery. Anaesthesia was induced and maintained with TCIs of propofol ( $Ce=3$  mcg/ml<sup>1</sup>) and remifentanyl ( $Ce=4$  ng/ml<sup>1</sup>). Acceleromyography at the adductor pollicis (TOF Watch S<sup>®</sup>) was established before rocuronium (0.6 mg/kg<sup>1</sup>) was administered in the aim to determine onset of intubating time and to access the extent of NMB.

Patients were randomly allocated to receive first subsequent dose of rocuronium (0.2 mg/kg<sup>1</sup>) following either reappearance of second response to conventional TOF stimulation-TOFc=2 (RTOF group, n=20) or until PTC was  $\geq 5$  (RPTC group, n=20). Just prior to administration of first additional dose of rocuronium, surgeon judged the quality of surgical condition concerning muscle relaxation either as clinically acceptable (excellent, satisfactory) or clinically unacceptable.

**Results and Discussion:** The mean interval between the initial and first subsequent dose of rocuronium was significantly longer in RTOF compared to RPTC group (33.5 min versus 29.5 min;  $p < 0.001$ ). Surgical conditions were judged as clinically acceptable in 20/20 patients in RPTC group and 18/20 patients in RTOF group ( $p=0.24$ ).

Similarly, excellent surgical conditions were found in 17/20 RPTC patients and 12/20 patients in RTOF group ( $p=0.062$ ).

**Conclusion(s):** Both PTC and TOF based NMB monitoring techniques enables optimal surgical conditions. Although PTC shortens the duration of NMB probably due to PTF phenomenon, there is no additional improvement in surgical conditions compared to conventionally used TOF monitoring and thus should not be advocated.

### 3AP5-5

#### The effect of the introduction of automated gas flow control on fresh gas flow rates

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**Background and Goal of Study:** There is a near linear relationship between fresh gas flow rates and consumption of inhalational agents. We have studied fresh gas flow (FGF) rates with the Datex ADU over the past 10 years and shown a continuing decrease in both mean and median FGF. Median FGF represent typical maintenance flow while means represent total consumption. In March 2011 we installed GE Aisys machines with end-tidal control (ETc) in 11 operating rooms. ETc allows the user to set a target end-tidal vapor concentration and specify a minimum fresh gas flow rate (not less than 500ml/min). The machine alters vapor delivery and FGF to maintain the desired target. ETc mode can potentially reduce FGF and vapor use. The aim of this study was to investigate FGF rates following introduction of ETc.

**Materials and Methods:** The ongoing project is approved by the New Zealand National Ethics Committee.

In June and December 2011 we collected log files from six machines. Logs include all key press events and the pattern of flows used by the machine in ETc mode. For each machine we extracted the proportion of time in fresh gas (FGc) or ETc mode while an inhalational agent was being delivered. We derived the mean fresh gas flow and the time spent at various FGF rates to construct frequency distribution curves. We used our 2006 data for comparison.

**Results:** Data were retrieved for 99 days in June and 154 days in December. Overall mean FGF was 1.5l/min in June and 1.2l/min in Dec. (2006 = 1.43). In June ETc was used 34% of the time, mean FGF in ETc mode was 0.95l/min and in FGc mode 1.84l/m. In December ETc use was 61%, mean FGF were 0.86 and 2.01 l/min.

Median FGF in June was 1.25l/min (Etc 0.6, FG 1.25) and in Dec 0.6 l/min (Etc 0.6, FGc 1.25)

The time spent at higher flow rates has increased. In 2009 7% of time was above 3l/min. In Jun 2011 this was 11% (Etc 4%, FG 15%) and in Dec 12% (4%, FG 21%). The 90<sup>th</sup>ile in Dec was 5.0 (Jun 6.25). In 2006 this was 2.25l/min

**Conclusion(s):** After an initial increase, mean FGF is now 16% less than prior to introduction of ETc. This is mainly due to increasing use of the ETc mode. Time at high FGF (>4l/min) has increased, possibly due to the Aisys interface. Reducing time spent at high FGF in FGc mode has the potential for further significant savings.

**Reference:**

Changing patterns in anesthetic fresh gas flow rates over 5 years in a teaching hospital. Kennedy RR & French RA *Anaesth Analg* 106:1487-90

### 3AP5-6

#### Evaluation of infusion rate accuracy and reliability of elastomeric and mechanical infuser pumps

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**Background and Goal of Study:** Disposable elastomeric and mechanical infuser pumps with pre-fixed flow rates are used for pain management. The aim of this study was to investigate infusion rate accuracy and reliability of elastomeric and mechanical infuser pumps.

**Materials and Methods:** Twenty elastomeric pumps (same model-A) and twenty mechanical infuser pumps (same model-B) were evaluated. The measurements concerned two levels of infusion rates (low flows 4ml/h and high flows 8-10 ml/h). The investigated pumps were filled with normal saline (n/s) and then they were connected with empty syringes of 60 ml, in order to record flow rates per hour for 12 hours.

After the end of the first injection of N/S, the same pumps were refilled and new recordings of flow rates per hour for 12 hours were noted. We evaluate the difference between estimated and recording flow rate every hour and also for 12 hours totally.

Statistical analysis was performed by ANOVA test and Bonferroni multiple comparisons test. Level of significance was set at  $p < 0,05$ .

**Results and Discussion:** At low flows infusion rates, a significant difference was found between estimated and recording flow rates in pumps B ( $p < 0,05$ ) compared to pumps A, at the first filling and also after refilling the infusion pumps. At high flows infusion rates, significant ( $p < 0,001$ ) differences were noted between estimated and recording flow rates for both studied types (elastomeric and mechanical) of infuser pumps.

These statistical significant differences were more pronounced at high flow infusion rates.

**Conclusion(s):** Using the method described above concerning the infusion rate accuracy of elastomeric and mechanical infuser pumps, we conclude that there are significant differences between estimated and recording flow rates for both types of studied infuser pumps and these differences are more pronounced at high flow infusion rates.

### 3AP5-7

#### ECG artifact in EEG monitoring

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**Background and Goal of Study:** Several studies have discussed the effects of electrocardiogram (ECG) artifact on commercially available electroencephalogram (EEG)-derived indices. Most reports failed to present the original recorded signal or its power spectrum. In this study, ECG artifact on EEG recordings was studied.

**Materials and Methods:** With IRB approval and written informed consent, patients scheduled for abdominal surgeries under propofol/remifentanyl/dexmedetomidine anaesthesia were enrolled. EEG from Fp1, Fp2, left outer canthus, left mastoid (M1) and Cz was recorded with NicoletOne Monitor™. Propofol infusion was titrated to SE value of Entropy™ to 50. No neuromuscular blockades were given. EEG signals were analysed off-line: when ECG artifact was seen on EEG suppression, the amplitude of R peaks and the power spectrum were calculated.

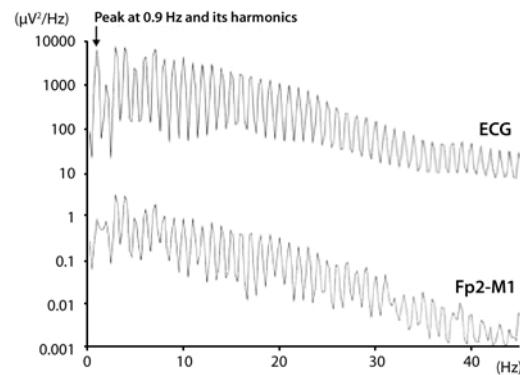
**Results and Discussion:** Among 22 anaesthetized females (25-69 years), 20 patients showed EEG burst-suppression. In all those 20 patients, the amplitude of ECG artifact exceeded the maximum amplitude of EEG during suppression.

When heart rate was constant, ECG power spectrum dominated during EEG suppression and its harmonics could be seen on EEG signals. The ECG power spectrum may also contribute significantly to the power spectrum of the EEG signals when it is high and the EEG amplitude is low. A typical example of Fp2-M1 derivation is shown.

Fig. 1a Typical example of ECG artifact on EEG (Fp2-M1).



Fig. 1b The logarithmic power spectrum of ECG and EEG during suppression.



[ECG and EEG power spectra during EEG suppression]

**Figure legend:** a. Upper trace shows burst-suppression EEG of Fp2-M1 and lower trace is ECG from chest leads. Notice that ECG dominates the EEG trace during suppression. b. Logarithmic power spectrum of a. Notice, the peak of heart rate is 0.9 Hz, and the peaks at harmonic frequencies are visible in both EEG and ECG spectra.

**Conclusion:** ECG is an important artifact in EEG recordings. It can seriously distort the estimation of both EEG and EMG in neuromonitoring during anaesthesia, because during suppression ECG power spectrum may dominate the power spectrum of EEG monitoring trace.

### 3AP5-8

#### Impact of certain neuromuscular blockade monitoring techniques on intensity of hemodynamic response during intubation

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**Background and Goal of Study:** Typical autonomic response to endotracheal intubation (EI) manifests itself by increasing blood pressure and heart rate. The aim of this study was to evaluate whether NMB monitoring techniques may impact hemodynamic response.

**Materials and Methods:** This was prospective; double blind study which involved 60 patients underwent elective abdominal surgery. Patients were randomly allocated into 3 groups. Anaesthesia was induced with propofol/remifentanyl and acceleromyography at adductor pollicis was established before rocuronium ( $0.6 \text{ mg} \cdot \text{kg}^{-1}$ ) was given to facilitate EI. EI was initiated after 95% suppression of 0.1 Hz single twitch (LST group), complete disappearance of responses to train-of-four stimulation (LTOF group) or after clinical criteria (good relaxation of the masseter muscle and the lower jaw, easy mask ventilation and fact that 60 sec elapsed since rocuronium was administered) were fulfilled (LCLIN group). Blood pressure and heart rate were measured in five time points: after positioning the patient ( $\text{HD}_0$ ), 30 s after propofol/remifentanyl ( $\text{HD}_1$ ), 30 s after rocuronium ( $\text{HD}_2$ ), 30 s ( $\text{HD}_3$ ) and 2 minutes following initiation of EI ( $\text{HD}_4$ ).

**Results and Discussion:** The interval between administration of rocuronium and initiation of EI was significantly shorter in LCLIN group (66.5 s), compared to LTOF group (75.44 s) and LST group (83.75 s), ( $p < 0.001$ ). There was statistically significant difference in systolic blood pressure at  $\text{HD}_3$  and  $\text{HD}_4$  time point between groups ( $p < 0.01$ ). Post hoc analysis shows that these values of systolic blood pressure in LCLIN group were significantly higher compared to the other two groups ( $p < 0.05$ ). Also systolic blood pressure after the fourth and fifth measurements were significantly higher compared to initial three measurements in LCLIN patients ( $p < 0.01$ ). By comparing the heart rate at  $\text{HD}_3$  and  $\text{HD}_4$  time points, significant difference between groups were noted ( $p < 0.01$ ). At  $\text{HD}_3$  heart rate was significantly higher in LCLIN patients compared to other groups ( $p < 0.01$ ). Additionally, at  $\text{HD}_4$  heart rate was significantly higher in LCLIN than in LTOF ( $p < 0.05$ ) and LST group ( $p < 0.01$ ). Also heart rate was significantly increased at  $\text{HD}_4$  time point compared to initial three measurements in ( $p < 0.05$ ) in LCLIN patients.

**Conclusion(s):** Even though NMB monitoring prolongs intubating time, its use prevents vasilation of the hemodynamic response associated with endotracheal intubation.

### 3AP5-9

#### Is Navigator a useful tool in guiding anesthesia practice in nephropatic patients? Preliminary study

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**Background and Goal of Study:** The Navigator (GE Healthcare), a recently introduced display for everyday use in O.R., shows the concentrations and predicted effects of combined anesthetic drugs (depth of anesthetic plan) to facilitate more precise titration and outcome. These data are based on pharmacokinetic and pharmacodynamic studies conducted in healthy volunteers or ASA I-II patients with no organ failure. The goal of this preliminary study is to evaluate the usefulness of Navigator in guiding anesthesia practice and in modifying anesthetic drug dosing in nephropatic patients in dialytic treatment.

**Materials and Methods:** We enrolled 10 patients (4 F- 6 M) with median age  $55.9 \pm 12.9$ , with chronic renal failure in dialytic treatment, who underwent major abdominal surgery. The patients were randomized in 2 groups: Control group, in which anesthesia was guided by standard monitoring, and Navigator group, in which anesthesia was guided also by Navigator data. We monitored HR, ECG, NIBP, SpO<sub>2</sub>, Et-CO<sub>2</sub> and Et-Sevoflurane, Entropy and TOF. All data

were recorded at: basal, LOC, OTI, surgical incision, every 15 min till the end of surgery, at recovery and extubation. All patients received balanced general anaesthesia, using drugs with no/very low renal impact. Induction: Remifentanyl (0.2  $\mu$ g/kg/min), Propofol and Cisatracurium.

Maintenance: Remifentanyl (0.1-0.2  $\mu$ g/kg/min), Sevoflurane (1-2%) and Cisatracurium. Recovery: stop of Sevoflurane and Remifentanyl administration, TOF-guided decurarisation.

**Results and Discussion:** In both groups, during anesthesia, we maintained Entropy values between 40 and 60, with a good correlation with the pharmacodynamic models. We observed a reduction in the consumption of Sevoflurane in Navigator Group (range: C 1-2 % [Mean 1.48%] vs N 1-1.7% [Mean 1.16%]). Both groups showed hemodynamic stability, with slightly higher values in N group. No case of awareness has been reported.

**Conclusion:** Navigator seems to be a useful tool in guiding anesthesia in patients in dialysis, resulting in a greater safety for the patients, considering the reduction of anesthetic drug dosing, due to a more precise titration, and a lower risk of awareness, with an adequate anesthetic plan. Using drugs with very low/no renal impact, we have the opportunity to be aware of anesthetic-analgesic interactions and of their pharmacodynamic effect also for patients in dialytic treatment, for which the models are not available at the moment for clinical practice.

## Clinical and Experimental Circulation

### 4AP1-1

#### Blood pressure excursions below the cerebral autoregulation threshold are associated with risk for acute kidney injury after cardiac surgery

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**Background and Goal of Study:** Acute kidney injury (AKI) after cardiac surgery with cardiopulmonary bypass (CPB) is associated with mortality.<sup>1</sup> Cerebral blood flow (CBF) autoregulation can be monitored using near infrared spectroscopy (NIRS).<sup>2,3</sup>

The hypothesis of this study was that mean arterial blood pressure (MAP) excursions below the lower limit of CBF autoregulation (LLA) during CPB is associated with risk for AKI after surgery.

**Materials and Methods:** With IRB approval and written informed consent, 349 patients undergoing cardiac surgery with CPB had CBF autoregulation monitored by calculating a continuous, moving Pearson's correlation coefficient between MAP and processed NIRS signals generating the variable cerebral oximetry index (COx) as previously described.<sup>2,3</sup> When CBF is autoregulated, there is no correlation between COx and MAP; when MAP is below the LLA, COx approaches 1 (ie, they are correlated). The LLA was defined as that MAP where COx increased from  $< 0.3$  to  $\geq 0.3$  with declining MAP.<sup>2</sup> AKI within 7 days of surgery was defined based on the RIFLE criteria.<sup>4</sup> The threshold for an excursion below the LLA was defined as mmHg  $\times$  min/h of CPB where MAP was  $<$  LLA. Data were analyzed with ANOVA and multivariate logistic regression analysis.

**Results and Discussion:** AKI developed in 121 (34.7%) patients. There was no difference in age for patients with AKI vs those without AKI ( $66 \pm 11$  vs  $66 \pm 11$  yrs, respectively,  $p = 0.674$ ). Patients with AKI were more likely than those without AKI to have a baseline pulse pressure  $> 60$  mmHg ( $p = 0.01$ ), diabetes ( $p = 0.013$ ), and a history of active tobacco smoking ( $p = 0.031$ ). Although the average MAP during CPB was not different, the MAP at the LLA and excursions of MAP  $\leq$  LLA were higher in patients with AKI than for those without AKI (see Table). Excursions of MAP  $\leq$  the LLA ( $p = 0.002$ ) and diabetes ( $p = 0.006$ ) were independently associated with risk for AKI.

**Conclusion(s):** Although average MAP during CPB was similar, excursions of MAP  $\leq$  LLA was independently associated with risk for AKI. Monitoring autoregulation with processed NIRS signals may provide a novel method for precisely determining MAP targets during CPB. Further, maintaining MAP above the threshold for CBF autoregulation may ensure perfusion to other organs during surgery.

#### References:

1. Ann Thorac Surg 2008;86:4-11; 2. Stroke 2007;38:2818-25; 3. Stroke 2010;41:1951-6; 4. Ann Thorac Surg 2006;81:542-6.

### 4AP1-2

#### Relation between mixed venous oxygen saturation and cerebral oxygen saturation measured by absolute and relative near-infrared spectroscopy during off-pump coronary artery bypass grafting

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**Background:** A major drawback of current standard anaesthesia monitoring is the lack of a non-invasive assessment of mixed venous oxygen saturation (S<sub>v</sub>O<sub>2</sub>), as a measure of global tissue oxygen balance. Near-infrared spectroscopy (NIRS) measures regional cerebral oxygen saturation (rS<sub>c</sub>O<sub>2</sub>) and could offer a continuous, non-invasive alternative.

However, former studies with the INVOS relative cerebral oximeter (Somatecs Corporation, Troy, MI) described only moderate correlations between S<sub>v</sub>O<sub>2</sub> and rS<sub>c</sub>O<sub>2</sub>, with wide limits of agreement.

We hypothesized that the Foresight absolute cerebral oximeter (CAS Medical Systems, Branford, CT, USA) would provide more reliable correlation between rS<sub>c</sub>O<sub>2</sub> and S<sub>v</sub>O<sub>2</sub>.

**Methods:** Forty two patients undergoing elective OPCAB surgery were enrolled. Four disposable sensors (2 INVOS sensors, 2 Foresight sensors) were applied bilaterally on the patient's forehead for continuous registration of rS<sub>c</sub>O<sub>2</sub>. The place of the sensors was determined at random by a computerized randomization list. S<sub>v</sub>O<sub>2</sub> was measured continuously via a pulmonary artery catheter (Edwards Lifesciences, Irvine, CA). Data were analyzed using linear regression and related-samples Wilcoxon signed rank test. Analysis of agreement was assessed with a Bland-Altman analysis.

**Results:** Foresight had a more narrow range in rS<sub>c</sub>O<sub>2</sub> values [58-89%] compared to INVOS [28-95%]. Regression analysis between rS<sub>c</sub>O<sub>2</sub> and S<sub>v</sub>O<sub>2</sub> showed similar correlation coefficients of 0.37 ( $p < 0.001$ ) and 0.39 ( $p < 0.001$ ) for Foresight and INVOS respectively. With INVOS a significantly steeper slope with a lower y-axis intercept,  $y = 0.62x + 20$  versus  $y = 0.22x + 53$  for Foresight ( $p < 0.001$ ) was observed. Bland-Altman analysis of agreement between rS<sub>c</sub>O<sub>2</sub> and S<sub>v</sub>O<sub>2</sub> showed a mean bias of 5.0% with limits of agreement of -7.7% and 17.7% for Foresight, and a mean bias of 8.8% with limits of agreement of -11.2% and 28.8% for INVOS. During major haemodynamic alterations, percentage change in rS<sub>c</sub>O<sub>2</sub> was significantly lower with Foresight ( $8.2\% \pm 3.0\%$ ) compared to INVOS ( $11.4\% \pm 5.4\%$ ) ( $p < 0.001$ ) and compared to S<sub>v</sub>O<sub>2</sub> ( $13.0\% \pm 5.6\%$ ) ( $p < 0.001$ ).

**Conclusion:** Both monitoring devices demonstrated a comparable correlation between rS<sub>c</sub>O<sub>2</sub> and S<sub>v</sub>O<sub>2</sub>, with large limits of agreement. However, the significantly lower regression slope between rS<sub>c</sub>O<sub>2</sub> and S<sub>v</sub>O<sub>2</sub>, and the decreased response to haemodynamic changes, suggest that Foresight rS<sub>c</sub>O<sub>2</sub> might underestimate the actual S<sub>v</sub>O<sub>2</sub> values during OPCAB surgery.

#### 4AP1-3

##### Comparison of central to mixed venous oxygen saturation in various hemodynamic conditions during neurosurgical procedures in the sitting position

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**Background and Goal of Study:** Mixed venous oxygen saturation ( $\text{SmvO}_2$ ) monitoring has already been validated as a surrogate for the balance between systemic oxygen delivery and consumption. Considering that, central venous (CV) catheters are used more routinely than pulmonary artery (PA) catheters, measurement of CV oxygen saturation ( $\text{ScvO}_2$ ) has emerged as an attractive alternative to monitoring of  $\text{SmvO}_2$ , as it is less risky and costly. Aim of the study was to compare  $\text{SmvO}_2$  to  $\text{ScvO}_2$  in various hemodynamic conditions, with a view to simplify intraoperative monitoring.

**Materials and Methods:** Prospective cohort study enrolling 51 patients (aged 41 to 69 yrs, ASA-PS II-III), scheduled to undergo elective neurosurgical procedures in the sitting position. Simultaneous blood gas samples from CV and PA catheters for oxygen saturation determination, were collected at four pre-defined time points: a) after induction to anesthesia (T1), b) 5 min after sitting position being settled (T2), c) 5 min before (T3) and d) 5 min after return to the supine position (T4). At the same time points cardiac index (CI) was also recorded. Thus, a total of 204 points of comparison were obtained intraoperatively. For statistical purposes Bland and Altman plot, Pearson correlation and linear regression analysis were used as appropriate.

**Results and Discussion:** No statistically significant difference among  $\text{SmvO}_2$  and  $\text{ScvO}_2$  values ( $78.24 \pm 5.66\%$  and  $76.64 \pm 5.87\%$ , respectively) was recorded. Mean differences (bias) and correlation coefficients of oxygen saturations obtained from both circulations are presented in the Table. The coefficient of determination ( $R^2$ ) between  $\text{SmvO}_2$  and  $\text{ScvO}_2$  values and CI was 0.324 and 0.286, respectively ( $p < 0.001$  for both), illustrating a rather weak relationship.

	T1	T2	T3	T4
$\text{SmvO}_2\text{-ScvO}_2$	0.45±3.9 (-7.2 to 8.1)	2.92±3.8 (-4.7 to 10.5)	1.74±4.4 (-6.9 to 10.4)	1.26±4.5 (-7.7 to 10.2)
R	0.651	0.767	0.736	0.554
p-value	<0.001	<0.001	<0.001	<0.001

Values are presented as mean±SD (range of limits-of-agreement); R, Pearson correlation coefficient

[Table]

**Conclusion(s):** It seems that, exact numerical values of  $\text{SmvO}_2$  are not equivalent to those of  $\text{ScvO}_2$  in varying hemodynamic conditions, during neurosurgical procedures performed in the sitting position. However, for clinical purposes, the trend of  $\text{SmvO}_2$  could be substituted by the trend of  $\text{ScvO}_2$ . Furthermore, in the same sample of patients, reliability of both  $\text{SmvO}_2$  and the  $\text{ScvO}_2$  as indicators of changes in CI, is limited.

#### 4AP1-4

##### Sevoflurane does not induce cardioprotection in patients undergoing cardiac surgery with and without cardiopulmonary bypass

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**Background and Goal of Study:** Sevoflurane induces pharmacologic postconditioning after myocardial ischemia-reperfusion. Cardiac surgery can cause myocardial ischemia-reperfusion injury. We hypothesized that the use of sevoflurane during cardiac surgery with and without cardiopulmonary bypass (CPB) would decrease postoperative myocardial damage.

**Materials and Methods:** With IRB approval and informed consent obtained from each patient, 16 patients undergoing scheduled Off-Pump Coronary Artery Bypass grafting (OPCAB) and 20 patients undergoing scheduled Aortic Valve Replacement (AVR) were enrolled in this study. Patients were randomly allocated to SEVO-20 or Control group. Anesthesia was induced and maintained with propofol, remifentanyl and rocuronium. In Control group, no further treatment was done. In SEVO-20 group, patient received 1 MAC of sevoflurane for 20 minutes after conclusion of graft anastomosis in OPCAB and conclusion of weaning from CPB in AVR. The primary outcome was the postoperative peak level of serum creatine kinase isoenzyme MB (CK-MB). The secondary outcomes were cardiac index at the arrival in ICU (CI) and

postoperative peak level of creatine kinase (CK). Data were compared using t-test. A p-value  $< 0.05$  was considered statistically significant.

**Results and Discussion:** OPCAB represents cardiac surgery without CPB and AVR represents that with CPB. Demographic data showed no significant difference. The other results are shown in tables.

OPCAB	SEVO-20	Control	p-value
CK-MB (ng/ml)	60.0 ± 56.8	21.6 ± 13.2	0.006
CI (l/min/m <sup>2</sup> )	3.7 ± 0.8	3.2 ± 0.6	0.120
CK (IU/l)	936 ± 453	520 ± 237	0.003

[Table 1. (Data are expressed as mean +/- SD.)]

AVR	SEVO-20	Control	p-value
CK-MB (ng/ml)	39.0 ± 15.4	45.9 ± 45.8	0.717
CI (l/min/m <sup>2</sup> )	3.6 ± 1.4	3.0 ± 0.9	0.151
CK (IU/l)	528 ± 388	766 ± 1111	0.604

[Table 2. (Data are expressed as mean +/- SD.)]

Among OPCAB patients, SEVO-20 group showed significantly higher CK-MB and CK than Control group. Among AVR patients, there was no significant difference. Sevoflurane administration after ischemic insult with and without CPB does not decrease myocardial damage. Cardioplegia during CPB and stabilizing technique during graft anastomosis in OPCAB may play more important role in cardioprotection than sevoflurane postconditioning.

**Conclusion(s):** Sevoflurane does not induce pharmacologic postconditioning during cardiac surgery with and without CPB.

#### 4AP1-5

##### Helium induced pre- and postconditioning in patients subjected to coronary artery bypass graft (CABG) surgery

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**Background and Goal of Study:** Helium induces early and late preconditioning in human endothelium in vivo (1). In animals, helium also induces postconditioning (2). We hypothesized that helium induces pre- and postconditioning in humans undergoing CABG surgery, thereby affecting postoperative troponine levels.

**Materials and Methods:** After ethical approval and informed consent, 125 patients scheduled for elective CABG were included in this single-center, randomized, prospective study and randomised in one of 5 groups; controls, helium preconditioning, helium postconditioning, helium pre-and postconditioning or sevoflurane preconditioning. Preconditioning was induced by 3 x 5 min inhalation of helium mixture (70% helium; 30%O<sub>2</sub>) just before aortic cross clamping, postconditioning was induced by inhalation of the same mixture for 15 min starting just before release of the aortic cross clamp. All patients received total intravenous anaesthesia according to standard anaesthetic procedures. Troponine-T was measured at 4, 12, 24, and 48 hours postoperatively.

**Results and Discussion:** Baseline characteristics (age:  $66 \pm 8.7$  y,  $p=0.47$ ; sex: 83% male,  $p=0.88$ ), Euroscore ( $2.7 \pm 1.9$   $p=0.36$ ) as well as duration of bypass ( $93 \pm 30$  min) and aortic cross-clamping ( $61 \pm 22$  min) were similar between groups.

Postoperative value of Troponine-T area-under-the-curve was 11 (5, 31, mean (interquartile range)) for controls, and no significant changes were observed after helium preconditioning 11 (6, 18), helium postconditioning 11 (8, 15), helium pre- and postconditioning 14 (6, 20) or after sevoflurane preconditioning 12 (8, 24). ( $p=0.13$ , one-way ANOVA after log transformation).

**Conclusion(s):** In this study, helium pre- and postconditioning did not reduce postoperative troponine release in patients undergoing CABG surgery. In contrast to previous findings (3), sevoflurane preconditioning did not reduce myocardial damage and troponine release.

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#### 4AP1-6

##### The effect of positive end-expiratory pressure on structure and function of right and left ventricle

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**Background and Goal of Study:** The positive end-expiratory pressure (PEEP) improves oxygenation in patients with respiratory distress, but may negatively affect the functioning of the cardiovascular system. The aim of this study is to study the effect of low and moderate levels of PEEP on structure and function of the right and left ventricle.

**Material and Methods:** The hospital ethics committee approved the study protocol and all participants provided their consent. 10 patients under pressure controlled mechanical ventilation were studied. The two-dimensional transesophageal echocardiography was used and a total of 16 parameters for each patient were recorded. Measurements were made initially with PEEP = 0 cm H<sub>2</sub>O, then 10 minutes after applying PEEP = 5 cm H<sub>2</sub>O and one more time 10 minutes after applying PEEP = 10 cm H<sub>2</sub>O.

**Results and Discussion:** After increasing PEEP gradually from 0 to 10 cm H<sub>2</sub>O, a statistically significant decrease in tricuspid ring systolic velocity - S<sub>1</sub>, from 10,83±4,2 to 8,73±35 cm/sec (mean±SD) was recorded. We also noticed a downward trend in Stroke Volume - SV (87,039±34,96 ml at PEEP 0 cm H<sub>2</sub>O vs 84,168±19,14 ml at PEEP 5 cm H<sub>2</sub>O vs 78,946±31,52 ml at PEEP 10 cm H<sub>2</sub>O), in E wave of mitral diastolic flow (0,709±0,17 vs 0,701±0,15 vs 0,611±0,11 m/sec), in E/A ratio (1,019±0,45 vs 1,0105±0,43 vs 0,868±0,27), in Tricuspid Annular Plane Systolic Excursion - TAPSE (2,7965±0,59 vs 2,5307±0,41 vs 2,36±0,64 cm), in ejection time of pulmonary artery - ET (262,7953±16,73 vs 230,9865±43,84 vs 231,831±36,21 msec) and in end diastolic area of right ventricle - EDA (21,861±5,82 vs 20,406±4,44 vs 19,237±4,75 cm<sup>2</sup>). A small upward trend in ejection fraction of left ventricle - EF (50,962±12,51 vs 55,845±14,37 vs 57,769±10,76%) and in left ventricle eccentricity index at end diastole - EccldD (0,9074±0,07 vs 0,9486±0,063 vs 0,9909±0,09) were also recorded. Regarding other parameters the statistical differences were insignificant.

**Conclusion:** From the above it seems that with increasing PEEP there is a downward trend in systolic right ventricular function, whereas left ventricular contractility remains almost unaffected with a slight upward trend in EF. Based on mitral flow measurements, it seems that diastolic left ventricular function is disturbed slightly. Final result, however, remains the declining trend in cardiac output with increasing PEEP.

#### 4AP1-7

##### Baseline cerebral oximetry values in end-stage renal disease surgical patients. A comparison between hemodialysis and peritoneal dialysis method

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**Background and goal of study:** Cerebral tissue regional oxygen saturation (rSO<sub>2</sub>) through near-infrared spectroscopy (NIRS) is a method for non-invasive monitoring of cerebral tissue oxygenation. The aim of this observational study was to evaluate the baseline cerebral rSO<sub>2</sub> values and identify factors that could predict cerebral tissue saturation in end-stage renal disease surgical patients.

**Material and Methods:** Thirty two end-stage renal patients older than 18 yr scheduled to undergo elective minor or major surgery were enrolled. The end-stage renal patients were allocated in two groups according to the method of dialysis (hemodialysis or peritoneal dialysis). Twenty two patients [aged 76 (21 - 85) years] were treated with hemodialysis and 10 [aged 61 (51 - 80)] were treated with peritoneal dialysis. Demographic and clinical characteristics of the study population, including age, gender, preoperative hemoglobin (preop Hb), mean arterial pressure (MAP) and arterial hemoglobin oxygen saturation (SpO<sub>2</sub>) were recorded.

**Results and Discussion:** Patients who were treated with hemodialysis had significant lower rSO<sub>2</sub> values compared with peritoneal dialysis patients, [median, 50% (28-63) vs 63% (45-69), p=0.002. Hierarchical linear regression model analysis showed that preoperative Hb and SpO<sub>2</sub> were positive predictive variables (B=0.353, p=0.01 and B=0.375, p=0.009, respectively). Moreover, the method of dialysis were independent predictors for baseline rSO<sub>2</sub>. The method of dialysis remained independent predictor for rSO<sub>2</sub> after controlling for the other significant variables (B=0.291, p=0.032), and peritoneal dialysis was associated with higher baseline values of rSO<sub>2</sub>. The lower cerebral saturation in hemodialysis patients could be explained by an inadequate per-

fusion and significant cerebral atrophy usually presented in end-stage renal diseases patients undergoing hemodialysis. Arterial hypoxemia, fluctuations in electrolytes as well as transient hypotension during hemodialysis results in cerebral atrophy and possibly induces brain damage.

**Conclusion:** In conclusion, end-stage renal disease patients undergoing hemodialysis treatment appear to have significant lower baseline cerebral tissue saturation values compared with peritoneal dialysis. However, more studies are needed to validate our findings, evaluate the role of brain rSO<sub>2</sub> monitoring and assess the clinical benefits of interventions aimed at improving rSO<sub>2</sub> in this specific group of patients.

#### 4AP1-8

##### NIRS cerebral oxygenation monitoring during induction of therapeutic hypothermia after cardiac arrest

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**Background:** Induced mild hypothermia improves survival and neurological outcome after CA. Using near-infrared spectroscopy (NIRS), the FORE-SIGHT® technology provides a non-invasive continuous monitoring of absolute cerebral tissue oxygen saturation (SctO<sub>2</sub>). Four wavelengths of laser light determine levels of oxygenated and deoxygenated hemoglobin in the cerebral microvasculature. In this study, SctO<sub>2</sub> was measured during the first 36 hours after CA.

**Methods:** After IRB approval and with informed consent, data were collected from 23 patients admitted after cardiac arrest. Cold saline (30 ml/kg) was administered as soon as possible. TH (33°C) was induced by endovascular (Coolgard®) or surface (Arctic Sun®) cooling and maintained for 24 hours. All patients were sedated (propofol/remifentanyl) for the duration of TH. NIRS-sensors were bilaterally applied to the frontotemporal area before start of TH.

**Results:** Of 23 patients, 11 patients did not survive until hospital discharge due to post-ischemic brain damage. Twelve patients survived until hospital discharge (8 without any neurological impairment). Temperature at admission was 34,6°C (± 0,5°C). Patients reached target temperature (33°C) 4 hours after the induction of TH. Two patients died during maintenance of TH due to hemodynamic shock. In all patients, SctO<sub>2</sub> started above 65%. Two and a half hours after induction of TH, SctO<sub>2</sub> decreased with 9% (± 3%). The decrease in SctO<sub>2</sub> during induction of TH was not associated with a major change in hemodynamic parameters (MAP before TH: 79 mmHg ± 19; at 33°C: 82 mmHg ± 9), nor with a major change in systemic oxygenation (SpO<sub>2</sub> before TH: 99% ± 1; at 33°C: 97% ± 3). In patients who survived until hospital discharge, SctO<sub>2</sub> returned to baseline values 3,5 hours after induction of TH, before the target temperature of 33°C was reached. In patients who did not survive the hospital stay, SctO<sub>2</sub> remained lower than baseline values when target temperature was reached. In this group, SctO<sub>2</sub> only returned to baseline values during maintenance of TH (10 hours after induction of TH). During maintenance of TH and rewarming (0,3°C), no further significant changes in SctO<sub>2</sub> values were observed.

**Conclusion:** During induction of mild hypothermia after CA, a decrease in cerebral oxygenation was observed. Furthermore, there was a difference in oxygenation between hospital survivors and non-survivors.

#### 4AP1-9

##### Effect on innate immunity after regular and prolonged 79% helium inhalation in healthy males

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**Background and Goal of Study:** Inhalation of short episodes of 70% or 75% helium reduces myocardial and neuronal cell damage in animals [1]. When helium is introduced as an additional tool to current reperfusion techniques, unknown side effects of helium breathing should be ruled out. Thirty-five min 50% helium inhalation decreased expression of anti-inflammatory markers on monocytes [2]. We demonstrated that 30-min helium breathing in healthy volunteers did not affect the immune response to *ex vivo* stimulation in whole blood [3]. To rule out that effects can be found when exceeding the normal duration of helium given in a tissue protective protocol, we investigated whether a 60-minute period of helium inhalation affects levels of proinflammatory cytokines TNF-alpha, IL-1beta and IL-6 and chemokine IL-8 after *ex vivo* stimulation of whole blood with lipopolysaccharide (LPS).

**Materials and Methods:** The study was approved by the ethical committee of the Academic Medical Center (METC) and written informed consent was obtained from all subjects. Experiments with 30-minutes were performed first [3]

and after data analysis a second group of volunteers underwent 60-minutes of breathing through a mask. Healthy, male volunteers (mean age 25,5 years) underwent two experimental 'cycles': one with heliox (79% helium and 21% oxygen) inhalation and one with inhalation of normal room air, with two weeks between experimental cycles. Blood sampling was done at T0 (baseline), T1 (25 or 55 min inhalation), T2 (1 h after inhalation), T3 (2 h after inhalation), T4 (6 h after inhalation), T5 (24 h after inhalation). After sampling, whole blood was immediately incubated with (LPS) or with RPMI (as control, CON) for 2, 4 and 24 hours or not incubated (0 h). The amount of TNF-alpha, IL-1beta, IL-6 and IL-8 in the samples was analyzed by cytometric bead array (Human Inflammatory Kit, BD) measured by FACS. Statistical analysis: Wilcoxon test for matched samples, all data are shown as mean  $\pm$  SEM.

**Conclusion(s):** Data are shown for both the 30 and 60 minutes breathing groups (see figure); TNF-alpha and IL-6 levels after 4 and 24 hours of incubation with LPS do not differ between helium and air breathing groups. No differences were found for IL-1beta or IL-8 either.

This suggests that no clinical relevant effect of helium breathing on innate immunity exists.

#### References:

1. Anesthesiology 2010; 112:1503-10 [2]Anesth Analg 2009; 109(1):101-8 [3] Anesthesiology 2010; A024 (abstract)

## 4AP1-10

### NIRS cerebral oxygenation monitoring during transcatheter aortic valve implant

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**Introduction:** Most recent attention in interventional cardiology is now directed towards the treatment of valvular heart disease. In high risk pts, transcatheter aortic valve implantation (TAVI) could offer a therapeutic solution. In the past years, Near Infrared Spectroscopy (NIRS) has been introduced as a useful non-invasive cerebral monitoring technique assessing cerebral oxygenation. As far as today, no reports have been published on the use of any NIRS technology during TAVI procedures. During valve prosthesis implantation, a transient partial cardiac standstill by rapid ventricular pacing (RVP) is induced to minimize cardiac motion and pulsatile transaortic flow. In most cases, this hemodynamic deficit is well tolerated, due to the brief duration of RVP. But as far as today no data are available on cerebral oxygenation during these critical periods of RVP.

**Patients and methods:** We report on 10 consecutive pts (all > 75yrs, with major comorbidities) suffering from severe aortic stenosis. Bilateral ForeSight sensors were applied after induction of anesthesia. In posthoc analysis, we were especially interested if any change in cerebral oxygenation (SctO2 monitoring) occurred during these RVP periods.

**Results:** In all pts, procedure was technically successfully performed. Mean SctO2 before RVP was 67% (59-71%) and immediately decreased during RVP to m54% (37-70%); this implies a mean decrease in SctO2 of 13% (1-25%). In 7 pts, RVP resulted in SctO2 decreases below 55% (m44%; range 37-52%). These decreases below 55% lasted for m20min (14sec-87min). Systolic blood pressure before RVP was m135mmHg (95-165mmHg) and decreased to m74mmHg (112-42mmHg) during RVP. In 6 pts, RVP resulted in a decrease in systolic blood pressure below 90mmHg, that was immediately countered by vasoactive drugs (adrenaline). In 2 pts, extensive hypotension persisted despite vasoactive support and CPR had to be initiated. In 1 pt, SctO2 values remained below 55% for 87min and pt was declared brain dead 48h later.

**Conclusion:** Transcatheter cardiac interventions, especially those with transient partial cardiac standstill, can induce longlasting intraprocedural inadequacy of cerebral perfusion, despite immediate restoration of normal blood pressure. Future strategies should therefore be focused on optimizing cerebral oxygenation before RVP.

## 4AP2-1

### Takotsubo cardiomyopathy after general anesthesia for carotid body tumor excision

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**Background:** Takotsubo syndrome or transient left ventricular apical ballooning syndrome has recently been described. This syndrome mimics an acute myocardial infarction (AMI), without demonstrable obstructive coronary artery disease. Left ventricular function can be severely compromised and recovers completely (in almost all patients) in a few days to weeks. Carotid body tumors (CBT) represent about 65% of the head and neck paragangliomas.

Tumor manipulation during surgery can lead to catecholamine release with haemodynamic instability.

**Case report:** Female patient, 55 years old, ASA II, admitted for excision of CBT. She had a normal physical examination and a good functional capacity. The laboratory tests, urinary catecholamines and their metabolites as well as ECG were normal. We proceeded to induction of general anesthesia with fentanyl, propofol and rocuronium and standard monitoring with arterial catheter. Maintenance of anesthesia was provided with oxygen and sevoflurane. During surgery, as the tumor was manipulated, the patient developed cardiac arrest in asystole, which reverted after one cycle of ALS and the surgical procedure continued without further complications.

At ICU admission she was in shock and with congestive cardiac failure. The chest X-ray showed diffuse bilateral infiltrates; ECG showed ST-segment elevation and the myocardial biomarkers were slightly increased. Vasopressor and inotropic support was necessary for 3 days. The echocardiogram revealed: „Left ventricular apical dilatation, severely compromised left ventricular function with apical akinesis and basal hyperkinesis, suggestive of apical cardiomyopathy.“ After shock resolution, beta-blockers and angiotensin-converting enzyme inhibitors were started for heart failure.

The patient showed good response to treatment with complete recovery and 30 days after discharge the echocardiogram showed normal contractility of the left ventricle.

**Discussion:** We describe a case with postoperative apical ballooning of the left ventricle that mimicked an AMI caused by excessive per operative catecholamine release.

Treatment is managed by supportive therapy, and we need to be alert for the differential diagnosis of cardiac failure.

#### References:

1. Yoshihiro J. Akashi et al. Circulation, Journal of the American Heart Association. 2008; 118:2754-62
2. Gavish D. et al. Anesthesiology. 2006; 105:621-3

## 4AP2-2

### Hereditary angioedema type II: perioperative management of coronary artery bypass graft surgery

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**Background:** Hereditary angioedema (HAE) is an autosomal dominant Orphan disease with estimated prevalence of 1-9/100000 people. It is characterized with low levels (Type I) or abnormal function (Type II) of C1 esterase inhibitor (C1-INH), and frequent attacks of subcutaneous swelling of face, extremities and abdominal organs. To our knowledge, there are no published case reports that describe perioperative management of coronary artery bypass grafting (CABG) on cardiopulmonary bypass (CPB) in a patient with type II HAE.

**Case report:** A 63 year old patient with diagnosed hereditary angioedema type II sustained non-ST elevation myocardial infarction. Percutaneous coronary intervention revealed three vessel disease which indicated coronary artery bypass grafting on cardiopulmonary bypass. Three days before surgery allergologist ordered Danazol 200 mg tid and II doses of fresh frozen plasma (FFP) two hours preoperatively. Anaesthesia was induced with Etomidat 20 mg and Fentanyl 400 mcg, and maintained with large doses of Fentanyl, Propofol and Midazolam, with O2 Air/Sevoflurane mixture. Muscles were relaxed with Succinylcholine 100 mg and Pancuronium 16 mg. Surgery was finished uneventfully, with total bypass time of 85 min, and cross clamp time of 45 minutes. He received IV doses of FFP prior to successful extubation in ICU later that day.

**Discussion:** CABG on cardiopulmonary bypass is the surgery with especially high risk for exacerbation of HAE.<sup>1</sup> Perioperative short-term therapy rely upon use C1-INH concentrate, which should be administered 24 hours before surgery.<sup>2</sup> We showed that if unavailable, it can be successfully replaced with perioperative use of attenuated androgen Danazol and fresh frozen plasma. It seems also that the choice and doses of various anaesthetic agents we used are both safe, and of less importance than the preoperative ‚boosting‘ of C1-esterase inhibitor levels.

#### References:

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2. Jerrold H. Levy, Douglas J. Freiberg, John Roback: Hereditary Angioedema: Current and Emerging Treatment Options. Anesth Analg 2010; 110: 1271-80.

**Learning points:** The patient with type II HAE undergoing CABG on cardiopulmonary bypass can be successfully managed with carefully planned perioperative use of FFP and short-term prophylaxis with high doses of Danazol (600 mg daily).

#### 4AP2-3

##### Peripheral circulatory failure induced by intraoperative blood loss in an adult patient with unoperated left single ventricle and secondary polycythemia undergoing colonectomy

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**Background:** Case reports regarding adult patients with single left ventricle have rarely been published due to their poor survival into adulthood. We hereby report anesthetic management of an adult patient with unoperated single left ventricle undergoing colonectomy.

**Case report:** A 46 year-old male visited our hospital complaining about stomachache. His CT scan revealed a perforation of the sigmoid colon and open colonectomy was planned. His past history was remarkable for unoperated single ventricle anatomy, which was diagnosed when he was 5 years old. He had a hemoglobin concentration (Hb) of 22.2 g/dl with a hematocrit of 61.8%. In the operating room, values of his arterial blood pressure and PaO<sub>2</sub> were 85/64 and 52 mmHg, respectively. Anesthesia was induced and maintained with sevoflurane, fentanyl and rocuronium. The operation lasted 2 hrs. Intraoperative blood loss and fluids administered were 350 ml and 2100 ml, respectively. During the skin closure, we noticed an abrupt decline of SpO<sub>2</sub> measurement from 94% to 82%. His Hb concentration was 16.8 g/dl and the progression of metabolic acidosis with serum lactate concentration of 9.0 mmol/L and Base deficit of 6.6 mmol/L was noted. We determined it to be peripheral circulatory failure due to decreased oxygen delivery and started transfusing packed red blood cells (RBCs). Four units of RBCs normalized his SpO<sub>2</sub>, serum lactate concentration and base deficit. His postoperative course was uneventful.

**Discussion:** We encountered an intraoperative finding of progressive lactic acidosis, which improved following transfusion of RBCs. According to our calculations, peripheral circulatory failure occurred when his arterial oxygen content decreased from 25.0 ml/dl to 19.9 ml/dl. Thus, we speculate that the margin of safety must lie within these values for this patient. This fact may lead us to reconsider the current indication of phlebotomy for patients with secondary polycythemia.

##### References:

1. Dean B Andropoulos, Stephen A Stayer: Anesthesia for Congenital Heart Disease, 2nd edition. Wiley-Blackwell 2010, pp571-572
2. Hobaika AB, Procopio AL: Anesthesia for pacemaker implant in an adult patient with unoperated univentricular heart. Case report. Rev Bras Anesthesiol 2007; 57: 90-3

**Learning points:** This case report suggests that high Hb in single ventricle patients is a life-sustaining compensatory mechanism, and therefore, their baseline values should be maintained to avoid devastating circulatory failure.

#### 4AP2-4

##### Echocardiographic findings and NTproBNP levels in liver transplantation

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**Background and Goal of Study:** Cardiac function alterations in cirrhotic patients are known as cirrhotic cardiomyopathy and consist of one or more of the following criteria: baseline increase in cardiac output but blunted systolic contractile response to stress; diastolic dysfunction; absence of overt left ventricular failure at rest; electrophysiological abnormalities. This cardiac dysfunction may lead to a perioperative reduction of cardiac and coronary flow reserve and affect outcome of patients.

The aim of this study was to evaluate cardiac function in cirrhotic patients undergoing liver transplantation by echocardiographic study and biomarkers, such as NTproBNP and High Sensibility troponin (HST)

**Materials and Methods:** 20 liver transplant recipients were enrolled. NTproBNP and HST values were recorded before anesthesia induction, during anhepatic phase, at reperfusion, at the end of surgery, on the 1st, 2nd, 3rd and 8th postop day, and before discharge. An echocardiographic evaluation was performed in each patient before and after surgery and before discharge. Anesthesia protocol was standardized and surgical procedure was performed according to Piggy back technique (tangential clamping of vena cava). Statistical analysis was conducted using Statistic for Windows 7.0 (StatSoft, Tulsa USA). Analysis of variance at one and two way, T student test and linear regression were performed. Significance was assumed at  $p < 0.05$

**Results and Discussion:** Our patients reported no cardiac adverse event. The echocardiographic study showed a mild preoperative diastolic dysfunction and ventricular filling resistance, characterized by a reversed E/A pattern. These parameters were already normal in the 2nd postoperative day ( $p=0,0004$ ). Notably, we found a relationship between MELD score and E/A

pattern ( $p=0,0000$ ). HST had normal baseline values which increased during the intraoperative period and come back to normal range in the postoperative period. NTproBNP showed high baseline values, suggesting a preexisting subclinical cardiac dysfunction. NTproBNP showed a further increase postoperatively and never returned to baseline values.

**Conclusion:** Even if the final outcome of these patients does not seem affected by these hemodynamic findings, NTproBNP along with echocardiographic evaluation seems to be useful for detecting a preexisting cardiac dysfunction not clinically evident. Moreover the degree of diastolic dysfunction correlates significantly with severity of liver disease.

#### 4AP2-5

##### Usefulness and feasibility of coronary artery examination after postoperative TnIc elevation

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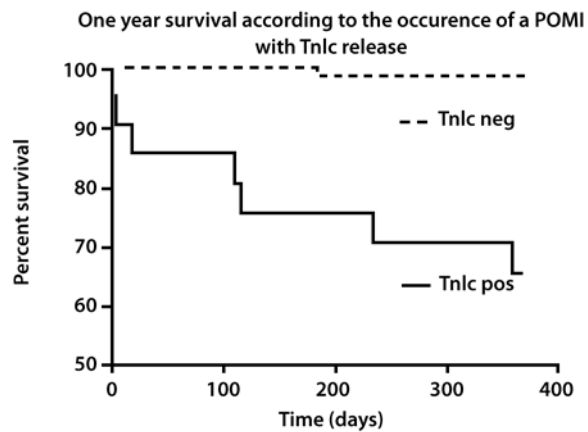
**Background and Goal of Study:** Although mostly asymptomatic, postoperative myocardial ischemias (POMI) are associated with a poor long-term outcome<sup>1</sup>. Nonetheless, very little is known about their relationship with significant coronary artery stenosis<sup>2</sup>. Thus, we performed a pilot study aiming to assess both the feasibility and the usefulness of systematic coronary artery examination after POMI through either coronarography (coro) or cardiac Multidetector Computed Tomography (MDCT).

**Materials and Methods:** The inclusion criteria were a revised cardiac risk index (RCRI) > 1 or the presence of 2 cardiac risk factors and moderate or high-risk surgery. TnIc measurements were performed in the recovery room and on the morning of postoperative days 1 to 3.

Patients were considered having a POMI when exhibiting at least one TnIc measurement above the 99<sup>th</sup> percentile of a normal population. MDCT or coro were chosen by the attending cardiologist according to the medical history and the clinical features.

Patients were followed-up postoperatively for one year in order to assess their clinical outcome.

**Results and Discussion:** From July 2006 to September 2009, 86 patients were included after giving informed consent. 20/86 (23%) exhibited a POMI. The one-year death rate was 7/20 in the later group vs 1/66 in the group without POMI. In a multivariate analysis using a cox model including the ASA status, age, RCRI, scheduled vs emergency surgery POMI remained the only predictor of death (HR=28 - 95%CI=3.5 - 250]).



[Figure 1]

6/20 had a MDCT and 1/20 a coro. These exams showed significant coronary artery stenosis in 3 patients.

**Conclusion(s):** Coronary stenosis seem frequent after POMI, a trial on a larger sample is warranted.

##### References:

- 1 - Levy M, et al. Anesthesiology 2011;114:796-806.
- 2 - Devereaux RJ. Anesthesiology 2009;111:223-6.

#### 4AP2-6

##### Case report: anesthetic management of a uterine fibroma with extension into the IVC and right atria

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**Background:** Intravascular invasion of solid organ tumors remains a rare occurrence. We report a case of IVC and RA extension from a uterine fibroma extending from right internal iliac vein up to RA.

**Case report:** 54yo female with PMH of uterine fibromas post myomectomy 5 years ago. Presents with abdominal fullness, SOB, near syncope, and bilateral lower extremity edema. No other cardiopulmonary comorbidities. CT of the chest, abdominal, and pelvis: large uterine fibromas with mass extension into the IVC and RA via the right internal iliac vein. Transthoracic echocardiogram showed a RA mass with protrusion into the RV during systole. After a multidisciplinary work-up (gynecology-oncology, vascular, cardiac, and anesthesiology); patient presented for exploratory laparotomy, TAH and BSO, removal of the IVC and RA mass on CPB. Patient anesthetized with midazolam, fentanyl, and propofol. Invasive lines and monitors were placed (right radial arterial line, right internal jugular introducer, left internal jugular triple lumen catheter, and transesophageal probe. Anesthesia maintained with isoflurane, fentanyl and pancuronium. Operative steps:

1. Uterine mass dissected and removed,
2. Ligation right iliac vein and identification of entry point into vascular bed.
3. SVC and left femoral artery were cannulated and CPB initiated.
4. Intravenous portion of mass removed via right atriotomy.
5. Vascular structures closed, patient weaned from CPB to ICU.

Patient discharged home few days later.

**Discussion:** Since 1975 there have been about 200 cases of Intravenous leiomyomatosis (IVL). These tumors have common ground. Develop in uterine tissue, metastatic spread by invasion into proximal vascular structures, and in 10-30% have extension into the heart (1). Most often reports focus on surgical management and diagnosis of IVL. Role that anesthesia plays. Coordination of specialties (gynecology, vascular, and cardiac surgery) as well as cardiac anesthesia and echocardiographic capabilities, placement of invasive monitoring and give blood products are key to these complex cases. Performed in one or two stage operations. CPB and circulatory arrest may be employed in intracardiac tumor extraction.

##### References:

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2. Kocica MJ, et al. Intravenous leiomyomatosis with extension to the heart: Rare or underestimated? *J Thorac Cardiovasc Surg* 2005;130:1724-6

#### 4AP2-7

##### A female patient with cerebral ischemia after percutaneous kyphoplasty due to a paradoxical embolism via a persistent foramen ovale (PFO) - is a perioperative transesophageal echocardiography (TOE) helpful in the context of cardiac risk stratification?

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**Background and Goal of Study:** Pursuant to a female patient's cerebral infarction following a kyphoplasty, we were faced with the question: How often do these patients exhibit an intracardial shunt and do these cases usually result in clinically relevant paradoxical embolisms?

**Materials and Methods:** We examined 97 patients after undergoing a percutaneous kyphoplasty. After explaining risks and objective written consent was obtained and a TOE was performed in order to detect a right-to-left shunt at cardiac level. Following induction of general anaesthesia the atrial and interventricular septum were inspected at a minimum of 2 levels. A "provocative manoeuvre" to raise the pressure in the right ventricle was performed by increasing the ventilation pressures (PEEP min. 15mmHg, Pinsp min. 25mmHg). For the shunt diagnosis we used both, color-duplex and i.v. contrast examinations (2ml air foamed with 10ml hydroxyethyl starch). Once the shunt had been diagnosed the probe was left in situ, in order to detect the transfer of hyperechogenic structures through the shunt during the operation. Prior to the patients' discharge a neurological examination was performed.

**Results and Discussion:** A shunt at cardiac level was diagnosed in 14 out of 97 patients (14.4%). In 4 out of 14 of these patients we observed hyperechogenic structures in the right heart during insertion of the trocar into the

vertebral body as well as during injection of bone cement. In one case we were able to observe a cardiac right-to-left transfer. At the time of discharge from hospital none of the patients showed symptoms of a cerebral infarction.

**Conclusion(s):** Cardiovascular embolization occasionally occurs through percutaneous kyphoplasty- Clinically relevant cerebral embolizations are very rare despite frequent intracardiac shunts- The TOE for purposes of perioperative risk stratification is to be viewed as questionable.

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#### 4AP2-9

##### Immediate reversal of clinically mute left-to-right shunt into life-threatening right-to-left shunt during positive pressure ventilation of an ASA II adult - a rare but possible cause of severe hypoxia during induction of anaesthesia

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**Background:** ASD II is a congenital heart defect with a left-right shunt, found in 5% of adults. Most pts with uncorrected ASD II have no clinical symptoms to adulthood; in 70% of cases symptoms appear in the fifth decade. We present a pt in whom reversed intrathoracic pressure during positive pressure ventilation caused sudden life-threatening symptoms of „acute Eisenmenger's syndrome“.

**Case report:** A 48-year old man with mild HT and type II diabetes was referred for elective neurosurgery. During induction of general anaesthesia, at onset of positive pressure ventilation via face mask the patient suddenly developed tachycardia of 150 bpm, central cyanosis, SpO<sub>2</sub> fall to 82% and significantly increased venous pressure (blood outflow from i.v. cannulae). Arterial blood gas analysis was identical with venous. Cyanosis and low SpO<sub>2</sub> did not resolve during 100% oxygen ventilation and exacerbated after intubation. Due to a life-threatening clinical condition surgery was postponed and anaesthesia discontinued (anaesthetics pharmacologically reversed). Chest X-ray in OR revealed significantly dilated mediastinum (absent on previous scans). Due to suspicion of a severe right-left shunt (no improvement with 100% O<sub>2</sub> ventilation) heart ultrasound was performed in the OR finding only symptoms of pulmonary hypertension. The pt's status improved significantly with the return of spontaneous ventilation - SpO<sub>2</sub> 98% (with falls to 74% on coughing), tachycardia subsided; he was transferred to the ICU for further diagnostics. A more detailed heart ultrasound revealed a left-to-right shunt through the foramen ovale, described as clinically insignificant. The patient was transferred to a cardiology clinic, where an amplatzer was placed (intravascularly) to block the ASD. Ten days later the neurosurgical procedure was re-attempted. The course of anaesthesia and of the surgery was uneventful and the pt. was discharged in good overall condition.

**Conclusion:** In patients with a clinically mute and ultrasound-insignificant ASD II left-to-right shunt any attempt at positive pressure ventilation may lead to an acute shunt reversal with severe, life-threatening symptoms. Any form of cyanosis/fall in SpO<sub>2</sub> which shown no improvement on ventilation with 100% oxygen requires direct withdrawal of positive pressure ventilation, reversal to spontaneous breathing and careful diagnostics. Even an apparently negligible left-to-right shunt may prove dangerous during positive pressure ventilation.

#### 4AP2-10

##### 2D and 3D diastolic strain rate by speckle tracking for assessing left ventricular end diastolic pressure

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**Background and Goal of Study:** Assessment of Left ventricular (LV) filling pressures is necessary to diagnose heart failure when LV systolic function is normal. Global systolic longitudinal strain and strain rate (SR) measured by 2 and 3 dimensional speckle tracking (2D-ST and 3D-ST) appears as promising techniques. We studied longitudinal global diastolic-SR in 2D and 3D-ST to predict left ventricular end diastolic pressure (LVEDP).

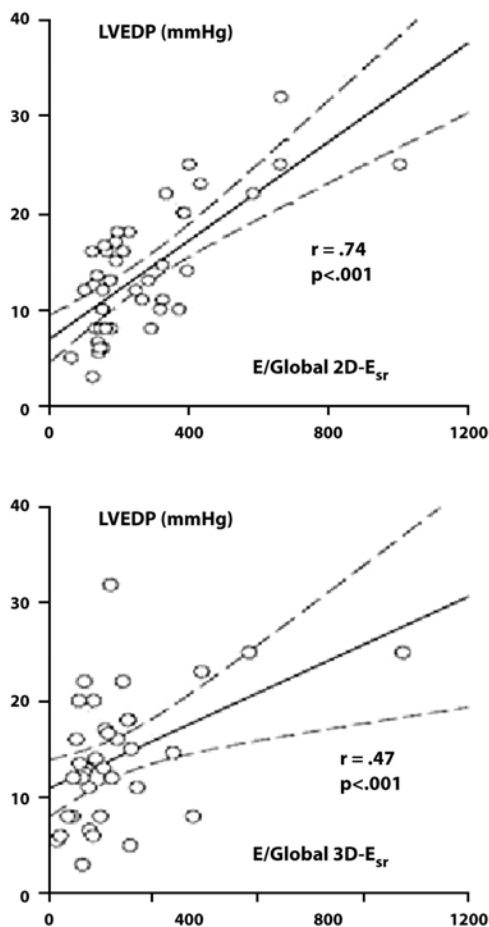
**Materials and Methods:** LVEDP measurement was performed in 52 consecutive patients referred for coronary angiogram (mean age= 64 ± 13 years, mean EF= 51 ± 16). A comprehensive transthoracic echocardiography (Ar-



tida, Toshiba) study was performed immediately after LVEDP measurement. Echocardiography data acquired included mitral early diastolic velocity (E) by conventional pulsed Doppler and high frame rate 2 and 3D apical views. Global longitudinal SR by 2D (2DE<sub>GSR</sub>) and 3D (3DE<sub>GSR</sub>) were assessed using longitudinal strain curves from speckle tracking analysis. LV filling pressures estimated using echocardiography data (E/2DE<sub>GSR</sub>, E/3DE<sub>GSR</sub>) were correlated to invasive LVEDP measurements.

**Results and Discussion:** The best correlation was found with E/Global 2D-E<sub>sr</sub>. A significant but weak correlation was found with E/3DE<sub>GSR</sub> (figure).

**Conclusion(s):** E/Global 2D-E<sub>sr</sub> can be used for assessing LVEDP



[Figure 1]

#### 4AP3-1

##### Nicorandil protects isolated mitochondrial bioenergetics against calcium overload in rat hearts

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**Background:** Nicorandil is a coronary vasodilatation agent used in the management of angina and is widely used to protect against perioperative cardiac ischemia/reperfusion (I/R) injury.

Studies demonstrate that activation of K<sub>ATP</sub> channels and prosurvival intracellular signaling pathways are required for the protective effect of nicorandil, but most of these experiments were conducted with in vivo models or isolated cardiomyocytes. Mitochondria appear to play a central role in the development of I/R injury as well as in protection against cardiomyocyte death.

The current study investigated whether nicorandil exerts a direct protective effect on mitochondria that is independent from its effects on cytosolic signal transduction cascades.

**Methods:** Cardiac mitochondria were isolated from adult male Wistar rats. Oxygen consumption was measured with an oxygen electrode, and respiratory control rate (RCR; a measure for the coupling of ATP synthesis) was calculated. Since elevated levels of intracellular Ca<sup>2+</sup> contribute to cardiomyocyte death during I/R, Ca<sup>2+</sup> overload was applied to induce mitochondrial dysfunction.

Experimental groups were as follows: (1) control, (2) Ca<sup>2+</sup> overload, and (3) pretreatment with nicorandil prior to Ca<sup>2+</sup> overload. To test the nitric oxide (NO)-donor effect of nicorandil on isolated mitochondria, a NO-scavenger, carboxy-PTIO, was used in a nicorandil pretreatment experiment.

**Results:** After exposure to Ca<sup>2+</sup> overload, state 3 respiration (ADP-stimulated oxygen consumption) was significantly decelerated (from 222.8±69.8 to 145.8±40.5 nmol/min/mg; control and Ca<sup>2+</sup> overload, respectively), resulting in a similar decrease in RCR (4.94±0.52 to 2.88±0.64; control and Ca<sup>2+</sup> overload, respectively). With pretreatment with nicorandil prior to Ca<sup>2+</sup> overload, state 3 respiration and RCR were slightly decreased when compared with control, although this difference did not reach the level of statistical significance (P = 0.10).

The protective effect of nicorandil on isolated mitochondria was abolished by carboxy-PTIO (140.9±26.5 nmol/min/mg and 3.12±0.59; state 3 respiration and RCR, respectively).

**Conclusions:** Nicorandil directly protected isolated mitochondrial bioenergetics through NO, independent of its effects on the cytosolic signal transduction cascade.

This suggests that nicorandil produces an immediate protective effect against I/R injury. Nicorandil may also have post-treatment protective effects if given at the time of reperfusion.

#### 4AP3-2

##### Influence of glucose and glycogen on lactate release after warm and cold ischemia of the rat liver

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**Background and Goal of Study:** Ischemia-reperfusion (IR) is a determinant in liver injury occurring during surgical procedures, ischemic state and liver transplantation. The nutritional status of the liver might contribute to the extent of tissue injury after warm and cold IR (1,2). The aim of this study was to compare the effect of glucose and glycogen content on lactate release, a marker of the ischemic insult, after cold and warm IR in ex vivo perfused rat livers.

**Materials and Methods:** After University Animal Care Committee approval, female Wistar rats were anaesthetised, the portal vein cannulated, the liver removed and perfused at a flow rate of 5 ml/min (± 12 cm H<sub>2</sub>O) in a closed ex vivo system with HBSS supplemented with insulin, HEPEs and O<sub>2</sub>.

Animals were randomly divided into three groups (n = 10 in each group): fed (glucose 1 g/l in perfusate) and fasting groups in which glucose 1 g/l or alanine 25 g/l was added to perfusate. The experiment consisted of three phases in both experimental conditions: perfusion for 15 min (4°C in cold or 37°C in warm group) followed by cold ischemia (4°C) for 24 hours or warm ischemia (37°C) for 1 h, and reperfusion during 60 min at 37°C in both groups. Glucose, lactate, ALT, AST, and LDH were analysed in perfusate samples at different time-points (data not shown).

The proportion of glycogen in hepatocytes and the number of activated caspase 3 apoptotic cells were determined in biopsies. Pearson's correlation (r<sup>2</sup>) P < 0.05.

**Results and Discussion:** Lactate production at the time of reperfusion was positively correlated with glucose concentration in perfusate (r<sup>2</sup>= 0.87; P < 0.01) and glycogen content in hepatocytes (r<sup>2</sup>= 0.94; P < 0.01) after cold but not warm IR (Table 1). There was no clear correlation between lactate and caspase 3 activation or enzymes release in the perfusate in the two experimental conditions.

Variable	Cold ischemia		Warm ischemia	
	r <sup>2</sup>	P-Value	r <sup>2</sup>	P-Value
Glucose	0.87	<0.01	0.08	0.67
AST	-0.36	0.06	-0.32	0.06
ALT	-0.36	0.06	-0.34	0.05
LDH	-0.38	0.04	-0.39	0.02
Glycogen	0.94	<0.01	-0.27	0.16
Caspase 3	0.22	0.47	-0.36	0.04

[Table 1]

**Conclusion(s):** Nutritional status and glucose influence lactate production after cold but not warm IR.

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1. Stadler M. et al. Anesthesiology 2005; 103: 978-86; 2. Tanigawa K. et al. Crit Care Med 1999; 27: 401-6

#### 4AP3-3

##### Cardioprotection following a short-term beta-blocker therapy on heart remodeling in spontaneously hypertensive rats

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**Background and Goal of Study:** It has been established, in both human clinical practice and experimental animal models, that beta-blockers can reverse left ventricular hypertrophy (LVH). All these studies have been conducted with drugs administered in the long-term.

We tested the hypothesis that short-term administration (48 hours) of the cardioselective beta-blocker esmolol could induce early regression of LVH using a model of stable compensated LVH.

**Materials and Methods:** Fourteen-month-old male spontaneously hypertensive rats (SHR) were randomized to receive treatment either with esmolol (SHR-E, n=8) or no treatment (SHR, n=8). After 48 hours of administration, left ventricular morphology and cardiac function were assessed from M-mode echocardiograms [left ventricular mass index (LVMI), ejection fraction (%EF)] and transmitral Doppler [early-to-atrial filling velocity ratio (E/A), E-wave deceleration time (Edec time)]. After echocardiography study, left ventricular subendocardial and subepicardial biopsies were taken to analyze changes in number (Nv) and cross-sectional area (CSA) of left ventricular myocytes.

**Results and Discussion:** Esmolol lowered SBP in treated SHR with respect to untreated SHR ( $P < 0.001$ ). Interestingly LVMI was lower in SHR-E than in SHR ( $P = 0.009$ ). There was a trend towards reduction of hypercontractility (%EF,  $P = 0.17$ ) in SHR-E compared with SHR. E/A ratio tended to be higher in SHR-E with respect to SHR ( $P = 0.55$ ). Nv in subendocardial and subepicardial regions was higher in SHR-E with respect to SHR ( $P < 0.001$ ). CSA in subendocardial and subepicardial regions was lower in SHR-E with respect to SHR ( $P < 0.05$  and  $P < 0.001$ ).

**Conclusion(s):** Our study showed that short-term treatment with esmolol (48 hours) produced a reduction of left ventricular mass and regression of the cardiomyocyte hypertrophy in SHR. These results could indicate the beneficial effects of esmolol on cardiac remodeling. However, these effects need to be assessed in future clinical prospective studies in humans.

**Acknowledgements:** This work was supported by a grant from FIS 10/02831, Spain.

#### 4AP3-4

##### Caffeic acid phenethyl ester (CAPE) effects in the kidney during ischemia and reperfusion in rats anesthetized with isoflurane

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**Background and Goal of Study:** The purpose of this investigation was to examine the effect of CAPE in renal ischemia/reperfusion injury (IRI) in rats anesthetized with isoflurane.

**Material and Methods:** All 26 male Wistar rats were anesthetized with isoflurane, intubated and mechanically ventilated. The animals were randomly assigned in three groups: G1 group (control; n=8), G2 group (CAPE; n=10) and G3 group (dilute, ethanol; n=8). Mean arterial pressure (MAP) was monitored for anesthesia control. Intraperitoneal CAPE (G2) or ethanol (G3) injections were realized 40 minutes before left renal ischemia. All animals underwent to right nephrectomy (RN) and left kidney was submitted to ischemia for 25 minutes. Serum creatinine (cr) values were determined in the beginning (M1), at the end of experiment (M2), and 24 hours after the experiment (M3). Rats were anesthetized with isoflurane, intracardiac blood sample was collected, and the left kidney removed for histological analysis, using a scale for tubular necrosis (0-5= injury maximum). Statistical analysis was applied to the values of serum creatinine and histological score injury and statistical differences were considered when  $p < 0.05$ .

**Results and Discussion:** The creatinine value in the CAPE group was significantly higher at M2 (0.8 mg/mL,  $p=0.0012$ ) and M3 (3.7 mg/mL,  $p=0.0014$ ) than the control group (0.5 mg/mL and 0.9 mg/mL) and dilute group (0.6 mg/mL and 1.0 mg/mL), respectively. Histological examination showed that G2 group had more pericapsular tubular necrosis (3.0[2.0;3.0]) than G1 group (2.0[1.0;2.0]) and G3 group (1.5[1.0;2.0]), ( $p < 0.001$ ). G2 group had more medullar tubular necrosis (2.0[2.0;3.0]) than G1 group (2.0[1.0;2.0]) and G3 group (1.0[0.0;2.0]), ( $p < 0.001$ ). We can infer that isoflurane and CAPE association developed higher creatinine values in CAPE group because happened a ROS block by CAPE, a ROS scavenger and blocker of preconditioning (APC) by isoflurane. It is necessary ROS release for the action of isoflurane as APC.<sup>1</sup>

**Conclusions:** CAPE promoted more functional and anatomical renal injury when rats were anesthetized with isoflurane than control and dilute groups, as demonstrated by histological analysis and serum creatinine values.

##### Reference:

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**Acknowledgements:** Financial Support from São Paulo Research Foundation (FAPESP).

#### 4AP3-6

##### Effects of helium on H<sub>2</sub>O<sub>2</sub>- and TNFalpha induced cell damage in HUVEC

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**Background and Goal of Study:** Helium induces preconditioning in human endothelium in vivo (1). In contrast, pretreatment of 3x5 minutes with helium failed to protect human umbilical vein endothelial cells (HUVEC) against 100  $\mu$ M H<sub>2</sub>O<sub>2</sub> induced damage (2). The preconditioning protocol plays a major role, and alterations of duration and repetition of the stimulus may cause differences in protection (3). We investigated the effect of different preconditioning stimuli on both H<sub>2</sub>O<sub>2</sub>- and TNFalpha induced damage in HUVEC.

**Materials and Methods:** HUVEC were isolated from fresh umbilical cords and grown upon confluency at passage 3 in plates before 3 independent experiments were performed. Cells were subjected to starving medium (M199, 10%FCS, Pen/Strep, Amfo, L-glutamine) without addition of growth factors for 10 h. Cells were treated for either 3 x 5 min or 1 x 30 min 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. Subsequently cells were either stimulated with H<sub>2</sub>O<sub>2</sub> (100 $\mu$ M for 1.5 hours), TNFalpha (40ng/ml for 24 hours) or left untreated. Adherent and detached cells were stained with Annexin V (A) and Propidium Iodide (PI), and Caspase 3 (C3).

**Results and Discussion:** Stimulation with H<sub>2</sub>O<sub>2</sub> resulted in increased percentage of late apoptotic cells (A+PI+) and necrotic cells (A-PI+) in both control gas (mean $\pm$  SD, 48% $\pm$ 11, resp. 37% $\pm$ 13) and helium pre-treated cells (34% $\pm$ 21, resp. 51% $\pm$ 32). Helium pre-treatment alone did not affect percentage of late apoptosis or necrosis compared to control gas.

Stimulation with TNFalpha increased percentage of necrotic cells in both control gas (26% $\pm$ 6) and helium treated cells (25% $\pm$ 8) when compared to unstimulated controls (15% $\pm$ 9). TNFalpha stimulation increased caspase 3 positive cells in control gas (4,6 $\pm$ 3) and helium pretreated cells (4,6 $\pm$ 2) compared to non stimulated cells (2,4 $\pm$ 2, resp 1.4 $\pm$ 1).

**Conclusion(s):** Different protocols of Helium pretreatment (3x5 min or 1x30) have no effect on H<sub>2</sub>O<sub>2</sub> 100  $\mu$ M induced damage in HUVEC. Pretreatment with 3 x 5 minutes of helium had no effect on TNF alpha induced cell damage.

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#### 4AP3-7

##### Argon-induced postconditioning of human myocardium: role of the "reperfusion injury salvage kinases" signalling pathway

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**Background and Goal of Study:** Administration of argon before prolonged coronary artery occlusion and reperfusion induces cardioprotection, and is referred to as preconditioning [1]. From a clinical point of view the question arises whether argon application after the ischemic episode induces postconditioning. The first aim of the present study was to test this effect. The second aim was to examine the role of the „Reperfusion Injury Salvage Kinases" pathway (PI3K/Akt, Extracellular signal-regulated kinase 1 and 2 (ERK 1/2) and mitochondrial permeability transition pore (mPTP)) in argon-induced postconditioning on isolated human myocardium.

**Material and Methods:** After the approval of local medical ethics committee, right atrial appendages were obtained during cannulation for cardiopulmonary bypass from patients scheduled for routine coronary artery bypass surgery and aortic valve replacement. The force of contraction (34 °C, stimulation frequency 1 Hz) of right atrial trabeculae was recorded during 30 min hypoxia

followed by 60 min reoxygenation. 70% argon was administered administered for 2 min before and 3 min after reoxygenation alone or in presence of 100 nM Wortmannin (a PI3K inhibitor), 20  $\mu$ M PD98059 (an ERK 1/2 antagonist), 50  $\mu$ M Atractyloside (a mPTP opener). The results are expressed in % of baseline. The force of contraction at the end of 60-min reoxygenation period (FoC<sub>60</sub>) was compared (mean  $\pm$  Standard Deviation) between the groups by a variance analysis.

**Results and discussion:** Argon (FoC<sub>60</sub> = 86  $\pm$  5% of baseline) significantly enhanced the recovery of force after 60 min of reoxygenation as compared with the Control group (FoC<sub>60</sub> = 49  $\pm$  7% of baseline). Wortmannin, PD98059, Atractyloside abolished argon-induced postconditioning (respectively FoC<sub>60</sub> = 54  $\pm$  1%; 65  $\pm$  2%; 57  $\pm$  10% of baseline; P < 0.001 vs. argon). Administration of inhibitors alone has no significant effect on the FoC<sub>60</sub> as compared with the Control group.

**Conclusions:** The current study demonstrates for the first time that argon applied briefly during early reoxygenation is able to induce postconditioning in isolated human myocardium. Additionally, postconditioning by argon is mediated by activation of PI3K and ERK 1/2, and inhibition of mPTP.

**Reference:**

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**Acknowledgements:** SL received a fellowship from Fondation de France.

#### 4AP3-8

##### The role of protein kinase C in anesthetic-induced preconditioning for cardiac progenitor cells derived from human embryonic stem cells

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**Background and Goal of study:** Volatile anesthetics protect myocardium from ischemia as a result of preconditioning. Studies with rat heart cells revealed protein kinase C (PKC) is suspected to be one of the major signaling components of anesthetic-induced preconditioning (APC) and Isoform PKC- $\delta$  d PKC- $\epsilon$  may play important roles in APC. We investigated whether isoflurane can improve hESC-derived CPCs survival rate under oxidative stress and the role of PKC in APC with cardiac progenitor cells (CPCs), derived from human embryonic stem cells (hESCs), that can multiply and generate cardiomyocytes offering a great potential for cardiac regenerative therapy.

**Material and Methods:** Undifferentiated hESCs were cultured in suspension with 20% FBS (fetal bovine serum) and 20 ng/ml of BMP-4 (bone morphogenetic protein-4) to form embryoid bodies and were grown onto Matrigel-coated plates for 2-3 weeks. To characterize the differentiated CPCs, immunostaining for Nkx2.5 (nonspecific transcriptional marker) and Isl-1 was performed. hESC derived CPCs were exposed to oxidative stress induced by H<sub>2</sub>O<sub>2</sub> and FeSO<sub>4</sub>. For anaesthetic preconditioning, CPCs were exposed to isoflurane (0.5mM). CPC survival was determined by trypan blue exclusion. A nonspecific PKC inhibitor, Chelerythrine chloride(1 $\mu$ M), a PKC- $\delta$  inhibitor, Rottlerin(0.2 $\mu$ M), and a PKC- $\epsilon$  inhibitor, myristoylated PKC- $\epsilon$  V1-2 peptide (1 $\mu$ M) were used to investigate the involvement of PKC. Results are presented as means  $\pm$  standard deviation. Data were analyzed using Mann-Whitney U test. Differences were considered significant when the P value was less than 0.5.

**Results and Discussion:** hESC-derived CPCs stained with Nkx2.5 were 95  $\pm$  3% of total cell number. Isoflurane (0.5 mM)-preconditioned CPCs showed a significantly lower death rate compared with control (0.5 mM: 12.7  $\pm$  9.3% vs. control: 31.4  $\pm$  10.2%; p < 0.05). Inhibition of PKC with Chelerythrine, Rottlerin, and myristoylated PKC- $\epsilon$  V1-2 peptide abolished the protective effects of isoflurane and cell death rate were 27.6  $\pm$  13.5, 27.7  $\pm$  12.6, and 26.7  $\pm$  11.3 respectively.

**Conclusion:** Isoflurane increased hESC-derived CPC survival under oxidative stress. Among PKCs, PKC- $\delta$  and PKC- $\epsilon$  may play significant roles in protecting myocardium from ischemia.

#### 4AP3-9

##### Pravastatin-induced cardioprotection is associated with anti apoptotic effects in human myocardium, *in vitro*

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**Background and Goal of study:** The importance of apoptosis in reperfusion injury is well established. We have showed that pravastatin, a HMG-CoA

reductase inhibitor, administered during reoxygenation induced cardioprotection [1]. The goal of this study was to examine the effect of pravastatin during reoxygenation on the expression of markers of apoptosis in human myocardium, *in vitro*.

**Material and Methods:** After the approval of local medical ethics committee, right atrial appendages were obtained during cannulation for cardiopulmonary bypass from patients scheduled for cardiac surgery. Right atria appendages were pinned in a chamber containing Tyrode's modified solution (34  $\pm$  0.5°C, stimulated at a frequency of 1 Hz) exposed to 30-min hypoxia and 60-min reoxygenation (Control group), pravastatin 50  $\mu$ M was administered throughout the reoxygenation (Prava group). The protein expression of BAD, phospho-BAD, caspase 3, Pim-1 kinase and Bcl-2 were measured 15 min after the start of reoxygenation and at the end of reoxygenation period (15 min and 60 min reox) using Western immunoblotting. Statistical comparison was made by analysis of variance.

**Results and Discussion:** Pravastatin significantly increase the ratio phospho-BAD (Ser 112) / BAD total as compared to the respective Control (+71% in Prava-15 min reox; +87% in Prava-60 min reox; P < 0.01). The level of caspase 3 was enhanced in presence of pravastatin as compared to the respective Control (+28 % in Prava-15 min reox; +43% in Prava-60 min reox P < 0.01). At 60 min reox, pravastatin abolished the decrease of caspase 3 expression observed in Control, suggesting that pravastatin preserve the myocardium against the caspase 3 activation. At 60 min reox, in Control Bcl-2 expression was significantly decreased as compared to that observed at 15 min of reoxygenation (P < 0.01). At 60 min reox, the level of Bcl-2 was enhanced in presence of pravastatin as compared to respective Control (+53% in Prava-60 min reox; P < 0.01), suggesting that pravastatin abolished the decrease of Bcl-2 observed in Control. The Pim-1 expression was enhanced in presence of pravastatin as compared to the corresponding Control (+62% in Prava-15 min reox; +39% in Prava-60 min reox; P < 0.01).

**Conclusions:** Pravastatin induced cardioprotection is associated to the phosphorylation of BAD, the activation of Pim-1 and Bcl-2, and maintain of the caspase 3 level.

**Reference:**

Lemoine S, Fuardo M, Massetti M, et al. *Anesth Analg* 2010; 110 (suppl.): S423.

#### 4AP3-10

##### Hyperglycemia abolishes the nephroprotective effects of melatonin and isoflurane during ischemia-reperfusion injury

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**Background and Goal of Study:** Perioperative ischemia/reperfusion (I/R) associated with transient hyperglycemia causes severe oxidative stress and is important in the development of renal injury. N-acetyl-5-metoxitriptamina (melatonin) is a powerful antioxidant<sup>1</sup> and may protect against acute kidney injury. The aim of this study was to evaluate the protective effect of melatonin in a model of renal ischemia and reperfusion and transient hyperglycemia in rats anesthetized with isoflurane.

**Materials and Methods:** After approval by the institution's Ethics Committee for Animal Research, rats were randomly assigned to six groups of six animals each: HM = melatonin+ I/R +Hyperglycemia; H = I/R + Hyperglycemia; I = I/R; M = melatonin + I/R; SH = sham + hyperglycemia; S = sham. Transient hyperglycemia (H) was produced by an intraperitoneal (i.p.) injection of glucose at a dose of 2.5 g.kg<sup>-1</sup> administered 30 min before ischemic onset. All rats underwent right kidney nephrectomy. Left kidney ischemia was performed for 25 min, except in the sham groups (S) and sham groups with hyperglycemia (SH). Melatonin (20 mg.kg<sup>-1</sup>) was i.p. injected 30 min before ischemia in animals with (MH) and without hyperglycemia (M). The evaluation of renal injury was made by measuring serum creatinine and by histological analysis of the kidney 24 hrs after the experiment.

**Results and Discussion:** The rats subjected to the effects of melatonin and I/R (M) and sham with (SH) and without hyperglycemia (S) did not exhibit significant changes in serum creatinine but the serum creatinine increased significantly in hyperglycemic (H,HM) animals regardless of whether they received melatonin (p=0,001). Histological analysis of renal tubular necrosis showed marked renal tubular necrosis in animals subjected to hyperglycemia (H), hyperglycemic animals given melatonin (HM) and non-hyperglycemic rats not given melatonin -I (p=0,001). There was no renal tubular necrosis in animals given melatonin (M) and sham with (SH) and without hyperglycemia (S).

**Conclusion(s):** These results indicate that 20 mg.kg<sup>-1</sup> of melatonin protected the kidney from I/R injury; however, this protection was abolished when the I/R was accompanied by transient hyperglycemia.

**References:**

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#### 4AP3-11

##### Cardioprotection by PKA activation is mediated by $mK_{Ca}$ -channels

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**Background and Goal of Study:** Activation of protein kinase A (PKA) induces myocardial preconditioning [1]. PKA is an upstream regulator of mitochondrial calcium-sensitive potassium ( $mK_{Ca}$ )-channels. In the present *in vivo* study, we tested the hypothesis that blockade of  $mK_{Ca}$ -channels abrogates cardioprotection by PKA activation with forskolin.

**Materials and Methods:** After approval of the local animal care and use committee, male Wistar rats were randomized into nine groups (each  $n=6$ ). Control (Con) animals were not further treated. Cardioprotection was investigated by administration of different concentrations of forskolin (For; 10, 30, 100 and 300  $\mu\text{g}/\text{kg}$ ) 10 min before ischaemia. In a second set of experiments, in addition to controls, animals were pretreated with the lowest protective concentration of forskolin (For30) either alone or combined with the  $mK_{Ca}$ -channel blocker iberiotoxin (For30+Ibtx), or iberiotoxin alone (Ibtx). All animals underwent 25 minutes ischaemia followed by 120 minutes of reperfusion. At the end of reperfusion, infarct sizes were measured by TTC staining and are presented as percent of the area at risk. Statistics: One-way ANOVA followed by Tukey's post hoc test. Data are mean  $\pm$  SD.

**Results and Discussion:** Infarct sizes in the control groups of both series were comparable ( $64\pm 6\%$  and  $67\pm 9\%$ ). While For10 was not protective (For10:  $63\pm 7\%$ ;  $P>0.05$  vs. Con), preconditioning with For at 30, 100 and 300  $\mu\text{g}/\text{kg}$  significantly reduced infarct size (For30:  $34\pm 6\%$ , For100:  $37\pm 3\%$  and For300:  $36\pm 8\%$ ; each  $P<0.05$  vs. Con). Furthermore, the  $mK_{Ca}$ -channel inhibitor iberiotoxin completely abolished the cardioprotective effect of forskolin (For30+Ibtx:  $63\pm 12\%$ ;  $P<0.05$  vs. For30), while iberiotoxin itself had no effect on infarct size (Ibtx:  $64\pm 11\%$ ;  $P>0.05$  vs. Con).

**Conclusion(s):** PKA activation with forskolin dose-dependently induces cardioprotection. PKA-induced preconditioning is mediated by  $mK_{Ca}$ -channels.

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#### 4AP4-1

##### The effects of intravenous anesthetics on the release of vascular endothelial growth factor and angiogenesis

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**Background and Goal of Study:** Intravenous anesthetics used during perioperative periods can affect angiogenesis, which is related to various pathological conditions. Vascular endothelial growth factor (VEGF) is an important regulator of angiogenesis. The aim of this study was to determine the effects of intravenous anesthetics on the release of VEGF and *in vitro* capillary tube formation.

**Materials and Methods:** A10 cells (DS Pharma Biomedical Co., Osaka, Japan), a rat aortic smooth muscle cell line, were stimulated with midazolam (1, 10, 50, 100  $\mu\text{M}$ ), diazepam (1, 10, 50, 100  $\mu\text{M}$ ), or propofol (1, 10, 100  $\mu\text{M}$ ). The media containing supernatants were collected every 12 hours for three days and subjected to ELISA analysis (Quantikine VEGF kit; R&D systems, Minneapolis, MN) according to the standard protocol to measure the concentration of VEGF released from A10 cells. The effects of intravenous anesthetics on the endothelial capillary tubule formation were investigated in co-cultured human umbilical vein endothelial cells and human diploid fibroblasts (Kurabo Industries Ltd., Osaka, Japan). Cells were incubated for ten days with mediums with or without 10 ng/ml VEGF-A, and stimulated with midazolam, diazepam, or propofol (50  $\mu\text{M}$  each). The area and the length of tubules, and the number of joints and paths in *in vitro* capillaries were assessed. Results were expressed as mean  $\pm$  SD. Data were compared by means of one-way ANOVA or one-way repeated ANOVA followed by the Student-Newman-Keuls test.

**Results:** The release of VEGF from A10 cells in all groups significantly increased in a time-dependent manner. Fifty  $\mu\text{M}$  of midazolam and diazepam significantly stimulated VEGF release (control:  $135.0\pm 49.5$  pg/ml, midazolam:  $205.0\pm 13.2$  pg/ml, diazepam:  $216.7\pm 2.9$  pg/ml for 36 hours;  $p<0.05$ ). One hundred  $\mu\text{M}$  of diazepam also significantly increased VEGF release for 24, 36, 48, 60, and 72 hours. Fifty  $\mu\text{M}$  of midazolam significantly impaired all the factors in *in vitro* capillaries in the presence of VEGF (the area of control:  $419.2\pm 86.4\times 10^3$  pixels, midazolam:  $79.3\pm 46.2\times 10^3$  pixels;  $p<0.05$ ). Propofol had no effect on the release of VEGF or capillary tube formation.

**Conclusions:** Midazolam and diazepam stimulated the release of VEGF from A10 cells. However, high-dose midazolam had inhibitory effects on angiogenesis in human umbilical vein endothelial cells and human diploid fibroblasts in the presence of VEGF

#### 4AP4-2

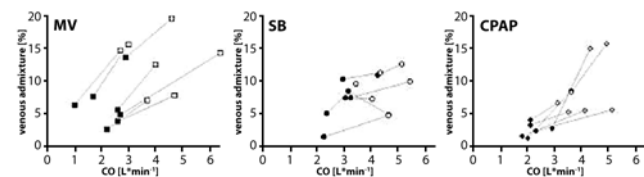
##### Pulmonary shunt is independent of cardiac output during unsupported spontaneous breathing

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**Background and Goal of Study:** Cardiac output (CO) affects pulmonary shunting during mechanical ventilation (MV). We investigated whether this relationship holds true when the ventilator is set to allow for unsupported spontaneous breathing (SB). During one lung ventilation, as a model of a non-recruitable major shunt, we modulated CO to see if that affects venous admixture ( $Q_{va}/Q_t$ ) during MV, unsupported SB and continuous positive airway pressure (CPAP) i.e. with PEEP to the ventilated lung.

**Materials and Methods:** In 7 anaesthetized supine piglets the left lung was occluded by an endobronchial blocker, resulting in major shunt. CO and  $Q_{va}/Q_t$  were measured during SB, CPAP and MV with tidal volumes and respiratory rate corresponding to SB at random; both at unrestricted and at venous return partially occluded by a balloon. The slopes of individual CO -  $Q_{va}/Q_t$  pairs were calculated and analyzed by t-test.

**Results:**  $Q_{va}/Q_t$  was CO dependent during MV (slope= $3.8\% \cdot \text{L}^{-1} \cdot \text{min}$ ,  $P<0.001$ ) and at 8 cmH<sub>2</sub>O CPAP (slope= $3.6\% \cdot \text{L}^{-1} \cdot \text{min}$ ,  $P=0.014$ ), whereas no CO dependence of  $Q_{va}/Q_t$  could be seen during unsupported SB (slope= $0.9\% \cdot \text{L}^{-1} \cdot \text{min}$ ;  $P=0.25$ ). (Figure: individual animals during MV, SB and CPAP; open: high CO, solid: low CO)



[CO -  $Q_{va}/Q_t$  relationships]

**Conclusions:** During unsupported SB pulmonary shunt is independent of CO but not during MV or CPAP. The higher airway (and alveolar) pressures prevailing during MV and CPAP might make  $Q_{va}/Q_t$  CO dependent.

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Dantzker DR, Lynch JP, Weg JG. Depression of cardiac output is a mechanism of shunt reduction in the therapy of acute respiratory failure. Chest. 1980;77(5):636-42.

#### 4AP4-3

##### Lipid emulsion increases left ventricular systolic pressure via blockade NO release and improve contractility by increasing intracellular calcium level

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**Background and Goal of Study:** Lipid emulsion has been used as a parenteral nutrition component and therapeutic drug for severe cardiac toxicity due to accidental overdose of local anesthetics. The aim of this study was to investigate the hemodynamic effects of lipid emulsion and related mechanism that was infused intravenously in an *in vivo* rat heart model.

**Materials and Methods:** Right femoral vein was cannulated for drug infusion. Randomized rats were administered as an IV infusion over 3 min with the normal saline or the nonselective NOS inhibitor L-NAME 10 mg/kg, and then lipid emulsion was continuously infused. A micromanometer catheter was advanced into the left ventricle via the right internal carotid artery for measurement of hemodynamic function. To identify the positive inotropic effect of lipid emulsion, the authors check the calcium level in the cytoplasm of the rat myocardial cell (H9C2).

**Results and Discussion:** Infusion of lipid emulsion resulted in significant increase of left ventricular systolic pressure and tendency of increasing left ventricular contractility. The increase of left ventricular systolic pressure induced by lipid emulsion was abolished by treatment of L-NAME. Lipid emulsion increased intracellular calcium level at the H9C2 cell.

**Conclusion(s):** Intravenously infused lipid emulsion caused the increase of

left ventricular systolic pressure via mainly blockade of nitric oxide release at the vascular endothelial cell. The improvement of myocardial contractility was also associated the increase of left ventricular systolic pressure. The improvement of myocardial contractility is maybe associated with increase of intracellular calcium concentration.

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#### 4AP4-4

##### <sup>18</sup>F-FDG-PET to assess response to therapy with esmolol in an experimental model of left ventricular hypertrophy

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**Background and Goal of Study:** An improvement in heart metabolism is fundamental for regression of left ventricular hypertrophy. This effect have been described in the literature after chronic treatments. However, early decrease of myocardial glucose metabolism has not been reported following short-term administration of these drugs.

**Materials and Methods:** We conducted a pilot study in our hospital. Fourteen-month-old males spontaneously hypertensive rat were treated intravenously with vehicle (SHR, n=3) or esmolol (SHR-E, n= 3) (300 mg × kg<sup>-1</sup> × min<sup>-1</sup>). Age-matched vehicle-treated male Wistar-Kyoto (WKY, n=3) rats served as controls. After 48 hours positron emission tomography/computed tomography (PET/CT) was applied to study cardiac glucose metabolism. Rats were anesthetized with isoflurane (3% induction and 1.5% for maintenance in 100% oxygen) and <sup>18</sup>F-FDG (2-deoxy-2[18F]fluoro-D-glucose) (39.37 ± 3.25 MBq [1.06 ± 0.08 mCi]) was administered. After images were obtained, the standardized uptake value (SUV) was used to evaluate FDG uptake by the heart. The SUV was calculated and normalized according to body weight and the injected dose of FDG (1).

**Results and Discussion:** SHR showed higher <sup>18</sup>F-FDG uptake than WKY (P < 0.01). Interestingly, PET acquisitions of the SHR showed lower <sup>18</sup>F-FDG uptake after 48 hours of treatment with esmolol than SHR treated with vehicle (P < 0.01).

There were no significant differences in SUV in either SHR-E or WKY (P = 0.63). Myocardial glucose metabolism in the SHR model was more marked than in the WKY, and esmolol produced a marked decrease in the myocardial metabolism of SHR.

**Conclusion(s):** Our study showed that short-term treatment with esmolol (48 hours) produced a marked decrease in the glucose metabolism of the hypertrophied ventricle. New studies are necessary to demonstrate that such effect could be considered a therapeutic success over the regression of left ventricular hypertrophy.

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**Acknowledgements:** This work was supported by a grant from FIS 10/02831, Spain.

#### 4AP4-5

##### Impact of permissive intra-abdominal pressure during NOTES surgery in adrenergic response and hepatic blood flow in pigs

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**Background:** Flexible endoscope based endoluminal and transgastric surgery (NOTES) promises to be a less invasive surgery approach. Potential patient advantages include less pain and no skin incisions. It is well known that increase intraabdominal pressure (IAP) during gas insufflation induces intra-abdominal blood flow changes and activation of renin-angiotensin-aldosterone system (RAAS), the major regulator of blood pressure and vascular response to injury.

However, it remains uncertain whether the fluctuations of IAP in NOTES, with peaks of up to 30mmHg, vs IAP in laparoscopy, are harmful. It seems that blood flow fluctuations may induce more endothelial shear stress and consequently worst response. Moreover, it has been speculated that the type of gas used could modulate these changes.

**Goal:** To evaluate adrenergic response and hepatic blood flow (HBF) during surgical procedure performed by NOTES, allowing variability of IAP vs laparoscopy at constant IAP

**Material and Methods:** 27 anaesthetized pigs undergoing transgastric cholecystectomy were randomised to either CO<sub>2</sub>-NOTES (CO<sub>2</sub>G, n=11), air-NOTES (airG, n=11) with levels of IAP as needed in relation of surgical requirements up to 30 mmHg; or CO<sub>2</sub>-laparoscopic (LG, n=5) at IAP of 15 mmHg. Systemic hemodynamic parameters and cardiac index (CI) were obtained by pulmonary catheter. Cardiac contractility (GEFG) by means of PICCO system was recorded. In all groups, stroke volume variability was kept < 12% with colloid infusions. Plasma aldosterone and renin activity (RA), as indirect markers of RAAS activation; and lidocaine clearance (MEGX), to monitor changes in HBF were obtained. All data was recorded at baseline, 5 min before deflation and 30 min after deflation.

**Results:** Throughout the study, there were significant increases in HR (p=0.012) and CI (p=0.048) in LG. No differences in MAP and GEFG were found between groups.

At the end of surgery, HBF had decreased around 35% in all groups. LG showed significant aldosterone increases (air-NOTES: 49± 9%; CO<sub>2</sub>-NOTES: 62±12%; LG: 123±16%, p=0.027) and RA showed a similar behaviour (air-NOTES: 58±15%; CO<sub>2</sub>-NOTES: 65±11; LG: 126±21%, p=0.039). 30 min after deflation all parameters returned to baseline levels.

**Conclusion:** This study suggests that fluctuations in IAP, with peaks of up to 30mmHg, do not induce a significantly different hyper-adrenergic response or HBF changes, compared to traditional laparoscopy, allowing for more permissive limits when using NOTES.

#### 4AP4-8

##### Intralipid attenuates bupivacaine-induced cardiotoxicity in isolated rabbit Purkinje Fiber

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**Background and Goal of Study:** Local anesthetic-induced cardiotoxicity remains a complication of regional anesthesia. Several case reports have shown back a preventive and curative effect of intralipids in a cardiac model of bupivacaine intoxication [1]. The aims of this study were to

- 1) evaluate the cardiac electrophysiologic effects of bupivacaine in an isolated rabbit ventricular Purkinje fiber model,
- 2) examine if intralipids could reverse bupivacaine cardiotoxicity.

**Material and Methods:** The heart of New-Zealand white rabbits was rapidly excised, Purkinje fibers were dissected from the left ventricle of the rabbit heart and was placed in a Tyrode's solution-perfused chamber (oxygenated, 37°C, stimulation 1 Hz). The effects of Bupivacaine on action potentials from the Purkinje fiber were determined by the measurement of: Resting membrane potential (RMP), Action potential amplitude (APA), Maximal upstroke velocity (V<sub>max</sub>), Action potential duration at 50% of total repolarization (APD<sub>50</sub>), Action potential duration at 90% of total repolarization (APD<sub>90</sub>).

Experimental protocol was: preparations were superfused with Tyrode's solution during 90 min (control group, n= 8). Bupivacaine was perfused alone (increasing concentrations, 10<sup>-6</sup> M, 10<sup>-5</sup> M and 5.10<sup>-5</sup> M) (n= 8), or in presence of intralipids 0.5% (n= 6), in an additional group intralipids (0.1%, 0.5% and 1%) were perfused alone (n=5).

**Results and Discussion:** RMP and APA were modified neither by bupivacaine, nor by intralipids. APD<sub>50</sub> and l'APD<sub>90</sub> were significantly decreased by bupivacaine alone or in presence of intralipids (P< 0.05 vs. control and intralipids alone). Bupivacaine 10<sup>-5</sup>M et 5.10<sup>-5</sup>M alone and in presence of intralipids significantly decreased V<sub>max</sub> (P< 0.001 vs. control and intralipids alone). Bupivacaine 5.10<sup>-5</sup>M have induced conduction blocks apparition (7/8 preparations), although no conduction block have been observed in control and intralipids alone groups.

Intralipids have significantly decreased conduction blocks induced by bupivacaine (1/6) in comparison to bupivacaine group. Intralipids prevent conduction blockade induced by bupivacaine.

Nevertheless, intralipids did not modify the effect of bupivacaine on the parameters of the cardiac action potential.

**Conclusion:** These results suggest that intralipid could be a potential therapeutic in the preventive treatment of bupivacaine induced cardiotoxicity.

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#### 4AP4-9

##### Impact of atorvastatin on the RNA expression of $\beta$ -adrenergic pathway in diabetic cardiomyopathy

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**Background and Goal of Study:** Hemodynamic instability is increased in diabetic cardiomyopathy. Atorvastatin is able to restore the positive inotropic effect of  $\beta$ -adrenoceptor stimulation but mechanistic of this restoration is still unclear. We conducted a RNA expression microarray analysis to evaluate the pleiotropic effects of atorvastatin and their influence on the RNA expression in diabetic cardiomyopathy.

**Materials and Methods:** Male Wistar healthy or diabetic rats (by streptozotocin) received orally 50mg.kg<sup>-1</sup>.day<sup>-1</sup> atorvastatin or saline during 15 days (3 by group). We extracted and quantified total RNA from left ventricle samples using Qiagen RNeasy extraction kit and NanoDrop1000, then assessed purity and integrity on Bioanalyzer Agilent (RNA integrity number RIN over 8).

We amplified and labeled RNA by biotin-16-UTP, then hybridized it on an Illumina Rat BeadChip (Ambion, CA, USA). A laser exposure quantified the relative abundance of the RNA retained in each location by the local probe. Quality of normalized data (with BeadStudio Software) was carefully assessed by an unsupervised analysis. In probes with signal exceeding 50% difference with background signal, a difference of 1,5 fold in gene expression and a p value < 0.05 between groups was considered as significant. Interpretation of the results was conducted using Ingenuity Pathway Analysis Software (Ingenuity System®, Redwood, USA).

**Results and Discussion:** More than 620 genes were differently expressed between diabetic and healthy rat left ventricles (286 upregulated and 340 downregulated). Atorvastatin affected the expression of 446 genes in diabetic left ventricles (145 upregulated and 173 downregulated).

We identified 12 genes involved in efficiency of  $\beta$ -adrenergic signaling and significantly modified in diabetic left ventricles treated by atorvastatin compared to non-treated. Modified genes stand at various levels of  $\beta$ -adrenergic signaling as Adenylate Cyclase 4, Phosphodiesterase 2A, Troponin C1, myosin (MYH7B and MYBPHL), endothelial Nitrite Oxide Synthase, RhoKinase 2, Ras (RRAD), Arrestin (ARRDC1), Phospholipase (PLA2G4B and PLA2G5). In contrast, none RNA expression was modify in  $\beta$ -adrenergic signaling pathway between healthy rats treated or not with statin.

**Conclusion:** These results confirm multiple modifications induced by "pleiotropic" effects of atorvastatin in rat diabetic cardiomyopathy compared to healthy rats. Further researches may be performed on RNA and protein expressions.

#### 4AP4-10

##### Hypothermia improves gastric mucosal oxygenation during haemorrhagic shock

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**Background and Goal of Study:** Hypothermia is known to improve tissue function in a variety of different organs during physiological and pathological conditions like haemorrhage [1]. On the other hand, it exerts various negative effects, e.g. reduction of cardiac output and vasoconstriction [1]. The impact of hypothermia on gastric mucosal microvascular oxygenation ( $\mu\text{HbO}_2$ ) during physiological and haemorrhagic conditions is unknown.

**Materials and Methods:** The effects of normothermia (37.5°C, blood temperature) and mild hypothermia (34°C) on  $\mu\text{HbO}_2$  were studied in repetitive experiments on five dogs anaesthetized with sevoflurane. In an additional series dogs underwent haemorrhage (loss of 20% of the estimated blood volume) either during normo- or hypothermia.

Systemic haemodynamics, gastric mucosal microvascular oxygenation (reflectance spectrophotometry) and blood temperature were recorded continuously. Arterial blood was sampled intermittently for blood gas analysis and calculation of systemic oxygen delivery ( $\text{DO}_2$ ).

Data are presented as means  $\pm$  SEM. t-test, p < 0.05

**Results and Discussion:** Hypothermia alone did not influence  $\mu\text{HbO}_2$ . Hypovolaemia strongly reduced  $\mu\text{HbO}_2$  from 76  $\pm$  1 to 51  $\pm$  7% during normothermia; however, this effect was attenuated during hypothermia (from 74  $\pm$  1 to 60  $\pm$  6%).

In contrast, systemic oxygen transport was reduced during haemorrhagic shock without differences between normothermia and hypothermia.

**Conclusions:** Hypothermia does not affect  $\mu\text{HbO}_2$  during physiological conditions, but attenuates the effects of haemorrhage on  $\mu\text{HbO}_2$ . This effect does not result from differences in oxygen delivery and thus mainly depends on regional conditions.

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#### 4AP4-11

##### Effects of hypothermia on gastric mucosal oxygenation during hypoxia

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**Background and Goal of Study:** Hypothermia is known to improve tissue function in a variety of organs even during additional challenges like hypoxia [1]. Since hypoxia reduces gastric mucosal microvascular oxygenation ( $\mu\text{HbO}_2$ ) [2], we analyzed whether hypothermia likewise improves  $\mu\text{HbO}_2$  during hypoxia. Additionally we evaluated the potential role of  $\text{K}^+_{\text{ATP}}$  channels as mediator, known to be involved in vasoregulation during hypoxia [3].

**Materials and Methods:** The effects of hypoxia ( $\text{F}_{\text{O}_2}=0.12$  for 15 minutes) on  $\mu\text{HbO}_2$  during normothermia (37.5°C, blood temperature) and mild hypothermia (34°C) were studied in repetitive experiments on five dogs anaesthetized with sevoflurane. In an additional series during hypothermia, glibenclamide (0.2 mg/kg over 10 minutes) or levosimendan (20  $\mu\text{g}/\text{kg}$  over 15 minutes, followed by continuous infusion of 0.25  $\mu\text{g}/\text{kg}/\text{min}$ ) were administered prior to hypoxia.

Systemic haemodynamics, gastric mucosal microvascular oxygenation (reflectance spectrophotometry) and blood temperature were recorded continuously. Arterial blood was sampled intermittently for blood gas analysis and calculation of systemic oxygen delivery ( $\text{DO}_2$ ).

Data are presented as means  $\pm$  SEM.

**Results and Discussion:** Hypoxia during normothermia reduced  $\mu\text{HbO}_2$  by 27  $\pm$  3 percentage points (pp). During hypothermia reduction was attenuated to 16  $\pm$  3 pp. Additional administration of glibenclamide or levosimendan during hypothermia did not change  $\mu\text{HbO}_2$  compared to hypothermia alone. Hypoxia reduced  $\text{DO}_2$  by -4  $\pm$  0.6 ml/kg/min during normothermia but only by -2  $\pm$  0.3 during hypothermia (p < 0.05).

**Conclusions:** Hypothermia ameliorates  $\mu\text{HbO}_2$  during hypoxia. This effect is related to an increased  $\text{DO}_2$  during hypothermia. Neither glibenclamide nor levosimendan influence this effect.

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#### 4AP5-2

##### Major cardiac and cerebrovascular events in patients with coronary stents undergoing noncardiac surgery.

##### RegistreStents Study, preliminary results

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**Background and Goal of Study:** The aim of this study is to register perioperative management in patients with coronary stents undergoing noncardiac surgery, to describe the incidence of major cardiac and cerebrovascular events (MACCE) and to assess the relationship between these events as well as bleeding complications with the perioperative management of antiplatelet therapy (APT).

**Materials and Methods:** Observational, multicenter and prospective study, approved by the Ethics Committee. All patients with coronary stents undergoing noncardiac surgery with admission from February 2010 to April 2011 were the basis of the study. Demographic data, preoperative active cardiac conditions, clinical risk factors and APT perioperative management were registered and analyzed in relationship to the outcome (in-hospital and up to 3 months after surgery). MACCE: Main cardiac events (Myocardial Infarction (MI), unstable angina and cardiac death) and cerebrovascular events (arrhythmia, heart failure, stroke, transient ischaemic attack) and APT management were registered, bleeding complications and overall mortality were collected as well.  $\chi^2$  test was used to compare qualitative variables and Mann-Whitney to compare quantitative variables.

**Results and Discussion:** We included 222 surgical procedures, 82 % were male, median age was 70.7 years, 154 (69.4%) underwent high-intermediate risk surgery. Preoperative active cardiac conditions were present in 22 (9.9%). Perioperative MACCE were present in 26 (11.7%), cardiac mortality 1 (0.5%) and overall mortality 4 (1.8 %). Bleeding events ( $\geq$  2 packed red cells and/or Hb (Haemoglobin) level decrease > 20g/L, postoperative intracerebral bleeding), global transfusion and postoperative severe anaemia (Hb  $\leq$  95 g/L) were

present in 39.6%, 22.5% and 27.5% respectively. Presurgical APT prescription was present in only 96.5% of them (30.2% dual APT). Perioperative APT was interrupted ( $\geq 5$  days) in 35.7% of procedures. MACCE were related to previous active cardiac conditions (recent MI, arrhythmia), renal failure (GFR  $< 60$  mL/min), proton-pump inhibitors, transfusion and postoperative severe anaemia. Statin therapy was associated to a lower incidence of events.

**Conclusion(s):** This population has high perioperative morbidity and mortality. With our sample size no correlation was found with perioperative APT management and MACCE, neither to haemorrhagic complications and transfusion.

#### 4AP5-3

##### Incidence and risk factors of perioperative cardiovascular complications in patients undergoing thoracic surgery

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**Background and Goal of Study:** Cardiovascular complications account for 13-23% of thoracic patients and these could increase perioperative mortality and morbidity.<sup>(1)</sup> The purpose of this study is to determine the incidence of perioperative cardiovascular complications and identify the preoperative and intraoperative predisposing factors thereto in patients undergoing thoracic surgery.

**Materials and Methods:** A retrospective cohort study of consecutive adult patients undergoing noncardiac thoracic surgery between 2005 and 2010 in a tertiary medical center was performed. Preoperative, perioperative and outcome variables were assessed using standard descriptive statistics. Perioperative mortality is defined as death from any causes within 30 days after the operation. Univariable and multivariable regression analysis were used to identify the associated risk factors.

**Results and Discussion:** During the study period, 76 of the 1,240 patients had cardiovascular complications after thoracic surgery, an incidence rate of 61.3: 1,000 (95% CI: 49.3-76.1). The perioperative mortality was 8.1:1,000 (95% CI: 4.4-14.8). Among the cardiovascular complications, cardiac arrhythmias (33%), hemothorax (21%) and heart failure (16%) were common. Patients with ASA physical status 2 and 3 (RR= 4.3; CI: 1.1-17.9 and RR = 19.1; CI: 2.6 - 137.5 respectively), preoperative coronary artery disease (RR = 3.4; CI: 1.3-8.7) and intraoperative fluid intake of more than 1,500 ml (RR = 1.6; CI: 1.0-2.3) were strong risk factors of postoperative cardiovascular complications.

**Conclusion(s):** The incidence of cardiovascular complications in patients undergoing thoracic surgery was 61.3 per 1,000 anesthetics. Major risk factors were ASA physical status 2 and 3, preoperative coronary artery disease and intraoperative fluid intake of more than 1,500 ml. Identifying preoperative and intraoperative risk factors provides an opportunity to conduct further study in predictive and preventive strategies to improve safety and quality of care.

##### References:

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#### 4AP5-5

##### N-terminal B-type natriuretic peptide versus revised Lee index for the assessment of the perioperative cardiac risk after major non cardiac surgery

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**Background and Goal of Study:** Risk stratification prior to non cardiac surgery relies mostly on clinical risk scores such as the revised cardiac risk index from Lee et al. N-terminal B-type natriuretic peptide (NT-pro BNP) has emerged as powerful tool for risk stratification in a variety of clinical scenarios. Therefore, it was the aim of the present study to evaluate the incremental value of the NT-pro BNP for risk prediction prior to major non-cardiac surgery.

**Materials and Methods:** In this prospective, single centre observational study, 87 patients were enrolled. Inclusion criteria were non emergent major non cardiac surgery, age above 55 years and at least one cardiovascular risk factor. Predefined endpoints were in-hospital mortality, and the combination of death, acute myocardial infarction, cardiac arrest, cardio-pulmonary resuscitation and acute decompensated heart failure. Secondary endpoints were total length of hospital stay and days at intensive care. Blood draw was performed within 4 days prior to surgery. NT-pro BNP was measured with an Elecsys assay.

**Results and Discussion:** From total 87 patients were enrolled, 9 patients (10.34%) deceased and 20 (22.3%) of the patients experienced the combined

end point. Total hospital stay was at median 13 (IQR 6-21) days. 49 (56.32%) did not need intensive care treatment, 21 (24.13%) one day and 17 (19.54%) two and more days at intensive care.

There was a significant association of the Lee index to mortality (0.7% Lee index=0; 2.5% Lee index=1 and 5.0% Lee index  $\geq 2$ ;  $p < 0.001$ ) and combined end point (1.4% Lee index=0; 4.5% Lee index=1 and 9.9% Lee index  $\geq 2$ ;  $p < 0.001$ ). Preoperative levels of NT-pro BNP were elevated in those patients who died as compared to survivors (655 pg/ml vs. 132 pg/ml;  $p < 0.001$ ). In the ROC curve analyses for the prediction of mortality NT-pro BNP was superior to the revised Lee index with an AUC for NT-pro BNP of 0.798 and for the Lee index of 0.622;  $p < 0.001$ .

Similar results were obtained for the combined endpoint, total length of hospital stay and number of days at intensive care.

**Conclusion(s):** NT-pro BNP, a novel cardiac marker, provide strong prognostic information in patients undergoing elective non cardiac surgery incremental to the widely accepted revised cardiac index according to Lee. Implementation of the assessment of NT-pro BNP for risk stratification prior to non cardiac surgery should be recommended.

#### 4AP5-6

##### Risk factors and complications of hyperglycemia in cardiac surgery

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**Background and Goal of Study:** Poor Blood Glucose (BG) control during cardiac surgery has been severally recognized as risk factor for postoperative complications. The present study was designed to investigate which preoperative conditions could impair BG control and which complications could be related to poor BG control during cardiac surgery.

**Materials and Methods:** After ethic committee approval, an observational, prospective study was designed. Patients submitted to cardiac interventions were considered. Demographic data and comorbidities were recorded, as well as preoperative BG. Intraoperative BG values derived from arterial blood gas analysis (AGA). Frequency of AGA was at discretion of the anesthetist in charge. BG values  $> 5.6$  mmol/L (101 mg/dL) were considered as pathologic. Univariate and multivariate regression analysis were employed to identify risk factors for high intraoperative BG and to identify postoperative complications related to this condition. A p values  $< 0,05$  was considered significant.

**Results and Discussion:** 1945 consenting patients were recruited for the analysis: mean age was  $66,1 \pm 10,4$  years, 450 patients were female and 1495 were male. In the univariate analysis, factors associated to intraoperative mean BG  $> 5,6$  mmol/L were: Body Mass Index  $> 30$  ( $p = 0,003$ ; OR 1,51, 1,14-1,99), diagnosis of diabetes ( $p < 0,0001$ ; OR 2,31, 1,59-3,34), preoperative BG  $> 5,6$  mmol/L ( $p < 0,0001$ ; OR 10,63, 7,81-14,47), Cardio-Pulmonar Bypass (CPB) ( $p < 0,0001$ ; OR 6,24, 4,16-9,37). In the multivariate analysis, preoperative BG  $> 5,6$  mmol/L and CPB resulted significantly associated to intraoperative BG  $> 5,6$  mmol/L (OR 10,08,  $p < 0,0001$  and OR 2,49,  $p < 0,0001$ , respectively). In the postoperative period, 321 patients (16,5%) developed cardiac failure; 415 (21,3) developed infections; 158 (8,1%) developed acute renal failure (ARF). In the univariate analysis, intraoperative BG  $> 5,6$  mmol/L resulted significantly associated to cardiac failure ( $p < 0,0001$  and OR 1,9, 1,33-2,71). ARF was only slightly associated ( $p = 0,074$ ; OR 1,53, 0,96-2,44).

**Conclusion(s):** As already reported, the present data confirmed the association between intraoperative hyperglycemia and cardiac failure. ARF was just marginally associated and there was no association with infections. Intraoperative hyperglycemia resulted associated with morbid obesity and preoperative hyperglycemia (stronger than previous diagnosis of diabetes). Role of CPB as risk factor for intraoperative hyperglycemia was confirmed.

#### 4AP5-7

##### Expanding indications of thoracic aortic aneurysms, the revised Cardiac Risk Index, and outcomes after TEVAR and hybrid procedure in high risk patients

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**Background and Goal of Study:** Since thoracic endovascular aortic repair (TEVAR) was established in 1993, as well as hybrid procedures which combine both open and endovascular techniques were first reported in 1999, some outcome reviews have been reported.

It has been shown that hybrid procedures reduce morbidity and mortality in high-risk patients who are not candidates for conventional open repair. Pa-

tients with thoracic and thoracoabdominal aortic aneurysm often major comorbidities, such as hypertension, diabetes, coronary artery disease and/or chronic kidney disease which have a significant impact on outcome. We hypothesize that the major comorbidities influence operative mortality rates and may cause severe complications during hybrid procedures with TEVAR.

**Materials and Methods:** The data was retrieved from 161 patients who underwent TEVAR and hybrid procedure operation for thoracic aortic aneurysms at the Jikei University hospital during the period from November 2006 to October 2010. Hybrid procedure patients were divided into 2 groups with the revised cardiac risk index (RCRI).

**Results and Discussion:** TEVAR itself was performed in patients with descending aortic aneurysm. Combination of open surgery and TEVAR was performed in patients with arch and distal arch aneurysms; prior total arch replacement+elephant trunk, total debranching and carotid-carotid artery bypass. Overall 30-day mortality of hybrid procedure was 12.2%. Those of TEVAR was 2.5%. Risk factors for early death were RCRI score, tobacco use, and hypertension. Overall 1-year mortality, including early deaths, of hybrid procedure was 26.8%. In arch and distal arch aneurysm cases, perioperative mortality, postoperative complication (incidence of stroke and paraplegia, endoleak) and hospital stay after TEVAR were not low especially in patient who had high risk preoperatively.

**Conclusions:** Usage of TEVAR and hybrid procedure with TEVAR appears safe and effective for high-risk patients who are not candidates for conventional open repair.

However, hybrid procedure for higher risk patients did not show a significant improvement in postoperative complications and outcomes as compared to low-risk patients. Preoperative major comorbidities may influence operative mortality rates and survival rates in hybrid procedures with TEVAR.

#### 4AP5-8

##### ASA PHYSICAL classification SYSTEM, Lee Risk Index, and a modified Customised Probability Index as predictors of mortality and morbidity in patients undergoing vascular noncardiac surgery

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**Background and Goal of Study:** Vascular surgery is associated with substantial perioperative and long-term mortality and morbidity. The aim of this study was to assess the short- (30 days) and long-term (2 years) prognostic value of ASA Physical Classification System, Lee Risk Index, and a Modified Customised Probability Index (CPI mod) for mortality and morbidity in patients undergoing vascular noncardiac surgery.

**Materials and Methods:** Patients undergoing elective or emergency vascular noncardiac surgery were evaluated preoperatively using above indices and were followed up for 2 years. Both mortality and morbidity (myocardial infarction, atrial fibrillation, ventricular arrhythmias, heart failure, stroke) during that period of time were recorded. Statistics: Fisher's exact test and ROC curve analysis.

**Results and Discussion:** 441 consecutive patients (mean age 68,87 years), who underwent surgery due to abdominal aortic aneurysm, carotid stenosis and peripheral vascular disease, were studied. The hospital ethics committee approved the study protocol and all participants provided their consent. The mortality and morbidity for all patients were 4.53% and 25% at 30 days and 12.99% and 49.7% at 2 years respectively.

Significant differences in patient outcomes were observed in relation to the nature (open vs endovascular) and urgency of surgery. All risk indexes, predicted for the total number of vascular surgeries 30 days- and 2 years-mortality and morbidity in our patients, with CPI mod being the best predictor. In elective endovascular abdominal aortic aneurysm repairs (EVAR), no scale predicted 30 day-mortality, while CPI mod was the only 2 years-mortality predictor. In urgent EVARs, ASA classification failed completely to predict either mortality or morbidity, while the best predictor was still CPI mod. In elective open abdominal aortic aneurysm repairs, CPI mod was the only 30 days- and 2 years-mortality predictor. In patients who underwent peripheral vascular surgery, CPI mod and Lee Risk Index predicted 30 days-mortality, and only Lee Risk Index 2 years-mortality. No scale was able to predict morbidity in these patients.

**Conclusion(s):** In comparison, CPI mod was proved superior in predicting outcome. In addition to other risk indexes, CPI mod predicts in elective open abdominal aortic aneurysm repairs 30 days- and 2 years-mortality, in elective EVARs 2 years-mortality and morbidity and in peripheral vascular surgeries 30 days-mortality.

#### 4AP5-9

##### Predictors of asymptomatic hemodynamically significant carotid stenosis in patients undergoing coronary artery bypass grafting

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**Background and Goal of Study:** The prevalence of hemodynamically significant carotid stenosis in patients with coronary artery disease(CAD) varies from 17% to 22%. Almost a third of post Coronary Artery Bypass Grafting(CABG) strokes is related to carotid stenosis, either symptomatic or asymptomatic. Timely diagnosis and adequate treatment of carotid stenosis could prevent unwanted perioperative events. The goal of our study was to evaluate the incidence of asymptomatic hemodynamically significant carotid artery stenosis in patients(pts)undergoing CABG and to estimate correlation between the degree of CAD and clinical factors in identifying asymptomatic preexisting carotid artery stenosis.

**Materials and Methods:** Two hundred patients asymptomatic of carotid stenosis that underwent CABG procedure at our Clinic were retrospectively evaluated. Pre-operative Color Doppler Ultrasound of carotid arteries was performed in all patients. Patients were divided on those with carotid artery stenosis < 50%, characterized as hemodynamically insignificant and those with carotid artery stenosis ≥50%, characterized as hemodynamically significant. We compared the frequency and distribution of common risk factors for atherosclerosis (hypertension, diabetes, hypercholesterolemia, hypertriglyceridemia, obesity, heritance, smoking), and the level of CAD in both groups of pts as well as their possible predictive value of the asymptomatic carotid stenosis. We used methods of descriptive and analytical statistics.

**Results and Discussion:** 15 pts(7.5%) had asymptomatic hemodynamically significant carotid artery stenosis. In 40% of these pts left main coronary artery(LMCA) stenosis was found, while in the group of pts without hemodynamically significant carotid artery stenosis LMCA stenosis was found in 7% of pts. Male gender (82,5%) was predominant( $p < 0.001$ ). Patients with asymptomatic hemodynamically significant carotid stenosis were significantly older ( $62.6 \pm 7.68$ ) than pts with hemodynamically insignificant carotid stenosis ( $57.79 \pm 9.58$ ) ( $p = 0.05$ ). Common risk factors for atherosclerosis were not identified as potential markers of carotid stenosis.

**Conclusion:** Our findings show that older age and LMCA stenosis could be considered as predictors of the presence of asymptomatic carotid artery stenosis in pts undergoing CABG, and in these patients adequate prophylactic and therapeutic measures should be undertaken both preoperatively and perioperatively.

#### 4AP5-10

##### Performance of logistic EuroSCORE and EuroSCORE II in off-pump coronary artery bypass grafting: a single-center cohort analysis

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**Background and Goal of Study:** The logistic European System for Cardiac Operative Risk Evaluation (EuroSCORE) model was designed to predict mortality after cardiac surgery. EuroSCORE (ES) II has recently been developed and to our knowledge there are no studies assessing its performance. The aim of this study was to evaluate and compare ES II and logistic ES predictive performances on postoperative mortality in a cohort of patients submitted to off-pump coronary artery bypass grafting (OPCABG) at our institution.

**Materials and Methods:** Medical records of patients submitted to OPCABG between 1 January 2010 and 31 December 2010 were retrospectively collected. In all patients the ES was calculated based on preoperative risk factors and postoperative in-hospital mortality by logistic ES and ES II models.

The discrimination and calibration of both models were assessed through the area under the receiver operator characteristic (ROC) curve and the goodness-of-fit test of Hosmer and Lemeshow (HL), respectively. The predictive ability of both models was also assessed by the mean estimated-to-observed mortality ratio (E/O).

Correlation was determined using Pearson's correlation coefficient. A two-tailed P value < 0.05 was considered significant.

**Results and Discussion:** Two hundred seventy six patients were included (mean age  $66.2 \pm 9.4$  years, 77.2% men). The area under ROC curve for prediction of mortality was 0.805 (95% confidence interval [CI] 0.686-0.924;  $P = 0.0003$ ) for logistic ES and 0.802 (95% [CI] 0.651-0.954;  $P = 0.0004$ ) for ES II.



Both logistic ES and ES II models showed good calibration in predicting in-hospital mortality (HL:  $P = 0.713$  and  $P = 0.709$  respectively).

The logistic ES (adjusted OR 1.08; 95% [CI] 1.01-1.14;  $P = 0.024$ ) and the ES II (adjusted OR 1.25; 95% [CI] 1.05-1.54;  $P = 0.015$ ) were independently associated with increased risk for death.

The mean E/O mortality ratio was 1.66 for logistic ES and 0.73 for ES II.

Pearson's correlation coefficient showed strong correlation between logistic ES and ES II ( $r = 0.830$ ;  $P < 0.001$ ).

**Conclusion(s):** Both logistic EuroSCORE and EuroSCORE II models were good predictors of in-hospital mortality. EuroSCORE II provided good discrimination and calibration ability for in-hospital mortality. The EuroSCORE II seems to be a useful model to estimate the risk of in-hospital mortality after OPCABG at our institution.

#### 4AP5-11

##### Risk factors for the development of haemodynamic side effects during non-cardiac surgeries

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**Background and Goal of Study:** It is essential for the daily practice to recognize the general profile of the patients submitted to non-cardiac surgeries, as well as to understand the risk factors for the development of haemodynamic side effects during the procedure. The Anesthesiology Research Group of the Federal University of São Paulo analyzed the relationship between patient's and procedure-related features and the occurrence of such complications.

**Materials and Methods:** This retrospective study was undertaken in a university hospital in São Paulo (Brazil) throughout a period of 18 months. Anesthesia reports, which were inaccurate or incomplete, were excluded from the analysis. Nonparametric data are reported as median and quartile and Spearman's correlation coefficient was employed. Parametric data are expressed as absolute and relative frequency and compared through Pearson's test. The alpha risk was considered to be  $\leq .05$  chance of committing a type one error.

**Results and Discussion:** From a total of 19,029 anesthesia performed, 13,174 reports (69.2%) were considered suitable for the analysis. The prevalence of haemodynamic events was: hypotension 8.1%, hypertension 1.1%, bradycardia 1.1%, tachycardia 0.7% and other arrhythmias 0.4%. The median age of the patients who developed haemodynamic instability was 51 (32 - 66) years compared to 33 (15 - 52) years of those who did not develop such complications ( $p < .0001$ ).

Other factors were also associated with the occurrence of haemodynamic side effects when a multivariate analysis was carried out ( $p < .05$ ): P3 physical status (OR = 1.97; CI95% 1.34 - 2.90), vascular surgery (OR = 2.20; CI95% 1.29 - 3.78), the attending physician being a second year resident (OR = 2.17; CI95% 1.66 - 2.83) and the use of opioids for spinal block technique (OR = 1.77; CI95% 1.31 - 2.41).

Understanding the factors associated with increased risk for haemodynamic events during non-cardiac surgery allows for better preparation and helps to prevent major complications, thus reducing morbidity and mortality related to surgical procedures.

The main haemodynamic side effect observed in our study was hypotension.

**Conclusion(s):** The main risk factors for haemodynamic side effects identified in our study were: P3 physical status, vascular surgery, the use of opioids for spinal block and the attending physician being a second year resident.

#### 4AP6-1

##### Impact of sodium bicarbonate administration and N-acetylcysteine on the prevention of contrast media-induced nephropathy in endovascular aortic aneurysm repair

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**Background and Goal of Study:** Contrast-induced nephropathy (CIN) can contribute to postoperative renal failure in patients undergoing endovascular aortic aneurysm surgery. The only proven strategy to prevent it is volume expansion, but the type of infusion to use is not clear.

Our goal was to evaluate the efficacy of sodium bicarbonate, compared to sodium chloride, to reduce the incidence of postoperative renal failure.

**Materials and Methods:** We conducted a prospective, double-blinded, randomized study in patients presenting for endovascular aortic aneurysm surgery. Patients received an infusion of sodium bicarbonate 150 MEq/L or NaCl 0.9%: 3 ml/kg over 1 h then 1 ml/kg/h until 6 h after the end of surgery. All

patients received N-acetylcysteine for 48 h (150 mg/kg iv then orally 2400 mg/day). The primary end point, CIN, was serum creatinine elevation beyond 25% of baseline 48 h postoperatively. Early biomarkers of renal injury were measured from urine (interleukin-18 (IL-18), neutrophil gelatinase-associated lipocalin (NGAL), N-acetyl- $\beta$ -D-glucosaminidase (NAG), kidney injury molecule 1 (KIM-1)) and blood (NGAL, cystatin C) specimens.

**Results and Discussion:** 34 patients (17 in each group) were included. The mean age for the cohort was  $73.8 \pm 6.3$  yrs and 83% were men. The Mehran risk score for developing CIN was 5.1 (predicting a 7.5% risk of CIN) and comparable between groups ( $p = 0.34$ ). CIN occurred in 1 patient (2.9%) in the bicarbonate group: difference 5.88%, 95% confidence interval [CI] -5.3% to 17.06%,  $p = 0.31$ . Baseline levels of cystatin C, NGAL, IL-18, NAG and KIM-1 were not different between groups. IL-18, NAG and KIM-1 significantly rose after exposure to contrast media. Furthermore, there was a significantly greater rise in NGAL and IL-18 after 3 h in the bicarbonate vs. sodium chloride group: 1115% vs. 240% increase ( $p = 0.03$ ) and 338% increase vs. 1.4% decrease ( $p = 0.01$ ), respectively.

**Conclusion:** Despite significant elevation in biomarkers of renal injury, we observed a low rate of renal failure following endovascular aortic surgery and exposure to contrast media, regardless of either bicarbonate or sodium chloride administration for volume expansion. The significance of these changes remains to be determined.

#### 4AP6-2

##### Dopamine infusion and crystalloids administration improve renal function during laparoscopic surgery

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**Background and Goal of Study:** Few studies have documented the influence of high intraabdominal pressure on renal function during laparoscopic procedures. In the present study, we aimed to evaluate the effects of a low dose of dopamine infusion and of a different amount of infused solutions on renal function during Pneumoperitoneum.

**Materials and Methods:** Thirty ASA I patients undergoing laparoscopy for ovarian cysts were randomly assigned to three groups. A control group (A) was given saline 5 ml/kg/h, a dopamine group (B) received dopamine 3 mcg/kg/min and saline 5 ml/kg/h, and patients belonging to group C received saline 10 ml/kg/h.

General anesthesia was managed with continuous infusion of Remifentanyl (0.15-0.25 mcg/kg/min) and Sevoflurane (MAC 1) and standardized for all patients. Arterial pressure, heart rate, vasopressin levels, total intraoperative diuresis and estimated glomerular filtration rate (eGFR) assessed by the modification of diet in renal disease (MDRD), were measured.

**Results and Discussion:** Arterial pressure and heart rate were higher in groups B and C than those in the control group (A) [ $p > 0.05$ ]. Baseline pre-operative values of ADH hormone were similar for all patients, but its intraoperative levels were significantly increased only in control group (A) [ $p = 0.004$ ]; no significant differences among groups B and C were found.

Total intraoperative diuresis resulted impaired in the control group (A) and improved in group C.

Furthermore, we found that Pneumoperitoneum negatively affected the renal function only in group A, as eGFR significantly decreased [ $p = 0.003$ ].

**Conclusion(s):** Our findings suggest that a low rate of saline infusion per hour could result in an impaired renal function during laparoscopy at 12 mmHg of intraabdominal pressure. This could be prevented by increasing the infusion of crystalloids or by using Dopamine infusion. Moreover, this condition seems to be related to a reduction of vasopressin levels in the blood.

eGFR: estimated glomerular filtration rate; TID: total intraoperative diuresis; ADH: anti-diuretic hormone; PO: plasmatic osmolarity; pre-Pnp: before Pneumoperitoneum; post-Pnp: 30 minutes after Pneumoperitoneum

	GROUP A		GROUP B		GROUP C	
	pre-Pnp	post-Pnp	pre-Pnp	post-Pnp	pre-Pnp	post-Pnp
eGFR (ml/min/1.73m <sup>2</sup> )	86	65	88	84	82	81
TID (ml)	400		650		730	
ADH (pmol/L)	2,6 $\pm$ 3	20,5 $\pm$ 4	2,5 $\pm$ 1	6,3 $\pm$ 3	2,5 $\pm$ 2	5,4 $\pm$ 3
PO (mmol/L)	292,8 $\pm$ 2	307,4 $\pm$ 4	289 $\pm$ 3	291 $\pm$ 2	288,9 $\pm$ 2	292,3 $\pm$ 2

[Table 1]

#### 4AP6-3

##### Prediction of fluid responsiveness by dynamic preload indices in patients undergoing major hepatic resection

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**Background and Goal of the Study:** Dynamic preload indices, based on the arterial pressure waveform (APW; semi-invasive) or on the plethysmographic waveform (PW; non-invasive) are increasingly used to assess fluid responsiveness. We compared the ability of the commercially available APW-based stroke volume variation (SVV) and the PW-based plethysmographic variability index (PVI) with self-calculated dynamic indices to predict fluid responsiveness in patients undergoing major hepatic resection.

**Materials and Methods:** After local IRB approval, 30 patients were included. Patients received a fluid bolus (FB) of 15 ml/kg in 30 minutes after completion of resection and were considered responders when stroke volume index (SVI) increased > 20 % above pre-FB values. SVV and SVI were measured by the FloTrac-Vigileo system (Edwards Lifesciences, Irvine, USA), PVI by the Masimo Radical 7 pulse co-oximeter® (Masimo Corp, Irvine, USA). The APW and PW were recorded using RugLoop software (Demed, Temse, Belgium) for calculation of APW-based systolic pressure and pulse pressure variation (SPV, PPV) and PW-based variation in peak amplitude (PWV<sub>peak</sub>) and pulse amplitude (PWV<sub>pulse</sub>) using an automated algorithm. Areas under the ROC curve (AUROC) were calculated to assess the ability of all indices to predict fluid responsiveness and to assess the optimal cut-off value.

**Results and Discussion:** 17/30 patients were fluid responsive. Mean SVI increased from 36 (12) to 45 (13) ml/m<sup>2</sup>.

ROC analysis revealed an AUROC for the APW based SVV, SPV and PPV of 0.81, 0.75 and 0.77 and for the PW based PVI, PWV<sub>peak</sub> and PWV<sub>pulse</sub> of 0.78, 0.87 and 0.77, respectively. Optimal cut-off values with associated sensitivity and specificity are shown in table 1.

	Cut-off value (%)	Sensitivity (%)	Specificity (%)
SVV	15	70	92
SPV	8	88	62
PPV	14	88	62
PVI	12	82	77
PWV <sub>pulse</sub>	21	70	85
PWV <sub>peak</sub>	12	88	77

[Table 1]

**Conclusion:** All investigated semi- and non-invasive dynamic preload indices are able to predict fluid responsiveness with similar sensitivity and specificity in patients undergoing major hepatic resection. However, the differences in cut-off values of the various dynamic preload indices should be acknowledged.

#### 4AP6-4

##### Implementation of goal-directed protocol in elderly patients undergoing femoral fracture repair

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**Background and Goal of Study:** Femoral fracture repair (FFR) is one of the most commonly performed major orthopedic operations in population aged over 65 years. Usually patients in this age carry co-morbidities that lead to severe complications. Strategies that may limit morbidity and mortality are therefore desired. Excessive or reduced fluid administration intraoperative provokes tissue oedema or hypoperfusion respectively. Goal Directed Therapy (GDT) is the targeted administration of intravenous fluids, blood and vasoactive agents, which is considered to reduce mortality. This randomized, single-blinded study was designed to evaluate the clinical impact of GDT performance in patients undergoing FFR under spinal anesthesia.

**Materials and Methods:** Twenty patients 65-92 years old, ASA II-III, were randomized to either the control (CTRL) group or to the protocol (GDT) group. Patients in the GDT group in addition to the standard monitoring were connected to the FloTrac/Vigileo (Edwards) hemodynamic monitoring system in order to measure cardiac output and a GDT was used to maximize the stroke volume.

**Results and Discussion:** There were no statistically significant intergroup differences in age, gender, surgery time, or preoperatively assigned P-POSSUM scores. Patients randomized to the control group had a greater fluid balance during the intraoperative period (2148±948mL vs. 1302±410mL, p=0.018) and more patients received ephedrine (CTRL 6/10 vs GDT 4/10). They also

received more blood during the intraoperative period (CTRL1800mL vs 300 mL) and the postoperative period (3/10 vs 1/10 CTRL 900 vs GDT 300 ml). At the end of the procedure the base excess for the CTRL group was -1.28±2.29 when for the GDT group was 0.82±1.39, p=0.023). The mean duration of hospital stay was reduced about one day in the GDT group (7.1± 0.739 days) compared to the control group (8±1.05 days, p=0.04).

**Conclusion(s):** GDT therapy under hemodynamic monitoring of cardiac output using pulse contour analysis changes the intra-operative fluid management, reduces length of hospital stay and may improve outcome.

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#### 4AP6-5

##### Hydroxyethyl starch in patients undergoing craniotomy in sitting position

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**Background and Goal of Study:** Cerebral perfusion pressure is jeopardized without optimal fluid administration during neurosurgery in the sitting position. Therefore we studied whether stroke volume directed administration of hydroxyethyl starch (HES 130 kDa/0.4) maintains haemodynamics better than Ringer's acetate (RAC). Possible coagulation disturbances were analyzed by thromboelastometry.

**Materials and Methods:** Thirty elective neurosurgical patients were randomized to receive either HES (HES group) or RAC (RAC group) in a goal directed fashion. After induction of standardized general anaesthesia stroke volume (SV), measured by arterial pressure waveform analysis, was maximized before placement in the sitting position. The first dose of 200ml was followed by boluses of 100ml until SV did not increase over more than 10%. SV was maintained during surgery by repeated administration of either study fluid. RAC 3ml/kg/h was infused in both groups during surgery.

**Results and Discussion:** Twenty-eight craniotomy-patients completed the study. The decrease in the cerebral mean arterial pressure was not different between the groups in the sitting position. Cardiac and stroke volume indexes (CI, SVI) increased in the HES group (P< 0.05) but not in the RAC group (N.S). During the sitting position, the mean (SD) cumulative volume of HES or RAC was 343 (94) ml or 450 (156) ml at 30 min (P=0.036), 371 (114) ml or 538 (257) (0.036) ml at 60 min, and 464 (284) ml or 707 (425) ml (P=0.087) at the end of surgery, respectively. The intraoperative fluid balance was more positive in the RAC than in the HES group (P=0.044, 95% confidence interval -978/ -14). Neither coagulation profile nor blood loss was different between the groups.

**Conclusion(s):** Fluid filling with HES boluses did not prevent hypotension but resulted in a positive response in CI and SVI during craniotomy in the sitting position. The 34% smaller administered volume of fluid, and less positive fluid balance in the HES group may decrease the consequences of excessive fluid administration in craniotomy patients.

#### 4AP6-6

##### Acute kidney injury in patients undergoing off-pump coronary artery bypass grafting: a single-center cohort analysis

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**Background and Goal of Study:** Acute kidney injury (AKI) is one of the major complications following cardiac surgery and is associated with increased morbidity and mortality.<sup>1</sup> The aim of this study was to characterize the incidence, risk factors and the impact of AKI in postoperative in-hospital mortality and major morbidity (defined by deep sternal wound infection, sepsis, pneumonia, stroke, intra-aortic balloon pump, myocardial infarction and severe dysrhythmias) of patients submitted to off-pump coronary artery bypass grafting (OPCABG).

**Materials and Methods:** Medical records and laboratory data of patients submitted to OPCABG from 1 January 2010 to 31 December 2010 were retrospectively reviewed. AKI was defined as an increase in admission serum creatinine (Scr) of at least 50% within the first week after surgery or/and an increase in Scr of at least 0.3 mg/dl within a timeframe of 48h. Multivariate regression analysis was used to determine independent predictors of AKI. T-Student test and Chi-square test were used for continuous and categorical variables, respectively. A two-tailed P value < 0.05 was considered significant.

**Results and Discussion:** Two hundred seventy six patients were studied (mean age  $66.2 \pm 9.4$  years; 214 male; 265 Caucasian; mean EuroSCORE II  $2.1 \pm 2.2$ ). One hundred five patients (38%) developed AKI within the first week following surgery. The incidence of AKI requiring renal replacement therapy was 2.5% ( $n=7$ ).

After adjusting for other covariates, admission SCr (adjusted odds ratio (OR) 5.9; 95% confidence interval [CI] 2.5-14.4;  $P < 0.0001$ ) and peripheral vascular disease (adjusted OR 2.0; 95% [CI] 1.1-3.6;  $P = 0.016$ ) were independently associated with increased risk for AKI.

There was no statistically significant difference between patients complicated with AKI compared to patients without AKI, regarding postoperative in-hospital mortality ( $P = 0.235$ ) and major morbidity ( $P = 0.974$ ).

**Conclusion(s):** In our study there was a high incidence of AKI in patients submitted to OPCABG. There was no increased in-hospital mortality or major morbidity in AKI versus no AKI patients. Admission SCr and peripheral vascular disease were risk factors for postoperative AKI.

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## 4AP6-7

### The effect of cyclosporine on rats submitted to hyperglycemia and renal ischemia under anesthesia with isoflurane or propofol

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**Background and Goal of Study:** Perioperative hyperglycemia is a morbidity and mortality predictor. The purpose of this investigation was to evaluate the effect of cyclosporine A (CsA) on renal ischemia/reperfusion injury (IRI) during transient hyperglycemia

**Materials and Methods:** After approval by IRB, rats were randomly assigned to six groups of six animals each: HISO (isoflurane = Iso + IRI); HP (Propofol = Prop + IRI); HISO CsA (Iso + IRI + CsA); HP CsA (Prop + IRI + CsA); SISO (Sham - Iso); SP (Sham - Prop). The animals received  $1 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  (equivalent to  $0.16 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  in humans) of either propofol (HP, HP CsA and SP) or isoflurane (HISO, HISO CsA and SISO). Hyperglycemia was induced by injecting  $2.5 \text{ g} \cdot \text{kg}^{-1}$  of glucose solution intraperitoneally for all groups.  $5 \text{ mg} \cdot \text{kg}^{-1}$  of cyclosporine was injected i.v. 5 min before reperfusion in groups HISO CsA and HP CsA. Both sham groups underwent right nephrectomy and hyperglycemia induction only. The other groups were submitted to left renal ischemia for 25 minutes. Serum creatinine levels were determined before (T1) and after 25 minutes of ischemia (T2). Twenty-four hours later (T3), blood collection and left kidney removal were performed for histological analysis by using a tubular injury score system (0 - 5 = injury maximum). In addition, cells from the left kidney were evaluated for apoptosis by flow cytometry (FCM) as a % of initial apoptosis (APTi), necrosis and viable cells (VC).

**Results and Discussion:** Serum creatinine (mg/dL) was statistically different ( $p < 0.0001$ ) at T3 in: 1. Group HISO ( $5.08 \pm 0.76$ ) versus others groups. 2. Groups HP ( $4.23 \pm 0.50$ ), HISO CsA ( $4.50 \pm 0.85$ ) and HPCsAvv ( $4.19 \pm 0.96$ ) were statistically different in comparison with SISO ( $0.65 \pm 0.10$ ) and SP ( $0.85 \pm 0.10$ ). Histological examination showed that groups SISO (0[0;0]) and SP (0[0;0]) were significantly different ( $P < 0.001$ ) from groups HISO (4.0[3;4]), HP (3[3;4]), HISO CsA (3[3;4]) and HPCsA(3[3;4]). FCM showed that APTi in groups HISO ( $86.29 \pm 8.98$ ) and HP ( $79.28 \pm 11.44$ ) were statistically different ( $p < 0.001$ ) as compared with groups HISO CsA ( $21.23 \pm 17.53$ ), HPCsA ( $15.06 \pm 11.26$ ), SISO ( $9.88 \pm 6.62$ ) and SP ( $10.33 \pm 5.26$ ). Necrosis cell percentage was higher in HP ( $p < 0.02$ ). VC percentage was statistically lower ( $p < 0.0001$ ) in groups HISO and HP.

**Conclusion(s):** CsA showed protection against IRI in the hyperglycemic groups by flow cytometry.

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## 4AP6-8

### Preoperative aspirin therapy and acute renal failure in patients undergoing CABG and/or valve surgery

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**Background and Goal of Study:** Acute renal failure (ARF) is a common postoperative complication and has significant impact on survival in cardiac surgery patients. Thus far, there is lack of an effective therapy to prevent it.

**Materials and Methods:** An observational cohort study was performed on consecutive patients ( $n= 5406$ ) receiving cardiac surgery in two university medical centers in the United States from 2001 to 2011. The exclusion of the patients were those with preoperative renal failure, preoperative last creatinine  $>2.0 \text{ mg/dL}$ , preoperative anticoagulants, ADP inhibitors, Gp IIb/IIIa inhibitors, antiplatelets, unknown aspirin use or other type cardiac surgery except CABG, valve or CABG plus valve surgery. Primary outcome is ARF, defined as increase of serum creatinine to  $> 2.0 \text{ mg/dL}$ , and 2 x most recent preoperative creatinine level, or a new requirement for dialysis postoperatively.

**Results and Discussion:** Of all patients, 3216 patients met the inclusion criteria and were divided into two groups: those taking ( $n=2243$ ) or not taking ( $n=973$ ) aspirin within 5 days preceding surgery. The groups did not differ significantly in baseline parameters including body mass index, smoking and chronic lung disease. Patients in the aspirin group were sicker and old, including more with hypertension, diabetes, peripheral arterial disease, previous myocardial infarction, angina, congestive heart failure, cerebrovascular disease, coronary artery disease (CAD), multiple and left main CAD. And the patients in the aspirin group were also found more with preoperative using beta-blockers and rennin-angiotensin system inhibitors but spent less time in bypass perfusion and cross-clamping. With multivariate logistic regression adjusted with propensity scores, however, the results of this study showed that preoperative aspirin therapy is associated with a significant decrease in the incidence of postoperative renal failure (3.8% vs. 6.4%, OR 0.526, 95% CI 0.319-0.811,  $P=0.006$ ) in the patients undergoing cardiac surgery. Other independent risk factors for postoperative ARF are diabetes, hypertension, cerebrovascular and peripheral vascular disease, congestive heart failure and multiple CAD (OR from 1.714 to 4.264, respectively).

**Conclusion(s):** The results of this study showed that preoperative aspirin therapy is associated with a significantly reduction in postoperative renal failure in the patients without preoperative renal failure undergoing CABG and/or valve surgery.

## 4AP6-9

### More fluid administration may be needed in mild- to moderate-risk patients receiving spine surgery in prone position

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**Background and Goal of Study:** Prone position can cause many physical changes, including decreasing cardiac output, stroke volume, and heart rate. Appropriate fluid administration could improve cardiac output, shortening hospitalization, and decrease mortality. In order to archive "optimal" strategy, continuous monitoring volume status in prone position in major surgery is important. The aim of our study was to evaluate whether patients using SVV (stroke volume variation) guided therapy to optimize fluid therapy and cardiac output improves clinical outcomes in prone position surgery during general anesthesia.

**Materials and Methods:** We reviewed patients receiving major spine surgery in prone position in orthopedics department from January to October in 2011. There were 145 patients enrolled according to inclusion criteria: ASA=2,3 and surgical time last over 180 minutes. Patient's characteristics (ASA, age, weight, height) and volume status (infusion volume, fluid type, blood loss, urine output, surgical time, dose of vasopressor) were recorded, and (V/T) infusion volume - milliliter per minute, (U/T) urine output - milliliter per kilogram per minute were used for correcting different surgical duration. Patients were classified into using SVV and not using SVV(nSVV).

**Results and Discussion:** The patient's characteristics and most of volume status parameters were not significant difference between two groups. However, the crystalloid volume, total volume not including blood products, and V/T were found significant higher in SVV group. It indicated that patient needed more volume in prone position during major spine surgery than we expect. Although our data showed that SVV group was not superior than nSVV in U/T. As we know, the clinical outcome should not be judged by one or two parameters, however, U/T may be the most easiest way to affect the decision of intraoperative fluid administration. For postoperative complications (PONV, pain, facial injury, ocular injury, mortality), no difference were found between two groups.

**Conclusion(s):** Our study could not show direct evidence of better outcome by using SVV in major spine surgery with prone position in more critical illness patients, however, the recommendation of fluid administration should be more "generous" in this situation.

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#### 4AP6-10

##### Impaired stroke volume response after liver graft reperfusion as a predictor of early major cardiovascular events and outcome in cirrhotic patient undergoing liver transplantation

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**Background:** Cirrhotic cardiomyopathy is defined as subnormal systolic and diastolic ventricular response to stress. Liver transplant (LT) stresses the heart mainly after graft reperfusion. Acute preload increase may unmask the latent myocardial dysfunction. The aim of this retrospective study was to assess the impact of liver cirrhosis on left ventricular function after liver graft reperfusion and to correlate those data with outcome.

**Methods:** 343 consecutive cirrhotic patients submitted to LT, without known cardiovascular disease, were analyzed. Pre-transplant data included: Demographic, clinical, echocardiography, systemic and hepatic hemodynamic data. Donor risk score was also recorded. Myocardial dysfunction was considered when, after graft reperfusion, stroke volume index increase ( $\Delta$ SVI) was  $\leq 15\%$  of baseline value (non-responder).

All patients were managed with pulmonary artery catheter and cardiac output was obtained by termodilution technique. Major cardiovascular (CV) events following LT and outcome, were recorded.

**Results:** Abnormal cardiac response was present in 199 patients (58%). Non-responder (NRG) showed higher: MELDs ( $p < 0.05$ ), alcohol etiology ( $p = 0.004$ ), hyperdynamic stated and hepatic vein pressure gradient ( $p < 0.01$ ) compared with responders (RG). Echocardiographic data at rest showed that structural and functional abnormalities occur to a similar degree in both groups, only left atrial diameter was higher in NRG ( $p < 0.005$ ).

After reperfusion, a significant higher percentage of non-responder needed high doses of vasoactive drugs (NRG: 39% vs RG:10%,  $p = 0.003$ ). The multivariate logistic regressions analysis found alcoholic etiology (OR: 2.69; 95% CI: 1.36 - 5.31;  $p = 0.004$ ) and SVRI (OR: 1.89, 95% CI: 1.05 - 3.40;  $p = 0.033$ ) to be independent predictors of non-responder.

Outcome: 26 patients (7.6%) develop major CV events and 4 patients died (1.1%). A multivariate Cox regression analysis showed the occurrence of non-response as the sole independent variable significantly associated with major CV events (HR = 3.84, 95% CI: 1.87 - 5.72,  $p = 0.031$ ). No differences were found in one, three and five year survival rates comparing non-responder and responder patients.

**Conclusions:** The inability to  $\Delta$ SVI  $> 15\%$  after graft reperfusion occurs in up to 55% of cirrhotic patients, been higher in alcohol etiology. Non-responders have higher risk of develop major cardiac events but a direct relation between the etiology and patient survival could not be established.

#### 4AP6-11

##### Transoesophageal doppler-guided fluid management in massive obstetric hemorrhage

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**Background:** Obstetric hemorrhage is the principal cause of maternal mortality. Aggressive fluid therapy is mandatory. Vasoactive treatment is also employed.

**Case report:** A pregnant woman presenting placenta percreta was scheduled for caesarean section (CS). After epidural anesthesia, intra-arterial balloons were placed and CS was started. After delivery, a massive bleeding began. Intra-arterial balloons were inflated, without efficacy. General anesthesia was induced. Sequentially, it was realized: a subtotal hysterectomy, an arterial embolization, a total hysterectomy with vesical repair.

Meanwhile, intensive fluid resuscitation was started. Despite 20 blood units, 10 plasma units, 3 platelets units, 500 ml of colloids and 3500 ml of crystalloids, during almost 5 hours, the patient presented extreme hemodynamic instability, needing noradrenaline (NA) infusion at 0,2 mcg/kg/min in order to maintain a mean arterial pressure (MAP) of at least 60 mmHg. Bleeding appeared controlled and analytical values were roughly in range (Hb 10,9 g/dl, Hematocrit 33,4%, Platelets 83.000/ $\mu$ L) although coagulation was still impaired (PT 21,6 sec., INR 1,9, aPTT ratio 2,2, fibrinogen 112 mg/dL) and acid-base equilibrium was disrupted (pH 7,15, BE -14,4, blood lactate 7,1 mmol/L). It was subsequently decided to employ a cardiac output (CO) monitor. A transoesophageal doppler (TOD) probe was inserted.

Data from the first measurement were: CI 2,2 L/min/m<sup>2</sup>, SVI 17,7 ml/m<sup>2</sup>, Ftc 274 msec, PV 80,7 cm/s, MA 7,31 m/s<sup>2</sup>. Intensive fluid resuscitation was then re-activated (10 blood units, 5 plasma units, 3 platelets units, 1000 ml of col-

loids and 3000 ml of crystalloids, in 2 hours). Hemodynamic improved and NA infusion could be reduced and, finally, discontinued. Last data registered in theatre were: CI 3,4 L/min/m<sup>2</sup>, SVI 38,3 ml/m<sup>2</sup>, Ftc 370 msec, PV 95,2 cm/s, MA 8,36 m/s<sup>2</sup>. Patient was translated to intensive care unit with no vasoactive support. She was discharged to ward 3 days later without complications.

**Discussion:** Obstetric hemorrhage supposes an appropriate fluid-therapy strategy. Mostly, MAP is the target for resuscitation and it is not uncommon to employ vasoactive drugs when fluids are ineffective.

However, excessive vasoconstriction could lead to hypoperfusion. Recently, CO has been proposed instead of MAP in resuscitation and optimization. TOD has been successfully employed in hemorrhagic shock. In consideration of these data, TOD could be useful during obstetric haemorrhage.

#### 4AP7-1

##### Normothermic cardiopulmonary bypass increases cerebral oxygenation during combined valve surgery

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**Background and Goal of Study:** The optimal temperature regimen of cardiopulmonary bypass (CPB) for valve surgery still remains unsettled. Hypothermia reduces tissue metabolic demands [1] but can impair autoregulation of cerebral blood flow and contribute to neurological morbidity [2]. The aim of our study was to evaluate the effects of different temperature regimens during complex surgical correction of combined valvular diseases on oxygen transport and cerebral oxygenation.

**Materials and Methods:** We enrolled 21 adult with combined valve surgery into ongoing prospective study. The patients were randomized into 2 groups receiving either normothermic (NT) or hypothermic (HT) CPB. In the NT group ( $n = 11$ ), the blood temperature during CPB was maintained at 36°C whereas in the HT group ( $n = 10$ ) patients were cooled to 32°C. All patients received intravenous anesthesia (propofol/fentanyl) aiming to maintain a cerebral state index (Cerebral State Monitor, Danmeter, Denmark) within 40-60. The oxygen transport and the cerebral oxygen saturation ( $ScO_2$ ) were assessed using a PiCCO<sub>2</sub> monitor (Pulsion Medical Systems, Germany) and a Fore-Sight cerebral oximeter (CASMED, USA), respectively. The perioperative hemodynamic optimization was conducted by goal-oriented protocol. In all patients, we recorded the parameters of hemodynamics and oxygen transport, as well as the duration of mechanical ventilation and the length of ICU and hospital stay.

**Results and Discussion:** The preoperative patient characteristics, cardiopulmonary parameters and duration of surgery did not differ significantly between the groups. During CPB, central venous oxygen saturation was significantly higher in the HT group. In parallel, cerebral oxygen saturation ( $ScO_2$ ) was significantly higher in the NT group during perfusion and postoperatively ( $p < 0.05$ ). Cardiac index, oxygen delivery and consumption increased in both study groups postoperatively ( $p < 0.05$ ). The duration of ICU stay tended to decrease in the NT group ( $p = 0.2$ ). The duration of respiratory support and the length of hospital stay were similar ( $p > 0.05$ ).

**Conclusion:** During combined valve surgery, normothermic CPB increases cerebral oxygenation as compared to the hypothermia regimen. These findings can be explained by better preserved autoregulation of cerebral blood flow following normothermia.

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#### 4AP7-2

##### The effect of mean arterial pressure during cardiopulmonary bypass on clinical and para clinical parameters during and after coronary artery bypass graft surgery

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**Background and Goal of Study:** Today, cardiovascular disease is one of the most common causes of death in the world. Coronary artery bypass graft (CABG) surgery with cardiopulmonary bypass (CPB) is considered as a treatment for ischemic heart diseases. One of the conflicting points during CPB is maintaining optimum mean blood pressure in a range between 50 to 90 mmHg. This study was aimed to examine the impact of two different ranges of mean arterial pressure during CPB on intra operative and post-operative clinical and Para clinical variables.

**Materials and Methods:** In this randomized clinical trial study, after approval of Department Research Committee and getting informed consent, 108 pa-

tients undergoing CABG surgery with CPB were enrolled. They were randomized into two groups (each 54 patients) by random allocation software. By administration of ephedrine and nitroglycerin, blood pressure was maintained at about 50 to 70 mmHg in one group and 70 to 90 mm Hg in the other group during CPB. The patients were studied for perioperative blood gas, urine output, pace maker and inotrope requirements, arrhythmia, blood urea nitrogen (BUN), creatinine (Cr), and also postoperative cognition and duration of intubation and intensive care unit (ICU) stay.

Data were analyzed by statistical software SPSS version 16 using appropriate tests including t-student, Mann-Whitney and  $Q^2$  tests. The differences between the two groups were considered significant with a p value of less than 0.05.

**Results and Discussion:** In this study, 92(85%) male and 16 (15%) female patients were enrolled. Mean age  $\pm$  standard deviation of patients was  $61.3 \pm 9.3$  years. Both groups were similar according to basic demographic and clinical variables.

Results showed that perioperative mean values of  $HCO_3^-$ , base excess (BE),  $PCO_2$ ,  $PO_2$ , BUN, Cr, duration of intubation and ICU stay, urine output, level of cognition, pace maker and inotrope requirements and incidence of arrhythmia had significant relationships with blood pressure during CPB.

**Conclusion(s):** Although a mean blood pressure range of 50 to 90 mmHg is considered safe during CPB in CABG surgery, our results showed that prognosis in patients with controlled blood pressure at about 70 to 90 mm Hg was better compared to the group with 50 to 70 mm Hg.

However, larger studies with more controlled variables are suggested to confirm our results.

#### 4AP7-3

##### Cerebral blood flow measured by microspheres during ventricular assist devices: pulsatile vs continuous flow. Experimental study in pigs

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**Background and Goal of Study:** To date, no studies have demonstrated which mechanical circulatory assist device is better to maintain adequate cerebral blood flow.

The aim of the study is to measure cerebral blood flow in two different left ventricular assist devices (LVAD): continuous centrifugal pump and pulsatile VAD, in both total support and partial support conditions.

**Materials and Methods:** Twelve healthy minipigs were used for this study. A Biomedicus centrifugal pump (BC) (n=6) and a new pulsatile device (CC) with an input compliant chamber (n=6) were implanted. LVAD was instituted by cannulation of the apex of the left ventricle (inflow cannula) and the ascending aorta (outflow cannula). Once the LVAD is established, a first (basal) injection of yellow microspheres in the left atrium is performed. Then the LVAD is initiated and working parameters adjusted to achieve a maximum pump flow (total support). These conditions are maintained during 30 minutes and afterwards a second injection of eosin microspheres is performed. Then the pump flow is reduced to a half of the maximum flow (partial support) and maintained during another 30 minutes; after that, a third injection of violet microspheres is performed.

Finally, the animal is sacrificed and tissue samples of both cerebral hemispheres are obtained to measure cerebral blood flow based on the number of microspheres counted in each sample. The value of the microspheres was expressed as a percentage compared to baseline.

**Results and Discussion:** During total support no statistically significant changes of cerebral blood flow were seen between both LAVD (BC vs CC) in either right ( $101 \pm 34$  vs  $84 \pm 24$ ;  $p=0,35$ ) or left ( $92 \pm 11$  vs  $75 \pm 27$ ;  $p=0,21$ ) frontal lobes.

However, a lower cerebral blood flow was observed with BC LVAD during partial support in right ( $102 \pm 25$  vs  $175 \pm 41$ ;  $p=0,006$ ) and left ( $100 \pm 18$  vs  $160 \pm 44$ ;  $p=0,02$ ).

**Conclusion:** Cerebral blood flow is higher during partial support when using a new LVAD with a compliant chamber (pulsatile flow) compared with Biomedicus centrifugal pump (continuous flow).

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#### 4AP7-4

##### Cibenzoline improves systolic anterior motion of mitral valve after mitral valve plasty

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**Background:** Systolic anterior motion (SAM) of the mitral valve can develop after weaning from extracorporeal circulation during mitral valvoplasty (MVP) for mitral regurgitation (MR). It often leads to left ventricular outflow tract obstruction (LVOTO) with MR, resulting in severe circulatory collapse due to reduced forward left ventricular stroke volume. Beta-blockers attenuate SAM and can resolve circulatory collapse after MVP. However, b blockers exert adverse effects such as bronchospasm due to their  $\beta_2$  blockade action. Here, we describe that the class Ia antiarrhythmic drug, cibenzoline succinate, alleviated SAM and improved hemodynamics a patient with SAM after MVP that resulted in circulatory collapse.

##### Case report:

**Case 1:** A 68-year-old male had upper abdominal pain, and thorough testing confirmed moderate MR; thus, MVP was indicated. Preoperative echocardiography confirmed moderate MR accompanied by prolapse of the medial scallop of the posterior leaflet. After separation from CPB, TEE monitoring confirmed SAM, and LVOTO and MR occurred. Severe circulatory collapse developed. Hypovolemia was suspected, and transfusion was performed, after which noradrenalin was administered, but patient condition did not improve. We then administered cibenzoline succinate (70 mg). After 3 minutes of cibenzoline administration, TEE confirmed the disappearance of SAM, LVOTO and MR, and hemodynamics improved substantially.

**Case 2:** A 54-year-old female had dyspnea on exertion, and thorough testing confirmed severe MR; thus, MVP was indicated. Ejection fraction was 68.2%, and the posterior leaflet was also elongated. Triangular resection of the posterior leaflet of the mitral valve and valve ring suturing was performed. The patient was then weaned from the CPB. TEE monitoring confirmed SAM, LVOTO and MR, and severe circulatory failure developed. Firstly, dopamine and dobutamine were stopped. Secondly, hypovolemia was suspected, and transfusion was performed, after which noradrenalin was administered; however, neither treatment improved the situation. We then administered cibenzoline succinate (70 mg), and After 3 minutes of cibenzoline administration, TEE confirmed the disappearance of SAM, LVOTO and MR, and hemodynamics improved substantially.

We concluded that when additional volume expansion fails to treat SAM after MVP, cibenzoline succinate should be administered before proceeding with further surgical manipulation.

#### 4AP7-5

##### A new approach using roller pump for lower limb ischemia during femoral-access PCPS

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**Background:** Percutaneous cardiopulmonary support (PCPS) is useful for resuscitation in cardiogenic shock patients. The femoral artery is generally used for arterial access. During femoral-access PCPS, however, placement of the arterial cannula may obstruct the femoral artery and decrease its distal blood flow. It causes lower limb ischemia, which is one of the severest complications and, in some cases, life threatening.

**Case report:** To provide sufficient limb perfusion, we inserted an 18G elastic intravenous catheter distally into the superficial femoral artery (SFA) and connected it to the side port of the PCPS arterial line as a bypass. Nevertheless, we had several cases that developed a complication of lower limb ischemia due to insufficient bypass flow and eventually died of it. We considered that the bypass flow is mostly dependent on the PCPS centrifugal pump and restricted by the side branch tube length and diameter. To maintain the sufficient lower limb perfusion, we placed a roller pump into the side branch and made compulsory flow into SFA. The flow rate (bpm) of the roller pump was adjusted by both the bypass pressure and the limb regional oxygen saturation (rSO<sub>2</sub>) measured by Edwards' INVOS. More than five cases including a fulminant myocarditis were treated with this method and showed favorable outcomes without developing lower limb ischemia.

**Learning points:** We conclude that this approach can be one of the solutions to lower limb ischemia during femoral-access PCPS.

## 4AP7-6

**Functional and histologic outcome after deep hypothermic circulatory arrest in rats: gender matters**

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**Background and Goal of Study:** Female gender is an independent risk factor within cardiac surgery setting. Aim of the study was to investigate the role of gender and hormonal status on functional and histologic outcome after CPB with 45 min of deep hypothermic circulatory arrest (DHCA) in intact and neutered female and male rats.

**Materials and Methods:** With IRB approval animals were assigned to 4 groups: female-intact, female-neutered, male-intact, male-neutered. At 12 weeks of age, animals were neutered or sham-neutered according to group assignment. After 28 days to allow for elimination of sex hormones, rats were exposed to 45 min of DHCA. 1 hour after DHCA, rats were allowed to recover. During 14 days after DHCA, functional outcome was assessed using the modified Hole Board-Test, histologic outcome with hematoxylin & eosin staining and both were scored according to an established protocol (1). The multivariable relationship of potentially predictive variables (histologic score, gender, castration, CPB) and neurologic function score was calculated by a general linear model.

**Results and Discussion:** Significantly fewer female rats survived 14 postoperative days after DHCA (44 % in the female-normal, 78 % in the female-neutered group versus 100 % in the male-normal and 85 % in the male-neutered group). Within the surviving female rats, neutered females have a better neurologic outcome compared to the intact females with physiologic hormone status. Within the male groups however, neutering significantly worsened postoperative neurologic function. Histologic outcome of the surviving rats at postoperative day 14 was improved in females compared to both male groups independent of sex hormone status (figure 1).

**Conclusions:** While survival and histologic outcome are fundamentally influenced by gender, functional outcome is determined by the presence and character of sex hormones present during CPB with DHCA.

**References:**

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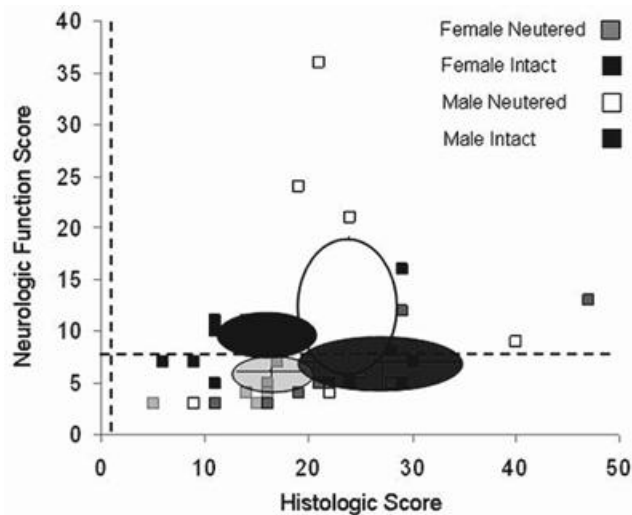


Figure 1 shows neurologic and histologic outcome in the surviving animals in all four groups after 45 min of DHCA. Female-neutered rats show a significantly better neurologic function compared to female-intact rats. Male neutered rats show a significantly worse neurologic function compared to male-intact rats ( $p < 0.05$ ). Dashed lines depict the 95 % confidence interval of naive control animals. Data are presented as marginal means and 95% confidence intervals to gather confounder-adjusted estimates of mean differences between subgroups.

[Figure 1]

## 4AP7-7

**Establishment of an ECMO support program following cardiothoracic transplantation**

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**Background and Goal of Study:** Extracorporeal membrane oxygenation (ECMO) is a vital support device instituted for the management of life threatening cardiac or pulmonary failure <sup>1</sup>. The aim of this study is to summarize our experience on the establishment of an ECMO support Program for acute severe cardiac or respiratory failure following cardiothoracic transplantation, including treatment indications, timing, complications and outcomes.

**Materials and Methods:** We performed a retrospective review of the 94 patients who underwent either heart or lung transplantation at our institution between January 2010 and November 2011. Six of the 94 patients were post-operatively treated with ECMO. Support therapy was initiated due to primary failure of the graft. All devices were placed on a peripheral veno-arterial configuration except for one which was centrally cannulated. We used heparin coated circuit tubings and bio coated cannulae and also maintained the patients on heparin infusion.

**Results and Discussion:** We had 6 patients placed on ECMO after transplantation; half of them were cardiac recipients and half lung recipients. ECMO was established in the first 8 hours post transplant in 4 cases. The support was continued for a median of 6 days (8 hours-12 days). One cardiac recipient and one lung recipient were successfully weaned from ECMO, but only the cardiac recipient was discharged from the ICU. All patients suffered from different degrees of bleeding and thrombocytopenia. All patients except for one developed renal failure, 4 of them requiring renal replacement therapy, the other one died of multiorgan failure within the first hours of support. Other complications we had during ECMO support were sepsis, multiorgan failure, cerebral haemorrhage and lower limb complications.

**Conclusion(s):** ECMO support means an alternative for treatment of refractory primary graft failure <sup>2</sup>. Correct selection of patients susceptible to ECMO implantation as well as timing and management of complications would result in improved morbidity and survival. No agreed criteria are being used to date, however. More studies are needed to define these criteria.

**References:**

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2. Marasco SF, Vale M, Pellegrino V, et al. Ann Thorac Surg. 2010;90:1541-1547

## 4AP7-8

**High versus normal blood flow during cardiopulmonary bypass coronary artery bypass grafting surgery: a randomized prospective double-blind oxyhemodynamic study**

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**Background:** Optimal blood flow to cardiopulmonary bypass (CPB) is a controversial matter, and so far there is no consensus about the oxyhemodynamic variables that could reflect the adequacy of blood flow during CPB. Although the use of body surface to calculate the blood flow is largely advocated, there are no standard definitions of ideal flow to be used during CPB.

**Objective:** To compare the changes in oxyhemodynamic variables elicited for two different arterial blood flow patterns in patients underwent coronary artery bypass graft surgery.

**Method:** Prospective, randomized, double blind study. Sixty six adult patients scheduled for coronary artery bypass grafting using normothermic CBP were divided into two different group according to blood flow parameters: Control group (2.2 to 2.7 L/min/m<sup>2</sup>) and High-flow group (3.0 to 3.5 L/min/m<sup>2</sup>). Variables analyzed were lactate, oxygen delivery, oxygen consumption, venous oxygen saturation and venous-arterial carbon dioxide gradient were measured at 10, 20, 40 and 60 minutes.

**Results:** The High-flow group showed a significant improvement of the oxygen delivery, oxygen consumption, venous oxygen saturation, and venous-arterial carbon dioxide gradient when compared to control group. The differences in oxyhemodynamic variables were more significant after 40 and 60 minutes of CPB. The systemic lactate concentration was not significantly different when compared High-flow group with Control group.

**Conclusion:** We concluded that blood flow from 3.0 to 3.5 L/min/m<sup>2</sup> better preserves oxyhemodynamic parameters during normothermic cardiopulmonary bypass in patients undergoing coronary artery bypass grafting when compared to flow of 2 to 2.7 L/min/m<sup>2</sup>. We also concluded high-flow in CPB does not change lactate concentration, suggesting similarity in tissue perfusion in both perfusion techniques.

#### 4AP7-9

##### Comparison of the effects of hydroxy ethyl starch 6% versus gelatin as replacement of prime fluid during coronary artery bypass graft

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**Background and Goal of Study:** Several fluids have been used in priming the cardio-pulmonary bypass (CPB) circuit in coronary artery bypass graft (CABG) surgery. Gelatin is a commonly used colloid fluid for priming which has some adverse effects especially on the coagulation system. Hydroxy-ethyl starch 6% (HES 6%) is a new colloid fluid which is widely used as a substitute for the intra-operative fluid replacement; however, few studies have evaluated its role in priming the CPB circuit.

This study was designed to compare the effects of gelatin versus HES 6% as replacement of prime fluid during CABG on coagulation, volume of chest tube (CT) drainage and urine output.

**Materials and Methods:** After approval of Local Research Committee, this clinical trial study was conducted. Patients who were a candidate for CABG and had signed an informed consent entered the trial. They were randomized into two groups: (i) in the first group the pump was primed with HES 6%, (ii) in the second group the pump was primed with gelatin.

Fluid replacement therapy was made by Ringer solution during the surgery. Prothrombin time (PT), partial thromboplastin time (PTT) and international normalized ratio (INR), were measured before, at the end and 24 hours after the operation. Volume of CT drainage was measured at 24 hours postoperatively and urine output was determined during and 24 hours after the surgery. Data were analyzed by SPSS software version 17 using appropriate tests including t-student, Mann-Whitney and Q<sup>2</sup> tests.

**Results and Discussion:** Totally 100 patients were recruited for this study, of whom 67 were males and 33 were females. The mean age of patients was 59 ± 8.9. The mean body mass index (BMI) of the patients was 28 ± 5.4. Both groups were similar according to these basic variables (P>0.05). Volume of CT drainage was not significantly different between the HES 6% and gelatin groups (P>0.05). In the HES and gelatin groups the urine output was not significantly different during and 24 hours after the surgery (P>0.05). PTT and INR did not show any significant difference between the two groups before, at the end and 24 hours after the surgery (P>0.05); however PT was significantly higher in gelatin group only at the end of surgery (16.5±1.5 vs. 15.7±2.7, respectively).

**Conclusion(s):** HES 6% could be a better option than gelatin for priming the CPB circuit. However, more studies with larger sample sizes are required to confirm our observation.

#### 4AP7-10

##### To assess the microcirculation by a multiparametric study in cardiac surgery

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**Background and Goal of Study:** Microcirculation disorders can compromise patient's prognosis. Despite an optimization of systemic hemodynamic parameters, assessment of tissue microcirculation at bedside remains a real challenge. Microcirculatory parameters such as tissue oxygen saturation (StO<sub>2</sub>) or capillary recruitment capacity (recovery slope of StO<sub>2</sub>; rsStO<sub>2</sub>) could be of help.

The aim of our study was to demonstrate clinical relevance of such a parameters in addition to a multiparametric monitoring including central venous oxygen saturation (ScvO<sub>2</sub>), venous to arterial carbon dioxide gap (PvaCO<sub>2</sub>) and lactatemia during the perioperative period of cardiac surgery (CS) with extracorporeal circulation (ECC).

**Materials and Methods:** After obtaining written consent, 33 patients were enrolled for scheduled CS with ECC in an observational pilot study. Non-inclusion criteria were emergency surgery and hemodynamic instability. Demographic and usual monitoring data were recorded in addition to lactatemia, ScvO<sub>2</sub>, PvaCO<sub>2</sub>, StO<sub>2</sub> and rsStO<sub>2</sub> at different time: baseline state (BS), induction of anesthesia (IA), under ECC every 30' (C30, C60), end of procedure (EP), and immediately after intensive care admission (ICU). Results are expressed as mean ± SD, and a p< 0.05 was considered significant.

**Results and Discussion:** Time evolution of the parameters is shown in Table. At baseline, rsStO<sub>2</sub> was significantly lower in patients with chronic renal failure (CRF) (3.7±1.6 %/s (n=7) vs 5.1±1.1 %/s (n=15); p< 0.05) and in patients

with hypertension (3.9±1.2 %/s (n=13) vs 5.1±1.4 %/s (n=15); p=0.03). rsStO<sub>2</sub> variation was impaired after IA and during ECC. At ICU time PvaCO<sub>2</sub> was above the physiological threshold of 6 mmHg without reaching statistical significance.

Time of the study (n)/Parameters	BS	IA	C30	C60	EP	ICU	Friedman's test (n)
Lactatemia (mM)		1.0±0.4 (18)	1.2±0.7 (18)	1.5±0.8 (12)	1.5±0.6 (18)	1.6±0.7 (7)	p=0.001 (9)
PvaCO <sub>2</sub> (mmHg)		6±3 (32)	6±2 (28)	5±2 (23)	6±3 (25)	8±5 (22)	ns (9)
ScvO <sub>2</sub> (%)		78±6 (32)	88±10 (28)	88±6 (22)	79±10 (26)	74±9 (26)	p=0.001 (14)
StO <sub>2</sub> (%)	82±6 (29)	85±6 (31)	85±8 (28)	87±8 (19)	86±8 (27)	85±8 (26)	p=0.013 (14)
rsStO <sub>2</sub> (%/s)	4.5±1.4 (28)	2.5±1.1 (28)***	2.5±1.2 (28)	1.8±0.8 (17)	2.8±1.2 (24)*	3.8±1.4 (28)**	p=0.001 (13)

[Time evolution of the microcirculation parameters]

\*\*\* p< 0.001 BS vs IA (27) \*\* p< 0.001 EP vs PO (22) \* p< 0.01 C60 vs EP (16); Wilcoxon's rank test

**Conclusion:** During CS with ECC, rsStO<sub>2</sub> was impaired by anaesthesia and ECC reflecting a microcirculatory dysfunction. Further studies are necessary to assess a possible relationship between rsStO<sub>2</sub> variations and the prognosis of patients.

#### 4AP7-11

##### Does β<sub>2</sub>-adrenergic stimulation attenuate fluid extravasation during hypothermic cardiopulmonary bypass? An experimental study in pigs

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**Background and Goal of Study:** The use of hypothermic CPB is associated with increased fluid filtration, edema formation and occasionally organ dysfunction. Cold-induced reduction in endothelial barrier function may play a role.

β<sub>2</sub>-adrenergic activation elevates cellular cAMP which contributes to maintain endothelial barrier properties.

The objective of this study was to evaluate whether β-adrenergic stimulation could influence the increase in fluid extravasation observed during hypothermic CPB.

**Materials and Methods:** 14 animals were randomly allocated to receive terbutaline infusion (T-group) (n=7) or a control-group without terbutaline (C-group) (n=7). All animals were given 60 min of normothermic- followed by 90 min of hypothermic CPB. Fluid input and -losses, plasma volume, colloid osmotic pressures of plasma and interstitial fluid, hematocrit, serum proteins and total tissue water content were measured and the fluid extravasation rates (FER) calculated.

**Results:** Start of normothermic CPB resulted in a 20 %-hemodilution with an abrupt increase in fluid requirements during the first 10 min. FER increased from 0.18 (0.06) pre-bypass to 0.78 (0.27) mL/kg/min (T-group) (P=0.002) and from 0.16 (0.05) to 0.93 (0.26) mL/kg/min (C-group) (P< 0.001) with no between-group differences.

Thereafter FER stabilized at a level of 0.32 (0.13) and 0.27 (0.14) mL/kg/min in the T-group and C-group, respectively.

After start of cooling FER increased in the T-group to 0.55 (0.12) mL/kg/min (P=0.046) and in the C-group to 0.54 (0.13) mL/kg/min (P=0.006) with no between group differences (P=0.738).

Statistics: SPSS was used. Values were presented as Mean (SD). Repeated measure analysis of variance was used and t-test, when appropriate.

**Conclusion:** In the present experimental setup we were unable to demonstrate any modulating effect of terbutaline on fluid extravasation during hypothermic cardiopulmonary bypass.

##### References:

1. Farstad M et al; Can the use of methylprednisolone, vitamin C, or α-trinositol prevent cold-induced fluid extravasation during cardiopulmonary bypass in piglets? *J Thorac Cardiovasc Surg* 2004; 127: 525-534
2. Diestel et al; Methylprednisolone and Tacrolimus Prevent Hypothermia-Induced Endothelial Dysfunction. *J Heart and Lung Transplantation* 2009; 28 (7): 718-724
3. Young-Soo et al; Changes in cardiovascular β-adrenoceptor responses during hypothermia. *Cryobiology* 2008; 57: 246-250

## 4AP8-1

### The novel use of clevidipine for intraoperative blood pressure management in pheochromocytoma patients

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**Background:** Clevidipine butyrate (Cleviprex) is a dihydropyridine L-type calcium channel blocker that reduces systemic vascular resistance. It has been approved for treatment of perioperative hypertension. Clevidipine has a short half-life of approximately 1 minute due to rapid metabolism by blood and extravascular tissue ester hydrolysis.

Clevidipine has not been studied in the setting of pheochromocytoma; a rare tumor of the chromaffin tissue of the adrenal glands causing the release of excessive amounts of catecholamines.

**Case report:** We present 2 cases in which Clevidipine was successfully used as the "sole agent" to manage intraoperative hypertension during adrenalectomy for pheochromocytoma.

Arterial access was achieved before entering the operating suite. Clevidipine infusion at 4 mg/hr was initiated immediately after induction. During direct laryngoscopy and intubation, moderate hypertension was noted. A 1 mg bolus of Clevidipine resulted in a prompt control of SBP in less than 90 seconds. Anesthesia was maintained to achieve BIS values between 40 and 50, and all blood pressure variances were managed by adjusting the Clevidipine infusions.

Multiple episodes of hypertension were noticed during the surgical manipulations of the mass with the highest systolic blood pressure being 290 mmHg. Two 1 mg boluses of Clevidipine were administered and the continuous infusion increased to 12 mg/hr achieving prompt SBP control within 2 minutes. We noticed a Clevidipine dose-related increase in heart rate to a maximum of 120 bpm, which was managed by intermittent boluses of Esmolol. Once the adrenal veins were ligated, all hypertensive periods ceased and the Clevidipine infusions were stopped. The patients were extubated in the operating suite, remained stable, and were discharged on POD 1.

**Discussion:** We successfully used Clevidipine in the intraoperative blood pressure management for 2 patients with pheochromocytoma. Clevidipine effectively and promptly provided accurate and predictable blood pressure control.

#### References:

- Manger WM, Gifford JW Jr. Pheochromocytoma: a clinical overview. In: Swales JD ed. Textbook of Hypertension. Oxford: Blackwell Scientific 1994; 941-58
- Munro J, Hurlbert BI, Hill GE. Calcium Channel Blockade and Uncontrolled Blood pressure during pheochromocytoma surgery. Can J Anaesth 1995; 42: 228-30

**Learning points:** We suggest that Clevidipine is a viable alternative to the other commonly used agents in patients with pheochromocytoma.

## 4AP8-2

### Autonomic nervous instability in postoperative orthostatic intolerance after hip arthroplasty

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**Background and Goal of Study:** Early postoperative mobilization is essential for rapid functional recovery but may be delayed by postoperative orthostatic intolerance (OI).<sup>1,2</sup> The mechanisms of OI are unknown but may include impaired cardiovascular regulation related to postoperative autonomic dysfunction. Thus, based on a previous study on OI before and after elective total hip arthroplasty (THA),<sup>2</sup> we performed heart rate variability analysis (HRV) in order to identify possible abnormal postoperative postural autonomic responses that may contribute to the pathophysiology of OI.

**Materials and Methods:** A secondary analysis of HRV in 23 patients scheduled for THA and mobilized using a standardized protocol before, 6 and 24 h after surgery. Beat-to-beat arterial pressure and interbeat intervals were measured by photoplethysmography using a finger cuff (Nexfin™). HRV were analysed using frequency domain autoregressive analysis with low (LF) and high frequency (HF) components derived from the 0.04 - 0.15 and 0.15 - 0.40 Hz band, respectively.

**Results and Discussion:** 23 patients (15 (65%) females) with a mean (SD) age of 64 (10) years, were included. Before surgery, arterial pressures and HR increased from supine to standing while total HRV and the LF/HF ratio remained stable (Table 1). At 6 and 24 h after surgery total HRV and postural responses in arterial pressures decreased compared to preoperatively. In addition LF/HF in the sitting and standing position were significantly reduced compared to the preoperative evaluation (P < 0.05).

Table 1. Blood pressure data and heart rate variability before, 6 and 24h after surgery in 23 patients undergoing total hip arthroplasty.

	Preoperative			6h			24h		
	Supine	Sitting	Standing	Supine	Sitting	Standing	Supine	Sitting	Standing
SAP (mmHg)	140 (17)	153 (20) <sup>*</sup>	158 (21) <sup>*</sup>	132 (21)	133 (25) <sup>§</sup>	112 (30) <sup>§</sup>	128 (19) <sup>§</sup>	132 (22) <sup>§</sup>	127 (24) <sup>§</sup>
HR (bpm)	71 (11)	75 (12) <sup>*</sup>	80 (13) <sup>*</sup>	82 (13) <sup>§</sup>	86 (14) <sup>§</sup>	88 (14) <sup>§</sup>	84 (12) <sup>§</sup>	87 (12) <sup>§</sup>	94 (12) <sup>§</sup>
Total HRV (ms <sup>2</sup> )	295 (150-895)	432 (209-946)	278 (149-636)	151 <sup>§</sup> (104-483)	177 <sup>§</sup> (87-495)	167 <sup>§</sup> (72-198)	118 <sup>§</sup> (61-274)	144 <sup>§</sup> (64-317)	99 <sup>§</sup> (55-235)
LF/HF	1.7 (1.3-2.5)	2.0 (1.1-2.8)	2.1 (1.4-2.6)	1.5 (0.9-2.5)	1.1 <sup>§</sup> (0.6-1.6)	1.0 <sup>§</sup> (0.7-1.6)	1.7 (0.8-3.0)	1.2 <sup>§</sup> (0.6-2.0)	1.1 <sup>§</sup> (0.7-2.4)

Data presented as mean (SD) or median (interquartile range) where appropriate. SAP, systolic arterial pressure; HR, heart rate; HRV, heart rate variability; LF, low frequency; HF, high frequency. <sup>\*</sup>Different from supine (P < 0.05), <sup>§</sup>Different from preoperative evaluation (P < 0.05)

[Table 1]

**Conclusion(s):** This study found decreased HRV after THA and a paradox decrease in the LF/HF ratio during postoperative mobilization suggesting that postoperative sympatho-vagal imbalance may contribute to the pathophysiology of OI after surgery.

#### References:

- Bundgaard-Nielsen M et al. Orthostatic intolerance and the cardiovascular response to early postoperative mobilization. Br J Anaesth 2009; 102:756-62
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## 4AP8-3

### Relationship between preoperative catecholamine levels and perioperative complications of adrenalectomy for pheochromocytoma

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**Background and Goal of Study:** During the resection for pheochromocytoma, it is common to experience complications related with catecholamine release from tumor. We retrospectively studied the relationship between preoperative evaluations and perioperative complications in patients who underwent adrenalectomy for pheochromocytoma.

**Materials and Methods:** Clinical records of patients who underwent resection for pheochromocytoma were retrospectively studied. Preoperative data (medications, urinary / plasma catecholamine levels), intraoperative data (blood pressure, blood glucose levels, and arterial blood gas analyses), and postoperative episodes of hypotension and hypoglycemia were abstracted from patient's medical recordings.

The minimum incision endoscopic surgery technique<sup>1</sup> was used in all patients as a minimally invasive surgical technique for adrenal tumor resection.

**Results and Discussion:** Twenty seven patients were included. We experienced 23 cases with intraoperative hypertension (systolic blood pressure  $\geq 180$ mmHg), 20 cases of high lactate level (> 2 mmol/L), and 7 cases of postoperative hypoglycemic episodes.

Receiver operating characteristic curve (ROC) analysis for preoperative urinary epinephrine levels demonstrated good performance for prediction of intraoperative hypertension (area under the curve (AUC) = 0.848), postoperative hypoglycemic episodes (AUC=0.871) and higher lactate levels (> 2 mmol/L, AUC=0.800). ROC for preoperative urinary norepinephrine levels demonstrated moderate performance for prediction of intraoperative hypertension (AUC=0.761) but did not show a predictive performance for higher lactate levels.

Preoperative urinary epinephrine levels showed moderate correlation with intraoperative peak plasma lactate levels ( $r_s=0.475$ ,  $p=0.0123$  (Spearman's rank correlation test)).

**Conclusion(s):** Preoperative high urinary epinephrine levels showed good predictive performance for perioperative complications in patients undergoing resection for pheochromocytoma. Pheochromocytoma releasing high levels of epinephrine should be carefully treated to prevent various complications in the perioperative period of the tumor resection.

#### References:

- Kageyama Y, Kihara K, Kobayashi T et al. Portless endoscopic adrenalectomy via a single minimal incision using a retroperitoneal approach: experience with initial 30 cases. International journal of urology 2004;11:693-9.



#### 4AP8-4

##### Impact of noradrenaline infusion method on mean arterial blood pressure: preliminary *in vitro* and *in vivo* results

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**Background and Goal of Study:** No guideline exists concerning noradrenaline (NA) infusion method. This study aimed to assess the impact of four infusion lines on NA flow rates and mean arterial blood pressure (MAP) during administration of NA infusions to Intensive Care Unit patients in circulatory failure.

**Materials and Methods:** 50mL syringes were filled with 0.5mg/mL NA in isotonic saline solution. Four infusion lines were compared:

- ID1 was made of a NA syringe pump (2mL/h) and a carrier saline solution syringe pump (8mL/h) connected to a Y extension set flushed with NA solution ( $V=1.23\text{mL}$ );
- ID2 used the same NA syringe pump directly connected to the central venous catheter;
- ID3 and ID4 used the same NA syringe pump at 2 mL/h connected to ISS syringe pump respectively at 8 and 5mL/h by a very low dead-space volume set with antireflux valve ( $V=0.046\text{mL}$ ).

*In vitro* tests were performed to measure NA flow by NA UV absorbance. Patients remaining in circulatory failure ( $\text{MAP} < 60 \text{ mmHg}$ ) after fluid resuscitation were allocated to one of the four groups in an open label design.

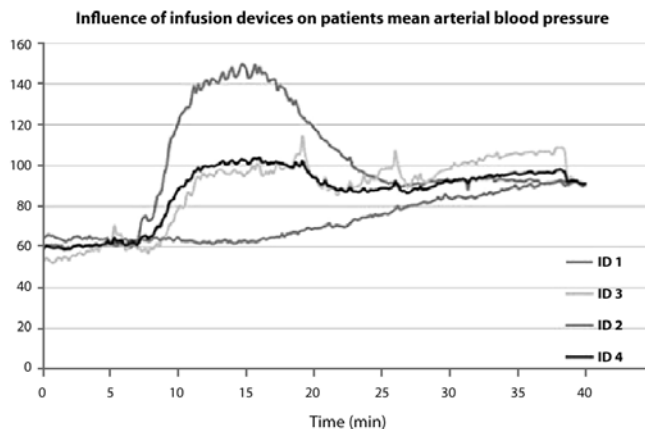
Clinical results were obtained by continuous recordings of the patients MAP during the infusion. Values of time to reach steady state ( $\text{MAP} \geq 70 \text{ mmHg}$ ) were compared using ANOVA performed on ranks according to Conover and Iman.

**Results and Discussion:** All patients reached the steady state. Times needed to reach NA mass flow rate and MAP steady state were significantly different between the four devices (table 1).

	ID1	ID2	ID3	ID4
Time to reach the steady state of NA mass flow rate (in vitro) median values min:sec [min - max] (number of trials)	40:00 [19:57 - 49:22] (10)	26:35 [8:20 - 33:10] (10)	12:34 [6:34 - 17:33] (10)	15:05 [10:01 - 22:29] (10)
Time to reach the steady state of MAP (in vitro) median values min:sec [min - max] (number of patients)	24:30 [24:00 - 29:30] (4)	34:10 [23:10 - 62:30] (9)	14:00 [9:20 - 26:10] (11)	14:20 [6:20 - 24:00] (3)

[Table 1]

ID1 system provided a severe hypertensive peak ( $\text{MAP} > 100 \text{ mmHg}$ ) at the beginning of the infusion while ID2 system shows the longest time to peak flow (figure 1).



[Figure 1]

**Conclusion :** These results highlight the impact of dead space volume set, flushing protocol and double syringe pump system on NA mass flow rate and their clinical consequences.

#### 4AP8-5

##### Autonomic blockade: assessment of the intrinsic heart rate in a closed-chest experimental porcine model

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**Background and Goal of Study:** The status of the autonomic nervous system (ANS) is a major determinant of cardiovascular health and prognosis. As a result, several clinical investigations need to be measured in the absence of the extrinsic stimuli of the ANS.

Previous studies on pharmacological denervation, showed a huge diversity of protocols, doses and intervals of drug administration, without considering differences between species. Our aim was to standardize a denervation method in a swine experimental model.

**Materials and Methods:** Sixteen Mini Pigs were premedicated with ketamine and anesthetized with propofol  $4.5 \text{ mg} \cdot \text{kg}^{-1}$  followed by an infusion of  $13 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$ . After instrumentation and a stabilization period, atropine in small intravenous doses of  $0.01 \text{ mg} \cdot \text{kg}^{-1}$  repeated a 3-min intervals was injected until there was not further change in heart rate or the change was in the range of  $\pm 1 \text{ bpm}$ ; then propranolol  $0.05 \text{ mg} \cdot \text{kg}^{-1}$  was given in the same mode until autonomic blockade was complete. (1)

**Results and Discussion:** The first three atropine doses caused a declining rise in heart rate superior to 1 bpm, the fourth dose caused an average change of  $0.25 \pm 2.1 \text{ bpm}$ . Each of the first four doses of propranolol  $0.05 \text{ mg} \cdot \text{kg}^{-1}$  caused a declining decrease in heart rate superior to 1 bpm, the fifth dose caused an average change of  $0.18 \pm 1.2 \text{ bpm}$ . The intrinsic heart rate was achieved after four doses of atropine and five doses of propranolol. The mean baseline heart rate was  $96.68 \pm 18$  and the mean denervated heart rate was  $97.56 \pm 17$ .

**Conclusion(s):** In this closed-chest porcine model, blockade of cardiac autonomic nervous activity was obtained by  $0.25 \text{ mg} \cdot \text{kg}^{-1}$  of propranolol and  $0.04 \text{ mg} \cdot \text{kg}^{-1}$  of atropine.

These doses produce an effective temporary blockade of the autonomic activity in this swine model. These doses should be employed in researches where the cardiac autonomic blockade was relevant.

**Citation:** Jose AD, Taylor RR. J Clin Invest. 1969;48:2019-31. Kanaya N et al. Anesthesiology. 2003;98:34-40.

#### 4AP8-6

##### Atropine increases the positive adrenergic effects of norepinephrine. A pilot study

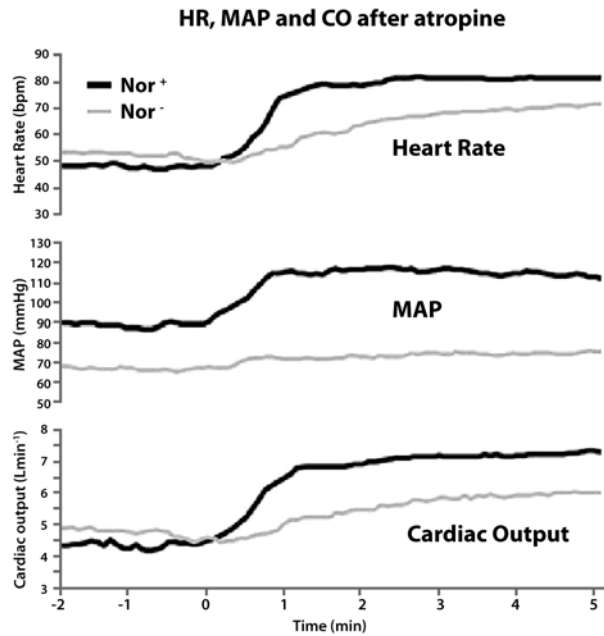
Kalmar A.F., Vos J.J., Weening M., Struys M.M.R.F., Scheeren T.W.L.  
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**Background and Goal of Study:** Atropine is a competitive antagonist of cholinergic receptors and is widely used to blunt the increased vagal tone that is often caused by surgical manipulations. It increases heart rate (HR) with minimal effects on mean arterial pressure (MAP) and cardiac output (CO). Norepinephrine (NOR) is a catecholamine used to increase MAP and CO in several medical conditions. Its effect is based on the positive inotropic and chronotropic effects via cardiac  $\beta_1$  receptors and at higher doses on vasoconstriction via vascular  $\alpha$  receptors.

There are currently no studies revealing the pharmacological interaction of these drugs in patients under total intravenous anesthesia. We therefore studied the effects of atropine on HR, MAP and CO of atropine in combination with (NOR<sup>+</sup>) or without low-dose NOR (NOR).

**Materials and Methods:** After local EC approval and written informed consent, 23 patients scheduled for ophthalmic surgery under general anaesthesia were included. If the MAP decreased  $< 80\%$  of baseline value, NOR  $0.05 \mu\text{g}/\text{kg}/\text{min}$  was started. If the HR was  $< 60\text{bpm}$  when vagal stimulation was imminent, atropine  $0.5\text{mg}$  was administered (all patients). HR, MAP and CO were recorded noninvasively (Nexfin, BMEye, Amsterdam). All recordings were synchronised at the moment of atropine administration and analysed in two groups (with or without NOR)

**Results and Discussion:** Changes in HR, MAP and CO were larger in the NOR<sup>+</sup> group (14 patients) than in the NOR group (9 patients). At 300 seconds, the mean (SD) HR increased  $32(18)$  vs  $19(11)$  bpm from baseline. The MAP increased  $24(11)$  vs  $5(8)$  mmHg. The CO increased  $3(1.9)$  versus  $0.7(0.8)$  L/min. All differences were significant ( $p < 0.05$ )



[Figure]

**Conclusions:** The haemodynamic effects of atropine are more prominent in the presence of NOR. This study reveals that atropine exerts more advantageous hemodynamic effects in the presence of low-dose NOR.

#### 4AP8-7

##### Autonomic Dysreflexia - a clinical case

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**Background:** Autonomic dysreflexia (AD) is characterized by massive disordered autonomic response to certain stimuli, most common bladder distension (75-82%)<sup>1</sup>. Generally occurs in patients with spinal cord injury at or above T6 level<sup>1</sup>. It is manifested by hypertension, headache, sweating, flushing, blurred vision, nausea and bradycardia<sup>2</sup>. Management include removal of the precipitating stimulus and pharmacological treatment of high blood pressure (BP)<sup>1</sup>.

Despite studies showing no advantage of the neuraxial block on the general anesthesia (GA)<sup>1</sup>, in urologic procedures spinal anesthesia has been recommended, as that successfully blocks sympathetic response<sup>3</sup>.

**Case report:** A 48-year-old female, ASA 3, presented for botulinum toxin injection due to neurogenic detrusor overactivity under GA. She had history of traumatic fracture at C7-T1 level at age 34, classified as ASIA A with C6 sensitive level and T1 motor level. She have experienced abrupt increased in BP and flushing in previous urodynamic studies. As she entered the operating room heart rate (HR) was 64bpm, BP 110/62mmHg, pulse oximetry 98%. After GA induction with IV fentanyl and propofol a LMA ProSeal™ was introduced. Maintenance was made with air, oxygen and sevoflurane. During surgery trends showed a progressive decrease in HR followed by a progressive increase in BP to 160/90mmHg. At 20 min. of surgery HR decrease till 37 bpm, so 1mg IV atropin was given.

In Post-Anesthetic Care Unit she complain of headache, dry mouth, and flushing in neck and upper thorax was noted. The BP remained high (maximum: 188/121mmHg, minimum: 140/90mmHg). The urinary catheter was permeable, so 10mg IV labetalol was given with complete reversion of symptoms. There weren't more complications during the hospital stay.

**Discussion:** The hypothesis AD is based on the following:

- 1) appearance of clinical features similar to previous urodynamic studies;
- 2) progressive decrease in HR;
- 3) BP remained high for long time without any factors that could explain it, like hypoxia, hypercapnia, pain or bladder distension;
- 4) complains of headache, dry mouth and flushing;
- 5) cessation of symptoms with beta-blocker administration.

##### References:

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2. Postgrad Med J (2005);81:232-35.
3. CMAJ (2003);169(9):931-35.

**Learning points:** The authors intend to highlight these potential severe complication in patient with high spinal injury. We suggest physicians to choose neuraxial anesthesia as it offers a sympathetic blockade.

#### 4AP8-8

##### Effects of low-dose carperitide on hemodynamic stability in postoperative patients undergoing cardiovascular surgery

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**Background and Goal of Study:** At the acute phase of cardiovascular postoperative period, the hemodynamic of patient is unstable frequently. Carperitide is an atrial natriuretic peptide, developed in Japan, used at a low dose in postoperative patients undergoing cardiovascular surgery because of the vasodilatory effect.

Despite low-dose carperitide is used in many cases, much remains to be learned about its effects on cardiac function and patient data. Therefore, we investigated the effects of low-dose carperitide.

**Materials and Methods:** Twenty one patients undergoing elective cardiovascular surgery from September to December in 2009 were assessed for study eligibility. Ten patients were selected into a carperitide group if carperitide was started on postoperative day1 (POD1), and eleven patients into a control group if carperitide was not started on POD1. In a carperitide group, continuous administration of less than 0.05 mcg kg<sup>-1</sup> min<sup>-1</sup> was started. The exclusion cases were chronic dialysis or treated with continuous hemodiafiltration or with dissection of the renal artery or below 15 years old. We compared the hemodynamic parameters, drug consumptions, serum values of sodium and creatinine, and urine volume between before initiation of carperitide (POD1) and after initiation of carperitide (POD2) among two groups. The t test was used to compare the differences between two groups and the Wilcoxon signed-ranks test was used to compare the differences in each groups. P value < 0.05 was considered statistically significant.

**Results and Discussion:** Between two groups, patient characteristics showed no significant differences, the uses of furosemide at POD2 were decreased in carperitide group (p=0.0233). In carperitide group, the mean arterial pressures were decreased (p=0.0092), but the cardiac index were maintained, and the serum values of sodium and creatinine were decreased (p=0.0050, 0.0482), urine volume were increased (p=0.0069) between POD1 and POD2.

**Conclusions:** We investigated the effects of low-dose carperitide on hemodynamic stability in postoperative patients undergoing cardiovascular surgery. Even if carperitide was used at a low dose, cardiac preload and afterload were reduced.

##### References:

1. Akira Sezai, Mitsumasa Hata, Tetsuya Niino, et al. Results of low-dose human atrial natriuretic peptide infusion in nondialysis patients with chronic kidney disease undergoing coronary artery bypass grafting. J Am Coll Cardiol 2011;58:897-903.

#### 4AP8-9

##### Comparison of Dobutamine with Isoproterenol in echocardiographic evaluation of cardiac $\beta$ -adrenergic response in rats

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**Background and Goal of Study:** Dobutamine and Isoproterenol are two  $\beta$ -adrenoceptor agonists. While Dobutamine is preferentially used in stress echography in clinical practice, Isoproterenol is the  $\beta$ -adrenoceptor agonist the most frequently investigated in experimental studies. Nevertheless, comparison between Dobutamine and Isoproterenol has not been performed in stress echocardiography. In this study, we compared the effects of two classical protocols with Dobutamine or Isoproterenol during stress echocardiography in rats.

**Materials and Methods:** Male Wistar healthy rats (n=8 in each group) were analyzed by echocardiography (Vivid 7 GE, Aulnay-sous-Bois, France) under general anesthesia with 1%-2% inhaled isoflurane. The cardiac function was recorded in basal contraction and after  $\beta$ -adrenoceptors stimulation by either Dobutamine (4 $\mu$ g/kg, intraperitoneally) or Isoproterenol (10 $\mu$ g/kg/min, continuous intravenous). Stress measurements were performed when the heart rate was stabilized. Data were analyzed by t-test using NCSS 2007. A p < 0,05 was considered as significant. Data are presented as stress measurements as percentage of basal value.

**Results and Discussion:** With Dobutamine or Isoproterenol, nor the positive inotropic effect measured with Left Ventricle Shortening Fraction ( $163\% \pm 20$  vs  $162\% \pm 16$  respectively; NS), neither the lusitropic effect measured with the peak of the early transmitral filling wave E ( $134\% \pm 25$  vs  $131\% \pm 25$ , respectively; NS) and the velocity of lateral mitral annulus Ea ( $129\% \pm 33$  vs  $124\% \pm 27$  respectively; NS) were significantly different.

In addition, the positive chronotropic effect was not significantly different when induced by dobutamine or isoproterenol as shown by a similar increase of heart rate (respectively  $121\% \pm 14$  vs  $119\% \pm 20$ ; NS). Cardiac filling pressures were similar between dobutamine and isoproterenol as shown by the ratio E/Ea (respectively  $106\% \pm 30$  vs  $110\% \pm 23$ , NS) and the deceleration time of E wave ( $99\% \pm 27$  versus  $73\% \pm 34$  respectively, NS).

**Conclusion(s):** In vivo, both inotropic and lusitropic effects of Dobutamine and Isoproterenol are similar in healthy rats. This finding should help to analyze and compare results obtained *in vivo* with one or the other of these  $\beta$ -adrenoceptor agonists.

#### 4AP8-10

##### The effect of milrinone on the induced hypotensive anesthesia in elderly patients

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**Background and Goal of Study:** This study was designed to evaluate the effect of hypotensive anesthesia with milrinone on cerebral and renal function in elderly patients undergoing orthopedic surgery and to compare with other hypotensive agents.

**Materials and Methods:** ASA I-II patients, aged 60 to 80 years, scheduled for spine surgery, were randomized to three groups: milrinone (M) group, sodium nitroprusside (S) group, nitroglycerine (N) group. In all patients, anesthesia was induced with 1.5 mg/kg propofol 0.8 mg/kg atracurium. Anesthesia was maintained with sevoflurane with N<sub>2</sub>O (FiO<sub>2</sub> 0.5) and 0.6 mg/kg/hr atracurium was infused. Ventilation was controlled to maintain ET/CO<sub>2</sub> at 35 mmHg and peak inspiratory pressure below 20 cmH<sub>2</sub>O.

During surgery, Ringer's lactate solution was infused at 10 ml/kg/h. In the event of bleeding, 6% hydroxyethyl starch or PRC were infused to maintain hemoglobin 10g/dL. A radial artery catheter was inserted and Vigileo monitor was connected to measure cardiac output. Cerebral oxymeter was attached to measure cerebral oxygen saturation.

After surgical incision, each study drug was infused: In the M group, 50 mcg/kg of milrinone was loaded over 10 min and continued at a rate of 0.5 mcg/kg/min. In the other groups, normal saline was loaded over 10 min and infused to maintain mean blood pressure at approximately 60 mmHg. Induced hypotension was achieved within 20 minutes from surgical incision, and then recorded vital sign, cardiac output (CO), cardiac index (CI), cerebral oxygen saturation (rSVO<sub>2</sub>), arterial blood gas analysis every 30 minutes. On initiating irrigation, the infusion of study drug was discontinued and aforementioned parameters were measured in 30 minutes.

Following surgery, volume of total fluid, estimated blood loss, urine output was recorded. Minimal mental status exam (MMSE) was evaluated just before surgery and 6 hours after surgery.

**Results and Discussion:** The three groups were similar in demographic and perioperative variables. Estimated blood loss (cc) was significantly lower in M group ( $562.5 \pm 381.4$ ) compared with N group ( $965.0 \pm 543.2$ ) or S group ( $1110.0 \pm 601.8$ ) ( $p < 0.05$ ). Hourly urine output (cc/kg/hr) was also higher in M group ( $1.33 \pm 0.52$ ) compared with N group ( $0.88 \pm 0.42$ ) or S group ( $0.78 \pm 0.42$ ) ( $p < 0.05$ ). CO, CI, rSVO<sub>2</sub>, MMSE were higher in M group. The differences were statistically significant.

**Conclusion(s):** Milrinone maintain CO during induced hypotension in elderly patients more than other hypotensive agents.

#### 4AP8-11

##### Preoperative intravenous Amiodarone vs Preoperative oral Amiodarone as a prophylaxis against atrial fibrillation after coronary artery bypass grafting

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**Background and Goal of Study:** Atrial fibrillation (AF) occurs as a common complication of surgical interventions. It may be found in 5% of all operated patients (pts), and more frequently in cardiosurgical (in 10% to 65% pts) than in non-cardiosurgical operations. It may be accompanied by very severe

symptoms and pts whose postoperative course was complicated by AF require longer hospitalization. The goal of our study was to compare the intravenously vs. perorally preoperative administration of Amiodarone (together with standard therapy for coronary artery disease) on the occurrence of AF after coronary artery bypass grafting (CABG) surgery, duration of postoperative AF and the length of stay in hospital.

**Materials and Methods:** We evaluated 90 pts undergoing CABG surgery at our Clinic from January 2010 until October 2011. Patients were divided into two groups. Group 1 consisted of 35 pts that received prophylactical Amiodarone intravenously 150 mg bolus after removing of aortic clamp during surgery, followed by 50 mg/h for the next 6 h and then 30 mg/h following 6h. Group 2 consisted of 55 pts that received prophylactical Amiodarone orally in dose of 600mg for 7 days prior surgery, followed by 200mg/day postoperatively until discharge.

**Results and Discussion:** Patients in Group 1 were predominantly male (82.9%), mean age  $64.11 \pm 8.02$  years. In Group 2, there was 74.5% of male pts, mean age  $64.13 \pm 7.88$  years. In Group 1 8/35 (22.9%) pts developed postoperative AF, while in Group 2 5/55 (9.1%) developed postoperative AF. There was no statistically significant difference between the groups in development of post-operative AF ( $p = 0.12$ ), but AF lasted significantly shorter in Group 1 ( $88.12 \pm 48.91$  min) compared to Group 2 ( $212 \pm 96.54$  min) ( $p = 0.01$ ). Also, hospital stay was significantly shorter in Group 1 ( $8.97 \pm 3.27$  days) compared to Group 2 ( $16.05 \pm 5.31$  days) ( $p = 0.001$ ).

**Conclusion:** Prophylactical use of Amiodarone either intravenously or orally efficiently decreases development of post-operative AF in patients undergoing CABG. With Intravenous Amiodarone, developed AF lasted shorter, and patients were in the hospital for a shorter time.

Parenteral administration of Amiodarone as a prophylaxis against postoperative AF could be considered more comfortable for patients, as well as for doctors, because the hospital stay is shorter, and in case AF develops, it lasts for a shorter time.

#### 4AP9-1

##### Haemodynamic stability and quality of recovery after Xenon anaesthesia in ASA III patients undergoing abdominal surgery

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**Background and Goal of Study:** Xenon is an inert gas eliminated unmodified through respiration. It has a poor blood solubility which provide a very rapid recovery. Xenon based anaesthesia has shown hemodynamic stability and organoprotective characteristics. This clinical study was aimed to compare the hemodynamic parameters, the awakening time and the quality of recovery and comfort in patients receiving either Xenon or Sevoflurane for long lasting abdominal oncological surgery.

**Materials and Methods:** After informed written consent, forty ASA III patients aged between 40-85 years undergoing major abdominal surgery were enrolled in the study and randomly allocated to receive either Xenon or Sevoflurane (20 patients each). They all were monitored with Vigileo Monitor®, TOF®, SpO<sub>2</sub>, EtCO<sub>2</sub>, Electrocardiogram and BIS. Anaesthesia was induced with Propofol, Cisatracurium and Fentanyl, and maintained with Cisatracurium, Fentanyl and either Xenon or Sevoflurane. Administration of Xenon or Sevoflurane was interrupted at the end of the surgical procedure and the awakening time was recorded. The post-operative sedation and comfort were evaluated using the Aldrete score.

Cardiac output (CO), cardiac index (CI) and systolic blood pressure were measured in each patient. Kruskal-Wallis and Welch two sample t-test were used for statistical analysis when indicated;  $p < 0.01$  was considered significant.

**Results and Discussion:** There were no differences between groups concerning demographic data, kind and duration of surgery. Mean duration of the surgical procedure was  $180 \pm 45$  minutes. Cardiac output (CO) and cardiac index (CI) were similar in the two groups (Xenon: CO:  $5.94 \pm 1.15$  l/min, CI:  $3.24 \pm 0.45$  l/min/m<sup>2</sup> vs Sevoflurane: CO:  $5.73 \pm 1.14$  l/min, CI:  $3.07 \pm 0.62$  l/min/m<sup>2</sup>;  $p > 0.01$ ) but mean blood pressure systolic was higher in Xenon group (Xenon:  $146.7 \pm 15.05$  mmHg vs Sevoflurane:  $120.4 \pm 10.71$  mmHg;  $p < 0.01$ ).

Patients who received Xenon showed less post-operative sedation (Xenon Aldrete score: 10/10 vs Sevoflurane Aldrete score: 7/10) and also a shorter awakening time compared to Sevoflurane group (Xenon:  $186.4 \pm 69.28$  seconds, Sevoflurane:  $355.0 \pm 62.25$  seconds).

**Conclusion(s):** Xenon based anaesthesia showed a shorter awakening time, absence of postoperative sedation and hemodynamic stability in all patients. These findings suggest that Xenon represent a new interesting compound to use in subjects undergoing major abdominal surgery.

#### 4AP9-2

##### Fast track anaesthesia with Xenon in cardiovascular surgery

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**Background and Goal of Study:** Xenon, a noble gas with anaesthetics properties, has gained a greater interest because of a rapid emergence from anaesthesia. This clinic study is aimed to evaluate the effects of Xenon on the quality of recovery and postoperative period in ASA III patients with known cardiovascular and respiratory risk factors (hypertension, hypercholesterolemia, smoking, emphysema).

**Materials and Methods:** After informed consent, we evaluated 40 patients of both genders, aged between 73 and 86 years, undergoing elective cardiovascular procedures for aortic or peripheral aneurysm/stenosis repair, or femoral/iliac cross-over in case of absolute contraindications to locoregional technique. The patients were randomly allocated to Xenon (Xe, n=20) or Desflurane group (Des, n=20). The mean duration of surgical procedure was  $210 \pm 50$  minutes. Propofol, rocuronium and fentanyl were used for induction of anaesthesia, while rocuronium, fentanyl and either Xenon or Desflurane were used for maintenance. All patients received a fluid filling with 10 ml/kg preoperatively and replacement of blood when blood loss was greater than 600 ml. Each patient was monitored for haemodynamic parameters (Vigileo monitor®) including cardiac output (CO), cardiac index (CI), arterial systolic pressure (PAS); arterial diastolic pressure (PAD), neuromuscular function (TOF Guard®); anaesthesia depth (Bispectral index, BIS®); postoperative sedation (Aldrete Score). They were all clinically monitored for 24 hours in the early postoperative period. Data were compared using Student's t-test. P values < 0.05 were considered significant.

**Results and Discussion:** CO, CI, PAS and PAD were slightly higher in the Xenon group compared to Desflurane, probably due to the lack of myocardial depression of Xenon. The other parameters did not differ significantly. The doses of drugs required for maintenance of anaesthesia were similar. The awakening time was sensibly shorter in the Xenon group and the Aldrete Score was sensibly higher ( $250+55$  sec vs  $600+45$ ,  $p < 0.001$ ;  $10/10$  vs  $6/10$ ).

**Conclusions:** The use of Xenon in the elderly patients offers advantages in the haemodynamic stability and the anaesthetic management. The absence of sedation and respiratory depression in the early postoperative period along with haemodynamic stability makes fast track anaesthesia possible even in this kind of patients.

#### 4AP9-3

##### The influence of xenon anesthesia on QTc interval

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**Background and Goal of Study:** Prolongation of the corrected QT-interval (QTc) may cause potentially critical ventricular arrhythmias. Most volatile anaesthetics can lead to an increase of QTc, due to blockade of rapidly acting potassium rectifier channels. Xenon (Xe) may alter QTc by both direct effects and indirectly through its sympathomimetic properties. Accordingly, we test the hypothesis that Xe based anaesthesia alters QTc.

**Materials and Methods:** Following local IRB approval Xe was evaluated in eight healthy volunteers and in 35 patients. In volunteers surface ECG, heart rate and radial arterial pressure were recorded in the awake state, following denitrogenation ( $F_{iO_2} > 0.9$ ) and during Xe mono-anaesthesia while breathing spontaneously via a face mask. In the observational study following oral premedication with midazolam ( $75-150 \mu\text{g kg}^{-1}$ ), general anaesthesia was induced by intravenous propofol ( $2.5 \text{ mg kg}^{-1} + 6 \text{ mg kg}^{-1} \text{ min}^{-1}$ ), remifentanyl ( $0.2 \mu\text{g kg}^{-1} \text{ min}^{-1}$ ) and rocuronium ( $0.6 \text{ mg kg}^{-1}$ ). Following denitrogenation ( $F_{iO_2} > 0.9$ ) Xe administration was started (endtidal Xe: 0.65). Surface ECGs and non-invasive blood pressure were recorded at 3 different stages: In the awake state, following anaesthesia induction and during steady-state of xenon anaesthesia before initiation of surgery. QT intervals were always determined of three consecutive cardiac intervals from ecg print outs in a double blinded fashion and corrected by using Bazett's formula.

**Results and Discussion:** In healthy volunteers, xenon slightly increased mean arterial pressure (from  $93 \text{ mmHg} \pm 5$  to  $107 \pm 6$ ) but did not alter heart rate (awake:  $64 \text{ min}^{-1} \pm 10$ ; xenon:  $70 \pm 10$ ) and QTc (awake:  $398 \text{ ms} \pm 21$ ;  $F_{iO_2} > 0.9$ :  $409 \pm 42$ ; xenon:  $409 \pm 28$ ;  $p = 0.37$ ). In patients, induction of anaesthesia with propofol and remifentanyl decreased arterial pressure (systolic/diastolic: from  $129 \text{ mmHg} \pm 13 / 70 \text{ mmHg} \pm 8$  to  $97 \pm 8 / 51 \pm 6$ ,  $p < 0.001$ ) as well as heart rate (from  $69 \text{ min}^{-1} \pm 11$  to  $61 \pm 12$ ,  $p < 0.001$ ) and was associated with the tendency to decrease QTc from  $414 \text{ ms} \pm 25$  to  $405 \pm 24$  ( $p = 0.06$ ). Discontinuation of propofol and administration of xenon increased

arterial pressure (to  $113 \text{ mmHg} \pm 13 / 62 \pm 8$ ,  $p < 0.001$ ), reduced heart rate (to:  $58 \text{ min}^{-1} \pm 10$ ,  $p = 0.04$ ) and normalized QTc to preanesthetic values ( $417 \text{ ms} \pm 32$ ,  $p = 0.3$  vs. awake).

**Conclusion(s):** Xenon mono-anaesthesia in healthy volunteers and general anaesthesia maintained with xenon/remifentanyl did not reveal increased QTc. Thus, we could not identify any adverse event of xenon on QTc.

#### 4AP9-4

##### Myocardial effects of isoflurane, sevoflurane and desflurane on right ventricular function in senescent rats

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**Background and Goal of Study:** Aging is associated with left ventricular systolic and diastolic dysfunction. Moreover, myocardial response to halogenated anaesthetics can be altered through the aging process. The effects of senescence on the right ventricle (RV) are less well studied.

**Materials and Methods:** Eight adult (4-month-old [4MO]; mean weight  $\pm$  SD:  $475 \text{ g} \pm 22$ ) and seven senescent (22-month-old [22MO]; mean weight  $\pm$  SD:  $578 \text{ g} \pm 46$ ) male Wistar rats were anaesthetized, instrumented with a RV conductance catheter and underwent well-controlled dose-responses to isoflurane, desflurane and sevoflurane inhalation (minimum alveolar concentration [MAC] 0.5, 1.0, 1.5). Steady-state and classical dynamic pressure-volume loops were recorded, as well as RV function parameters and systemic haemodynamics.

**Results and Discussion:** Aging was associated with an impairment of the RV diastolic relaxation ( $dP/dt_{\text{min}}$ ,  $P = 0.0017$ ), whereas the RV systolic function was unaltered ( $dP/dt_{\text{max}}$ ,  $P = 0.3820$ ; preload-adjusted  $dP/dt_{\text{max}}$  [PADP/dt<sub>max</sub>],  $P = 0.9425$ ; preload-recruitable stroke work [PRSW],  $P = 0.1624$ ), as was the RV cardiac output ( $P = 0.1550$ ). Senescent rats were globally characterized by a greater inter-individual variability.

In both age groups, RV contractility remained stable under increasing desflurane inhalation ( $P$  value of the 4MO and 22MO, respectively:  $dP/dt_{\text{max}}$ ,  $P = 0.4757$  and  $P = 0.6340$ ; PADP/dt<sub>max</sub>,  $P = 0.0748$  and  $P = 0.8575$ ; PRSW,  $P = 0.5266$  and  $P = 0.6073$ ), while it was the most decreased by sevoflurane exposure ( $dP/dt_{\text{max}}$ ,  $P < 0.0001$  and  $P < 0.0001$ ; PADP/dt<sub>max</sub>,  $P < 0.0001$  and  $P = 0.0003$ ; PRSW,  $P < 0.0001$  and  $P = 0.0386$ ; NS between age groups). Isoflurane produced intermediate alterations. Sevoflurane inhalation also impaired diastolic function ( $dP/dt_{\text{min}}$ ,  $P < 0.0001$  and  $P = 0.0147$ ); this was not observed under desflurane or isoflurane inhalation.

**Conclusion(s):** In rats, RV dysfunction occurring with advanced age results from impairment of diastolic relaxation. Because sevoflurane not only profoundly alters RV systolic function but also diastolic relaxation, this halogenated anaesthetic should not routinely be used in an older population group. On the other hand, desflurane, more than isoflurane, is devoid of any major systolic or diastolic RV dysfunction and should be regarded as safe in senescent individuals.

#### 4AP9-5

##### A comparison of cardiac electrophysiological effects of propofol and sevoflurane in a closed chest porcine model

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**Background and Goal of Study:** The electrophysiological effects of propofol and sevoflurane on the human heart have been evaluated separately; however, no clinical or experimental study has compared the effects of both anaesthetics on the electrical properties of the heart. The aim of this study was to compare the direct effects of propofol and sevoflurane on the cardiac conduction system in an experimental closed chest porcine model.

**Materials and Methods:** 36 pigs were premedicated with ketamine and anaesthetized with propofol  $4.5 \text{ mg kg}^{-1}$  in 18 consecutive animals the anaesthesia was maintained with propofol ( $P$ ):  $13 \text{ mg kg}^{-1} \cdot \text{h}^{-1}$  and in the remaining consecutive 18 animals with sevoflurane ( $S$ ) [ $2.66\%$ , 1 MAC in pigs]. An electrophysiologic evaluation was performed. We evaluated sinus node function [sinus node recovery time (SNRT) and sino-atrial conduction time (SACT)], atrio-ventricular (AV) nodal function, Wenckebach cycle length (WCL) and effective refractory periods (ERP). Significant changes between propofol protocol and sevoflurane protocol, were analyzed by Mann-Whitney-test for impaired data.

**Results and Discussion:** In the sevoflurane group, as compared with the propofol group, SNRT [ $907 \pm 231$  vs.  $753 \pm 146 \text{ ms}$  ( $p = 0.02$ )], WCL [ $272 \pm 54$  vs.  $234 \pm 39 \text{ ms}$  ( $p = 0.03$ )] and AVNERP [ $327 \pm 34$  vs.  $290 \pm 30 \text{ ms}$  ( $p = 0.002$ )]

were significantly longer. Ventricular refractoriness was also longer in the sevoflurane than in the propofol group:  $298 \pm 27$  vs.  $255 \pm 38$  ms ( $p=0.007$ ). No significant differences were observed in atrial refractoriness and in His-Purkinje function.

**Conclusion(s):** In this closed-chest porcine model, sevoflurane depressed parameters of sinus and atrioventricular nodal function to a higher degree than propofol. In addition, sevoflurane increased ventricular refractoriness as compared with propofol. This electrophysiological differences may be relevant in certain patients such as those with susceptibility to bradyarrhythmias or those with cardiac repolarization abnormalities. If these results were confirmed in humans, they should be taken into consideration for the choice of anaesthetic agents.

#### 4AP9-6

##### Effect of remifentanil on cardiac output and spontaneous respiration

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**Background and Goal of Study:** Hemodynamic and ventilatory consequences from remifentanil remain controversial. This study aimed to measure the effect of remifentanil on cardiac output(CO) and spontaneous respiration.

**Material and Methods:** 17 patients requiring elective surgery under general anaesthesia were enrolled. After arrive in the operating theatre, radial arterial catheter was inserted and connected to the Vigileo-FloTrac system(Edwards Lifescience, Irvine, CA, USA). During the study, subjects inhaled 50% oxygen by a face mask. The following variables were recorded before(baseline) and during continuous infusion of remifentanil at rate of  $0.25 \mu\text{g kg}^{-1}\text{min}^{-1}$ : heart rate(HR), mean blood pressure(MBP), CO, systolic volume(SV), and respiratory rate(RR). Arterial blood gases analysis(ABGs) were performed at baseline and 5 min after administration of remifentanil.

**Results and Discussion:** Patients were 44-85 yr old, with a mean age of  $65 \pm 12$  yr. Hemodynamic data and the results of ABGs were shown in Table1.

	Baseline	Remifentanil	P value
Heart rate(beat min <sup>-1</sup> )	69.8±9.7	67.6±10.1	0.03
Mean blood pressure(mmHg)	104.8±23.0	104.0±19.8	0.64
Cardiac output(L min <sup>-1</sup> )	5.7±1.4	5.9±1.4	0.27
Systolic volume(mL)	84.8±25.7	87.5±24.9	0.04
Bispectral index	96.3±3.2	95.8±3.8	0.44
Respiratory rate(breath min <sup>-1</sup> )	13.6±3.4	13.1±3.2	0.56
SaO <sub>2</sub> (%)	99.0±1.0	99.3±0.7	0.16
PaO <sub>2</sub> (mmHg)	145.4±29.5	152.7±36.0	0.10
PaCO <sub>2</sub> (mmHg)	38.3±4.1	40.4±3.9	<0.01

[Table1]

HR was slightly decreased by remifentanil infusion compared to the baseline value. Instead, there was a slight increase in SV and thereby CO remained constant. Although RR remained unchanged, partial pressure of arterial carbon dioxide(PaCO<sub>2</sub>) were slightly increased. A modest elevation of PaCO<sub>2</sub> found in our results, which did not have been a difficult matter, but it may be interpreted cautiously.

In present study in older subjects during spontaneous breathing, moderate dose remifentanil did not affect cardiorespiratory function. Numerous research designed to investigate the effect of remifentanil have been made in healthy young individuals or with low dose of remifentanil, whereas there are only a small number of studies similar to ours in patient population or study protocol. Therefore, our findings have clinical significance.

**Conclusion:** Remifentanil infusion at moderate dose did not impair CO and spontaneous respiration in elderly.

#### 4AP9-7

##### Hemodynamic stability in an optimized propofol-remifentanil based anesthesia for ophthalmic surgery

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**Background and Goal of the Study:** A deep level of anesthesia is often required in ophthalmic surgery to obtain optimal surgical conditions, which may induce significant cardiovascular impairment and compromise tissue

oxygenation. We investigated the hemodynamic stability and tissue oxygenation in a balanced general anesthesia with remifentanil, low-dose propofol, norepinephrine and goal-directed fluid administration in patients undergoing ophthalmic surgery.

**Material and Methods:** 40 consecutive patients were included after informed consent was obtained. Anesthesia was induced with 1-3 mg kg<sup>-1</sup> propofol, 1 μg kg<sup>-1</sup> remifentanil, 0.1 mg kg<sup>-1</sup> cisatracurium and an additional bolus of norepinephrine 10 μg, if required. Anesthesia was maintained with 4 mg kg<sup>-1</sup> min<sup>-1</sup> propofol, 0.25 μg kg<sup>-1</sup> min<sup>-1</sup> remifentanil and 0.05 μg kg<sup>-1</sup> min<sup>-1</sup> norepinephrine if required and further titrated to a MAP above 80% of baseline. Propofol or remifentanil infusion was increased upon the discretion of the anesthetist and targeted to a BIS value between 40 - 60. Voluven® 500ml was administered if the plethysmographic wave variation was > 10%.

Tissue oxygen saturation (StO<sub>2</sub>) was measured by near-infrared spectroscopy using the Inspectra device (Model 650, Hutchinson Technology, USA) at the left thenar eminence. Hemodynamics (cardiac index (CI), mean arterial pressure (MAP) and heart rate (HR)) were measured non-invasively (Nexfin, BMEye, Amsterdam).

**Results and Discussion:** Mean (SD) StO<sub>2</sub> increased from 83 (6) % before induction to 86 (4) % 20 minutes after induction of anesthesia ( $p < 0.05$ ) and remained stable throughout the procedure. Cardiac index dropped from 3.0 (0.7) to 2.1 (0.4) L min<sup>-1</sup> after 20 minutes ( $p < 0.05$ ).

Furthermore MAP decreased from 109 (16) to 83 (14) mm Hg and HR from 73 (12) to 54 (8) bpm (both  $p < 0.05$ ). 14/40 patients received a 500 ml Voluven bolus. The median (range) norepinephrine administration rate was 0.05 (0.0 - 0.10) μg kg<sup>-1</sup> min<sup>-1</sup>. The overall median (IQR) BIS value from induction of anesthesia to the end of the procedure was stable in all patients and was 44 (40 - 51), while 3/40 patients required additional propofol or remifentanil.

**Conclusion:** This balanced protocol based on remifentanil, low-dose propofol, norepinephrine and goal-directed fluid therapy preserves StO<sub>2</sub> while other hemodynamic variables are within a clinically acceptable range, suggesting this protocol to be feasible for use in anesthesia for ophthalmic surgery.

#### 4AP9-8

##### Comparison of Xenon and desflurane anaesthesia on haemodynamic parameters in patients undergoing cardioverter defibrillator implantation

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**Background:** Xenon (X) has been shown to provide stable anaesthesia with protective myocardial effects, in contrast to traditional inhalational anaesthetics. Desflurane (D) may depress myocardial function. The study was designed to elucidate the differences in haemodynamic effects in patients with severely depressed left ventricular (LV) function, undergoing a cardioverter defibrillator implantation, using either D or X.

**Methods:** In this randomized prospective study the most important inclusion criterion was a preoperative LV ejection fraction of < 40 %, as assessed on echocardiography or left ventricular angiography.

Excluded were patients with COPD or acute myocardial infarction < 3 m before surgery. Analysis took place at 65% Xenon or 1 MAC D. Cardiac output (CO) was calculated from time velocity integral of aortic flow, effective aortic valve area and heart rate (HR). Afterload was calculated from the product of LV end-systolic area and systolic arterial pressure (SAP). As a measure of contractility, LVOTacc. was derived from the ratio of aortic flow velocity and the time to peak.

**Results:** Thirty-three patients received D (n =16) or X (n=17). An independent t-test was used.

	D (SD)	X (SD)	p <0,05*
SAP (mmHg)	118 (23)	142 (31)	0.03*
DAP (mmHg)	66 (16)	80 (13)	0.01*
HR (s/min)	53 (23)	73 (18)	0.07
CO (L/min)	3.29 (1,34)	3.20 (0,94)	0.45
Afterload (cm2/ mmHg)	2630 (1684)	3848 (1037)	0.15
LVOT acc. ( m/s²)	7.76.10-6 (3,27.10-6)	10.2.10-6 (3.73.10-6)	0.12

[Table 01]

**Discussion:** X nor D showed effects on systolic ventricular function. However, X led to more stable blood pressures with preserved afterload indices.

## 4AP9-9

## Palpation of carotid artery decreases the size of jugular vein

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**Background and Goal of Study:** Injury of carotid artery during jugular vein cannulation can be minimized using ultrasound imaging, however conventional or land mark method still seems to be popular due to its simplicity and high success rate. Palpation of carotid artery is recommended during conventional method to avoid unintentional puncture of the carotid artery in spite of the possibility of causing jugular vein compression.

In this study we evaluated the change in size of jugular vein during palpation, and whether head down position attenuate these changes.

**Materials and Methods:** After approval from institutional ethical committee, 20 volunteers (23-52yo) were enrolled as subjects, and were positioned in supine. An operator was assigned to press the subjects' neck. Cross sectional area, transverse and conjugate diameter of the right jugular vein were measured using linear-type ultrasound probe (3-11MHz, iE33, PHILLIPS) positioned laterally at a level of laryngeal prominence so that not to interfere the palpation from anterior surface of the neck by the operator.

Minimum pressure was gently added to detect the palpation of the carotid artery. The operator performed the procedures without seeing the ultrasound images. Area (cm<sup>2</sup>) and diameters (cm) were measured before and after palpation at supine and head down (5 degree) position, respectively.

Data are shown in means +/- SD. Statistical significance was tested using paired t-test. A p value less than 0.05 was considered significant.

**Results and Discussion:** Head down increased the length of conjugate diameter and area of jugular vein (0.93±.26 vs 1.01±.23 cm, 1.04±.21 vs 1.20±.28 cm, 0.88±.39 vs 1.01±.37 cm<sup>2</sup>, p< 0.05).

Palpation of carotid artery decreased length of transverse and conjugate diameter as well as the area of jugular vein in both supine and head down position (0.93±.26 vs 0.80±.26 cm, 1.04±.21 vs 0.88±.23 cm, 0.88±.39 vs 0.66±.36 cm<sup>2</sup>, respectively, p< 0.05). Head down plus palpation of carotid artery decreased conjugate diameter and area of jugular vein (0.93±.26 vs 0.88±.29 cm, 0.88±.39 vs 0.72±.35 cm<sup>2</sup>, p< 0.05), but not the length of transverse diameter.

Since compression of jugular vein occurred even at the minimum strength, benefit of protection of carotid artery may be offset by the compression of jugular vein. Skin marking may be an alternatively available.

**Conclusion(s):** We concluded that the fingers pressing the carotid artery are not appropriate to ease for jugular vein puncture.

## 4AP9-10

## High thoracic epidural anesthesia increases hyperemic myocardial blood flow

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**Background and Goal of Study:** Cardiac autonomic control serves to optimize the coupling between myocardial oxygen supply and metabolic need by regulating microvascular resistance. The regulation of microvascular resistance may be altered by blockade of sympathetic nervous outflow during high thoracic epidural anesthesia. With this study we aimed to investigate whether cardiac sympathetic blockade influences resting and hyperemic microvascular perfusion as reflected by myocardial blood flow (MBF).

**Materials and Methods:** Six cardiovascular healthy patients (1 woman, 5 men; age 36-63 years) scheduled for high thoracic epidural anesthesia were included. Injection of lidocaine 2% via an epidural catheter inserted at level Th3-Th5 resulted in a sensory block from at least Th1 to Th6. Myocardial contrast echocardiography (MCE) was used for quantification of myocardial blood flow in ml/min/g by analysis of replenishment curves obtained during continuous contrast infusion. MCE was performed with and without thoracic epidural anesthesia at rest and during adenosine-induced hyperemia. Individual increases in myocardial blood flow were assessed by calculation of myocardial blood flow reserve (MBFR):  $MBF_{hyperemia}/MBF_{rest}$ . Data are presented as mean±SD. Paired t-tests were used for comparison of dependent samples. A P-value < 0.05 was considered to reflect a significant difference.

**Results:** Resting myocardial blood flow was 1.06±0.26 ml/min/g and 0.88±0.33 ml/min/g (P=ns) with or without thoracic epidural anesthesia. During adenosine-induced hyperemia, myocardial blood flow increased to 2.75±0.90 ml/min/g without and to 4.02±0.90 ml/min/g with thoracic epidural anesthesia (P=0.02). In this small sample size individual increases in myocardial blood flow in response to hyperemia were comparable with and without thoracic epidural anesthesia, indicated by MBFR of 3.4±0.4 and 3.0±0.9 respectively.

**Conclusion(s):** These preliminary data suggest that thoracic epidural anesthesia augments hyperemic myocardial blood flow in cardiovascular healthy patients. This may indicate that thoracic epidural anesthesia alters the regulation of myocardial microvascular resistance, although further measurements are necessary to confirm and elucidate the exact mechanism of the present observation.

## Respiration

## 5AP1-1

## Effects of transpulmonary pressure on ventilator induced lung injury in a rodent model of acute lung injury

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**Background and Goal of Study:** Mechanical ventilation is life-saving for patients with ALI and ARDS. Ventilation induced lung injury (VILI) is the most common complication.

Mechanisms of VILI are still not completely understood. Previous results suggest transpulmonary pressure (Ptp) as a main determinant of VILI. The objective was to investigate the influence of Ptp on VILI.

**Materials and Methods:** After ethics approval male SD-rats were anesthetized and tracheotomized. ALI was induced by instillation of hydrochloric acid (0.05M, pH 1-2) and allowed to develop for one hour of controlled ventilation (V<sub>t</sub> 8 ml/kg; PEEP 5 cmH<sub>2</sub>O; respiratory rate (RR) set to achieve PaCO<sub>2</sub> 40-55 mmHg).

Animals were randomized to pressure controlled ventilation (PCV, n=12) maintaining previous settings or BIPAP with either equal airway pressure (Paw) and RR reduced to 2/3 (BIPAP<sub>AW</sub>, n=9) or equal RR and Paw reduced to achieve steady Ptp (BIPAP<sub>TP</sub>, n=10) and ventilated for 5 hours. Physiologic parameters were assessed throughout the experiments, Wet-to-dry-Ratio was used to assess lung edema; Work of Breathing (WOB) was calculated as described previously.

**Results and Discussion:** Data (mean ± SD) are shown in Table. Groups showed no significant differences at baseline. Pre-defined criteria for Paw and

Ptp were successfully achieved in all groups. Lung injury was characterized by a decrease in P/F-Ratio (from 421 ± 93 to 308 ± 85 mmHg) and dynamic compliance (from 0.42 ± 0.06 to 0.23 ± 0.04 ml/cmH<sub>2</sub>O). We found that:

- 1) Lower Ptp did not reduce pulmonary edema;
- 2) spontaneous breathing efforts did not affect hemodynamics and lung injury. It seems that the amount of spontaneous breathing during BIPAP is more important for determination of VILI than the pressure.

Group	Paw (cmH <sub>2</sub> O)	Ptp (cmH <sub>2</sub> O)	Cdyn (ml/cmH <sub>2</sub> O)	VE/kg (ml*kg <sup>-1</sup> *min <sup>-1</sup> )	WOBvent (J/l)	WOBrat (J/l)	MAP (mmHg)	CO (ml/min)	W/D-Ratio
PCV	19.7 ± 2.4	16.4 ± 3.2	0.20 ± 0.05	0.60 ± 0.19	0.53 ± 0.26	0.08 ± 0.05*	100.9 ± 39.8	102.3 ± 29.2	8.1 ± 1.9
BIPAP <sub>AW</sub>	20.5 ± 2.1	19.1 ± 4.4	0.21 ± 0.06	0.51 ± 0.21	0.42 ± 0.39	0.31 ± 0.16	93.9 ± 25.9	122.0 ± 38.2	7.8 ± 2.6
BIPAP <sub>TP</sub>	17.2 ± 3.1*	16.1 ± 4.1	0.24 ± 0.08	0.51 ± 0.15	0.23 ± 0.20	0.33 ± 0.22	86.7 ± 35.2	115.8 ± 22.3	10.4 ± 2.7*

[Parameters after 5h of ventilation; \*p<0.05 vs oth]

**Conclusion(s):** In a rodent model of ALI variation of the peak transpulmonary pressure during controlled or assisted ventilation with BIPAP had no influence on pulmonary edema. Titration of ventilatory support by RR or Paw was not comparable.

**References:**

Henzler D et al. Intensive Care Med 2010 36 Suppl2: 354; Schmidt A et al. Intensive Care Med 2011 37 Suppl1: 291

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## 5AP1-2

### Anaesthesia machine role for sevoflurane anaesthesia induction

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**Background and Goal of Study:** Inhalational anaesthetic agents show rapid onset of action and short recovery time. Sevoflurane is the agent of choice for inhalational induction. In order to reach high concentrations, a high fresh gas flow (FGF) is usually required for enough time, but the anaesthesia circuit must be filled first. Our goal is to know the time needed to reach a sevoflurane concentration of 95% of the maximum allowed by the vaporizer (3 time constants -3TC-) with increasing FGF with a mock lung, and the differences between two anaesthetic machines. Secondly, we aim to know the maximum sevoflurane end-tidal concentration (ETSevo).

**Materials and Methods:** Local investigation committee approved the protocol. Six ventilators were analyzed: 3 Dräger Primus (Dräger, Spain) and 3 General Electric Avance (General Electric, Spain). After autocheck, the ventilator was connected to a 1L mock lung. A sidestream gas analyzer (Cardiicap monitor s/5, General Electric, Spain) was connected to the Y piece. With the vaporizer filled, controlled mechanical ventilation was started (tidal volume = 500 mL, respiratory rate = 12/min). After no sevoflurane trace check, the vaporizer was open to 8%, the time to maximum ETSevo and the 95% of the maximum ETSevo (3TC) were recorded. If no 8% ETSevo was observed, recordings were maintained for at least 5 minutes to make sure that the maximum ETSevo was reached. If 8% ETSevo was not reached, the recording was maintained during at least 5 minutes. The same process was repeated for 6, 9 and 12 L/min. For each FGF, the test repeated 5 times. The comparison between ventilators was made with student's t test. ANOVA with Bonferroni's post-hoc correction was used for within ventilator comparisons.  $p < 0.05$  was considered significant.

**Results and Discussion:** A total of 90 tests were made. (table 1)

FGF (L/min)	Maximum ET Sevo (vol%)			3TC (sec)		
	6	9	12	6(**)	9(**)	12(**)
GE Avance	8,3 ± 0.1(*)	7,5 ± 0,5(*)	6,4 ± 0,2(*)	33,6 ± 2,2(*)	27,6 ± 1,5(*)	28 ± 0,8
Dräger Primus	8,1 ± 0,1 (*)	7,1 ± 0,2 (*)	6,7 ± 0,1(*)	178,1 ± 23,9(*)	97,8 ± 2,1(*)	75,6 ± 2,1

(\*)  $p < 0.05$  within each ventilator. (\*\*)  $p < 0.05$  between ventilators.

[Table 1. Data show mean ± DE.]

The General Electric Avance reaches 3TC faster than the Dräger Primus for all the FGF. For the GE Avance, the FGF increase shortens the 3TC until 9L/min. Further FGF increase does not shorten 3CT time. For the Dräger Primus, FGF increase shortens the 3TC in all cases. For all ventilators, as the FGF increases, the maximum ETSevo decreases.

**Conclusion(s):** GE Avance is faster than the Primus.

## 5AP1-3

### Influence of airway obstruction on the efficacy of superimposed high frequency jet ventilation vs high frequency jet ventilation in a porcine model

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**Background and Goal of Study:** Two ventilation methods commonly used for airway surgery, superimposed high frequency jet ventilation (SHFJV) and high frequency jet ventilation (HFJV), have not been compared in the presence of severe airway obstruction. Our hypothesis was that SHFJV would improve gas exchange and increase lung volume compared with HFJV in this situation.

**Materials and Methods:** In ten anaesthetised piglets (25-32 kg), various degrees of tracheal obstruction were produced by the insertion of 2 cm long stents with inner diameters (ID) 2,4,6 and 8 mm into the trachea via a tracheostomy. SHFJV and HFJV using 7 frequencies (50-600 min<sup>-1</sup>) were applied in a randomised order (5 minutes for each frequency and mode), via an endotracheal tube. Chest wall volume variations were measured continuously by Opto-Electronic Plethysmography (OEP) and p<sub>a</sub>O<sub>2</sub> and p<sub>a</sub>CO<sub>2</sub> were measured at the end of each condition.

**Results and Discussion:** With the 8 mm ID stent, SHFJV maintained p<sub>a</sub>O<sub>2</sub> above 29.4 (3.7) kPa at all frequencies, whereas with HFJV, p<sub>a</sub>O<sub>2</sub> decreased

progressively with increasing frequency leading to severe hypoxia (4.2 (0.8) kPa at 600 min<sup>-1</sup>,  $p < 0.05$  vs SHFJV). The highest p<sub>a</sub>CO<sub>2</sub> with SHFJV was 5.9 (0.9) kPa (at 600 min<sup>-1</sup>), and with HFJV 12.3 (2.1) kPa (at 600 min<sup>-1</sup>,  $p < 0.05$ ). With decrease of stent ID both SHFJV and HFJV resulted in lower p<sub>a</sub>O<sub>2</sub> and higher p<sub>a</sub>CO<sub>2</sub> levels. At 2 mm ID, SHFJV kept p<sub>a</sub>O<sub>2</sub> above 15 (10) kPa at all frequencies ( $p < 0.05$  vs 8 mm). However, although HFJV at a frequency of 50 min<sup>-1</sup> gave an acceptable p<sub>a</sub>O<sub>2</sub> of 11.9 (12.3) kPa, p<sub>a</sub>O<sub>2</sub> decreased to 3.9 (1.3) kPa at frequencies ≥ 150 min<sup>-1</sup> ( $p < 0.05$  vs SHFJV). P<sub>a</sub>CO<sub>2</sub> was about 12 kPa with SHFJV and about 15 kPa with HFJV for all frequencies.

Preliminary OEP data detected considerable amounts of air trapping and a marked reduction of tidal volume with increasing degree of stenosis.

**Conclusion(s):** For moderate airway obstruction SHFJV provides adequate oxygenation at all of the investigated frequencies. HFJV at f ≤ 150 min<sup>-1</sup> also provides acceptable oxygenation at mild airway obstruction. In this porcine model, none of the modalities could provide adequate CO<sub>2</sub> removal with an airway stenosis of ID ≤ 4 mm, although SHFJV could maintain oxygenation for at least five minutes.

## 5AP1-4

### Spontaneous breathing improves lung function during ultraprotective ventilation in experimental lung injury

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In ARDS, mechanical ventilation (MV) with V<sub>T</sub> < 4 mL/kg may be necessary to assure lung protection, but can yield pronounced atelectasis and impaired gas exchange. Spontaneous breathing could attenuate such effects. We investigated the effects of 4 protective MV modes on lung function and distribution of ventilation in a model of acute lung injury (ALI),

- 1) controlled protective MV according to the ARDS network (ARDSnet);
- 2) controlled ultraprotective MV (ULTRAcon);
- 3) ultraprotective MV with superposed unassisted spontaneous breathing (ULTRAspon); and
- 4) continuous positive airway pressure combined with spontaneous breathing assisted by pressure support (CPAP+PS). ALI was induced in 36 pigs by lung saline lavage followed by high V<sub>T</sub> (≈ 40 mL/kg).

After that, animals were ventilated according to the ARDSnet protocol and randomly assigned to one of the 4 modes. MV according to the ARDSnet protocol was delivered with APRV with inspiratory pressure (P<sub>insp</sub>) < 30 cm H<sub>2</sub>O, targeted at V<sub>T</sub> = 6 mL/kg, PEEP = 16 cm H<sub>2</sub>O, I:E = 1:1, RR < 35/min targeted at pH > 7.30. In ULTRAcon, ULTRAspon and CPAP+PS groups, an extracorporeal lung assist device (ILA) was placed to partially remove CO<sub>2</sub>.

The sweep gas flow in the ILA was titrated to PaCO<sub>2</sub> = 50-70 mmHg. In ULTRAspon and CPAP+PS, spontaneous breathing was resumed. MV in ULTRAcon and ULTRAspon was accomplished with APRV, PEEP of 16 cm H<sub>2</sub>O, P<sub>insp</sub> titrated to V<sub>T</sub> = 3 mL/kg, RR of 15/min and I:E ratio titrated to obtain a mean airway pressure (P<sub>mean</sub>) comparable to MV according to the ARDSnet protocol. CPAP+PS was delivered with a CPAP level equivalent to the P<sub>mean</sub> during MV according to the ARDSnet protocol, PS was adjusted to V<sub>T</sub> ≈ 3 mL/kg. During 6 hours, lung function and distribution of ventilation by EIT, were assessed hourly. Extracorporeal CO<sub>2</sub> removal resulted in lower PaCO<sub>2</sub> compared to ARDSnet. During ultraprotective MV, peak airway pressures (P<sub>peak</sub>) were lower than in ARDSnet, whereby ULTRAspon showed the lowest P<sub>peak</sub> values. In ULTRAspon and CPAP+PS, P<sub>mean</sub> values were lower than in ARDSnet and ULTRAcon. In ULTRAspon, CPAP+PS and ARDSnet, oxygenation improved compared to ULTRAcon. Only ULTRAspon and CPAP+PS redistributed ventilation from central to dorsal lung areas.

In this model of ALI spontaneous breathing during ultraprotective MV reduced airway pressures, redistributed ventilation to dependent zones, and improved gas exchange, partially counterweighing the deleterious effects of so-called ultra-low V<sub>T</sub> on lung function.

## 5AP1-5

### Effects of random and pseudo-random variable ventilation on lung function in experimental lung injury

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Mechanical ventilation with variable tidal volumes (V<sub>T</sub>) is able to improve lung function in acute lung injury (ALI). These beneficial effects have been demonstrated for random, as well as biologically variable ventilation. To our knowledge, higher organized variable ventilation patterns (pseudo-random) have not been investigated. We compared the effects of true random variable

(noisy) ventilation, two types of pseudo-random variable ventilation with periods of 4 and 10 cycles (period4 and period10, respectively), and conventional (non-variable) volume controlled ventilation on lung function in experimental ALI. ALI was induced in 28 pigs with lung saline lavage followed by mechanical ventilation with high  $V_T$  ( $\approx 40$  mL/kg), and animals were assigned to one of the mechanical ventilation modes.

Ventilatory settings were:  $V_T = 6$  mL/kg, PEEP = 12 cmH<sub>2</sub>O, respiratory rate (RR) titrated to pH > 7.30. During noisy ventilation,  $V_T$  varied randomly, following a normal distribution with a coefficient of variation of 40%. In the groups period4 and period10, strictly the same set of values of  $V_T$  as in the noisy group was used.

However, the random time series was divided into 2 and 5 percentiles, respectively. The pattern of period4 was constructed to yield periodically 2 increasing and 2 decreasing  $V_T$  values, while period10 used 5 increasing and 5 decreasing  $V_T$  values. In the group with monotonic ventilation,  $V_T$  was kept constant. Lung function and distribution of ventilation by EIT were assessed hourly during 6 hours. The two-hit model resulted in severe hypoxemia (PaO<sub>2</sub>/FiO<sub>2</sub> = 54.70 ± 15.85 mmHg).  $V_T$ , RR and minute ventilation as well as distribution of ventilation and hemodynamics did not differ among groups. Period10 improved oxygenation and reduced peak airway pressure compared to monotonic mechanical ventilation.

All types of variable ventilation decreased the mean airway pressure compared to monotonic mechanical ventilation. Noisy ventilation and period10 were associated with reduced elastance of the respiratory system compared to monotonic mechanical ventilation.

In this model of ALI with severe hypoxemia, only a pseudo-random pattern of  $V_T$  improved gas exchange, while all types of variable ventilation reduced airway pressures compared to monotonic mechanical ventilation. Randomness in the time series of  $V_T$  does not seem to be required for variable mechanical ventilation to improve lung function in ALI.

## 5AP1-6

### Molecular hydrogen ameliorates lipopolysaccharide-induced acute lung injury in mice

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**Background and Goal of Study:** Acute lung injury (ALI) is still a leading cause of morbidity and mortality in critically ill patients. Recently, our and other studies have found that hydrogen gas (H<sub>2</sub>) can exert an effective therapeutic role in many disorders including stroke, ischemia-reperfusion injury, organ transplantation, sepsis, neurodegenerative diseases via reducing oxidative stress, inflammation and apoptosis.

In the current study, we investigated whether H<sub>2</sub> or hydrogen-rich saline (HS) could exert protective effects in a mouse model of ALI induced by intratracheal administration of lipopolysaccharide (LPS).

**Materials and Methods:** Adult male C57BL/6 mice weighing 20 to 25 g were used in this study and all experimental protocols were approved by the Institutional Animal Care and Use Committee of Tianjin Medical University. ALI was induced by intratracheally giving a single dose of aerosolized LPS (25 µg/mouse; *Escherichia coli* 0111:B4, Sigma). H<sub>2</sub> treatment was given by 2% H<sub>2</sub> inhalation for 1 hour beginning at 1 and 6 hours after LPS administration, respectively. HS treatment was given by intraperitoneal injection of 10 ml/kg HS at 1 hour after LPS administration.

**Results and Discussion:** LPS-challenged mice exhibited significant lung injury characterized by the deterioration of histopathology and histologic scores, wet-to-dry weight ratio, oxygenation index (PaO<sub>2</sub>/FiO<sub>2</sub>) as well as total protein in the bronchoalveolar lavage fluid (BALF), which was attenuated by 2% H<sub>2</sub> inhalation.

Moreover, H<sub>2</sub> treatment dramatically prevented the LPS-induced pulmonary cell apoptosis in LPS-challenged mice, as reflected by the decrease of TUNEL staining positive cells and caspase-3 activity.

Furthermore, H<sub>2</sub> treatment markedly attenuated LPS-induced lung neutrophils recruitment and inflammation, as evidenced by down-regulation of lung myeloperoxidase activity, total cells and polymorphonuclear neutrophils in BALF, as well as pro-inflammatory cytokines (TNF-α, IL-1β, IL-6 and HMGB1) and chemokines (KC, MIP-1α, MIP-2, and MCP-1) in BALF. Intraperitoneal injection of HS also significantly attenuated the LPS-induced ALI. In addition, H<sub>2</sub> treatment inhibited LPS-induced pulmonary NF-κB p65 nuclear translocation and DNA-binding activity.

**Conclusion:** These results demonstrate that molecular hydrogen treatment ameliorates LPS-induced ALI through down-regulation of NF-κB-induced lung inflammation. H<sub>2</sub> may be useful as a novel anti-inflammatory therapy to treat ALI.

## 5AP1-7

### Analysis of cytotoxicity induced by proinflammatory cytokines in the human alveolar epithelial cell line, A549

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**Background and Goal of Study:** Epithelial cell injury under hyperinflammatory conditions is critical in the development of septic acute lung injury. The aim of the present study is to analyze the cytotoxic effects of a mixture of proinflammatory cytokines in the human alveolar epithelial cell line, A549.

**Materials and Methods:** The cytotoxicity of proinflammatory cytokines were assessed in A549 cells by measuring lactate dehydrogenase released into the culture medium and by crystal violet staining of surviving cells. Activation of the caspase-dependent apoptotic pathway was evaluated by monitoring cleavage of cytokeratin 18 by caspases using ELISA. To estimate the cytotoxic signaling pathways responsible for epithelial injury, agents with anti-inflammatory or antioxidative properties were screened for cytoprotective effects in the epithelial injury model.

**Results and Discussion:** Inflammatory cytokines exerted cytotoxicity in A549 cells. A mixture of interleukin-1β, tumor necrosis factor-α, and interferon-γ (designated as cytomix) augmented cytotoxicity compared with each individual cytokine. Treatment with glucocorticoid (dexamethasone), tetracycline-derived anti-inflammatory antibiotics (minocycline or doxycycline), angiotensin II receptor blockers (losartan or telmisartan), or antioxidants (dimethyl sulfoxide, catalase) attenuated cytomix-induced cytotoxicity, including caspase activation.

**Conclusion(s):** Inflammatory cytokines showed synergistic cytotoxic effects on A549 cells. Caspase-dependent apoptosis was speculated to be one mechanism responsible for the cytokine-induced cytotoxicity. Agents with anti-inflammatory or antioxidative properties such as glucocorticoid, tetracycline-derived antibiotics, angiotensin II receptor blockers, or antioxidants showed substantial effect in attenuating cytokine-induced cytotoxicity and may be candidates for treatment options.

## 5AP1-8

### Impact of long coaxial breathing circuits and flow sensor location on mechanical ventilation

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**Background:** Radiological interventions have been established for mechanically ventilated patients. In such cases, a long coaxial breathing circuit (LCC) is convenient for ventilator management; however, the inspiratory resistance with LCCs may be higher than that seen with standard circle breathing circuits (SCCs) and can be a matter of concern. Furthermore, the location of the flow and pressure sensor of the ventilator will additively contribute to changes in tidal volume (TV). Therefore, we examined the effect of both breathing circuit type and flow sensor location on ventilation in a two-chamber test lung (TTL).

**Materials and Methods:** We tested the Hamilton-C2 (HC2) and Puritan Bennett 840 (PB840) ventilators; the HC2 has a flow and pressure sensor proximal to the airway, whereas the PB840 has built-in sensors. TV was compared for different ventilator settings while using a combination of the 2 ventilators and 2 commercial breathing circuits (LCC and SCC): pressure support ventilation (PSV) mode (PEEP, 5 cmH<sub>2</sub>O; PS, 10 cmH<sub>2</sub>O) and pressure control ventilation (PCV) mode (PEEP, 5 cmH<sub>2</sub>O; inspiratory pressure, 10 cmH<sub>2</sub>O; inspiratory time, 2 s). At each setting, the exhaled TV measured by the ventilator volume monitor was recorded after the airway pressure had stabilized, and all the measurements were repeated 10 times. Data were analyzed by two-way ANOVA with the Bonferroni post-hoc test (P < 0.05).

**Results:** The flow resistance and static compliance of the LCC and the SCC were assessed by the PB840 ventilator; the static compliances were 3.1 and 2.8 ml/cmH<sub>2</sub>O, respectively, and the flow resistances were 2.7 and 0.9 cmH<sub>2</sub>O, respectively. In the PCV mode, the mean TV with the HC2 ventilator was 563 ml for the SCC and 560 ml for the LCC; the mean TV with the PB840 ventilator was 539 ml for the SCC and 607 ml for the LCC. In the PS mode, the mean TV with the HC2 ventilator was 557 ml for the SCC and 550 ml for the LCC; the mean TV with the PB840 ventilator was 521 ml for the SCC and 578 ml for the LCC. The TV obtained when an LCC was used with the PB840 ventilator was significantly higher than that obtained for other combinations under similar pressure settings.

**Discussion and Conclusion(s):** Our results confirm that when a 2.4 m LCC without a flow sensor proximal to the airway is used, ventilator settings have to be modified to prevent an increase in TV during pressure-regulated ventilation.



## 5AP1-9

## Reduction of pulmonary shunt by spontaneous breathing is largely independent of hypoxic pulmonary vasoconstriction

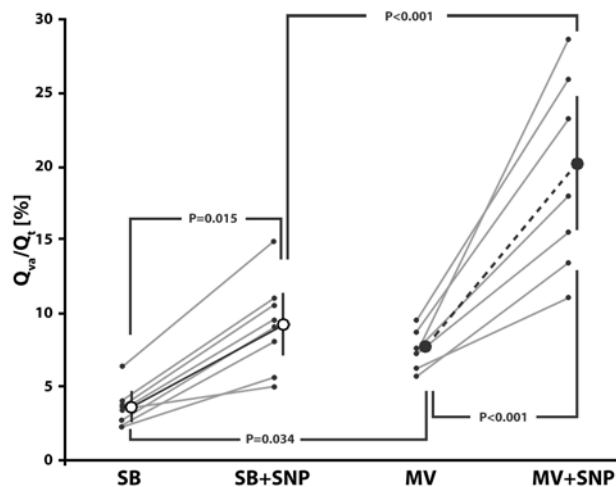
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**Background and Goal of Study:** Spontaneous breathing (SB) causes less pulmonary shunting than mechanical ventilation (MV) without recruitment of atelectasis. (1) We investigated whether hypoxic pulmonary vasoconstriction (HPV) was the main mechanism responsible for the reduced shunt during SB.

**Materials and Methods:** In 8 anaesthetized supine piglets lung collapse was induced by negative pressure application to the endotracheal tube. Either SB was resumed or muscle relaxation and MV was maintained with the same tidal volume and respiratory frequency as during SB. After reaching a plateau in  $\text{PaO}_2/\text{FIO}_2$  (within 30 mins) HPV was blunted by sodium nitroprusside (SNP), titrated to achieve at least a 30% drop in mean arterial pressure. After a stabilization period the whole procedure was repeated at the other ventilatory mode (i.e. SB after MV). Venous admixture ( $Q_{va}/Q_t$ ) was calculated as a measure of pulmonary shunting. ANOVA with Student-Newman-Keuls post hoc test was used; values are means (95% confidence interval).

**Results and Discussion:** In SB group  $Q_{va}/Q_t$  was less than during MV. With blunted HPV (SNP infusion)  $Q_{va}/Q_t$  increased from 3.6% (2.7 to 4.5) to 9.2% (7.1 to 11.4) in SB, and from 7.7% (6.8 to 8.7) to 20.2% (15.6 to 24.7) in MV group, respectively.



[Q<sub>va</sub>/Q<sub>t</sub> in SB and MV before and during SNP infusion]

**Conclusion(s):** The pulmonary shunt was lower during SB and increased less when HPV was blunted. During MV shunt was higher and increased sharply with blunted HPV. Would HPV be the only or the main mechanism for the better oxygenation during unsupported SB we would expect a sharp increase in shunt with blunted HPV.

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1. Vimlati L, Kawati R, Hedenstierna G, Larsson A, Lichtwarck-Aschoff M. Spontaneous breathing improves shunt fraction and oxygenation in comparison with controlled ventilation at a similar amount of lung collapse. *Anesth Analg*. 2011; 113(5): 1089-95.

## 5AP1-10

## Protective effects of volatile agents against bronchoconstriction induced by an allergic reaction in sensitized rabbit pups

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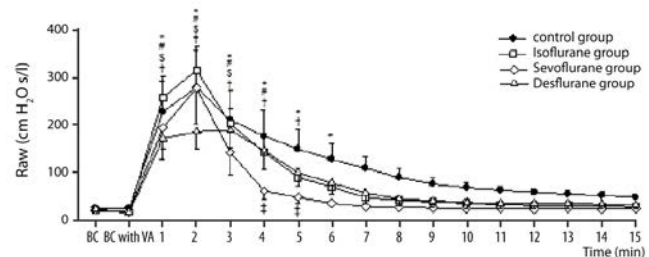
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**Background and Goal of Study:** Volatile agents exert a differential protective effect on the airways and lung periphery following cholinergic stimulation (1). We hypothesize that they may also have different ability to inhibit the lung response to an allergic reaction particularly in the presence of bronchial hyperresponsiveness (BHR).

We investigated the ability of isoflurane (Iso), sevoflurane (Sevo) and desflurane (Des) to prevent lung constriction induced by an allergic reaction in a model of BHR.

**Materials and Methods:** Low-frequency respiratory input impedance data (Zrs) were collected in ovalbumin (OVA)-sensitized five-week old rabbit pups. Measurements were performed at baseline condition in control (Group C, n=10) and during inhalation of 1 MAC Isoflurane (Group Iso, n=12), Sevoflurane (Group Sevo, n=9) or Desflurane (Group Des, n=9). After 1 mg intravenous OVA, respiratory airway resistance (Raw), tissue damping (G), and elastance (H) were obtained from Zrs by model fitting in each minute for 15 min.

**Results :** Respiratory mechanics were comparable in all groups at baseline conditions. Raw was markedly increased following administration of intravenous OVA (Figure 1) with significant attenuation after 3 minutes in animals under sevoflurane. There was a parallel and significant elevation in G ( $208 \pm 63\%$ ,  $280 \pm 90\%$ ,  $331 \pm 57\%$  (mean  $\pm$  SE%) in group C, Sevo, Iso, respectively,  $p < 0.05$ ), with a more pronounced deterioration in animals of group Des ( $510 \pm 122\%$ ,  $p < 0.05$ ).



[Figure 1.]

**Conclusions:** Commonly used volatile agents failed to inhibit the most severe acute phase of the anaphylactic constrictor response both in the central airways and lung periphery. However, recovery from the acute response was faster when anaesthesia was maintained with sevoflurane, while desflurane worsened the ventilation heterogeneities that develop after allergen exposure.

## References:

1. Myers CF et al. *Can J Anaesth*. 2011; 58(11):1007-15.

## 5AP1-11

## In vitro lung model to assess gas exchange by multiple inert gas elimination technique (MIGET) using micropore membrane inlet mass spectrometry (MMIMS)

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**Background:** Currently, gas exchange analysis by MIGET based on MMIMS is under evaluation by several groups<sup>1,2</sup>. MMIMS-MIGET shunt has been shown to correlate well with Riley shunt in a porcine lavage lung model<sup>1</sup>. Membrane oxygenators have been used as model to describe nitric oxide and carbon monoxide transfer<sup>2</sup>. So far, MIGET has not been tested in such a setup to assess predefined ventilation perfusion ( $V_A/Q$ ) distributions. In this study we aimed (I) to design an in vitro lung model (IVLM) which comprises 5 separate gas exchange compartments and (II), to compare shunt fractions derived from MMIMS-MIGET with preset reference shunt values of the IVLM.

**Methods:** Five oxygenators (Quadrox-i neonatal; MAQUET/D) switched in parallel within a closed extracorporeal membrane oxygenation circuit were ventilated in total with  $2.5 \text{ l min}^{-1}$  sweep gas at an  $\text{FIO}_2$  of 0.21, and perfused using a micro-diagonal pump (DeltaStream DP-II; Medos/D) with human blood at a rate of  $2.5 \text{ l min}^{-1}$  via 2 mixing chambers situated up- and downstream to the parallel gas exchange compartments. Inert gas solution<sup>1</sup> (6 solubilities) was infused at a rate of  $1.5 \text{ ml min}^{-1}$ .

Variable reference shunt (IVLMS) was established by bypassing one or more oxygenators with blood flow, measured by in-line flow meters. Duplicate blood samples were taken at 0, 20, 40, 60 and 80% reference shunt simultaneously from the mixing chambers up- and downstream of the gas exchange assembly, and were processed by MMIMS-MIGET for determination of shunt fraction (MS) from retention data<sup>3</sup>.

**Results:** The in vitro lung model performed well, allowing stable control of compartmental blood and gas flows, as well as reproducible inert gas transfer. Ten pairs of IVLMS and MS ranged from 0 to 80% (IVLMS) and from 1.9 to 39.1% (MS).

Linear regression was  $\text{MS} = 0.43 \cdot \text{IVLMS} + 2.4$  ( $P = 0.000$ ,  $r^2 = 0.99$ ). Mean bias ( $\pm 2 \text{ SD}$ ) was  $-20.5\%$  ( $\pm 33.2\%$ ) by Bland-Altman analysis. Coefficient of variation for MS was 5.9%.

**Conclusion:** MMIMS-MIGET shunt reflects true shunt fraction qualitatively and reproducibly. However, the proportionally increasing underestimation of true

shunt by MS could point to an inherent difference between inert gas technique and oximetric shunt determination.

#### References:

1 Baumgardner JE, J Appl Physiol 2000; 89: 1699. 2 Dinges B, A & A 2009; 109:1831; 2 Svitec et al. Ann Biomed Eng 2008;36:992; 3 Wagner PD, J Clin Invest 1977; 59: 203

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## 5AP2-1

### Asynchronous differential lung ventilation after single-lung transplantation in emphysema patient

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**Background:** Differential Lung Ventilation (DLV) is used to salvage ventilatory support in severe unilateral lung disease in the critical care setting. Synchronization of both ventilators has been proposed for years.

**Case report:** A 52-year-old woman underwent right lung transplantation because of emphysema. Six hours after surgery the chest-ray showed right infiltrates, becoming worse throughout the first day gas analysis deterioration (pH 7.26, pO<sub>2</sub> 68, pCO<sub>2</sub> 66, ratio pO<sub>2</sub>/FiO<sub>2</sub> 170).

Asynchronous DLV with left double-lumen tube was instituted. 24 hours later, infiltrate reduction and arterial blood gas improvement were observed (pH 7.34, pO<sub>2</sub> 141, pCO<sub>2</sub> 53, ratio pO<sub>2</sub>/FiO<sub>2</sub> 256). Pulmonary artery catheter monitoring showed no signs of hemodynamic instability during DLV. Extubation was possible on the fifth postoperative day and the patient was discharged from Postanaesthetic Critical Care Unit on the seventh day.

	ALLOGRAFT	NATIVE LUNG
Mode	BIPAP	Controlled Volume
PEEP	10	2
FiO <sub>2</sub>	0.55	0.55
Respiratory Rate	15	10
Tidal Volume	500	300
I:E	1:1.5	1:4

[Ventilatory Parameters]

**Discussion:** Single lung transplantation in emphysema patients who develop a primary graft dysfunction (PGD) is one of the indications of DLV since there is a great difference in allograft and native lung compliances. DLV allows adequate ventilation of the oedematous allograft using high levels of PEEP and preventing hyperinflation of the native lung.

In these patients, mediastinal shift toward the transplanted lung is avoided when native lung is allowed to be emptied, using ventilatory modes with low tidal volumes, low respiratory rates and prolonged expiratory times. Recent suture over the allograft bronchus forces to place a contralateral double-lumen tube.

#### References:

1. Y Shargall. J Heart Lung Transplant 2005; 24:1489-1500.  
2. JB Mitchell. Journal of Cardiothoracic and Vascular Anesthesia 2002; 16 (4): 459-462

#### Learning points:

1. Synchronization in DLV is not mandatory when low tidal volumes, low respiratory rates, and prolonged expiratory times are used to ventilate native lung.
2. When DLV is instituted after single lung transplantation, preserving the recent suture may be taken into account and double-lumen endotracheal tube will be positioned in the native lung.

## 5AP2-2

### The human carotid body transcriptome with focus on oxygen sensing and inflammation - a comparative analysis

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**Background and Goal of Study:** The carotid bodies (CBs) master oxygen sensing and signaling in respiration and regulate the hypoxic ventilatory response (HVR). Anesthetics blunt the HVR which can harm patients post-operatively, where both residual effects of anesthetics and hypoxic events are common (1). Interference with CB oxygen sensing and signaling is suggested as one mechanism behind adverse residual effects of anesthetic agents. Our aim is to characterize the CB transcriptome with focus on oxygen sensing

in unique *human* CB tissue. Animal CBs are extensively studied in contrast to human, and we hypothesize that there are differences between CB gene expression on oxygen sensing in humans and mice.

**Materials and Methods:** CBs from patients undergoing radical neck dissection were studied with microarray and PCR. The resulting gene lists were compared with transcriptomes of mice CBs from two published studies (2,3) and with other tissues in public databases using on-line-tools.

**Results and Discussion:** The human CB expressed ~ 13 500 genes and is unique in its tissue profile. It overexpresses genes in inflammation in comparison with brain and adrenal gland. We demonstrated molecules in oxygen sensing such as cystathionine  $\gamma$ -lyase, heme-oxygenase 2 (enzymes synthesizing the gaseous messengers H<sub>2</sub>S and NO), AMP-kinase, superoxide dismutase and NADPH-oxidase 2 and 4 (enzymes involved in the processing of reactive oxygen species and the energy status of the cell). In the human CB two important oxygen sensing K<sup>+</sup> channels were expressed (TASK-1 and Maxi-K) and also components of the systemic inflammatory response (toll-like receptors 1 and 4 and cytokines of both the early and late response). There were similarities but also clear differences in gene expression between human and mice CBs.

**Conclusion(s):** The CB is the peripheral regulator of breathing during hypoxia. We show key oxygen sensing components in the human CB, as well as inflammatory response elements, some being targets for anesthetic agents, for example the TASK-1 K<sup>+</sup> channel. Distinct differences between human and animal CB gene expression are shown, why animal CB function data not easily can be translated onto humans. This calls for further studies on human CB oxygen sensing and signaling function.

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## 5AP2-3

### Transpulmonary pressure as a guide for applying an alveolar recruiting strategy during OLV for thoracic surgery

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**Background and Goal of Study:** One-lung ventilation (OLV) impairs respiratory mechanics and ventilation/perfusion matching. Under such conditions the application of a lung recruiting manoeuvre (RM) has been shown to improve oxygenation and induces alveolar recruitment, while external PEEP alone produces unpredictable effects.

Aim of the study was to use transpulmonary pressure (P<sub>t</sub>) to guide the application of a RM or external PEEP during OLV and to compare their respective effects.

**Material and Methods:** Thirty consecutive patients undergoing thoracic surgery in lateral decubitus were studied. In all patients esophageal pressure (P<sub>es</sub>) was measured and P<sub>t</sub> calculated as airway pressure-P<sub>es</sub>. After shifting to OLV, a RM followed by 5cmH<sub>2</sub>O external PEEP or an external PEEP of 6-8cmH<sub>2</sub>O were randomly applied when P<sub>t</sub> was  $\leq$ 3. Respiratory mechanics, haemodynamics and blood gases were recorded at: post intubation (T<sub>0</sub>), lateral OLV (T<sub>1</sub>), lateral OLV post PEEP/RM (T<sub>2</sub>), end of surgery (T<sub>3</sub>). Factorial ANOVA was performed. Data are presented as mean  $\pm$  standard deviation.

**Results:** On T<sub>1</sub> n10 patients had a P<sub>t</sub> 3.5  $\pm$  0.3 cmH<sub>2</sub>O and the elastance of respiratory system (E<sub>r</sub>) 17.4  $\pm$  2.9 cmH<sub>2</sub>O/ml and their ventilatory setting remained unchanged throughout the study (G<sub>control</sub>); n20 patients had a P<sub>t</sub> of 2.2  $\pm$  0.5 cmH<sub>2</sub>O and were randomized to receive either a RM (G<sub>RM</sub>, n10) or PEEP (G<sub>PEEP</sub>, n10). On T<sub>2</sub> P<sub>t</sub> significantly increased both in G<sub>RM</sub> and G<sub>PEEP</sub> (4.9  $\pm$  2.4 and 7.9  $\pm$  0.2 cmH<sub>2</sub>O/ml respectively; p < 0.01 vs T<sub>1</sub>). In all patients with P<sub>t</sub>  $\leq$  3 the E<sub>r</sub> increased on T<sub>1</sub> (21  $\pm$  4 cmH<sub>2</sub>O/ml, p < 0.001). On T<sub>2</sub> E<sub>r</sub> decreased either in G<sub>RM</sub> (17.8  $\pm$  5.7 cmH<sub>2</sub>O/ml; p < .03) and in G<sub>PEEP</sub> (15.35  $\pm$  3.3 cmH<sub>2</sub>O/ml; p < .03), then remained stable. E<sub>L</sub> decreased in G<sub>RM</sub> (14.2  $\pm$  5.7 cmH<sub>2</sub>O/ml on T<sub>2</sub> vs 17.7  $\pm$  8.5 cmH<sub>2</sub>O/ml on T<sub>1</sub>; p < 0.01), in G<sub>PEEP</sub> (12.6  $\pm$  3.1 cmH<sub>2</sub>O/ml on T<sub>2</sub> vs 17.9  $\pm$  2.8 cmH<sub>2</sub>O/ml on T<sub>1</sub>; p < 0.05), while the E<sub>ow</sub> remained stable. Recruited volume was 343  $\pm$  123 ml in G<sub>RM</sub> and 253  $\pm$  199 ml in G<sub>PEEP</sub> (NS). PaO<sub>2</sub>/FiO<sub>2</sub> remained stable throughout the study in G<sub>control</sub>; it decreased on OLV T<sub>1</sub> in the remaining patients (p < 0.01 vs T<sub>0</sub>) and increased both after RM (T<sub>2</sub> 216  $\pm$  70 vs T<sub>1</sub> 317  $\pm$  125; p < .03) and G<sub>PEEP</sub> (T<sub>2</sub> 195  $\pm$  79 vs T<sub>1</sub> 313  $\pm$  86 (p < .03). Haemodynamic parameters remained unmodified throughout the study.

**Conclusion:** These preliminary data shows that a)PI can be used to identify patients who really need an alveolar recruitment strategy; b)when PI guides, RM plus PEEP or PEEP alone have similar effects on respiratory mechanics and oxygenation

### 5AP2-4

#### The influence of postoperative anesthesia on relation between ventilation and perfusion after lobectomy and parcialectomy of patients with a cancer of lung

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**Background and Goal of Study:** In the early postoperative period after lobectomy and parcialectomy at oncological patients the significant changes between ventilation and perfusion develop, which substantially restricts respiratory excursions of a thorax because a painful syndrome with possible development atelectasis and pneumonias.

**Materials and Methods:** Depending on a kind of postoperative anesthesia, all patients after pneumonectomy have been divided in two representative groups: investigated 10 patients who have received postoperative anesthesia infusion in epidural catheter a solution ropivacaine 0,2% - 275,0 + phentanylum 0,005% - 12,0 + epinefrine 0,001% - 6,0 with a speed 5 ml/h microinfusion pump "Vogt Medical" (Germany) within 4 day and the control 10 patient- postoperative anesthesia spent bolus ropivacaine 0,75% - 4,0 and narcotic drugs at a pain.

To all patients for 4 day after operation it has been executed ventilation and perfusion scintigraphy with an estimation relation V/Q. Research was made on gamma-camera "Omega 500" ("Technicare" USA, Germany).

**Results and Discussion:** In group of patients with continuous postoperative epidural anesthesia on 4 day after operation in the injured lung V/Q was equal  $0,9 \pm 0,6$  and came nearer to physiological norm, in group of comparison V/Q it has been broken -  $1,4 \pm 0,06$  ( $p=0,006$ ). In not operated lung at patients with continuous postoperative epidural anesthesia V/Q also came nearer to 1,0, in group of comparison remains lowered -  $0,7 \pm 0,03$  ( $p=0,005$ ).

**Conclusion(s):** Continuous postoperative infusion epidural anesthesia promotes restoration relation ventilation and perfusion after operation up to normal values.

### 5AP2-5

#### Hematopoietic CD34+ stem cells mobilization in patients undergoing elective lung resection

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**Background and Goal of Study:** CD34+ blood haematopoietic stem cells (HSC), under appropriate stimuli, may mobilize and differentiate to repair damaged organs such as heart or liver, while up to now data are lacking on CD34+ mobilization in presence of lung parenchyma damage. Aims of this study were to evaluate the presence of CD34+ HSC activation following lung surgical trauma and the potential role of patients and surgery-related factors in this mobilization.

**Materials and Methods:** The study was performed in patients undergoing elective surgical lung resection, age  $\geq 18$  years, ASA II-III, without inflammatory response syndrome. Blood samples for WBC and HSC count were collected before surgery ( $T_0$ ), on 24 ( $T_{24h}$ ), 72 ( $T_{72h}$ ) hours, 5 ( $T_{5d}$ ) and 7 ( $T_{7d}$ ) days postoperatively.

Quantification of CD34+ cells was performed by flow Citometry. The degree of intraoperative lung parenchyma manipulation was arbitrarily established immediately at the end of the surgical procedure for every patient by the same thoracic surgeon by means of a 6-point score from 1 to 6 (1 = light manipulation, 6 = heavy manipulation). Age, sex, ASA, degree of lung parenchyma manipulation and presence of fever were evaluated by means of stepwise multivariate analysis as possible indicators of CD34+ HSC variations over time.

**Results and Discussion:** Fifty-one patients were included in the study. On  $T_0$  WBC and CD34+ were  $6266 \pm 2258$  and  $1.38 \pm 0.78$  cells/ $\mu$ l, respectively. CD34+ increased significantly on  $T_{5d}$  and  $T_{7d}$  ( $p < 0.04$  vs  $T_0$ ). The stepwise multivariate analysis showed patients age  $< 63$ y (median value,  $p < 0.02$ ), ASA III ( $p < 0.03$ ), and an higher amount of lung parenchyma manipulation ( $p < 0.05$ ) as indicators of CD34+ increase.

**Conclusion:** Our data suggest that in patients undergoing elective lung resection, HSC are mobilized from bone marrow, reaching their highest level from 5 to 7 days postoperatively.

Patients' age and the amount of lung parenchyma's surgical manipulation seems a trigger for HSC mobilization.

### 5AP2-6

#### Changes in oxygen consumption, oxygen saturation by pulse oximetry and regional oxygen saturation during one-lung ventilation in elective thoracic surgery

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**Background and Goal of Study:** To evaluate the changes in oxygen consumption ( $VO_2$ ), oxygen saturation by pulse oximetry ( $SpO_2$ ) and regional oxygen saturation ( $rSO_2$ ) during one-lung ventilation (OLV) in different elective thoracic surgery procedures.

**Materials and Methods:** Prospective, observational study in 10 patients undergoing elective thoracic surgery procedures with OLV. Electrocardiogram, heart rate, invasive blood pressure,  $SpO_2$ ,  $rSO_2$ , bispectral index (BIS) and  $VO_2$  measured by indirect calorimetry were continuously monitored. Data were registered by S/5TM Datex-Ohmeda monitor with  $VO_2$  CAIOVX (Datex-Ohmeda) module. Measurement of  $VO_2$ ,  $SpO_2$  and  $rSO_2$  were registered after anaesthesia induction (basal value, bipulmonary ventilation, BPV), 10 minutes after induction (BPV 10), at the beginning of OLV (OLV 0), after 30, 60 and 90 minutes of OLV (OLV 30, OLV 60, OLV 90) and at the end of the surgery when bipulmonary ventilation is reinstated (BPV F). Statistical analysis: The difference between variance and kurtosis values was analyzed and there was an absence of normal deviation. Friedman test for multiple tied values was used without finding differences ( $p=0,298$ ). Paired values differences were analyzed separately using Wilcoxon test.

#### Results and Discussion:

	BPV 0	BPV 10	OLV 0	OLV 30	OLV 60	OLV 90	BPV F
$VO_2$	281.3 $\pm 105.72$	198.14 $\pm 74.47$	170 $\pm 73.47$	199.62 $\pm 26.86$	182.25 $\pm 32.87$	195.5 $\pm 36.81$	210.5 $\pm 38.44$
$rSO_2$	76.42 $\pm 10.75$	72.14 $\pm 8.61$	69.85 $\pm 6.46$	71.42 $\pm 7.5$	68.71 $\pm 3.63$	67.42 $\pm 6.52$	69.71 $\pm 7.99$
$SpO_2$	97.12 $\pm 1.88$	97.12 $\pm 1.95$	96.5 $\pm 2.67$	95.5 $\pm 3.16$	95.62 $\pm 2.55$	95.12 $\pm 2.69$	98.37 $\pm 3.11$

#### [Results]

At the beginning of OLV a statistically significant decrease ( $p=0,042$ ) in the measurements of  $VO_2$  occurred, compared to values obtained at the reinstatement of bipulmonary ventilation (BPV).

$rSO_2$  values decrease after induction of anaesthesia and during OLV. The difference between the values in BPV at the beginning and at the end of surgery was statistically significant ( $p=0,042$ ).

Changes in  $SpO_2$  between BPV at the beginning and at the end of surgery were statistically significant ( $p=0,042$ ).

**Conclusion(s):** Sudden variations of  $VO_2$  measurements show cardiorespiratory changes that jeopardize homeostasis and require an early intervention. During OLV periods of hypoxaemia and subsequent tisular hypoxia often occur, being  $VO_2$  measurement by indirect calorimetry a useful non-invasive monitoring to detect and treat them.

It would be necessary to increase the number of patients in the future to establish a correlation between the parameters measured in this study.

### 5AP2-7

#### Effects of different ventilation modes on shunt during one-lung ventilation

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**Background and Goal of Study:** In lung cancer surgery, large tidal volume (TV) and elevated inspiratory pressure are known risk factors for postoperative acute lung injury. For one-lung anaesthesioprotective ventilation with reduced tidal volume and lower airway pressure became indispensable during last decade. However a common agreement about ventilation mode during one-lung anaesthesia has still not been ensued (1-2). Aim of this study is to investigate effects of pressure or volume-controlled modes on shunt and respiratory pressures for one-lung ventilation.

**Materials and Methods:** Twenty-four patients undergoing thorocotomy were enrolled for the study. During two lung ventilation (TLV1) on PCV for each patient TV to maintain end-tidal  $CO_2$  was defined. Patients were randomly assigned to two groups; and about 60% of the determined TV was used during

OLV. For the first group (GI) (n=14) ventilation mode was pressure controlled; whereas for the second (GII) (n=10) it was volume controlled. At the end of 20 minutes, ventilation mode changed for each group (VCV for GI and PCV for GII). When TLV was re-established all patients were ventilated with PCV (TLV2). Hemodynamic data (heart rate, blood pressure, etc) and respiratory parameters (TV, respiratory rate, airway pressure, oxygenation, shunt) were recorded. Student's t test and ANOVA were used to determine the significance of parametric values.

**Results and Discussion:** Shunt was increased during OLV for each ventilation mode (TLV1 %18±6; PCV %36±10.4, VCV %37±10.3, TLV2 %15±7, p< 0.001), as well as TV were decreased (TLV1 567±81ml; PCV 372±63ml; VCV 363±53ml, TLV2 522±95ml, p< 0.001). Airway pressure were similar between two ventilation modes.

**Conclusion(s):** Reduced TV during OLV were found to be associated with similar effects on shunt and airway pressure with PCV and VCV. Both of them seem reliable alternative for protective ventilation strategy during lung resection.

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## 5AP2-8

### Protective lung ventilation during thoracic surgery

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**Background and Goal of Study:** Protective lung ventilation (PLV) is currently considered the most appropriate in thoracic surgery to prevention acute lung injury (ALI). This study evaluated the incidence of intraoperative hypoxia and its management, consequences at the level of gas exchange and postoperative complications in patients undergoing lung resection under PLV.

**Materials and Methods:** In a descriptive, observational study 47 patients undergoing lung resection were included. Parameters used in OLV were: tidal volume of 5 or 6 ml / kg of ideal weight on right and left thoracotomy respectively, positive end-expiratory pressure (PEEP) of 5 cm H<sub>2</sub>O and FIO<sub>2</sub> of 0.6. Two samples of arterial blood gasses were taken; one during double-lung ventilation and the second, twenty minutes after initiated OLV. Intraoperative ventilation pressures, end-tidal carbon dioxide concentration (EtCO<sub>2</sub>), hemodynamic stability, minimum pulse oximetry saturation (SpO<sub>2</sub>) during OLV, management of hypoxia and post-operative complications were recorded.

**Results and Discussion:** SpO<sub>2</sub> < 90% occurred in 2 patients (4.25%) and SpO<sub>2</sub> < 95% occurred in 21 patients (44.6%) during OLV. Management during SpO<sub>2</sub> < 95% were: increase of FIO<sub>2</sub> in 32%, administration of 5 cmH<sub>2</sub>O of continuous positive end-expiratory pressure (CPAP) in 30%, use of fiberoptic bronchoscopy in 6%, application of 10 cmH<sub>2</sub>O PEEP in 2% and lung recruitment maneuvers in 11% of patients.

In OLV plateau pressure was 19.3 ± 3.1 cmH<sub>2</sub>O, PaO<sub>2</sub> 105 ± 39 mmHg; EtCO<sub>2</sub> 39.5 ± 5 mmHg, and PaCO<sub>2</sub> 53.8 ± 7 mmHg.

Postoperative complications in hospital were: 2 pneumonia, 3 atelectasis and 3 air leaks. Hypoxia, defined by a decrease SpO<sub>2</sub> < 90%, during one-lung ventilation (OLV) has become less common, but still occurs in about 10% of cases. Increase of FIO<sub>2</sub>, use of CPAP, use of fiberoptic bronchoscopy and lung recruitment maneuvers are considered effective in the management of hypoxia on OLV and were the most common measures that we used.

The arterial-alveolar gradient of CO<sub>2</sub> was greatly increased, which results in any case of severe respiratory acidosis; due to this fact, we recommend an arterial blood gas analysis or increasing minute ventilation when the EtCO<sub>2</sub> is superior to 40 mmHg.

**Conclusion(s):** In our study hypoxia was easily resolved. Severe hypercapnic acidosis could be observed in some patients. Postoperative complications were rare and there were no cases of acute lung injury.

## 5AP2-9

### Control of functional separation of the lungs and evaluation of the correct positioning of the double lumen endotracheal tube (DLT) during thoracic surgery

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**Background and Goal of Study:** Proper placement and verification of the correct position of endotracheal double lumen tube (DLT) is a prerequisite for thoracic surgery. In this study we present the experience with the use of DLT in three different times. so, we estimate the contribution of fiber-optic bronchoscopy, we determine the role of simple diagnostic testing methods like

as auscultation, we assign the arterial blood gas monitoring and respiratory parameters and we evaluate the hemodynamic monitoring of central venous oxygen saturation (ScVO<sub>2</sub>) in order to ensure the proper positioning of the DLT and the safety of the patient.

**Materials and Methods:** Three groups were evaluated. The first group (95 patients) was a study group regarding the role of fiber-optic bronchoscopy in positioning and confirming the correct placement of the DLT.

The second group (88 patients) was a study group regarding the training of medical personnel in placing the DLT.

Finally, the third group (a small group of 20 patients, studied subsequently), concerns the role of ScVO<sub>2</sub> in thoracic operations.

**Results and Discussion:** In the first group, control with fiber-optic bronchoscopy revealed wrong positioning of the DLT at 38 patients (40%). After placing the patients in lateral position, 14 of them required minor adjustments of the correct placement of the DLT. In the second group, anaesthesiological maneuvers were improved regarding synchronization of movements and speed. Moreover, the prediction of difficult intubation led to the use of smaller sized DLT. Evaluating parameters such as arterial blood gases, inspiratory pressure, compliance, capnography and arterial pressure waveforms helped in understanding the physiology of one lung ventilation and anaesthesia.

Finally, in the third group the use of ScVO<sub>2</sub> monitoring was very important in 5 patients especially, where the prompt recognition of declined values constituted reliable index of corrective movements and therapeutic interventions.

**Conclusion(s):** The fiber-optic bronchoscopy is considering important in verification of the correct placement of the DLT. The ScVO<sub>2</sub> monitoring is also equally important especially in operative period. Furthermore, the experience of anaesthesiologist is the significant parameter.

#### References:

- ScVO<sub>2</sub>: Interests and limitations S. Shaefi , *Euroanaesthesia* 2008 Copenhagen

## 5AP3-1

### The effects of different ventilatory strategies on pulmonary gas exchange in laparoscopic cholecystectomy

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**Background and Goal of Study:** Respiratory function and pulmonary gas exchange are affected in laparoscopic cholecystectomy.

The aim of this randomized double blind study was to compare the effects of different ventilatory strategies (Pressure or Volume controlled ventilation-PCV/VCV-) on pulmonary gas exchange in laparoscopic cholecystectomy.

**Materials and Methods:** 120 patients scheduled for laparoscopic cholecystectomy were randomly allocated into 4 groups (30 patients each) 5 min before CO<sub>2</sub> insufflation :PCV with PEEP of 10 cm H<sub>2</sub>O(group A), PCV with zero PEEP(B), VCV with PEEP of 10 cmH<sub>2</sub>O(C) and VCV with zero PEEP(D).

Induction and maintenance of anaesthesia was similar in every patient: midazolam 2 mg, propofol 2 mg/kg with cisatracurium 0.15 mg/kg (induction) and a continuous infusion(µg/kg/min) of cisatracurium (1-2) and remifentanyl (0.1-0.2).

For ventilation we used a Primus (Dräger Corp., Germany): O<sub>2</sub>/air 50%, V<sub>Tidal</sub> 7-10 ml/kg and respiratory rate 12/min. Blood gas analysis were recorded: awake, 5 min after induction of anesthesia at zero end-expiratory pressure, and 5, 20 and 40 min after CO<sub>2</sub> insufflation.

We analyzed PaO<sub>2</sub>, PaCO<sub>2</sub> (both mmHg), hemodynamic data (SBP,DBP, HR) and pulmonary compliance (ml/cmH<sub>2</sub>O) using ANOVA repeated measures and Fisher exact test as required for statistical analysis (p< 0.05 as significant).

**Results and Discussion:** Patient's characteristics and hemodynamic data in 4 groups were comparable. There were no significant differences among groups in PaO<sub>2</sub>, PCO<sub>2</sub> or compliance when patients were awake or at 5 min after induction of anesthesia. We didn't found significant statistical differences in PaCO<sub>2</sub> at 5 min of CO<sub>2</sub> insufflation but PCO<sub>2</sub> levels were higher in patients of groups C and D at 20 and 40 min with respect to group A and B (p< 0.05).

	Preinsufflation		Postinsufflation		
	Awake	5 min postinduction	5 min	20 min	40 min
Group A (PCV+ PEEP)	37.3	38.3	38.4	37.3	39.4
Group B (PCV)	36.4	37.2	37.3	37.8	38.6
Group C (VCV+ PEEP)	37.1	38.2	41.6	45.5*	45.1*
Group D (VCV)	38.4	37.2	40.9	44.4*	46.2*

[PCO<sub>2</sub> levels (\*p<0.05)]

Compliance levels (ml/cmH<sub>2</sub>O) were higher in patients of groups A (41.7) and B (42.4) than in group C(36.6) and D(37.1), ( $p < 0.05$ ) but there were no differences in PaO<sub>2</sub> levels after CO<sub>2</sub> insufflation. Hypoxemia didn't appear at any time in the study.

**Conclusion:** In our study, PCV was associated to a higher compliance and lower PaCO<sub>2</sub> levels probably because increases alveolar ventilation with respect to VCV.

### 5AP3-2

#### Intraoperative determination of respiratory mechanics and oxygenation in morbid obese patients undergoing bariatric surgery

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**Background:** Obesity may affect pulmonary function in a number of ways as decreased compliance (C<sub>sr</sub>) and diminished lung volumes and capacities mainly functional residual capacity (FRC).

**Objective:** To describe the behavior and relationships between Intraoperative respiratory mechanics (C<sub>sr</sub> and FRC) and oxygenation (PaO<sub>2</sub>/FiO<sub>2</sub>) in morbid obese patients undergoing laparoscopic bariatric surgery.

**Methods:** Thirty patients with BMI  $\geq 46 \pm 6$  kg/m<sup>2</sup>, scheduled for laparoscopic bariatric surgery were included in this prospective study. After 5 min of pre-oxygenation, intravenous anesthesia was induced and maintained. Volume controlled ventilation (ventilator Engström CS@GE) was set up: VT=8 ml·kg<sup>-1</sup> predicted body weight; RR=12; PEEP=10 cmH<sub>2</sub>O; FiO<sub>2</sub> 0.5. A recruitment maneuver (RM) with incremental PEEP and pressure control ventilation (PCV) was applied 15 min after pneumoperitoneum (pneumo) set up. Optimal PEEP was calculated and established. After pneumo withdrawal PEEP was set up again at 10 cmH<sub>2</sub>O.

Respiratory mechanics(respiratory system compliance (C<sub>sr</sub>) and FRC) were recorded using the ventilator tools at 4 time points: 5 min. after induction(T1), 15 min. after pneumoperitoneum set up(T2); 15 min after RM-PEEP optimization(T3); and 15 min. after pneumoperitoneum withdrawal (T4). PaO<sub>2</sub>/FiO<sub>2</sub> ratio was determined at T1,T3 and T4.

#### Results:

Respiratory mechanics Variables	Mean $\pm$ SD
FRC (T1)	1674,72 $\pm$ 594,94
FRC (T2)	874,31 $\pm$ 260,80
FRC (T3)	1542,732 $\pm$ 332,16
FRC (T4)	1788,58 $\pm$ 520,80
C <sub>sr</sub> (T1)	49,83 $\pm$ 10,05
C <sub>sr</sub> (T2)	38,14 $\pm$ 6,62
C <sub>sr</sub> (T3)	45,93 $\pm$ 8,07
C <sub>sr</sub> (T4)	58,00 $\pm$ 12,60

#### [Results 1]

Oxygenation	Mean $\pm$ SD
PaO <sub>2</sub> /FiO <sub>2</sub> (T1)	337,40 $\pm$ 142,42
PaO <sub>2</sub> /FiO <sub>2</sub> (T2)	341,38 $\pm$ 109,84
PaO <sub>2</sub> /FiO <sub>2</sub> (T4)	458,60 $\pm$ 114,65

#### [Results 2]

After performing the pneumo (T2) CRF and C<sub>sr</sub> decrease significantly respect to (T1).The RM improved respiratory mechanics and PaO<sub>2</sub>/FiO<sub>2</sub> equaling values of FRC and C<sub>sr</sub> in (T3) with (T1).

After pneumo removal C<sub>sr</sub> and PaO<sub>2</sub>/FiO<sub>2</sub> were even better than prior to pneumo.

**Conclusion:** Data suggest that in this patients CRF and C<sub>sr</sub> decrease significantly after pneumo, and RM followed by individually adjusted optimal PEEP allowed complete recovery of respiratory mechanics as well as oxygenation after pneumo.

### 5AP3-3

#### Use of transpulmonary pressure as a guide for setting PEEP during laparoscopic surgery

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**Background and Goal of Study:** Abdominal insufflation during laparoscopy may impair respiratory mechanics. The application of ventilator strategies aimed at recruit lung tissue by increasing its distending pressure, i.e. transpulmonary pressure (P<sub>i</sub>), may counteract the effects of increased abdominal pressure. To our knowledge few data are available on the use of P<sub>i</sub> to guide external PEEP application during laparoscopy.

Aim of the study was to evaluate the hypothesis that PEEP titrated in order to obtain a P<sub>i</sub> >5cmH<sub>2</sub>O has beneficial effects on respiratory mechanics and gas exchange during laparoscopic hysterectomy in Trendelenburg position (T). Materials and

**Methods:** Ten consecutive women undergoing laparoscopic hysterectomy were studied. In all patients an oesophageal thin latex balloon-tipped catheter was inserted to measure oesophageal pressure (P<sub>es</sub>). P<sub>i</sub> was measured as airway pressure-P<sub>es</sub>. After induction of pneumoperitoneum, a PEEP of 5-8 cmH<sub>2</sub>O was applied only in case P<sub>i</sub> < 5cmH<sub>2</sub>O and titrated to keep P<sub>i</sub> >5 cmH<sub>2</sub>O. Respiratory mechanics, haemodynamics and blood gases were recorded at four times: baseline (T<sub>0</sub>), pneumoperitoneum pre-PEEP (T<sub>1</sub>), pneumoperitoneum post-PEEP/ after 30 min in case of no PEEP application (T<sub>2</sub>), end of surgery (T<sub>3</sub>). Data were analyzed by one-way ANOVA and are presented as mean  $\pm$  standard deviation.

**Results:** On T<sub>1</sub> in 8 patients E<sub>rs</sub> was 26.14  $\pm$  3.98 cmH<sub>2</sub>O/ml and P<sub>i</sub> was <5 cmH<sub>2</sub>O (G<sub>PEEP</sub> 3.15  $\pm$  1.91 cmH<sub>2</sub>O) and an external PEEP of 5 cmH<sub>2</sub>O was applied, in 2 patients E<sub>rs</sub> was 22  $\pm$  2.69 cmH<sub>2</sub>O/ml and P<sub>i</sub> was >5 cmH<sub>2</sub>O (G<sub>NO-PEEP</sub> 6.89  $\pm$  1.76 cmH<sub>2</sub>O), and ventilator setting remained unmodified. On T<sub>2</sub> in G<sub>PEEP</sub> E<sub>rs</sub> was 16  $\pm$  6.92 cmH<sub>2</sub>O/ml ( $p < 0.01$  vs T<sub>1</sub>). E<sub>rs</sub> on T<sub>1</sub> was 6.95  $\pm$  3.05 cmH<sub>2</sub>O/ml ( $p < 0.01$ ) and on T<sub>2</sub> decreased to 4.02  $\pm$  3.48 cmH<sub>2</sub>O ( $p < 0.01$ ). E<sub>i</sub> remained unchanged. In G<sub>NO-PEEP</sub>, respiratory elastance components remained unmodified. PaO<sub>2</sub>/FiO<sub>2</sub> in G<sub>PEEP</sub> was 497  $\pm$  42 on T<sub>1</sub> and 554  $\pm$  196 on T<sub>2</sub> ( $p < 0.05$ ), in G<sub>NO-PEEP</sub> remained unmodified.

**Conclusions:** These preliminary data suggest that pneumoperitoneum does not cause in all patients an increase of E<sub>rs</sub>. The measure of P<sub>i</sub> could be helpful to recognize those patients who may benefitate from the application of external PEEP to counteract the detrimental effects of pneumoperitoneum on respiratory mechanics, thus avoiding its use if not necessary.

### 5AP3-4

#### Extracorporeal life support in ARDS due to H1N1 virus: results of an Italian referral ARDS center

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**Introduction:** The aim of our study was to assay the efficacy of extracorporeal life supports (ECLS) in patients with ARDS affected by H1N1 virus and conventional therapy refractory hypoxemia.

**Materials and Methods:** In 2011, we had 9 H1N1 affected patients by our experienced medical center, who were all refractory to conventional therapy, so that they needed ECLS: 3 of those 9 had severe hypercapnia and a normal heart function, received extracorporeal carbon dioxide removal.

Instead the other 6 patients were eligible for extracorporeal membrane oxygenation (ECMO) according to the ELSO guidelines.

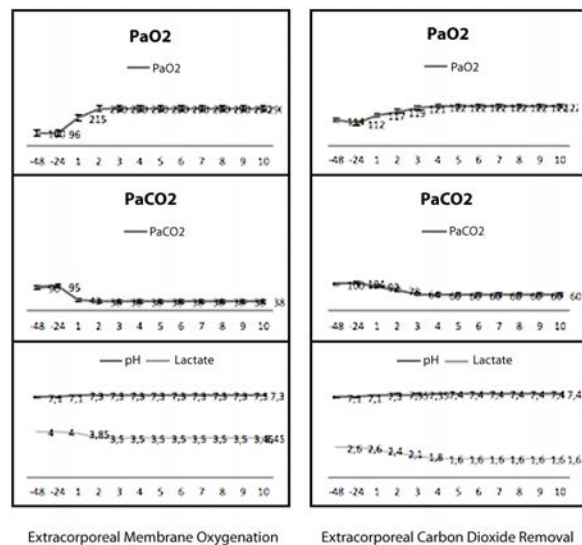
All the patients were monitored by evaluating 4 parameters: PaO<sub>2</sub>, PaCO<sub>2</sub>, pH, lactate. Those were registered from 48 hours prior to 10 days after ECLS.

**Results:** 48 hours prior ECLS the group of patients which received extracorporeal carbon dioxide removal showed PaO<sub>2</sub> 115  $\pm$  14 mmHg, PaCO<sub>2</sub> 100  $\pm$  20, pH 7.2  $\pm$  0.2 and lactate concentration 2.6  $\pm$  0.8 mMol/L, respiratory rate 22  $\pm$  2 bpm.

After 10 days of extracorporeal carbon dioxide removal treatment these patients reported PaO<sub>2</sub> 122  $\pm$  9 mmHg, PaCO<sub>2</sub> 60  $\pm$  12 mmHg, pH 7.4  $\pm$  0.05, lactate concentration 1.6  $\pm$  0.2 mMol/L and respiratory rate decreased to 14  $\pm$  2 bpm. 48 hours prior ECLS the ECMO-group patients showed PaO<sub>2</sub> 100  $\pm$  23 mmHg, PaCO<sub>2</sub> 90  $\pm$  35, pH 7.1  $\pm$  0.1 and lactate concentration 4  $\pm$  0.2 mMol/L. They showed as well a pulmonary compliance of 22 ml/cmH<sub>2</sub>O, Vt 5  $\pm$  1.2 ml/kg, PEEP 16  $\pm$  2 cmH<sub>2</sub>O and a FiO<sub>2</sub> 100%.

After 10 days of ECMO treatment the patients reported PaO<sub>2</sub> of 290  $\pm$  45 mmHg, PaCO<sub>2</sub> of 38  $\pm$  10 mmHg, pH of 7.3  $\pm$  0.1 and a lactate concentration of 3.5  $\pm$  0.5 mMol/L. Mechanical ventilation was set in order to let Pplat < 30 mmHg, a Vt of 5 ml/kg, a PEEP of 10 cmH<sub>2</sub>O, so that we obtained a RR of 9  $\pm$  1 bpm, and a progressive FiO<sub>2</sub> decrease.

**Conclusion(s):** As clinical experience suggested us, ECLS treatment improves gas exchange and let the operator keep the ventilation on the patient in a safe way, if it was applied early, while trying to recruit pulmonary parenchyma.



[Figure 1]

### 5AP3-5

#### Laparoscopic versus open colorectal surgery: implications for postoperative pulmonary function

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**Background and Goal of Study:** Pulmonary complications remain a leading cause of morbidity after major abdominal surgery. The impairment of lung function followed by atelectasis and pneumonia after laparotomic abdominal surgery is well accessed by several evidences. Instead, the impact of laparoscopy on reduction of postoperative pulmonary function is not as well documented. The purpose of this study is to compare the lung function of patients undergoing major abdominal open or laparoscopic surgery.

**Materials and Methods:** Seventeen consecutive patients undergoing blended anesthesia (general + epidural) for colorectal resection were enrolled. Ten of them underwent laparotomy, and seven laparoscopy. Were performed Pulmonary function tests were performed preoperatively (T0), one hour late of extubation (T1), six hours (T2) and at 24 hours (T3). The spirometric tests were performed under best pain relief conditions (VAS = 0).

**Results and Discussion:** There were no significant differences between two groups of patients in demographic characteristics, pre-operative assessment and T0 pulmonary function tests. The difference between the baseline spirometric values (T0) and postoperative values obtained at T1, T2 and T3 were analyzed by statistical analysis (t-test 95%) showing a smaller reduction in FEV1 in the laparoscopic group than the laparotomy group at T1, T2 and T3. However, better results of FVC and CV were associated with the laparoscopy group.

**Conclusion(s):** The patients undergoing major abdominal laparoscopic surgery have better postoperative lung function compared to those receiving open surgery. Further studies are needed to reach similar conclusions about pulmonary postoperative complications.

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- F.Keust et al. Laparoscopic vs small incision cholecystectomy: implication for pulmonary function and pain *Acta Anest Scan*2008;52:363-373

### 5AP3-6

#### Perioperative acute respiratory distress - a case report

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**Background:** Negative pressure pulmonary edema (NPPE) is a well-recognized complication of upper airway obstruction. Two mechanisms of edema

formation are described: can be related to increased hydrostatic forces generated by high negative inspiratory pressure or by disruption of the alveolar and epithelium microvascular membranes from severe mechanical stress (protein-rich edema). It's more common in young, healthy male patients undergoing general anaesthesia.

**Case report:** Female patient, 22 years, with hypertension, medicated with oral contraceptive, proposed for tympanoplasty. Anesthetic induction was performed with fentanyl 0,15mg, propofol 200mg and cisatracurium 6mg. She was intubated and IPPV initiated. Anesthetic maintenance was achieved with sevoflurane and fentanyl (0,1mg). A period of tachycardia (130-150) was treated with labetalol 20mg. After extubation, during transport to post anesthetic care unit (PACU), begun a period of apnea, and recovered after bag mask ventilation and stimulation. Tachycardia started again, with normal blood pressure, associated with dyspnea, normal pulmonary examination, pO2 68mmHg, pCO2-32.2.

Treatment was initiated with salbutamol, aminofiline and oxygen support. Chest radiograph showed diffuse bilateral opacities. On reobservation had on physical examination crackles bilaterally. An angio-CT excluded pulmonary embolism and revealed pulmonary edema. There was no need for positive pressure ventilation. It was initiated furosemide 20mg iv bolus 4/4h. After 12 hours the patient improved and was discharge from ICU, with no oxygen support.

**Discussion:** There are several causes for acute perioperative respiratory distress: aspiration pneumonitis, pulmonary embolism, anaphylaxis, acute lung injury, fluid maldistribution, cardiogenic pulmonary edema and NPPE.

Clinical picture and radiologic findings were most consistent with NPPE. It's a rare complication (0.1%), and occurs more frequently on extubation period, after laryngospasm, or less frequently after oropharyngeal surgery or postoperative residual curarisation.

Although many patients recover with conservative management, some require continuous positive pressure ventilation or temporary intubation with mechanical ventilation. Treatment with diuretics is still controversial.

#### References:

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**Learning points:** High index of suspicion, excluding other diagnosis and prompt treatment are important in managing NPPE, as in this case.

### 5AP3-7

#### Alveolar de-recruitment test and surfactant therapy in patients with acute lung injury

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**Background and Goal of Study:** Acute lung injury (ALI) is characterized by formation of atelectases and lung consolidation resulting in increased pulmonary shunt and hypoxemia. The recruitment maneuver (RM) is able to increase the pulmonary tissue aeration and improve gas exchange. However, RM can be accompanied by several adverse effects, and its' stability may be related to the activity of surfactant. The aims of our study were to assess the relationship between effects of de-recruitment and RM and to evaluate the efficacy of RM combined with surfactant instillation in patients with ALI.

**Materials and Methods:** Thirteen adult patients with ALI requiring mechanical ventilation (MV) were enrolled into a prospective randomized study. All patients were mechanically ventilated and sedated with midazolam/fentanyl. After RM and assessment of its' efficacy, all the patients underwent de-recruitment test.

Following the repeated RM, the intratracheal instillation of bovine surfactant (surfactant group, n = 6) or vehicle (0.9% NaCl) only (conventional therapy group, n = 7) was performed. We registered respiratory parameters and blood gases. Hemodynamic parameters, including cardiac index and extravascular lung water index (EVLWI), were measured using the transpulmonary thermodilution technique.

**Results and Discussion:** The de-recruitment test reduced arterial oxygenation in 62% of the patients. We did not find any correlation between the response to the RM and the response to the de-recruitment test. The baseline EVLWI correlated with changes in SpO2 following the de-recruitment test. The surfactant did neither affect PaO2/FiO2, PaCO2, EtCO2, nor lung compliance, selected PEEP values, nor FiO2. The surfactant group demonstrated an increase in EVLWI at 24 and 32 hrs.

**Conclusions:** In ALI, the de-recruitment test has no predictive value regarding the subsequent effects of RM. This necessitates a search for other predictors of the response to alveolar recruitment. Surfactant instillation was not superior to conventional therapy and might even promote pulmonary edema in patients with ALI.

### 5AP3-8

#### Effect of preoperative chest physiotherapy program on the oxygenation, after laparoscopic bariatric surgery

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**Background and Goal of Study:** Morbid obese patients are at increased risk of perioperative respiratory complications (hypoxemia) due to decreased lung volumes, decreased chest wall compliance, raised intra-abdominal pressure, muscle inefficiency and decreased muscle endurance.

The goal of the study is to compare the effect of a preoperative respiratory physiotherapy program on oxygenation (P02/FiO2) in patients after laparoscopic bariatric surgery.

**Materials and Methods:** After ethical committee approval 29 consecutive patients were randomized in control group (CG; n=10) and physiotherapy group (PTG; n=19). PTG received a respiratory physiotherapy program which included lung re-expansion (Voldyne5000) and respiratory muscle training (threshold IMT) 20 minutes a day, for 30 consecutive days before surgery.

Total intravenous anaesthesia was induced and maintained. Volume controlled ventilation was set up: VT=8 ml.kg<sup>-1</sup> predicted body weight; RR=12; PEEP=10 cmH2O; FiO2 0.5. A recruitment maneuver followed by optimal PEEP was applied 15 min after pneumoperitoneum set up (45 TLP). After pneumoperitoneum withdrawal (30 reverse TLP), PEEP was set up again at 10 cmH2O. Oxygenation was determined using PaO2/FiO2 data at four time points:

(T1): 5 min after induction;

(T2): 15 min after pneumoperitoneum withdrawal;

(T3): 1 hour after surgery;

(T4): 24 hours after surgery.

In order to know the training effects we measured FVC, FEV1, PiMAX, and PeMAX with a spirometer (Datospir-600): basal, before and 24 hours after surgery.

**Results and Discussion:** The data shown an increase in the P02/FiO2 ratio at all time points for the study group respect control group, although results were only statistically significant (p=0,021) for time four (T4).

Control group (n=10)	mean±sd
1	285,90 ± 114,88
2	451,90 ± 135,93
3	256,80 ± 48,21
4	318,75 ± 92,21

[Control group PO2/FiO2 ]

Physiotherapy group (n= 19)	Mean ± SD
1	365,21 ± 154,20
2	462,89 ± 109,01
3	318,06 ± 71,14
4	320,57 ± 78,15

[Physiotherapy group PO2/FiO2]

U Mann-Whitney test	PO2/FiO2 1	PO2/FiO2 2	PO2/FiO2 3	PO2/FiO2 4
Sig. asintót. (bilateral)	,15	,64	,02	1,00

[Statistical analysis]

**Conclusion(s):** Preliminary results suggest that a program of respiratory physiotherapy could improve oxygenation in morbidly obese patients.

### 5AP3-9

#### Effects of respiratory preoperative physiotherapy on the intraoperative respiratory mechanics and oxygenation in patients undergoing laparoscopic bariatric surgery

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**Background:** Morbid obese patients are at increased risk of respiratory complications in the perioperative period (hypoxemia) due to decreased lung volumes (FRC, ERV,VC), decreased chest wall compliance, raised intra-abdominal pressure, muscle inefficiency and decreased muscle endurance.

**Objectives:** compare the effects of a preoperative respiratory physiotherapy program on the intraoperative respiratory mechanics and oxygenation in pa-

tients undergoing laparoscopic bariatric surgery.

**Methods:** After ethical committee approval 29 consecutive patients (BMI 46,13 ± 6,1) were randomized in control group (CG; n=10) and physiotherapy group (PTG; n=19). PTG received a respiratory physiotherapy program which included lung re-expansion (Voldyne5000) and respiratory muscle training (threshold IMT) 20 minutes a day, for 30 consecutive days before surgery. Training effects were measured with spirometry before and after training (Datospir-600; FVC, FEV1, PiMAX, PeMAX).

Total intravenous anaesthesia was induced and maintained. Volume controlled ventilation was set up (ventilator Engström CS GE): VT=8 ml.kg<sup>-1</sup> predicted body weight; RR=12; PEEP=10 cmH2O; FiO2 0.5. A recruitment maneuver (RM) followed by optimal PEEP was applied 15 min after pneumoperitoneum set up (45 TLP). After pneumoperitoneum withdrawal (30 reverse TLP), PEEP was set up again at 10 cmH2O. Respiratory mechanics: dynamic respiratory system compliance (Csr) and FRC were recorded using the ventilator tools at 4 time points: (T1): 5 min after induction; (T2) 15 min after pneumoperitoneum set up; (T3) 15 min after RM-PEEP optimization; (T4) 15 min after pneumoperitoneum withdrawal. PaO2/FiO2 was determined at T1, T3, T4.

**Results:** we exclude 6 patients in PTG from the statistical analysis, because they do physiotherapy exercises less than 12 days. Mann-Whitney and Wilcoxon tests were used for intergroup and intragroup comparisons, respectively (SPSS). Intragroup PTG comparisons (n=13) show a significant PiMAX (p=0,003) and PeMAX (p=0,039) increase after training. Intergroup comparison shows that Csr, FRC, and PaO2/FiO2 were higher in the PTG at all time-points though no statistical significance was reached possibly due to sample size.

**Conclusion:** These preliminary data suggest that in morbidly obese patients a respiratory physiotherapy program could enhance respiratory muscle strength and passive respiratory mechanics.

### 5AP4-1

#### Biphasic cuirass ventilation as an alternative to extracorporeal membrane oxygenation during tracheal stenting with rigid bronchoscope

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**Background:** Respiratory management during tracheal stenting for tracheal and bronchial stenosis is challenging because positive pressure ventilation cannot be conducted during the procedure. Deep sedation to prevent deleterious cough reflex from invasive stimulation by rigid bronchoscopy should lead to weakness or disappearance of spontaneous breathing and induce severe hypoxemia, which sometimes requires extracorporeal membrane oxygenation (ECMO) support. Biphasic cuirass ventilation (BCV) using an external cuirass ventilator noninvasively increases the volume of spontaneous breathing and can be theoretically used as an alternative to ECMO support. We report three cases of tracheal stenosis where we successfully provided respiratory management during tracheal stenting using BCV.

**Case report:** A 46-year-old man with metastatic mediastinum cancer behind his trachea was presented for silicon Y-shaped tracheal stenting. With severe secretion and tracheal stenosis, his SpO<sub>2</sub> was 93% with 2 l/min of oxygen flow through nasal cannula. A cuirass ventilator was applied to his anterior thorax and BCV was performed during the procedure. His oxygenation did not worsen even when propofol administration was increased up to 3.5 mcg/ml blood concentration to prevent cough reflex.

The complete procedure was done without complication. Next, a 63-year-old man with undifferentiated lung carcinoma and I-stenting implanted for tracheal stenosis was presented for a procedure to replace the I-stent with a Y-stent. This was because of stenosis from granulation tissue growing at the upper end of the stent and from an advanced tumor in the left main bronchus. After induction of anesthesia, BCV was started. Fentanyl 500 mcg and propofol 1100mg were used during the procedure of 215 min, respectively, but SpO<sub>2</sub> was kept stable.

The final case is a 32-year-old man who had already taken an operation for stenting due to left bronchial stenosis caused by tuberculosis scarring 6 years ago. He had dyspnea caused by granulation tissue at the distal end of the stent. We planned the removal of the stent and ablation of the scar. After induction of anesthesia, BCV was started and SpO<sub>2</sub> remained more than 87% even during ablation.

**Discussion:** Although we did not measure the increase in ventilatory volume, it is likely that BCV supported spontaneous breathing and prevented severe hypoxemia during tracheal stenting. Therefore, we believe BCV can be used as an alternative to ECMO.

## 5AP4-2

### Prospective observational study: the most useful parameter for predicting extubation failure in patients extubated within 48 h after cardiac surgery - RSBI should be adjusted for actual body weight

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**Background and Goal of Study:** Failure of extubation in patients after cardiac surgery increases mortality and morbidity in intensive care units (ICUs). The rapid shallow breathing index (RSBI) during spontaneous breathing trial (SBT) is considered the best predictor of weaning from ventilation in a general ICU setting. The aim of this prospective, observational study was to assess RSBI in cardiac surgery patients extubated within 48 h after surgery. We also investigated whether RSBI should be adjusted for patient anthropometric parameters because tidal volume (TV) is dependent on them.

**Materials and Methods:** SBT was implemented in the continuous positive airway pressure (CPAP) mode with a positive end expiratory pressure (PEEP) of 5 cmH<sub>2</sub>O and pressure support (PS) of 5 cmH<sub>2</sub>O for 30 min before extubation. Respiratory parameters were measured during SBT and compared between failed extubation (FE) and successful extubation (SE) groups.

**Results and Discussion:** A total of 202 patients were enrolled consecutively in the study. Six patients (3%) were not able to tolerate SBT, 22 patients (11%) required noninvasive ventilation (NIV) or reintubation within 48 h after extubation, and 174 (86%) tolerated the procedure without intervention. RSBI was significantly higher in the FE group (51.6 vs 96.6,  $p < 0.01$ ; threshold value 80 breaths/min/mL/kg, sensitivity 90%, specificity 91%, area receiver operator characteristic 0.951). The following factors affected RSBI: actual body weight (ABW), predicted body weight (PBW), and ideal body weight (IBW). RSBI adjusted for ABW was found to be the most useful predictor of weaning from intubation, with a likelihood ratio of 10.4 and diagnostic accuracy of 0.94.

**Conclusion(s):** As shown in a previous study, RSBI is the best predictor of weaning from intubation in patients following cardiac surgery. However RSBI should be adjusted for actual body weight.

## 5AP4-3

### Effect of prone positioning with thoraco-pelvic supports on respiratory mechanics during spine surgery

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**Background and Goal of Study:** Optimal surgical access to posterior cervical and thoracic spine, necessitates establishment of prone position. Among the variety of prone positions used in clinical practice, the most popular is regarded the one with two padded supports one each for the thorax and pelvis, keeping the abdomen free. Goal of the study was to ascertain the impact of prone position with thoraco-pelvic supports on respiratory system mechanics, during spine surgery.

**Materials and Methods:** Prospective study enrolling 68 candidates (42 M/26 F, aged 54.7±16 yrs, ASA 1-3, BMI 26.8 ± 4.4 kg/m<sup>2</sup>, smokers 41%, lung disease 38%, limited activity 18%), scheduled for elective spine surgery in two-supports prone position.

The following respiratory parameters were recorded: peak airway (Ppeak), plateau (Ppl) and mean (Pmean) pressure, dynamic (DLC) and static (SLC) lung compliance and resistance (R). Measurements were obtained 10 min after anesthesia induction (T1), 10 min after prone position (T2), 10 min before (T3) and after return to supine position (T4), maintaining the mechanical ventilation pattern unchanged for each patient and the TOF ratio ≤ 2 twitches, throughout the study. Repeated measures ANOVA and independent T-test were used for data analysis (mean±SD).

**Results and Discussion:** During the study course and compared to baseline, the respiratory parameters changed significantly (Table). Although, BMI > 30 kg/m<sup>2</sup>, lung disease and limited activity influenced adversely the absolute values of the studied parameters, statistical significance during posture change was comparable to normal individuals.

Parameters	T1	T2	T3	T4	p-value
Ppeak (cmH <sub>2</sub> O)	19.5±3.7	22.8±4.2*	22.7±4.3*	20.8±3.5*	0.000
Ppl (cmH <sub>2</sub> O)	16.5±3.1	19.6±3.5*	20.1±3.6*	17.4±2.9*	0.000
Pmean (cmH <sub>2</sub> O)	8.9±1.4	9.7±1.5*	10.1±2.6*	9.1±1.4	0.003
DLC (ml/cmH <sub>2</sub> O)	56.3±11	46.8±9.2*	44.2±11*	52.6±11*	0.000
SLC (ml/cmH <sub>2</sub> O)	73.2±14	59±12*	57.7±10*	69.3±13*	0.000
R (cmH <sub>2</sub> O/L/s)	14.1±2.4	16.2±3*	16.6±2.8*	14.6±2.4	0.000

[Table. \* $p < 0.001$ , † $p < 0.01$ , \* $p < 0.05$ ]

**Conclusion(s):** Albeit, prone position with thoraco-pelvic supports during spine surgery compromises respiratory mechanics in terms of compliance deterioration and airway pressures and resistance elevation, this remains within acceptable range and is almost completely reversible with re-positioning. Obesity, lung disease and limited activity seem to affect respiratory parameters in an adverse manner, but their relative contribution to deterioration due to posturing change is negligible.

## 5AP4-4

### Respiratory mechanics in volatile and intravenous anesthesia

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**Background and Goal of Study:** To evaluate the influence of central analgesia and the general anesthesia with Sevoflurane on respiratory mechanics of patients who had laparoscopic surgery.

**Materials and Methods:** We examined 65 patients who had laparoscopic surgery in two variants of anesthesia: the general anesthesia with Fentanyl and Seduxene - 19 (group I), and the general anesthesia on the basis of Sevoflurane - 46 patients (group II). Mean age was 49±13 years. All patients were I-II classes of ASA. For evaluation of respiratory mechanics we estimated peak inspiratory pressure (PIP, cm H<sub>2</sub>O), dynamic lung compliance (C<sub>dyn</sub>, ml/cm H<sub>2</sub>O). Stages of respiratory mechanics assessment: 1 - after intubation; 2 - after applying of carboxyperitoneum (CP); 3 - after CP. Significance value at statistical data processing considered accurate at  $p < 0.05$ .

**Results:** After intubation (1 stage) the data of respiration mechanics in both groups could not be significantly distinguished. After applying of CP statistically significant decrease of C<sub>dyn</sub> in both groups was observed in comparison with 1 stage (initial data) 30.7±5.7 ml/cm H<sub>2</sub>O in group I and 39.7±7.8 ml/cm H<sub>2</sub>O in group II ( $p < 0.001$ ), and PIP was also statistically significantly increased in both groups 18.3±1.6 cm H<sub>2</sub>O in group I and 17.4±1.7 cm H<sub>2</sub>O in group II. From the moment of CP removal (3 stage) the data of respiration mechanics was statistically significantly ( $p < 0.001$ ) different from initial one: C<sub>dyn</sub> in group I remained at 37.4±5.5 ml/cm H<sub>2</sub>O, and in group II - 49.9±9.1 ml/cm H<sub>2</sub>O. PIP after CP removal remained increased in comparison with 1 stage: in group I - 15.4±1.6 cm H<sub>2</sub>O, in group II - 14.0±2.0 cm H<sub>2</sub>O ( $p < 0.001$ ). In comparison of respiration mechanics parameters in groups I and II, the statistically significant ( $p < 0.001$ ) decrease of lungs compliance (C<sub>dyn</sub>) was registered at the second and third stages of anesthesia in Fentanyl group in comparison with the Sevoflurane group. After removal of CP (3 stage) PIP was significantly increased ( $p < 0.01$ ) in group I.

**Conclusion(s):** Despite negative influence of a pneumoperitoneum on respiration mechanics, volatile anesthesia with Sevoflurane unlike general anesthesia with Fentanyl provides satisfactory condition of elastic properties of lungs that allows to minimize restrictive component of respiratory insufficiency of the nearest post surgery period.

## 5AP4-5

### Obese patients: pulmonary complications in PACU

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**Introduction:** Obesity is classified by the world health organization (WHO) in 3 classes: classes II or severe [Body mass index (BMI) = 35.0-39.9] and III or morbid (BMI ≥ 40.0) are the object of this study. Obesity has been associated with respiratory events and the majority of these occur in the Post-Anesthesia Care Unit (PACU). The aim of the study was to evaluate the outcome and the incidence of postoperative pulmonary complications in patients with severe or morbid obesity.

**Methods:** Prospective control study with matching of 27 pairs of class II or III obese adult patients (Obese) and patients with BMI < 35 (Non-obese, control group) similar with respect to gender distribution, age and type of surgery, admitted after elective surgery in the PACU (in May 2011). The studied pulmonary adverse events were airway obstruction, hypoxia, respiratory failure, decreased inspiratory capacity and respiratory arrest. Descriptive analyses of variables were used to summarize data and the Mann-Whitney U test, Chi-square or Fisher's exact test were used for comparisons.

**Results:** Obese patients had a higher frequency of obstructive sleep apnea (89% versus 11%,  $p < 0.001$ ); were scheduled less frequently to high risk surgery (7% versus 41%,  $p = 0.005$ ), had more frequently bariatric surgery (59% versus 0%,  $p = 0.002$ ) and had more frequently pulmonary adverse events in PACU (33% versus 7%,  $p < 0.018$ ). The most frequent pulmonary adverse event was decreased inspiratory capacity that was more frequent in obese patients (26% versus 4%,  $p < 0.025$ ). The length of stay in PACU was longer for obese patients (120 minutes versus 84 minutes,  $p < 0.01$ ).



**Conclusion:** Decreased inspiratory capacity was the most frequent pulmonary adverse event in the immediate postoperative period in obese patients (class II and III). Even though there was a longer stay in PACU there was no impact in the length of hospital stay.

### 5AP4-6

#### Integrated pulmonary index (IPI) is associated with duration of postoperative respiratory support after coronary artery bypass grafting and body mass index

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**Background and Goal of Study:** The integrated pulmonary index (IPI) merges four vital parameters including end-tidal CO<sub>2</sub>, respiratory rate, pulse rate, and SpO<sub>2</sub>, as measured by capnography and pulse oximetry, into a single index value [1]. The aim of this study was to explore the role of IPI during the weaning from mechanical ventilation after off-pump coronary artery bypass grafting (OPCAB).

**Materials and Methods:** Seventy-two adult patients after elective OPCAB were enrolled into a prospective study and randomized to four groups. Three groups received the postoperative recruitment maneuver (RM): 1) CPAP 40 cm H<sub>2</sub>O for 40 sec, 2) PEEP of 15 cm H<sub>2</sub>O for 5 minutes, 3) increased tidal volume for 40 sec to provide peak pressure of 40 cm H<sub>2</sub>O during inspiration. In addition, we had the control group without RM. During the RM and throughout 12 hrs of the postoperative period, all the patients were closely monitored with ECG, invasive arterial pressure and blood gases while all the components of IPI were registered with portable oximeter/capnograph (Capnostream 20, Oridion, Israel). The postoperative respiratory support was discontinued according to the weaning protocol. Data are presented as median (25<sup>th</sup>-75<sup>th</sup> percentiles) and analyzed using non-parametric statistical methods. A *p* value below 0.05 was regarded as statistically significant.

**Results and Discussion:** We found no baseline differences in the studied parameters between the groups. The IPI values did not differ significantly between the RM groups throughout the study period. The baseline IPI correlated with the duration of the postoperative respiratory support ( $\rho = -0.27$ ,  $p = 0.03$ ,  $n = 64$ ). As compared to the control group, the duration of mechanical ventilation after OPCAB was shorter in the PEEP 15 RM group: 160 (123-225) min vs. 218 (167-308) min, respectively ( $p = 0.017$ ). The IPI values at 12 hrs after extubation correlated negatively with the body mass index ( $\rho = -0.37$ ,  $p = 0.008$ ,  $n = 52$ ).

**Conclusion(s):** The integrated pulmonary index (IPI) may predict the duration of postoperative mechanical ventilation and may be a valuable adjunct to the bundle of postoperative monitoring after OPCAB. The RM after ICU admission using PEEP 15 cm H<sub>2</sub>O for 5 minutes reduces the time of respiratory support. The obese patients may demonstrate a delayed deterioration of respiratory function.

#### References:

1. Taft A. et al. *Annual meeting of the ASA*, 2008.

### 5AP4-7

#### Postoperative complications in patients with STOP-BANG $\geq$ 3 score submitted to general anesthesia

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**Background and Goal of Study:** Obstructive sleep apnea (OSA) is presumed to be a risk factor for postoperative morbidity and mortality. Patients with STOP-BANG $\geq$ 3 had a high risk of OSA. The aim of this study was to evaluate postoperative complications in adults with STOP-BANG $\geq$ 3 who received general anesthesia.

**Materials and Methods:** Prospective control study with matching of 59 pairs of adult patients with a classification of STOP-BANG $\geq$ 3 and patients with STOP-BANG $<$  3 similar with respect to gender, age and type of surgery, admitted after elective surgery in the post-anesthesia care unit (PACU) in May 2011. Demographics data, perioperative variables, and postoperative length of stay in the PACU and in the hospital were recorded. Descriptive statistics were used and the Mann-Whitney test, the chi-square test and the Fisher exact test were used for comparisons;  $p < 0,05$  was considered significant.

**Results and Discussion:** Both pairs of study subjects had median age of 56 years old, included 25% males and in 59% were submitted to intraabdominal surgery. Patients with STOP-BANG $\geq$ 3 had a higher median body mass index (31 vs 24 Kg/m<sup>2</sup>,  $p < 0.001$ ) and had more frequently co-morbidities, including hypertension (58% vs 24%,  $p < 0.001$ ), dyslipidaemia (46% vs 17%,  $p < 0.001$ )

and insulin-treated diabetes mellitus (17% vs 2%,  $p = 0.004$ ).

These patients were submitted more frequently to bariatric surgery (20% vs 2%,  $p = 0.002$ ). Patients with STOP-BANG $\geq$ 3 had more adverse respiratory events (37% vs 12%, respectively;  $p < 0,001$ ), namely mild to moderate desaturation (14% vs 2%,  $p = 0.015$ ) and decreased inspiratory capacity (31% vs 7%,  $p = 0.001$ ).

**Conclusion(s):** After general anesthesia patients with STOP-BANG $\geq$ 3 had an increased incidence of postoperative respiratory complications, the most frequent of them were oxygen desaturation and decreased inspiratory capacity.

#### References:

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### 5AP4-8

#### Impaired pharyngeal function and airway protection after morphine or midazolam

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**Background and Goal of Study:** Hypoxia due to respiratory complications is common in the postoperative period. Even low doses of drugs commonly used in anesthesia (inhalational, propofol, NMBA) causes pharyngeal dysfunction and increases risk for aspiration. Morphine and midazolam are in lower doses often considered safe and used in settings with a lower degree of monitoring. The goal of this study was to ascertain if morphine and midazolam impairs pharyngeal function, airway protection and normal integration of breathing and swallowing.

**Material and Methods:** Swallowing and breathing were studied in 32 healthy volunteers, mean age 25 years (20-35), 16/32 women after approval from the Regional Ethics Committee on Human Research, Karolinska Institutet, Stockholm, Sweden. Pharyngeal function and breathing was recorded by pharyngeal manometry, an oral and nasal bidirectional gas flow meter and videofluoroscopy during series of 3 bolus' swallows of 10 ml contrast medium. After control recordings at normo- and hypercapnia (5% CO<sub>2</sub>) an intravenous infusion (20 min) of morphine (0.1mg/kg) or midazolam (0.05mg/kg) was administered. Recordings were repeated 3 times during spontaneous drug metabolism, at normo-, hyper- and then normocapnia. Degree of pharyngeal dysfunction (0-100%) was defined as contrast medium leaking from the mouth before initiating swallowing, penetrating to the larynx or being left in the pharynx after completing the swallowing maneuver.

**Results and Discussion:** A total of 464 swallows were analyzed. Median (range) degree of pharyngeal dysfunction was 0% (0-67) during control at normo- and hypercapnia, increasing after administration of morphine to 6%\* (0-44), 22% (0-67) and 11%\* (0-67) and after midazolam to 17%\* (0-56), 22%\* (0-67) and 22%\* (0-67) when comparing control to drug exposure at peak, medium (at hypercapnia vs. control at hypercapnia) and low drug concentrations (vs. control, Wilcoxon, \* $p < 0.05$ ). The degree of pharyngeal dysfunction in this study is in accordance to what we previously have found in young volunteers during subanesthetic levels of anesthetics and NMBA. Drug exposure did not affect that swallowing almost always occurred during the expiratory phase of the respiratory cycle but increased the duration of the apneic period during swallowing.

**Conclusion:** Morphine and midazolam in clinically relevant dosages causes pharyngeal dysfunction and impaired airway integrity and may contribute to postoperative respiratory complications.

### 5AP4-9

#### TCI of propofol to simulate physiological sleep and evaluate upper airway in patients with SAHS

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**Background and Goal of Study:** It is mandatory to examine the sites of pharyngeal collapse for surgical treatment decision-making in obstructive sleep-apnea-hypopnea syndrome patients. Drug-induced sleep endoscopy (DISE) allows, under pharmacological sedation, to evaluate the upper airway. Developed in multiple centers throughout Europe, DISE was first described in 1991 and we have started to perform it in our hospital. The goal of this paper is to describe the anaesthetic technique we use to recreate natural sleep, avoiding the shortcomings of fluctuating blood and tissue concentrations of anesthesia agent.

**Materials and Methods:** 20 patients underwent DISE examination. We adopted a protocol that we followed in all cases. All the sleep endoscopies were

carried out in an endoscopy room with the same endoscopist and only three different anaesthetists. The patients were in a supine position. The clinical assessment included heart rate, non-invasive blood pressure (NIBP), oxygen saturation (SpO<sub>2</sub>) and electrocardiography monitoring. No supplemental oxygen was used. We adopted the technique of target controlled infusion (TCI) of propofol. A starting concentration of 2 mcg/mL was chosen and it was increased in incremental doses of 1 mcg/mL to achieve snore. Then, the nasoendoscope was introduced and the upper airway evaluated. The following variables were observed: plasma concentration of propofol when they started to snore, total propofol consumption, minimal SpO<sub>2</sub> achieved, hemodynamic perturbations (hypotension, bradycardia or electrocardiogram changes), spasms and needling of manual mandibular advancement.

**Results and Discussion:** All the patients were male. The mean age was 49.92 (22-66) years. The mean plasma concentration of the drug when they started to snore was 3,25 mcg/mL and the total propofol consumption was between 250 and 320 mL. The mean minimal SpO<sub>2</sub> was 76% on air, being the lowest one 57% on air. Nor hemodynamic changes neither other side effects were registered and only one patient required mandibular advancement.

**Conclusion(s):** Our results suggest that a target-controlled infusion of propofol is a good choice to reproduce the snoring and apnoea patterns related to a spontaneous sleep. It is a safe technique for all patients, regardless of their conditions, as it produces proportional changes based on pharmacokinetic principles and allows the titration of the achieved concentration against the required clinical effect in each patient.

## Transfusion and Haemostasis

### 6AP1-1

#### Correlation between activated clotting time and activated partial thromboplastin time during endovascular treatment of cerebral aneurysms

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**Background and Goal of Study:** Endovascular treatment (EVT) of intracranial aneurysms requires a continuous anticoagulation to avoid thromboembolic complications. Activated clotting time (ACT) and the activated thromboplastin time (APTT) have been used to monitor anticoagulation. The aim of this study was to compare ACT and APTT for the monitoring of the anticoagulation during EVT.

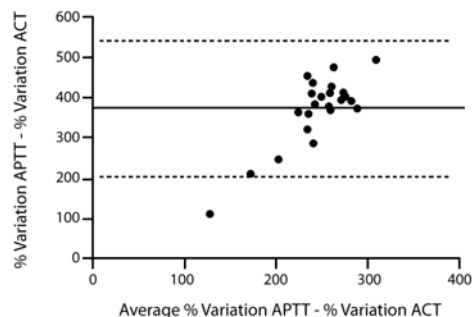
**Materials and Methods:** Patients referred for EVT were included. After induction, baseline ACT and APTT were recorded, followed by a bolus infusion of unfractionated heparin (50 U<sub>i</sub>.kg<sup>-1</sup>). The same tests were controlled after five minutes. Correlation and agreement between both tests were evaluated for the percentage of change after the bolus.

**Results and Discussion:** 24 were included for analysis.

	n=24 (%)	SD or Proportion
Age (yr)	53	13
Height (cm)	165	7
Weight (kg)	69	16
Aspirin	7	29%
Clopidogrel	5	21%
Previous exposition to heparin	11	46%
Thrombosis	0	0%
Bleeding	0	0%
ICU stay (day)	1.04	0.2%

[Patient characteristics and outcomes]

Mean (SD) % variation for APTT was 432.1 (75.7) and 60.6 (23.0) for ACT ( $p < 0.001$ ). With the Bland-Altman method, value of Bias (SD) is 372 (86) with 95% limits of agreement range from 203 to 540.



[Figure - Bland-Altman plots]

Pearson correlation for % variation shows  $r$  (95% CI) = -0.23 (-0.58 to 0.19) with  $p = 0.29$  and R square = 0.05. 100% of the APTT values could be defined as excessive anticoagulation by opposition of the 8% obtained with ACT.

**Conclusion(s):** This prospective observational study shows that ACT test is not well correlated with APTT and leads to a systematic excessive coagulation during EVT of IA.

#### References:

1. Kubalek R, et al. *Neuroradiology* 2003; 45: 325-7.
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### 6AP1-2

#### Assessment of hemostatic balance in patients with liver cirrhosis with thromboelastometry

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**Background and Goal of Study:** With complex laboratory tests it has been shown that patients with liver disease may be in hemostatic balance as a result of concomitant changes in both pro- and antihemostatic pathways. These complex tests are not designed for bedside assessment of coagulation and thus cannot be used during surgical procedures. Rotational thromboelastometry (ROTEM) has been proposed to guide transfusion therapy in liver transplantation. There is an evidence of a lack of agreement between ROTEM parameters and clotting factors activity. We hypothesized that ROTEM parameter CT (clotting time) in test ExTEM best describes the balance between the pro- and anticoagulant proteins. The aim of the present study was to determine whether CT in test ExTEM could be used for intraoperative assessment of hemostatic balance in patients with liver cirrhosis.

**Materials and Methods:** Plasma and whole blood samples were collected from 46 adult patients undergoing liver transplantation. Concentration of clotting factors, antithrombin III, protein C and S were determined and ROTEM tests were performed. ROTEM tests with signs of hyperfibrinolysis or heparin presence were excluded. Spearman Rank correlation and ROC curve were used to analyze the data.

**Results and Discussion:** A total of 236 samples were investigated. A fair agreement was found between mean activity of clotting factors II, VII, X and CT in test ExTEM, and more strong agreement between ratio of antithrombin to mean activity of clotting factors and CT in test ExTEM.

	Antithrombin III	Mean activity of clotting factors II, VII, X	Ratio (3*Antithrombin III/FII + FVII + FX)
CT-ExTEM	-0,083	-0,433*	0,636*

[Correlation between CT-ExTEM and clotting factors]

\* $p < 0,01$

ROC curve analysis showed that CT > 80 had the maximum diagnostic value. It predicted shift of the balance to hypocoagulation (Ratio > 1,5) with sensitivity of 87% and specificity of 98%.

	AUC	Sensitivity, %	Specificity, %	PPV, %	NPV, %
CT-ExTEM > 80	0,962	87,1	98,1	83,3	98,5

[The data of ROC curve analysis]

AUC - area under curve, PPV - positive predictive value, NPV - negative predictive value

**Conclusion:** Our findings suggest that prolongation of CT greater than 80 sec in test ExTEM could serve as reliable marker of flip of hemostatic balance toward hypocoagulable state and warrant the correction of clotting factors deficiency.

### 6AP1-3

#### Rotem® demonstrates a marked reduction of fibrinogen concentrations after cardiopulmonary bypass undetected by classical coagulation tests

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**Background and Goal of Study:** Fibrinogen plays a key role in the maintenance of hemostasis. In acute blood loss, fibrinogen is the first coagulation factor to decrease to critically low levels. Hypofibrinogenemia can be detected by classical coagulation tests or by whole blood clotting tests such as ROTEM®.

We sought to show by means of ROTEM® that cardiopulmonary bypass (CPB) significantly reduces plasma fibrinogen levels in an on pump coronary bypass group (CABG) versus an off pump group (OPCAB).

**Materials and Methods:** 104 consecutive patients undergoing first time elective coronary bypass surgery with or without CPB were included. Blood samples for routine coagulation tests and ROTEM® were performed at 5 time points: before the induction of anesthesia, at the first dose heparin injection, 15 minutes after protamine, at the ICU arrival and 4 hours postoperatively.

**Results and Discussion:** 42 and 62 patients underwent respectively CABG and OPCAB. 40 patients in the CABG and 55 in the OPCAB group took a daily dose of aspirin which was discontinued in respectively 25% and 16% of them. Postoperative bleeding was similar in both groups. One patient in each group needed surgical revision.

	Group	Pre induction	Post Heparin	Post Protamine	ICU arrival	4h Postop
Hb (g/dL)	CABG	12.7±1.7	11.2±1.5**	8.6±1.3***††	10.3±1.3**	10.0±1.2**
	OPCAB	12.1±1.7	10.8±1.6**	9.7±1.5**	10.0±1.4**	10.0±2.1**
Platelet count (100/mL)	CABG	227±69	208±58**	126±51**	137±36***††	136±39**
	OPCAB	212±51	198±49**	136±46**	156±45**	147±41**
Fibrinogen (mg/dL)	CABG	318±69	265±60**	170±44***†††	179±42***†††	198±50**
	OPCAB	357±98	307±83**	243±73**	232±68**	231±81**
Fibtem MCF (mm)	CABG	20±5	15±5**	9±4***††	9±4***††	10±4***††
	OPCAB	23±7	18±5**	14±5**	13±6**	14±7**

[Table 1]

\*\*P < 0.001 within groups; †P < 0.05 and ††P < 0.001 between groups.

	CABG (N = 42)	OPCAB (N = 62)	P
Patients transfused with packed RBC N(%)	26 (62)	23 (37)	0.02
Patients transfused with platelets N(%)	8 (19)	1 (2)	< 0.001
Patients transfused with FFP N(%)	7 (17)	3 (5)	0.09
Patients transfused with fibrinogen N(%)	5 (12)	0	< 0.001
Units packed RBC transfused, median (IQR)	3 (2, 4)	2 (1, 3)	0.02
Units platelets transfused, median (IQR)	12 (11, 13)	0	< 0.001
Units FFP transfused, median (IQR)	2 (2, 3)	3 (2, 3)	0.06

[Table 2]

**Conclusion(s):** CPB decreases fibrinogen concentrations and coagulation parameters significantly compared to off pump surgery. ROTEM® illustrates low fibrinogen levels not detected by classic coagulation tests, and allows rapid and objective transfusion.

### 6AP1-4

#### In vitro effect of clinical propofol concentrations on red blood cell aggregation and deformability

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**Background and Goal of Study:** Although propofol infusions are widely used, little information is available on its time-related effects on RBC aggregation, deformability, and morphology. Therefore, the authors undertook this *in vitro* study to investigate the effects of propofol at the plasma concentrations required for sedation and general anesthesia, on RBC aggregation, deformability, and morphology over periods of 1, 2, or 4 h.

**Materials and Methods:** Blood containing propofol at plasma concentrations of 0, 2, 4 mg/ml was incubated in a water bath at 37 °C for 1 h, 2 h, or 4 h. RBC elongation indices (EIs), which represent RBC deformability, and aggregation indices (AIs), which represent RBC aggregation, were measured. In addition, RBC morphological indices (MIs), which represent RBC morphology, were calculated.

**Results and Discussion:** EIs and AIs were similar at propofol concentrations of 0, 2, and 4 mg/ml after 1, 2, or 4 hours of incubation. MIs at propofol plasma concentrations 0 or 2 mg/ml were similar after 1 h, 2 h, and 4 h of incubation, however, MI at a propofol concentration of 4 mg/ml after 4 h of incubation was higher than for the same propofol concentration after 1 h or 2 h of incubation (P < 0.05, respectively). No significant difference was observed between MIs at propofol plasma concentrations 0, 2, or 4 mg/ml after 1 h, 2 h, or 4 h of incubation.

**Conclusion(s):** Clinical propofol plasma concentrations were not found to change RBC deformability or aggregation *in vitro* after incubation for up to 4 hrs. Thus, our findings suggest that propofol at normal clinical levels has no adverse effects on the microcirculation.

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### 6AP1-5

#### Evaluation of the hemostatic process in cardiac surgery by thromboelastography (TEG), thromboelastometry (ROTEM) and Sonoclot analysis

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**Background and Goal of Study:** Excessive bleeding remains a major source of postoperative morbidity and mortality in cardiac surgery. Perioperative monitoring of the hemostatic process may be helpful in diagnosing possible causes of bleeding.

In this study, we compared the suitability of TEG, ROTEM and Sonoclot in cardiac surgery by comparing the results obtained from these instruments, and by investigating whether there were any significant correlations between the variables obtained from the instruments and results from routine laboratory coagulation tests.

**Materials and Methods:** The study was approved by The Regional Committee for Medical Research Ethics. 35 patients scheduled for elective cardiac surgery were included. TEG, ROTEM and Sonoclot analyses were performed, and blood samples for analysis of platelet counts, INR, APTT, fibrinogen, D-dimer and antithrombin were collected preoperatively before induction of anesthesia, and 1 and 20 hours postoperatively. Repeated measurement analysis of variance was used for analysis of the TEG, ROTEM and Sonoclot variables, and p-values < 0.05 were considered significant. Correlation was evaluated by Spearman's rho, and due to testing at three time points, p-values < 0.01 were considered significant.

**Results and Discussion:** There were significant differences with time for all TEG variables (p ≤ 0.006), mainly between the preoperative results and the results recorded 1 hour after surgery. Several, but not all of the ROTEM variables also changed significantly with time (p ≤ 0.042). Only 1 variable obtained from the Sonoclot analysis (SonACT) differed significantly with time (p < 0.0005).

There were significant correlations between fibrinogen and the TEG variables MA, K and alpha (p ≤ 0.013), the ROTEM variable MCF (p ≤ 0.004), and the Sonoclot variable clot rate (p ≤ 0.017). The Sonoclot variables SonACT and clot rate correlated with APTT (p ≤ 0.007). These results show that both the TEG and ROTEM instruments may be used to detect changes in hemostasis following cardiac surgery. TEG may be somewhat more sensitive than ROTEM. Sonoclot analysis is less suitable to monitor hemostatic changes in cardiac surgery patients. Variables from all three instruments correlated strongly with plasma fibrinogen, and may be used to indicate fibrinogen concentration in these patients.

**Conclusion(s):** TEG and ROTEM may both be used to monitor hemostatic function in cardiac surgical patients. Sonoclot analysis seems to be less useful.

## 6AP1-6

### Clot formation as measured using thromboelastography (ROTEM<sup>®</sup>) in healthy newborns

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**Background and Goal of Study:** Thromboelastometry is a whole-blood assay that is used to evaluate the visco-elastic properties during blood clot formation and clot lysis. The aim of this study was to evaluate clot formation using thromboelastography (ROTEM<sup>®</sup>) in cord blood from infants.

**Material and Methods:** Five milliliters of blood were taken from the umbilical cord in 10 full-term infants during a cesarean section. Coagulation was activated either with ellagic acid (INTEM) or tissue factor (EXTEM), and cytochalasin D was additionally used to inactivate platelet factor (FIBTEM). The measurements consisting of 4 variables were performed: clotting time (CT), clot formation time (CFT), maximum clot firmness (MCF) and amplitude of the clot firmness after 10 minutes (A10). The data were compared with adult reference values obtained from 10 healthy volunteers. The prothrombin time (PT), the activated partial thromboplastin time (APTT), the serum concentration of fibrinogen, and the platelet count were also performed for the infants. Differences among the cord and adult blood samples were analyzed using an unpaired t-test. The criterion for the rejection of the null hypothesis was  $P < 0.05$ .

**Results and Discussion:** EXTEM and FIBTEM revealed that the MCF and A10 were significantly shorter in infants than in adults (Table 1), suggesting that the diminished clot strength might have been attributable to an impaired polymerization of neonatal fibrin. PT and APTT were prolonged compared with the adult reference intervals. While healthy newborns have transiently low levels of vitamin-K-dependent coagulation factors, this is normally balanced by the paralleled decrease in fibrinolytic activity, and the whole-blood values for clot formation tested by thromboelastometry were within the normal limit.

**Conclusion(s):** Neonatal fibrin shows impaired polymerization properties resulting in normal clot formation and poor clot strength.

	CT(s)	CFT(s)	MCF(mm)	A10(mm)
Neonates (n=10)				
INTEM	167.4±6.3	72.8±5.8	56.1±1.8	48.7±2.1
EXTEM	40.0±2.2	98.0±7.1	54.2±1.8*	48.7±2.1*
FIBTEM	39.1±2.5	(-)	8.9±0.7*	8.6±0.6*
Adults (n=10)				
INTEM	174.3±34.8	73.2±14.5	60.8±6.4	56.1±4.4
EXTEM	43.9±6.3	88.7±20.1	72.9±3.9	56.9±5.3
FIBTEM	41.0±7.8	(-)	14.9±5.7	16.0±6.2

[Table 1. Thromboelastograph parameters]

mean ± SD \* $P < 0.05$  compared with values for adults.

## 6AP1-7

### Perioperative hemostasis in patients exposed to a high protamine-to-heparin dosing ratio: the value of the heparinase-modified thromboelastometric clotting time

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**Background:** We studied the association of the protamine-to-heparin dosing ratio with thromboelastometric parameters and postoperative blood loss in cardiothoracic patients.

**Methods:** The study included 182 patients undergoing elective cardiac surgery with cardiopulmonary bypass (CPB). Patients were divided into a low-to-normal ( $\leq 1$ ) or high ( $> 1$ ) protamine-to-heparin dosing ratio group. Hemostatic parameters included the activated clotting time (ACT), classical coagulation tests, rotational thromboelastometry (HEPTEM, INTEM) and blood loss at 6, 12 and 24 hours postoperatively.

**Results:** There were no differences in preoperative hemostatic or CPB characteristics or post-CPB classical coagulation tests between high and low protamine-to-heparin dosing groups.

The postoperative classical coagulation tests, including the aPTT and PT, revealed no differences among groups. However, patients in the high dosing ratio group had a longer heparinase-modified intrinsic clotting time (HEPTEM CT;  $346 \pm 179$  vs.  $256 \pm 85$  s;  $P < 0.001$ ) than patients in the low dosing group, while there was no association of the post-CPB HEPTEM CT with heparin or

protamine dosing solely. In 62% of the patients, the HEPTEM CT exceeded the INTEM CT, with a larger difference between HEPTEM and INTEM CT in the high dosing group ( $64 \pm 134$  vs.  $14 \pm 59$  s;  $P = 0.01$ ). There was no association between the post-protamine ACT and the HEPTEM CT. Overall blood loss was higher in patients who received a high protamine-to-heparin dosing ratio when compared to the low dosing group.

**Conclusion:** The findings highlight the importance of the protamine-to-heparin ratio rather than solely heparin dosing in maintenance of postoperative hemostasis in cardiothoracic patients.

Moreover, the heparinase-modified thromboelastometric clotting time is sensitive to protamine overdosing, and its residual heparin-sensing capacity should therefore be reevaluated.

## 6AP1-8

### In vitro thromboelastographic evaluation of the efficacy of frozen platelets transfusion

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**Background and Goal of Study:** Supply of fresh liquid blood products to combat areas is logistically challenging. Consequently, Spanish medical military corps in order to manage acute trauma hemorrhage send to operation zones frozen blood components. The objective of this study is to evaluate by thromboelastography the hemostatic effectiveness of frozen Vs fresh platelet transfusion.

**Materials and Methods:** A prospective experimental study was performed in a platelet in vitro transfusion model. After IRB approval and informed signed consent, blood samples (10 ml) were obtained from 10 patients with non-autoimmune thrombocytopenia which was divided into three citrate-containing tubes.

The first tube was used to make a baseline measurement of patients' complete blood count, and coagulation studies (including fibrinogen concentration). Baseline ROTEM<sup>®</sup> analysis (EXTEM and FIBTEM test) was also performed. A volume equivalent to transfusion of 1.4 U / 10 kg of body weight of fresh standard 22°C stored platelets and thawed frozen platelets concentrate was added to the second and third tubes respectively. The same determinations were also performed in the second and third tubes post-transfusion.

The statistical analysis consisted in uni-variate lineal regression for mean comparison between groups (standard Vs frozen platelets).

**Results and Discussion:** The mean patients' baseline platelet count was  $17.8 (\pm 8.8) \times 10^3/\text{mL}$ . The mean platelet count of fresh and frozen platelet units was  $678.8 (\pm 75.1) \times 10^3/\text{mL}$  and  $1085 (\pm 491.5) \times 10^3/\text{mL}$  respectively ( $p = 0.019$ ).

The increase in post-transfusion mean platelet count was greater with frozen than with fresh platelets;  $119.5 (\pm 33.4) \times 10^3/\text{mL}$  and  $90.4 (\pm 17) \times 10^3/\text{mL}$  respectively ( $p = 0.029$ ).

Mean patients' baseline EXTEM MCF was  $40.2 (\pm 4.7)$ . After in vitro transfusion of fresh platelets the mean increase in EXTEM MCF value was statistically significant ( $p < 0.001$ ), reaching values within the normal range;  $62.6 (\pm 3.8)$  while the increase in EXTEM MCF following transfusion of frozen platelets was poor;  $43.9 (\pm 5.5)$  achieving only a slight improvement over baseline values. Power determination (two-sided test) was 83.5% (Beta Risk = 16.5%), for alpha risk = 5%.

**Conclusion(s):** In vitro frozen platelets transfusion provides a platelet count increment greater than fresh platelets. However, ROTEM analysis assessment indicates a significantly reduced functionality of frozen platelets compared to fresh platelets.

## 6AP1-9

### Postoperative changes in coagulation and platelet count in patients receiving epidural catheter for hepatic resection: a retrospective study

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**Background and Goal of Study:** Partial hepatectomy is an established effective and potential curative therapy for patients with benign and malignant hepatobiliary disease. Disorders of coagulation may be present before or occur after hepatic resection, even in the absence of massive transfusion. Although continuous epidural anaesthesia and analgesia is an accepted technique for patients undergoing major hepatic resections, some institutions now consider the procedure to be unsafe.

**Materials and Methods:** We retrospectively studied patients subject to hepatic resection in whom an epidural catheter was used to evaluate the prevalence of changes in coagulation profile.

We included data from March 2003 to November 2011. Age, sex, American Society of Anaesthesiologists physical status, type of procedure, preoperative partial thromboplastin time, international normalized ratio and platelet count were noted.

**Results and Discussion:** 38 cases received an epidural catheter before hepatic resection. Of these 10.5% patients were ASA I, 57.9% ASA II and 31.6% ASA III. There was a predominance of male patients (57.9%).

The average age of the patients were 58 years old. The average duration of surgery was 3.6 h. Preoperative PT and INR were within reference ranges in 84.2% of 38 patients. 15.8% had some degree of coagulopathy in the postoperative period. The platelets counts were below in 21.1% of the patients. One patient had low platelet count (100000) in preoperative period.

There were no major complications associated with the epidural insertion, manipulation or removal. Hypotension has occurred in 18.4% of which 5.3% was interpreted as a consequence of the catheter perfusion.

**Conclusion(s):** Coagulopathy increases the risk of bleeding complications associated with regional techniques and possible devastating sequelae of epidural haematoma and spinal cord compression. This has implications for anaesthetic practice, particularly when considering the use of an epidural catheter in patients undergoing hepatic resection.

This study did not show an increase in the incidence of significant changes in coagulation and platelet count in patients with epidural catheter.

## 6AP1-10

### Preoperative assessment of antiplatelet therapy in patients undergoing cardiac surgery: a preliminary study

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**Background and Goal of Study:** Antiplatelet therapy may be associated with increased perioperative blood loss and transfusion requirements. There is however an interindividual variability in the response to these drugs. The primary aim of this preliminary study was to investigate the preoperative degree of platelet inhibition in cardiac surgery and to compare Platelet Function Analyzer-100 (PFA-100) and multiple electrode aggregometry (MEA) with light transmission aggregometry (LTA), the gold standard for assessment of platelet function.

**Materials and Methods:** After ethical committee approval and informed consent, 25 cardiac surgery patients on active antiplatelet therapy with aspirin and/or clopidogrel or discontinued at less than 7 days were included in this study. Platelet function was studied in the day before surgery by LTA and MEA in aspirin patients and by LTA, MEA and PFA-100 in clopidogrel patients. Definite suppression of platelet aggregation was defined by maximum aggregation of less than 20% by LTA. Those between 20 and 70% were categorized as having residual platelet reactivity (RPR).

Those with greater than 70% were classified as resistant. Aggregation measured by MEA was quantified as the area under the aggregation curve (resistance was defined for values within normal ranges). For PFA-100, resistance was defined by a normal closure time. Agreement between tests was assessed by Kappa ( $\kappa$ ) analysis.

**Results and Discussion:** Rates of aspirin resistance were 36.4% ( $n=4/11$ ) and 23.8% ( $n=5/21$ ) by LTA and MEA, respectively. Based on LTA, a RPR rate of 27.3% ( $n=3/11$ ) and a definitive suppression rate of 36.4% ( $n=4/11$ ) were detected for aspirin.

Rates of clopidogrel resistance were 11.1% ( $n=1/9$ ), 14.3% ( $n=1/7$ ) and 37.5% ( $n=3/8$ ) by LTA, MEA and PFA-100, respectively. Based on LTA, an RPR incidence of 88.9% ( $n=8/9$ ) was detected for clopidogrel. No definitive suppression was detected for clopidogrel. There was fair agreement between LTA and MEA ( $\kappa=0.38$ ) in aspirin patients and between LTA and MEA ( $\kappa=0.28$ ) or PFA-100 ( $\kappa=0.30$ ) in clopidogrel patients.

**Conclusion(s):** Our preliminary results are in accordance with previously reported incidences of aspirin and clopidogrel resistance. Platelet function tests were not equally effective and demonstrated fair correlation among themselves. Further clinical research is needed in order to draw more definite conclusions.

## 6AP1-11

### Can preoperative thromboelastography be useful managing pharmacologic thromboembolic prophylaxis in bariatric surgery?

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**Background and Goal of Study:** Morbid Obesity (MO), body mass index (BMI)  $> 35 \text{ kg.m}^{-2}$  has been demonstrated to be a major risk factor for cardiovascular disease and venous thromboembolic (VTE) events. Although mortality after bariatric surgery (BS) is an uncommon event, pulmonary embolism (PE) is the most common cause of mortality. Clinicians have few tools to preserve the delicate balance between VTE prophylaxis and hypothetical risk of enhancing hemorrhagic complications. ROTEM thromboelastometry measures dynamic coagulation process and is the most rapid test for providing a global assessment of haemostatic function. The aim: to evaluate if preoperative thromboelastography may guide the need of pharmacological anticoagulation prophylaxis in bariatric surgery.

**Materials and Methods:** After IRB approval, 112 consecutive MO undergoing BS without earlier history of VTE or known hypercoagulable state were enrolled. Intermittent sequential compression devices (SCD) were used in all patients. Demographic, anthropometric, inflammatory cytokines and incidence of metabolic syndrome (MS), a cluster of cardiovascular risk factors: insulin resistance, abdominal obesity, dyslipemia and hypertension were recorded. After surgery, clinical VTE events for a 3 months period were also recorded. The ROTEM study performed before surgery included: clotting time (CT), clot formation time (CFT), alpha angle ( $\alpha$ ) and maximum clot firmness (MCF) to calculate, by standard formula, the coagulation index (CI). We considered patient's hypercoagulable risk when  $CI > 3$  and  $MCF > 69 \text{ mm}$ . Our protocol are in table.

**Results and Discussion:** 112 MO (83 women),  $45 \pm 12$  years old, with a BMI  $46 \pm 7 \text{ kg.m}^{-2}$  and waist/hip ratio  $0.94 \pm 0.08$  were studied. The incidence of metabolic syndrome was 47%. 14 (12.5%) patients had  $MCF > 72 \text{ mm}$ . The mean length hospital stage was  $48 \pm 12$  hours. BMI did not correlate well either CI or MCF. We only found correlation between CI and MS ( $r=0.737$ ;  $p=0.031$ ). One patient with a BMI of 41,  $MCF=75$  and  $CI 7.2$  develop PE, diagnostic by D-dimers and angio-TAC, 32 hours after hospital discharged. No others postoperative clinical VTE events were observed.

**Conclusion(s):** Our study suggests that preoperative thromboelastography can be useful managing pharmacologic thromboembolic prophylaxis in bariatric surgery.

## 6AP2-1

### Evaluation of recombinant activated factor VII, prothrombin complex concentrate and fibrinogen concentrate to reverse apixaban in a rabbit model

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**Background:** As a potent anticoagulant agent, apixaban exposes to a risk of bleeding. An effective way to reverse its effects is needed. Objectives were to study efficacy and safety of recombinant activated factor VII (rFVIIa), prothrombin complex concentrate (PCC) and fibrinogen concentrate to reverse the anticoagulant effect of apixaban in a rabbit model of bleeding and thrombosis.

**Methods:** First, a dose ranging study assessed the minimal apixaban dose that increased bleeding. Then, 63 anaesthetized and ventilated rabbits were randomized into 5 groups: control (saline), apixaban (apixaban and saline), rFVIIa (apixaban and rFVIIa), PCC (apixaban and PCC) and fibrinogen (apixaban and fibrinogen). The Folts model was applied: a stenosis and an injury were carried out on the carotid artery, inducing thrombosis, detected as cyclic flow reductions, which were recorded over 20 minutes. Then the following were measured: ear immersion bleeding time, clotting times, anti-Xa activity, thrombelastometric parameters and thrombin generation test (TGT). Ultimately, a hepato-splenic section was performed and the total amount of blood loss after 15 min was evaluated as primary end point.

**Results:** Apixaban increased blood loss ( $12[9-14] \text{ g}$  vs.  $8[5.5-11] \text{ g}$  for control (median [range]),  $p < 0.0003$ ), lengthened ear bleeding time, Prothrombin Time (PT), thrombelastographic clotting time and decreased thrombin generation. rFVIIa decreased ear bleeding time ( $81[70-100] \text{ s}$  vs.  $118[106-154] \text{ s}$ ,  $p < 0.05$ ), but without efficacy on blood loss. PCC and rFVIIa decreased PT as

well as thrombelastographic clotting time and shortened the lag time in TGT. Fibrinogen concentrate, surprisingly, increased blood loss and BT whereas it improved thromboelastographic clot firmness and increased thrombin generation to supraphysiological levels. Regarding safety, neither rFVIIa, PCC nor fibrinogen concentrate increased cyclic flow reductions.

**Conclusion:** rFVIIa, PCC and fibrinogen concentrate improved laboratory parameters, but did not reverse apixaban induced-bleeding.

## 6AP2-2

### Blood loss reduction in scoliosis surgery. A retrospective comparative study of aminocaproic and tranexamic acid

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**Background and Goal of Study:** Scoliosis correction surgery is always associated with considerable blood loss. Volume replacement with crystalloids, colloids, allogenic and/ or autologous blood is required. Complications like blood transfusion reactions, infection and volume overload are common. Reduction of the amount of transfusion, which can decrease morbidity and improve patient's outcome, is the ultimate goal of the intraoperative management. Aminocaproic and Tranexamic acid are the most commonly used antifibrinolytics to prevent significant blood loss during scoliosis repair. The goal of the study was to compare the efficacy of both drugs in combination with other blood conservation techniques in reduction of the blood loss in pediatric scoliosis surgery.

**Materials and Methods:** The charts of 59 patients who underwent posterior spinal fusion with instrumentation for idiopathic scoliosis during 2009 and 2010 were reviewed. All patients were 11-19 years old, 37 were females, and 22 were males. All of them had 10-12 segments correction and the starting hematocrit was 36-42%. The same anesthetic and surgical techniques were used in all of the cases.

**Results and Discussion:** The review of anesthetic records of the patients showed that out of 59 patients 30 patients received antifibrinolytic medication and 29 did not. There was no blood transfusion given to the patients who got antifibrinolytic medication and 5 patients were transfused in the non-antifibrinolytic group (transfusion rate 17.24%). The average starting hematocrit among transfused and non-transfused patients was 38.5% and 38.9% respectively (no statistically significant differences). The average amount of crystalloids among non-transfused patients was 8.5 cc/kg/h, when 11.2 cc/kg/h among transfused patients. The urine output was similar in both groups. The estimated blood loss which was recorded 1000-1300cc for the transfused group and 400-1000cc for the non-transfused group. Among 30 patients who received antifibrinolytics, 9 were given Aminocaproic acid and 21 Tranexamic acid. Both groups did not demonstrate any statistically significant difference in amount of recorded estimated blood loss.

**Conclusion(s):** The data obtained in this study emphasized the benefits of the antifibrinolytic use in combination with crystalloid restriction technique. Both antifibrinolytic drugs exhibit similar effectiveness in blood loss reduction.

## 6AP2-3

### Impact of continued use of antiplatelet agents (APA) on outcome in patients undergoing minimal invasive lumbar spine surgery - preliminary results

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**Background:** The number of patients scheduled for surgery who are on APA therapy is growing. This creates a dilemma of whether to withhold APA treatment before surgery to avoid bleeding versus maintaining APA therapy perioperatively in order to prevent cardiovascular morbidity. Recently, Kang et al reported that patients who underwent spine fusion had significantly higher post-surgical bleeding and bleeding-related complications despite discontinuing aspirin 7 days before surgery when compared with patients who did not receive aspirin[1]. Our hypothesis was that continuation of APA will not adversely affect outcome in minimally invasive spine surgery.

**Methods:** After local IRB approval, 55 patients scheduled for minimal invasive lumbar spine surgery (laminectomy, discectomy or foraminotomy) were included in this prospective, observational study. 21 patients continued APA therapy (aspirin: n=16, others: n=5) in the perioperative period. 34 patients either discontinued APA therapy >5 days prior to surgery (n=7) or never received APA. Perioperative treatment was conducted according to departmental standards. Demographic, surgical and perioperative data were recorded

as well as readmission rate in the 60 postoperative days. Morbidity was followed during the outpatient visit (a week after surgery) and by telephone interview 30 and 60 days postoperatively.

**Results:** Patients receiving APA were significantly older (control: 55±19 y/o, APA: 68±12 y/o), with higher ASA scores (ASA 3 - control: 23%, APA: - 67%), higher rate of cardiovascular disease (control: 15%, APA: 43%) and longer anesthesia duration (control: 95±35 min, APA: 123±13 min). None of the patients had postoperative neurological or cardiovascular complications and there were no readmissions. There was no significant difference between the groups regarding postoperative length of stay. Postoperative hematocrit and platelet count significantly decreased at POD1 in both groups. None of the patients required blood transfusion. Compared to preoperative levels, a significant (p < 0.01) increase in leukocyte count was observed in POD1 in both groups.

**Conclusion:** Unlike in major spine surgery, our preliminary data suggest that APA therapy may be continued in the perioperative period. The observed leukocytosis after minimal invasive lumbar spine surgery needs further investigation.

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## 6AP2-4

### Effect of high versus low dose of tranexamic acid (TXA) on fibrinolysis during cardiac surgery

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**Background:** TXA is the antifibrinolytic of choice in Europe since the withdrawal of aprotinin. The effect of different dose scheme on fibrinolysis during cardiopulmonary bypass (CPB) has not yet been evaluated by thromboelastography (TEG, Haemoscope).

**Materials and Methods:** 46 adults scheduled for elective or semi-urgent cardiac surgery under CPB were included in this double-blind, randomized, controlled trial (RCT) approved by the local ethic committee. Exclusion criteria were: age < 18 years old, circulatory arrest, emergent procedure, preoperative coagulopathy or anticoagulation with unfractionated heparin. Patients were divided into 3 groups: BART (30 mg/kg, 16 mg/kg/h), Middle (5 mg/kg, 5 mg/kg/h), or Placebo (normal saline). A bolus was administered after anesthesia induction followed by a continuous infusion until the end of CPB. Anesthesia protocol was left to the discretion of the physicians. Occurrence of fibrinolysis by TEG, characterized by an early maximum amplitude reduction (LY30 time, MA) was defined as the primary objective. Secondary outcomes were: CPB time, exposure and amount of blood product, blood loss, eGFR (using Cockcroft formula), incidence rate of seizure or other adverse events. 5 TEG tests were performed during the study period (baseline, post-bolus, per-CPB, end-CPB, after protamine). One or two way ANOVA were used as statistical test when required, a p < 0.05 was considered as significant.

**Results and Discussion:** After informed consent, 40 adults were included in our study and 6 patients were excluded for technical troubles. No fibrinolysis was observed in any group. Time significantly influences each TEG variable (p < 0.001), however no statistical difference between group and no interaction "Time x Group" was found. When groups were compared, a statistically significant difference was found for "r" at CPB time between BART and Placebo group (Mean diff (95% CI) = 5.5mm (0.09-11) with p < 0.05). No difference was found regarding the secondary outcomes, excepted for CPB (p= 0.04) and aortic clamp (p= 0.02) times, longer for placebo.

**Conclusion:** When evaluated by TEG, we were unable to detect any fibrinolysis even in the placebo group. Moreover no difference was found between high dose and low dose scheme of TXA in term of fibrinolysis and secondary outcomes. Further well-powered studies are needed to evaluate the best dosing scheme according to the pharmacokinetic profile of TXA.

## 6AP2-5

### Intra-operative tranexamic acid reduces blood loss and length of hospital stay after unilateral knee replacement surgery

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**Background and Goal of Study:** Major orthopaedic surgery is associated with significant blood loss, potentially requiring allogenic blood transfusion. This is associated with risks and increased costs. Tranexamic acid has been used to reduce peri-operative blood loss.<sup>1,2</sup>

This study compares blood loss, transfusion requirements and length of hospital stay after total knee replacement with and without intra-operative use of Tranexamic acid.

**Materials and Methods:** We conducted a retrospective review of 40 patients who underwent unilateral knee replacement between November 2010 and February 2011.

20 patients received Tranexamic acid (1g iv) before tourniquet deflation. The 20 patients in the compared group did not receive Tranexamic acid. Both patient groups were closely matched with respect to age, gender, ASA grade and weight. We measured peri-operative change in Hb, use of allogenic transfusion and length of hospital stay.

**Results and Discussion:** The mean age for patients in group A was 62.9 years compared to 65.6 years for group B. The mean difference in haemoglobin was 1.93 g/dl in group A compared with 3.41 g/dl in group B. 3 Patients in group B required blood transfusion, none of the group A patients needed blood. The mean length of hospital stay was 4.45 days for group A and 5.4 days for group B. We did not see any adverse effects with Tranexamic acid. Tranexamic acid appears to be a cost effective and readily available means to reduce transfusion requirements in knee replacement surgery.

**Conclusion(s):** Intra-operative use of a single dose of Tranexamic acid significantly reduces the post-operative drop in haemoglobin, transfusion requirements and length of hospital stay after unilateral knee replacement.

**References:**

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**6AP2-6**

**Tranexamic acid reduces blood transfusion without increases in thrombotic complications in joint replacement surgery**

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**Background and Goal of Study:** The efficacy of prophylactic tranexamic acid (TXA) in knee arthroplasty (KA) has been widely demonstrated, based in a fibrinolytic effect of tourniquet. More controversial is the efficacy in hip arthroplasty (HA). Finally, de keystone in the use of TXA is thrombotic risk. The objectives of our study were firstly to evaluate the comparative efficacy of TXA in the two joint replacement surgeries and secondly the evaluation of thrombotic complications.

**Materials and Methods:** In a double blind prospective study patients scheduled for KA or HA were randomly assigned into two groups. In the group TXA, 10 mg/kg of antifibrinolytic drug was administer prophylactically and then repeated after 3 hours. In the control group, saline was given matching the protocol. For the evaluation of efficacy the amount of blood drained, calculated blood loss and allogenic transfusion was register. A complete ultrasound examination of limbs and a computed tomographic pulmonary angiography was done in all patients. A six-month review of medical records in the hospital and regional health registry completed the study. T-test was used for quantitative variables and Chi-square test for qualitative variables.

**Results and Discussion:** Forty-four patients were included: 22 patients were randomized to TXA (11 KA and 11HA) and 22 to placebo (11KA and 11 HA). Groups were similar in sex, age, preoperative haematocrit and coagulation parameters. Mean (SD) values in haemoglobin (Hb) reduction and transfusion are summarised below (table 1). Five patients had a thrombotic complication, but only one was clinically relevant. No more thrombotic complications were detected in the six month surveillance.

	Control group (n=22)		TXA group (n=22)		p
	HA (n=11)	KA (n=11)	HA (n=11)	KA (n=11)	
Reduction in Hb (6h postop) g/dl	2.12(0.1)	1.94(0.6)	1.77(0.1)	1.38(0.59)	p=0.4
Reduction in Hb (96h postop) g/dl	3.98(1.1)	3.45(1.1)	2.83(1.4)	2.35(1.1)	p<0.05
Drained blood (ml)	281(185)		140(136)		p<0.05
Calculated blood losses (96h) (ml)	1525(663)		966(467)		p<0.05
Allogenic transfusion (U)	5		0		p = 0.042
Deep venous thrombosis	0		1		p > 0.05
Pulmonary thromboembolism	3		2		p > 0.05

[Table 1: Tranexamic acid effects]

**Conclusion(s):** Tranexamic acid reduces transfusion requirements and blood losses in knee and hip arthroplasty, without differences in the efficacy between the two surgeries. Moreover we can affirm that the prophylactic use of tranexamic acid doesn't increase the risk for thrombotic complications.

**6AP2-8**

**Antifibrinolytics use during liver transplantation: implementing Essen algorithm**

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**Background and Goal of Study:** Prophylactic administration of antifibrinolytic agents during liver transplantation (LTX) has been shown to reduce blood loss [1]. However, these drugs are blamed for higher rate of pulmonary embolism (PE) and hepatic artery thrombosis (HAT). Due to safety reasons the prophylaxis is usually avoided in any hypercoagulable state. Thromboelastometry-based protocol for antifibrinolytic use, or "Essen algorithm", seems to be the most logical approach [2].

**Materials and Methods:** Since introduction of routine intraoperative RoTEM monitoring (2008) 61 LTXs were performed. 59 tumor-free pts were analysed. Before acceptance of antifibrinolytic prophylaxis protocol in our center 45 pts were treated with bolus of tranexamic acid (TA) only in case of early hyperfibrinolysis (Lysis Index LI45< 85%) - "treatment" group. Then 14 pts were allocated for prophylactic use of TA (10 mg/kg\*h) in case of CTex >80 sec and MCFex< 35 mm - "prophylaxis" group. No coagulation factors were used, except FFP and platelets. Red cell salvage was done.

**Results and Discussion:** 13 of 14 pts (92%) from "prophylaxis" group met TA infusion criteria. In "treatment" group early lysis (LI 45< 85%) was revealed only in 6 of 45 pts (13%) and late lysis (LI45>85% and LI60< 85%) - in 10 patients (22%). Looking retrospectively, 37 of 45 pts (82%) would have received prophylaxis according to preoperative CTex. In "treatment" group the preoperative CTex correlated well with severity of hyperfibrinolysis throughout the operation. Prophylaxis with TA resulted in significant decrease of PRC transfusion (588±777 ml vs. 1114±812 ml). The FFP consumption was not different between groups (4575±1947 ml vs. 4483±2354 ml).

**Conclusion:** The proposed predictors of hyperfibrinolysis during LTX (CTex>80 and MCFex< 35) are proven to be reliable. Prophylactic use of antifibrinolytics are not indicated in small proportion of liver transplant recipients (8-18% in our study). As "normal" CTex can be found in some pts, who are formally suitable for prophylaxis (ex, cirrhotic pts), routine preoperative thromboelastometric screening is recommended.

**References:**

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**6AP2-9**

**Does intraoperative low molecular weight hydroxyethyl infusion impair immediate graft function in renal transplant recipients?**

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**Background and Goal of Study:** Volume management is crucial during renal transplantation. Whether colloids or crystalloids are more suitable for volume replacement is an on-going controversy<sup>1</sup>. Several studies suggest that hydroxyethyl starch (HES) may induce osmotic-nephrosis-like lesions.

**Materials and Methods:** This retrospective single-centre cohort study analyzed 162 patients who underwent renal transplantation during 2010 in University Hospital of Coimbra, Portugal. 18 patients were excluded (12 received albumin during the procedure, 3 with age under 18 years, 3 with multi-organ transplantation). Patients were divided into two groups. Patients in group **CRYS** (N: 117) received only crystalloid solution (balanced crystalloid solution, normal saline or acetated Ringer's) only. Patients in group **HES** (N: 31) received a minimum of **500 ml 6% HES 130/0.4** during the surgical procedure. Statistical analysis was performed with SPSS 17.0 (t- student test, Mann-Whitney and Pearson Correlation test). P< 0.05 was considered to be significant.

**Results and Discussion:** There were no significant differences in the characteristics of the patients between the two groups of kidneys recipients (only a

small imbalance of age in donors and male in recipients). **Delayed graft function (DGF)**, defined as the need for dialysis during the first post-transplant week occurred in 27/117 (23.0%) in group CRY and in 15/31 (48.4%) cases in group HES. ( $p = 0.056$ ). **Serum creatinine levels** were significantly lower in group CRY compared with HES group. ( $p = 0.026$ ). 30 days after transplantation mean serum creatinine was, respectively, 1.22 and 2.19 mg/dl.

**Conclusion(s):** In this single-centre retrospective study infusion of low molecular weight 6% HES 130/0.4 during renal transplantation was found to have **no influence** on the rate of DGF. However is associated with **higher creatinine levels** after 7 and 30 days. This could be related with higher donor age and haemodynamic instability during transplantation rather than to HES itself.

#### References:

<sup>1</sup>Jakob SM, Prevention of acute renal failure-fluid repletion and colloids. *Int J Artif Organs* 2004; 27: 1043-1048.

## 6AP2-10

### Reversal of fondaparinux induced bleeding in anesthetized rats

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**Background:** The pentasaccharide fondaparinux, a specific and antithrombin-mediated FXa inhibitor, is used for prevention and treatment of venous thrombo-embolic events. There is currently no accepted reversal procedure for fondaparinux associated bleeding.

**Goal of Study:** To assess the ability of activated prothrombin complex concentrates (APCC, 100 U/kg), rVIIa (200 µg/Kg) or tranexamic acid (TA, 100 mg/kg) to reverse the anticoagulant effect of fondaparinux in a rat arterial bleeding model.

**Materials and Methods:** Male Wistar rats, 500±50g bw were anticoagulated by intravenous administration of fondaparinux (400 µg/Kg). A tail transection was performed and one of the three haemostatic drugs, or saline, was administered (10 animals per group).

The primary criteria of judgement was bleeding duration (BD) - maximal observation period: 30 min. Per protocol mean arterial pressure (MAP) variation assessed the effect of blood loss on systemic haemodynamic. *Ex vivo* thrombin generation (TG) assay was studied in plasma. For this coagulation test, the total amount of thrombin work is referred to as endogenous thrombin potential (ETP), whereas the so-called Lag Time (LT) corresponds to the initiation phase and the time to clot formation.

**Results and Discussion:** BD was increased by fondaparinux from 742 s (450-1800 s) to 1505 s (800-1800 s) ( $p < 0.01$ ). APCC reduced BD to 400s (285-480) ( $p < 0.001$ ) and MAP was maintained throughout the observation period. Neither rVIIa nor TA had a statistically significant effect on these parameters. Regarding TG, fondaparinux prolonged LT from 1.7±0.2 to 2.3±0.2 min ( $p < 0.01$ ) and decreased ETP from 612±115 to 230±41 nM\*min ( $p < 0.01$ ). APCC overcorrected ETP up to 1961±910 nM\*min ( $p < 0.001$ ), whereas rFVIIa normalized LT without improvement of ETP.

**Conclusion(s):** This study suggests that APCC may have a benefit after fondaparinux induced bleeding. AT and rVIIa showed no significant effect in this model.

## 6AP2-11

### Reduced blood loss during Caesarean section under the action of tranexamic acid

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**Background and Goal of Study:** Despite significant progress obstetric care, the problem of bleeding during labor remains unfinished. Annually in the world from obstetric hemorrhage dies to 125 thousand women.

**Materials and Methods:** We performed a randomized, double-blind study in 37 patients who underwent cesarean section. Patients were divided into 2 groups: 1st group (19) received preoperative (30 minutes before operation) tranexamic acid 10 mg / kg. 2nd group (18) received preoperative placebo. Condition of hemostasis was monitored by haemoviscoelastography.

**Results and Discussion:** All included in the study patients before the surgery had moderate hypercoagulation and normal fibrinolysis: increasing of the intensity of clot formation (ICF) to 11.4% compared to normal rates; the intensity of the retraction and clot lysis (IRCL) is 16.45 ± 1.40 in both groups. At the start of operation in patients (group 1) - ICF decreased on 9.7% ( $p < 0.05$ ), and IRCL decreased on 27.6% ( $p < 0.05$ ) compared with preoperative. In group 2, there was ICF decreased on 8.8% ( $p < 0.05$ ), and IRCL increased on 11.4%

( $p < 0.05$ ) compared with preoperative. At the end of operation condition of hemostasis in both groups came almost to the same value - a moderate hypo-coagulation, depressed fibrinolysis. In both groups there was no thrombotic complications. Intraoperative blood loss in the 1st group was 300±40.5 and in the 2nd was 500±60.6.

**Conclusion(s):** Using of tranexamic acid before surgery significantly reduces intraoperative blood loss on 60%, without thrombotic complications.

## 6AP3-1

### Recombinant human erythropoietin (r-HuEPO) and intravenous iron for treatment of postoperative anemia in colorectal surgery

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**Background and Goal of Study:** Postoperative anemia is a common issue in patients with colorectal cancer and it has a multifactorial origin: anemia from the malignant process, blood loss during the surgery and inflammatory response to surgery with functional iron deficit.

The aim of our study is to investigate the combining of r-HuEPO and intravenous iron and its effect to the hemoglobin level and to the reduction of blood transfusion after surgery.

**Materials and Methods:** This is a prospective, randomized and placebo-controlled study. 52 patients are enrolled in it, and they were all anemic (Hb ≤ 8.9g/dl on the third day after surgery).

Patients were divided in 2 groups. Group I of 26 patients was treated with 100 mg of IV sucrose hydroxide iron (ferritin) - three times a week, and 30 000 U of sc. r -HuEPO - twice a week. This treatment continued for 14 days. Group II of 26 other patients was the group of control. Hemoglobin level is assessed on 7-th and 14-th day after initiation of the therapy. Blood transfusion units are count in both groups. Blood transfusion is used when the hemoglobin value ≤ 8g/dl, and it was recorded in a blood sample. It calculates the number of transfused patients and the amount of applied blood units.

The continuous variables are presented as average, standard deviation, while categorical variables are reported in percentage data. Evaluation of continuous variables is made with t test for two independent samples. Statistical significance is considered when  $p < 0, 05$ .

**Results and Discussion:** There was no difference between two groups regarding age, sex and type of surgery. Patients who received r-HuEPO and intravenous iron received no blood transfusion after surgery [0 patients vs. 10 patients of the group II, that received a total of 15 blood units (38.46%)]  $p < 0, 05$ . The average level of hemoglobin on 7-th day after treatment was 10.6 ± 0.2 g/dl (group I) and 9.2 ± 0.4g/dl (group II) and on 14-th day it was 12.2±0.3 g/dl (group I) and 10.1±0.3 g/dl (group II).

There was a statistically significant difference between two groups regarding the hemoglobin level on the 7-th day ( $t = -16.1, p = 0.001$ ) and on the 14-th day ( $t = -3.23, p = 0.001$ ) after treatment.

**Conclusion(s):** Use of r-HuEPO combined with intravenous iron significantly increases the baseline level of hemoglobin 14 days after treatment on post-operative period in patients with colorectal cancer, and it decreases the need of blood transfusion.

## 6AP3-2

### Postoperative anaemia and the need for effective patient blood management (PBM) are major concerns in elective orthopaedic surgery - a multicentre observational study (PREPARE)

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**Background and Goal of Study:** Preoperative anaemia compromises surgical outcome (Musallam et al., Lancet 2011;378:1396) and increases the risk of requiring perioperative blood transfusions which in turn are associated with adverse outcomes.

This study assessed the prevalence of pre- and postoperative management of anaemia in patients undergoing elective orthopaedic surgery.

**Materials and Methods:** Consecutive adult patients in 6 European countries undergoing elective orthopaedic hip, knee or spine surgery (Jan-Jul 2010) and with available pre- and postsurgical haemoglobin (Hb) levels were enrolled in this non-interventional study.

Endpoints included prevalence of pre- (primary endpoint) and postsurgical anaemia (Hb < 13 g/dL [male], Hb < 12 g/dL [female]), time to first blood transfusion and transfused blood units.

**Results and Discussion:** Data from 1534 patients (49.9% hip, 37.2% knee, 13.0% spine surgery; mean age 64.0±12.3 years, 61.3% female) in 15 centres



were analysed. Anaemia prevalence increased from 14.1% pre to 85.8% post surgery. Mean ( $\pm$ SD) Hb levels decreased by  $1.9\pm 1.5$  and  $3.0\pm 1.3$  g/dL ( $p < 0.001$ ) in preoperatively anaemic and non-anaemic patients, respectively. Ferritin and TSAT were assessed in less than 10% of patients. Perioperatively, 60.4% of anaemic and 30.0% of non-anaemic patients received anaemia treatment (34.3% overall) with a comparable, transfusion-dominated treatment pattern (Table). During surgery, 14.8% of anaemic and 2.8% of non-anaemic patients ( $p < 0.001$ ) received a blood transfusion ( $2.4\pm 1.5$  and  $2.2\pm 1.4$  units/patient). Median (interquartile range) time to first intraoperative blood transfusion (excluding cell saver blood) was 130 (88, 158) vs. 179 (135, 265) min ( $p < 0.001$ ). The incidence of postoperative complications was higher in preoperatively anaemic patients compared to non-anaemic patients (36.9% vs. 24.0%).

**Conclusion(s):** In this study, over 80% preoperatively non-anaemic patients became anaemic after elective orthopaedic surgery, and preoperative anaemia increased intraoperative transfusion risk. Despite the known adverse outcome of preoperative anaemia and blood transfusions, patient blood management measures such as iron status assessment, i.v. iron treatment and erythropoiesis stimulation are still underused in orthopaedic surgery in Europe.

Perioperative anaemia treatment option	Blood transfusion	oral iron	i.v. iron	Erythropoiesis stimulating agent (ESA)
Preoperatively anaemic (n=217)	80.9%	27.5%	6.9%	6.1%
Preoperatively non-anaemic (n=1317)	81.5%	23.0%	16.5%	3.5%

[Perioperative treatment in elective surgery]

### 6AP3-3

#### The use of cell salvage during anaesthesia

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**Background:** Intra-operative cell salvage is an important method of blood conservation.<sup>1</sup> There are three important components for it to be used regularly: familiarity with guidelines; working knowledge of the device and the ability to set up and operate it.<sup>1</sup> Cell Salvage is currently underused at Cork University Hospital. We identified the need for research on Irish anaesthetists' experiences and training of cell salvage.

**Goal of the Study:** To evaluate the anaesthetists experience of intra-operative cell salvage and the effectiveness of the teaching intervention.

**Methods and Materials:** Following ethical approval and informed consent, 45 anaesthetists completed a questionnaire examining factors known to influence the use of cell salvage. They attended a tutorial on how to set up and operate the cell salvage device. In six months, a 2nd questionnaire will evaluate their experience and the effectiveness of the teaching intervention. This is the data from the first questionnaire.

**Results:** Two percent were familiar with cell salvage guidelines. Fifty six percent had no working knowledge of the device and 69% were unable to set up and operate it. In the last year, 75% of consultants and 48% of junior doctors had been involved in a case where they thought it would have been beneficial to have used the device. Ninety five percent agreed that cell salvage had a future role in blood conservation strategies.

**Discussion:** Since 2005, cell salvage has shown to be safe and effective and endorsed by NICE.<sup>2</sup> It has shown to be more cost effective than donor blood.<sup>3</sup> Despite its efficacy, recent reports have highlighted its lack of routine use.<sup>1,3</sup> In our study identified barriers to the use of cell salvage included: a lack of familiarity with guidelines; infrequent formal training; a reluctance to set up device without prior training and the need for a competent assistant to use the device.

**Conclusion:** This study evaluated anaesthetists experience and training of cell salvage. Identified barriers to the use of cell salvage included: a lack of familiarity with guidelines and infrequent formal training. The impact of an educational intervention will address these issues.

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### 6AP3-4

#### Does postoperative hemoglobin level influence functional recovery in total knee arthroplasty? The preliminary results of a prospective cohort

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**Background and Goal of Study:** Postoperative anemia may be associated with a decrease in functional recovery. The aim of this study is to know if moderate anemia influences the postoperative vigor and rehabilitation capacity in patients undergoing a total knee arthroplasty, and if iron treatment of postoperative anemia could play a role.

**Materials and Methods:** A prospective observational cohort study of 90 consecutive patients undergoing a total knee arthroplasty was conducted. Major outcome variables were Barthel index, quality of life (EQ5 test) and distance walked in 6 minutes (6MWT) in pre and 21 postoperative day, total iron deficiency and postoperative iron administration. Patients were categorised according to their hemoglobin (Hb) level at day 21 after surgery (8-9.5, 9.6-10.9, > 11 g/dl)

**Results and Discussion:** There was no difference between Hb groups in the 6MWT at day 21 in the postoperative period ( $p=0.5$ ) and in the decrease of 6MWT preoperatively versus postoperatively ( $p=0.8$ ). Similar results were found with the degree of dependence (Barthel test difference).

However, Barthel scores at 21 day shows a significant correlation with Hb groups ( $p=0.02$ ).

On the other hand, postoperative 21 Hb was higher in patients intravenous iron treatment. No relation was found between 6MWT and most of the variables of our study, neither total iron deficiency nor postoperative iron route treatment.

**Conclusion(s):** Moderate anemia is not associated with an impaired of functional recovery during firsts 21 days on postoperative period after total knee arthroplasty. Postoperative intravenous iron treatment increase Hb level but not improves postoperative vigor.

#### References:

- Vuille- Lessard E, Boudreault D, Girard F, Ruel M, et al Postoperative anemia does not impede functional outcome and quality of life early after hip and knee arthroplasties. Transfusion 2011. doi: 10.1111/j.1537-2995.2011.03272.x

### 6AP3-5

#### Effects of induced relative hypoxia during the postoperative period of abdominal oncologic surgery, on hemoglobin and reticulocyte levels: a prospective, randomized-controlled clinical trial

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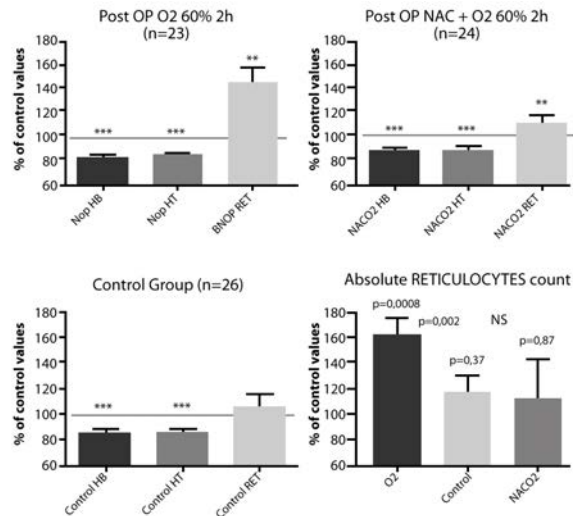
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**Background and Goal of Study:** Anemia is a frequent complication in oncologic patient. Erythropoietin (EPO) stimulating agents are known as alternatives to transfusion.

However, they expose patients to thrombosis and are expensive. Recently, a new phenomenon, the "normobaric oxygen paradox" (NOP), has been described. In brief, transient hyperoxia followed by a return to normoxia acts as an effective trigger for EPO production. The mechanism depends on free O<sub>2</sub> radicals and on reduced glutathione (GSH) availabilities. Also, N-acetylcystein (NAC) is known to regenerate the stock of GSH. Very few clinical trials have investigated this phenomenon<sup>1</sup>. The goal of this study was to test the NOP theory on the evolution of hemoglobin and reticulocytes in patients receiving intermittent oxygen with or without NAC compared to a control group.

**Materials and Methods:** This prospective, randomized study includes 78 patients (3 groups). The first group (G1; n=26) received 60% FiO<sub>2</sub> for 2 hours on the 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> day postoperatively. The second group (G2; n=26) in addition to O<sub>2</sub>, received NAC 200 mg/day for 5 days. The third group (G3; n=26) was the control group which didn't receive any O<sub>2</sub> variation. On postoperative day 6, hemoglobin and reticulocytes were measured and compared to the baseline values. A total of 5 patients were excluded for discontinuing O<sub>2</sub> and/or early discharge from hospital.

**Results and Discussion:** The reticulocytes count in G1 showed a statistically difference values compared to G2 and G3. These findings correlate with other clinical trials<sup>2</sup>. The fact that no statistical difference of hemoglobin level was recorded could be attributed to the early discharge.



[Reticulocytes count and hemoglobin G1,G2 and G3]

**Conclusion(s):** Induced relative hypoxia seems to be an effective stimulus for reticulocyte synthesis. However, further investigations are needed to confirm these findings and their impact on hemoglobin.

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### 6AP3-6

#### Intraoperative blood salvage reduces the requirements for allogenic blood transfusion and transfusion related inflammatory response in abdominal aortic aneurysm surgery

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**Background and Goal of Study:** Intraoperative blood salvage (IBS) is a procedure involving recovering blood losses during surgery and re-infusing it into the patient. IBS is known to reduce the perioperative morbidity and mortality associated with complications related to perioperative allogenic transfusion (AT).

The aim of this study was to investigate whether the IBS reduces the need for allogenic transfusion requirements and for non-invasive ventilation (NIV) and/or oxygen supplementation and whether it was associated with decreases levels of inflammatory markers following abdominal aortic aneurysm (AAA) surgery.

**Materials and Methods:** This retrospective study involved 51 patients under both elective and emergency AAA surgery throughout the period from February to October 2010. During study period IBS using Haemonetics cell saver 5+ was applied in 24 (46.2%) patients (CS group), while it wasn't used in 27 (51.9%) cases (NCS group).

Values of certain inflammatory biomarkers included: white blood cell count (WBCC), C-reactive protein (CRP), procalcitonin (PCT) and fibrinogen were monitored during the first 48 hours postoperatively. Secondary outcome measures included: the need for allogenic transfusion and for non-invasive ventilation (NIV) and/or oxygen supplementation.

**Results and Discussion:** The requirements for intra and postoperative allogenic red blood cells transfusions was significantly higher in patients from NCS group compared to patients in CS group (3.63 vs. 0.58 units per patient;  $p < 0.001$ ). Non-invasive respiratory support was more frequently used in patient from NCS group (4/27) compared to those in CS (1/24) group but difference was not statistically significant ( $p=0.17$ ).

The postoperatively average WBCC was significantly higher among patients in NCS group compared to those from CS group ( $12.89 \times 10^9$  vs.  $10.44 \times 10^9$ ;  $p=0.014$ ). Also CRP plasma levels postoperatively were significantly higher in NCS group compared to CS group ( $67.18 \text{ mgL}^{-1}$  vs.  $47.54 \text{ mgL}^{-1}$ ;  $p=0.015$ ). There were no significant difference considering both fibrinogen ( $p=0.09$ ) and PCT ( $p=0.11$ ) values between study groups.

**Conclusion(s):** The usage of intraoperative blood salvage reduces postoperative requirements for allogenic blood transfusion and need for non-invasive respiratory support following major vascular surgery and might be associated with decreased levels of certain inflammatory markers.

### 6AP3-7

#### Perioperative anemia, transfusion and complications in patients with hip fracture

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**Background and Goal of Study:** We conducted a study to describe in our hospital, the epidemiology of perioperative anemia in patients with hip fracture and to evaluate the relationship between hemoglobin (Hb) measurements and clinical outcomes. Also determine the clinical and hematologic that may affect the use of transfusions, the incidence of postoperative complications and its relationship to transfusion in these patients.

**Material and Methods:** A retrospective study of patients undergoing hip fracture surgery > 64 for two consecutive years (January 2007- December 2008) in our center. We registered: age, sex, ASA, type of surgery and date, comorbidities, baseline Hb (the first test after admission), clinical trigger Hb transfusion, the number of units transfused, surgical complications related to hospital stay, mortality at 30 days after admission and during the first year after the fracture.

**Results and Discussion:** From a population of 765 patients, were excluded from analysis 10 of them due to lack of data on clinical history. The 52.5% required transfusion (56.1% women, 39.3% men). The relationship of transfusion / ASA was II: 42.0%, III: 55.2%, IV: 64.9%. The distribution transfusion / age was 36.6% for < 75 years, 47.4% of 75-85th, 62.0% in > 85th.

The mean baseline Hb transfused patients was 11.6 g / dl, and 12.9 g / dl in patients who did not require transfusion. The percentage of patients with anemia was 45.8%. Of these, 70% required transfusion. The 17.4% of patients requiring transfusion suffered some kind of infectious complication ( $p 0.02$ ). Year mortality in patients transfused was 26.3% and 21.2% in non-transfused. ( $p 0.101$ ). Mortality at 30 days of transfused patients was 7.6% and 6.4% in non-transfused ( $p 0.530$ ). Year mortality in patients with preexisting anemia is 30.8% versus 17.3% of patients without anemia ( $p 0.000$ ). The 30-day mortality in patients with preexisting anemia was 10% versus 4.7% among non-anemic ( $p 0.005$ ).

**Conclusion:** Infectious complications are more common in transfused patients than in non-transfused. Mortality in transfused patients with preexisting anemia is higher than in non-anemic patients.

**References:**

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### 6AP3-8

#### Predictive study of transfusion requirements in burn patients

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**Background and Goal of Study:** The purpose of this study was to compose a formula that could anticipate the number of blood units transfused (NBUT) that a burn patient will require during hospitalization. Factors related to blood transfusion (BT) and mortality were also analyzed.

**Materials and Methods:** Patients scheduled for burn surgery were sequentially studied during 18 months. Demographic data, comorbidities, percentage of total body surface area burned (%TBSA), number of surgeries and complications associated to the burns were recorded. Hemoglobin values (Hb) were recorded at the admission, preoperatively, postoperatively and at hospital discharge; the lowest value between surgeries was also registered. Need of BT and NBUT were recorded. Chi-Square, T-Student, Mann-Whitney, Anova test and ROC curve were used to analyze the data. A p value < 0,05 was considered significant.

**Results and Discussion:** 183 patients were included in the study. Two groups were formed: those receiving no BT (NT; 68,8%) and those who did receive it (YT; 31,2%). The mean %TBSA was 7,2% in NT vs. 27,2% in YT ( $p < 0,001$ ). Number of surgeries was 1,1 in NT and 2,6 in YT ( $p < 0,001$ ). The mean NBUT in YT was 14,3 (1-55). In group YT, %TBSA showed significant difference considering the NBUT ( $p=0,049$ ): it was 5,5 in patients who has %TBSA < 15 vs. 10 in those who has %TBSA > 15.

Using relative risk (RR), the following parameters were identified as risk factors for BT: >15%TBSA (RR=7,1), Hb < 11,7 g/dl (RR=3,9), two or more surgeries (RR=7,1), complications (RR=3,4) and cardiovascular comorbidities (RR=1,6).

Factors associated with mortality were: >15%TBSA ( $p=0,001$ ); cardiovascular ( $p=0,031$ ), respiratory ( $p=0,02$ ), and endocrine ( $p=0,04$ ) comorbidities; compartment syndrome ( $p=0,09$ ); inhalation injury ( $p < 0,001$ ); two or more surgeries ( $p=0,007$ ); NBUT ( $p < 0,001$ ).

The regression model, with a determination coefficient of 73.4%, derived in this formula:  $n^{\text{units}} = 1,77 + (0,245 \times \% \text{TSBA}) + (4,766 \times n^{\text{surgeries}}) - (0,66 \times \text{preoperative Hb})$ .

**Conclusion(s):** We propose a formula to estimate BT requirements in burn patients. The cutoff points for BT were:  $> 15\% \text{TBSA}$ , preoperative Hb  $< 11,7 \text{g/dl}$ . Risk factors related to BT were:  $\% \text{TBSA}$ , preoperative Hb, cardiovascular comorbidities, inhalation injury or escharotomies and being subjected to two or more surgeries. Factors associated with mortality were:  $> 15\% \text{TBSA}$ , cardiovascular and endocrine comorbidities, inhalation injury and escharotomies, number of surgeries and NBut.

## 6AP3-9

### Implementation of routine cell salvage in a Scottish cardiac surgical unit

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**Background and Goal of Study:** The use of red cells and blood products is relatively common during and after cardiac surgery. In recent years there has been a drive to decrease blood use and many units now routinely use intraoperative cell salvage. In Scotland it has been hard to introduce its routine use as blood is supplied free of charge while cell salvage disposables are not. Given the potential benefits to patients of decreased exposure to allogeneic blood the Scottish National Blood Transfusion Service funded 225 sets of cell salvage disposables for use in our unit.

Four surgeons agreed to use cell salvage routinely during their cardiac cases with a view to assessing its effectiveness in decreasing allogeneic transfusion. We also sought to assess any influence on length of stay and on rates of infection.

**Materials and Methods:** 225 consecutive patients were prospectively studied. We noted admission Haemoglobin (Hb), discharge Hb and autologous and allogeneic blood use for each patient. We also noted ITU and hospital length of stay and evidence of infections. We then selected 225 consecutive patients from our units database to act as historical controls; this group mirrored the cell salvage group in terms of each individual surgeon's workload.

**Results and Discussion:** Patients in both groups had similar demographic details although there was more valve and complex surgery in the cell salvage group. There was no difference in the use of red cells in the cell salvage group compared to the control group (2.1 v 1.96 units/ patient) or any difference in the use of FFP (0.95 v 0.79 units). There was significantly increased platelet use (0.39 v 0.21,  $p = 0.023$ ). Patients in the cell salvage group had a slightly lower admission Hb (13.5 v 13.7  $\text{g.dL}^{-1}$ ) and a significantly lower discharge Hb (9.7 v 9.97  $\text{g.dL}^{-1}$ ,  $p = 0.024$ ). Although there was no difference in ITU stay (61.5 v 61.1 hours), patients in the cell salvage group had shorter hospital stays (10.5 v 11.2 days) and were also noted to have fewer documented infections (11 v 14%).

**Conclusion(s):** It is disappointing that we could not demonstrate a decrease in transfusion requirements, perhaps reflecting more complex surgery in the cell salvage group. It is encouraging that these patients had shorter hospital stays and fewer infections. While analysis of the impact of cell salvage continues, efforts should be made to establish its increased use.

## 6AP3-10

### Critical haemoglobine at patients with perioperative extensive blood loss

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**Background and Goal of Study:** Allogenic blood transfusion (ABT) can be not ordered by a certain level of the haemoglobin (Hb), but must be based on a risk of developing complications of inadequate oxygenation. Proper values of the critical haemoglobin (Hbcrit) for different conditions still are not determined. In this randomized prospective study we have studied the dependency between perioperative Hb level and outcome, as well as have valued the influence of the acute normovolemic hemodilution (ANG) on amount of the perioperative ABT and development of the postoperative complications.

**Materials and Methods:** Depending on minimum level of the perioperative Hb 114 patients that suffered major abdominal surgery were randomly assigned to group A ( $n=38$ ,  $\text{Hb} > 9 \text{g/dl}$ ), group B ( $n=35$ ,  $\text{Hb} = 8.9-7 \text{g/dl}$ ), group C ( $n=41$ ,  $\text{Hb} < 6.9 \text{g/dl}$ ). Each group consisted of "ANG-patients" and "no ANG-patients". The indication to immediate blood transfusion were hemodynamic instability, myocardium ischemia,  $\text{Hb} < 5 \text{g/dl}$ . Amount of ABT, organs dysfunction, mortality were defined. Statistical processing of results were or-

ganized using  $\chi^2$ -test and Fisher's exact test.

**Results and Discussion:** Postoperative complications appeared at 13 (34.2%) group A patients, 21 (60%) group B patients, 23 (56.1%) group C patients ( $p_{1,2} = 0.038$ ,  $p_{1,3} = 0.044$ ). The pulmonary dysfunction developed at 4 (10.5%) group A patients, 16 (45.7%) group B patients, 14 (34.1%) group C patients ( $p_{1,2} = 0.014$ ,  $p_{1,3} = 0.029$ ).

The 2 systems defeat was defined at 5 (13.1%) group A patients, 3 (8.5%) group B patients, 10 (24.3%) group C patients ( $p_{2,3} = 0.049$ ). Mortality in group A has formed 7.9%, in group B - 2.9%, in group C - 19.5% ( $p_{2,3} = 0.033$ ). In group A ANG did not influence the investigation parameters. In group B ABT was necessary for 1 (4%) ANG-patient ( $n=25$ ) and 8 (80%) no ANG-patients ( $n=10$ ) ( $p < 0.001$ ). In group C ABT was necessary for 2 (18.1%) ANG-patients ( $n=11$ ) and 29 (96.6%) no ANG-patients ( $n=30$ ) ( $p < 0.001$ ). In group C significant postoperative complications occurred at 3 (27.2%) ANG-patient compared with 20 (66.6%) no ANG-patients ( $p < 0.05$ ). The differences between other parameters were not statistically reliable.

**Conclusion(s):** Reduction of Hb less than 7  $\text{g/dl}$  at patients subject to operations on organs of the abdominal cavity is critical and requires blood correction. Making ANG at abdominal operations allows to decrease the ABT and reduces postoperative complications.

## 6AP4-1

### The utility of ABO/Rh type and screening in pediatric patients undergoing elective surgery

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**Background and Goal of Study:** With the exception of thoracic and neurosurgical procedures, transfusion during elective surgery is relatively rare in the pediatric population. The purpose of the ABO/Rh type and screening in patients scheduled to undergo elective surgery is to facilitate transfusion when required during the operation. However, routine ABO/Rh type and screening can be justified only when the probability of transfusion is substantial. We performed this observational study to estimate the utility of routine ABO/Rh type and screening in pediatric patients undergoing elective surgery.

**Materials and Methods:** Electronic medical records of Seoul National University Children's Hospital between June 2006 and June 2010 were retrieved and analyzed. Of all elective pediatric cases performed during the study period, patients who had ABO/Rh type and screening done within 3 days before their surgery were identified. Afterwards, records were analyzed to see if blood was actually ordered for that patient and if the patient was transfused.

**Results and Discussion:** The following end points were analyzed according to the surgical department, types of surgery, and time: number of patients with ABO/Rh type and screening/total number of patients, number of patients for whom pRBC was ordered/ number of patients with ABO/Rh type and screening, number of patients who were transfused/ number of patients for whom packed red blood cells (pRBC) was ordered, number of patients who were transfused/ number of patients with ABO/Rh type and screening.

The number of surgical cases, ABO/Rh type and screening performed, whether pRBC was ordered, and whether pRBC was transfused are summarized in table 1. The overall incidence of ABO/Rh type and screening for pediatric patients undergoing elective surgical procedures was 32.2%, and of those tested 37.9% were actually transfused. The incidence of ABO/Rh type and screening and transfusion thereafter amongst surgical departments and various surgical procedures ranged from 1.5 - 97.9% and 15.5 - 75.8%, respectively (table 2). The incidence of ABO/Rh type and screening and transfusion thereafter decreased over time.

Our study shows the current incidence of ABO/Rh type and screening and transfusion thereafter in a single pediatric hospital during the past 4 years. A tailored approach depending on the planned surgical procedure may decrease the use of ABO/Rh type and screening and also decrease the consequent discomfort and costs.

## 6AP4-2

### Human neutrophil alpha-defensins 1-3 form fibrinogen and thrombospondin-1 nets that bind microorganisms and activate platelets

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**Background and Goal of Study:** Human neutrophil  $\alpha$ -defensins (HNPs) are important constituents of the innate immune system. Beyond their antimicrobial properties, HNPs also have pro-inflammatory features. While HNPs in

plasma from healthy individuals are barely detectable, their level is strongly elevated in septic plasma. Thrombosis and inflammation are intertwined processes and activation of human PMNL and subsequent degranulation is associated with full activation of surrounding platelets, that interact with fibrinogen and thrombospondin<sup>1,2</sup>. This caused us to study the effect of HNP on platelet function.

**Materials and Methods:** The effect of HNPs on platelet activation parameters and apoptosis was investigated via aggregometry, flow cytometry, confocal microscopy and ELISA technique.

Formation of protein nets from fibrinogen and thrombospondin-1 as well as adhesion of *S. aureus* and *Candida albicans* to these nets was studied using confocal laser scanning microscopy.

**Results and Discussion:** HNPs activated platelets in pathophysiologically relevant doses, inducing fibrinogen and thrombospondin-1 binding, aggregation, platelet granule secretion, sCD40L shedding, and procoagulant activity. HNPs induced membrane pore formation, microparticle formation, mitochondrial membrane depolarization and caspase-3-activity. Confocal microscopy revealed the HNP-induced formation of fibrinogen and thrombospondin-1 nets, which bound platelets as well as microorganisms. HNP-induced platelet activation was markedly inhibited by GPIIb/IIIa inhibitors. Heparin, heparinoid, serpins and  $\alpha_2$ -macroglobulin, which bind to HNPs, blocked HNP-1 induced platelet activation in contrast to direct thrombin inhibitors like hirudin.

**Conclusion(s):** HNPs activate platelets and induce platelet apoptosis. Since HNPs are released by neutrophils after activation, they probably contribute to the prothrombotic NET formation in host defense. The described mechanism links again thrombosis and infection.

#### References:

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## 6AP4-3

### Differences in management of massive haemorrhage in cardiovascular surgery and non-cardiovascular surgery - a retrospective study

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**Background and Goal of Study:** The present guidelines for management of massive haemorrhage are not clearly distinguishable from surgical procedures.

We hypothesized that management of massive haemorrhage in cardiovascular surgery is more difficult and needs more blood components than that in non-cardiovascular surgery.

**Materials and Methods:** We have managed 26,675 surgical patients in the past 5 years. Cases with coagulopathy before the operation and cases of emergency cardiovascular surgery were excluded from this study. Within this period, we selected cases with blood loss of more than 6,000 mL during surgery. Twelve patients who underwent cardiovascular surgery (group C) and 25 patients who underwent non-cardiovascular surgery (group N) were included in the study. Fibrinogen concentrate or cryoprecipitate was not administered in any of the cases.

Data for requirement of blood components (red blood cells (RBC), fresh frozen plasma (FFP), and platelet concentrates (PC)) were obtained from anaesthesia records. Data were also obtained for prothrombin time (PT), fibrinogen, and platelet count recorded before and after surgery. Data were analyzed by the t-test, and  $p < 0.05$  was considered significant.

**Results:** Blood losses in groups C and N were not significantly different ( $8,836 \pm 3,038$  vs  $7,911 \pm 1,935$  mL,  $p = 0.46$ ). The volume ratios of FFP/RBC were significantly different ( $1.06 \pm 0.39$  vs  $0.65 \pm 0.27$ ,  $p < 0.001$ ); however, larger quantities of autologous blood (cell salvaged blood) were infused in group C. Transfusion requirements were not significant, but PC was greater in cardiovascular surgery ( $26 \pm 19$  vs  $8 \pm 10$  units,  $p = 0.006$ ), whereas postoperative platelet counts were not different ( $63 \pm 20 \times 10^9/L$  vs  $67 \pm 32 \times 10^9/L$ ,  $p = 0.96$ ).

In addition, postoperative fibrinogen and PT were not significantly different between the two groups. At 28 days after surgery, all patients in group C were alive, and 2 patients in group N had died from septic shock and severe hepatic failure.

**Conclusions:** The results of this study indicate that management of massive haemorrhage commonly requires administration of coagulation factors regardless of the surgical procedure, especially in cardiovascular surgery.

Moreover, platelet count should be maintained above  $50 \times 10^9/L$  according to European guidelines. Hence, a greater number of units of PC is required to maintain the recommended platelet count in cardiovascular surgery.

## 6AP4-4

### Coagulation disorders and neuraxial obstetric analgesia

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**Background:** Factor XI deficiency is a rare coagulopathy associated with prolongation of activated partial thromboplastin time (aPTT).<sup>1</sup> Although plasma levels of factor XI have no good correlation with bleeding risk, levels below 15% usually indicate the need of fresh frozen plasma administration (FFP), while levels above 50% seldom are associated with significant bleeding risk.<sup>2</sup> This is a case report of the management of a neuraxial technique in a parturient with a coagulopathy.

**Case report:** Woman of 35 years old, with severe deficiency of factor XI and no history of bleeding, that was presented for vaginal delivery at 40 weeks and 2 days of gestation. She didn't have alterations in the physical examination but analytically she had an aPTT of 60.8 seconds and plasma levels of factor XI about 3% of the normal values.

By decision with fellow of Immunohemotherapy and Obstetrics, it was decided to perform epidural analgesia at 4 cm of cervical dilation, after confirmation of availability of FFP and after obtaining informed consent. It was obtained peripheral venous access (18G) and the parturient was monitored (cardiotocography, indirect blood pressure and urine output). The epidural catheter was placed in a single attempt at L3/L4, atraumatic, with Tuohy needle (18G). We administered a bolus of 20 mg of ropivacaine 0.1% and 10  $\mu$ g of Sufentanyl. We have subsequently administered boluses of 20 mg of ropivacaine 0.1% when VAS > 4, with intervals of about one hour.

The mother had complete pain relief and did not have any complaints or neurological deficits. The labor lasted about five hours.

The newborn had Apgar 9 and 10 at 5 and 10 minutes respectively. There were no complications during the puerperium, including neurological, and it wasn't required the administration of FFP.

**Discussion:** In this clinical report and literature no complications have been reported. The deficiency of factor XI doesn't seem to be a contraindication for neuraxial obstetric analgesia.<sup>2</sup>

#### References:

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**Learning points:** In the absence of consensus about the safety of neuraxial techniques in parturients with factor XI deficiency in the literature, discussion of risk / benefit should be considered in each case.<sup>1</sup>

## 6AP4-5

### Massive hemorrhage in a patient with Klippel-Trenaunay-Weber syndrome

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**Background:** Klippel Trenaunay Weber syndrome (SKTW) is rare congenital disease characterized by cutaneous hemangioma, bone and soft tissue hypertrophy and venous/lymphatic anomalies related with arterio-venous malformations and coagulopathy. There are about 1000 case reports found in the literature, of which only 12 include anaesthetic approach<sup>1</sup>.

**Case report:** The authors report a case of a patient diagnosed with SKTW submitted to a right superficial femoral artery aneurismectomy and femoral-popliteal bypass, under general anaesthesia complicated with massive hemorrhage (total blood loss of 8050mL against 500-1000mL estimated for this kind of procedure), due to angiodysplasia of right leg.

**Discussion:** Although patients suffering from this syndrome present a much higher risk of hemorrhage than normal population, in this particular case the amount of blood loss was largely underestimated concerning the nature of the procedure<sup>2</sup>. The anaesthetic approach, mainly regarding the use of large bore venous catheters, rapid fluid infusers, cell-saver, and a goal directed fluid and blood replacement may have improved the patient's outcome.

#### References:

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**Learning points:** Concerning the rarity of this disease with very few anaesthetic reports regarding surgical procedures and anaesthetic management of these patients, the authors find this case, of singular interest.

## 6AP4-6

### Audit on evidence based blood transfusion in Intensive Care Unit (ICU) patients in a district general hospital

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**Background and Goal of Study:** This is a retrospective audit comparing current transfusion practice in our ICU with the best available current evidence and with an audit recipe published by the Royal College of Anaesthetists (RCOA). Many non-randomised studies have found associations between blood transfusions and increased infection rates, prolonged ICU length of stay and increased mortality among critically ill patients.

**Materials and Methods:** Retrospective audit covering time period from October 2010 to March 2011. 50 transfusion episodes looked at. List of patients received blood was given by blood bank. Both surgical and medical patients included, data collected from Critical Care Ward Manager (electronic patient data system).

#### Results and Discussion:

##### 1) Transfusion triggers

- Haemoglobin (Hb) < 70 g/l (mean trigger Hb 63 g/l): 10 episodes,
- Transfusion trigger Hb 70-80 g/l (mean trigger Hb 72.5 g/l): 29 episodes,
- Transfusion trigger Hb > 80 g/l (mean trigger Hb 85.9 g/l): 11 episodes.

##### 2) Number of Units per episode:

- 1 unit = 9 episodes,
- 2 units = 36 episodes,
- 3 units = 1 episode,
- > 3 units = 4 episodes.

##### 3) Type of patient episodes:

- Number of episodes with bleeding = 4, their transfusion trigger was between 41-83 g/l and mean post-transfusion Hb was 97.7 g/l.
- Number of episodes with Acute Coronary Syndrome (ACS) = 2, their transfusion trigger was between 72-77 g/l and mean post-transfusion Hb was 87.5 g/l.
- Number of episodes with Chronic Ischaemic Heart Disease (IHD) = 5, their transfusion trigger was between 69-84 g/l and mean post-transfusion was 89 g/l.
- Number of episodes with early sepsis = 9, their mean transfusion trigger was between 64-86 g/l and mean post-transfusion Hb was 98.7 g/l
- Remaining episodes = 29, their transfusion trigger was between 61-104 g/l, their mean post-transfusion Hb was 93.1 g/l. One patient did not have post transfusion Hb done, as patient died.

**Conclusion(s):** In most cases there was compliance with standards. Still there is a room for improvement in reaching the standards. Traditional prescription of at least 2 red cell units per transfusion was noted.

Recommendations like educating doctors and CCU nurses, breaking tradition of routinely giving 2 units of blood and re-audit in 1 years time were made.

#### References:

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## 6AP4-7

### Benefits haemoviscoelastography over traditional diagnostic methods of hemostasis

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**Background and Goal of Study:** Despite the evidence of perioperative hypercoagulability in cancer patients, there are no consistent data evaluating the extent, duration, and specific contribution of platelets and procoagulatory proteins by in vitro testing. This study compared efficacy of haemoviscoelastography (HVG) versus thromboelastography for monitoring of coagulation imbalance.

**Materials and Methods:** 556 Patients undergoing open surgery for abdominal cancer received HVG, a viscoelastic test, measures clot formation and includes information on the cellular, as well as the plasmatic coagulation system. We examined the efficacy of a variety of coagulation tests. A complete coagulation screen activated clotting time (ACT), thromboelastography (TEG) and haemoviscoelastography (HVG) were performed before surgery and biperarin anticoagulation monitoring on postoperative days 1, 3, 5 and 7. There were analyzed for the reaction time and the maximal amplitude (MA).

**Results and Discussion:** We calculated the elastic shear modulus of standard MA and HVG MA which reflect total clot strength and procoagulatory protein component, respectively. The difference was an estimate of the plate-

let component. There was a 16% perioperative increase of standard MA, corresponding to a 49% increase of HVG MA ( $P < 0.05$ ) and an 79-85% contribution of the calculated platelet component to HVG MA. We conclude that serial standard thromboelastography and HVG may reveal the independent contribution of platelets and procoagulatory proteins to clot strength. Using multiple linear regressions, all coagulation, TEG and HVG variabilities were used to model postoperative hypercoagulation. Results showed that some components of the TEG failed to identify hypercoagulation ( $r < 0.2$ ,  $P > 0.75$ ). However, three components of the routine coagulation assay, including bleeding time, prothrombin time, and platelet count could be modeled to show prolonged postoperative hypercoagulability ( $P < 0.01$ ). We conclude that all components of the HVG reflect postoperative coagulopathies, these results suggests that it may be useful in determining the coagulation status of cancer patients perioperative.

**Conclusion(s):** Postoperative hypercoagulability, occurring for at least 1 week after major cancer abdominal surgery, may be demonstrated HVG. Hypercoagulability is not reflected completely by standard coagulation monitoring and TEG and seems to be predominantly caused by increased platelet reactivity.

## 6AP4-8

### Influence of epidural anesthesia on the hemocoagulation disorders and quantity of the septic complications at patients with acute necrotizing pancreatitis

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**Background and Goal of Study:** According to many authors, the acute necrotizing pancreatitis (ANP) still remains one of the difficult problems of abdominal surgery. The complexity of the pathogenesis of the disease, features of the pancreas pathomorphology, abdominal hypertension, high mortality (30-70%), necessitate search for new ways to treat this disease.

**Materials and Methods:** The study was conducted in 44 patients with the ANP, which were divided into 2 groups according to type of analgesia: epidural or opioids. Patients from 1st group (23) had epidural analgesia by ropivacaine 6-14 mg/hour during 7-10 days, and from 2nd (21) - opioid analgesia by trimeperidine 20mg 3 times a day during the same period. We monitored level of septic and thrombo-hemorrhagic complications by clinical and instrumental data, during month after treatment starting. The hemostatic system was evaluated using indicators of hemoviscoelastography (Analyzer "Mednord-01M").

**Results and Discussion:** It was found that all patients with ANP initially have hypercoagulation and fibrinolysis inhibition. Level of hemostatic disorders correlate with the level of septic complications, treatment in ICU, mortality. In 1st group we noted a deep vein thrombosis (DVT), 2 pneumonia, 7 - pseudopancreatic cysts and abscesses, 2 deaths and time of stay in the ICU to 15.4 days. In the 2nd group: 3 cases of deep vein thrombosis, 4 - pneumonia, 10 - pseudopancreatic cysts and abscesses, 2 episodes of gastro-duodenal bleeding, 5 deaths and time of stay in the ICU to 27.8 days.

**Conclusion(s):** The using of epidural anesthesia in patients with ANP reduced the number of septic complications on 36.6%, and reduce the mortality rate from 23.8% (2nd gr.) to 8.7% (1st gr.). We think, that violations of blood coagulation and microcirculation are the basis for ischemia, necrosis in tissues and septic complications. Epidural analgesia is effective method to decreasing level of septic and thrombo-hemorrhagic complications and mortality in ANP patients.

## 6AP4-9

### Anaphylatic reaction following administration of prothrombin complex concentrate (PCC) in a patient with IgA deficiency

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**Background:** Ig A deficiency (IgAD) is the most common primary immunodeficiency, with a reported incidence of 1:700<sup>1</sup>, affecting especially males. It is characterized by an IgA production defect and low serum IgA levels (< 0.05 g/l). We report the case of a patient with IgAD presented for urgent surgery. Our purpose is to warn about potential complications of blood products (BPs) transfusion in these patients.

**Case report:** Male patient, aged 35, ASA II, IgAD, presented for urgent appendectomy. He was hypocoagulated with warfarin due to repeated pulmonary embolism in the context of proteins C and S deficiencies, with INR 2.4. No documented allergies. For hypocoagulation reversal, we administered vitamin K (10 mg, iv) and PCC (Octaplex®) at 1 ml/min. After 3 ml, the pa-

tient developed chest erythema, dyspnoea and tachycardia without hypotension. PCC was immediately suspended and hydrocortisone (400 mg, iv) was administered with slow resolution of symptoms. The patient remained monitored with infusion of unfractionated heparin until the next day. After clinical improvement and INR normalisation, the patient underwent appendectomy without complications.

**Discussion:** Most IgAD patients are asymptomatic. About 40% have antibodies for IgA and some are susceptible to severe anaphylactic reactions to BP transfusion.

The suggested approach<sup>1</sup> for BPs transfusion in these patients should include the detection of anti-IgA. If negative, standard BPs transfusion is safe. In the presence of anti-IgA, we should obtain IgA deficient BPs. At emergent situa-

tions and in case of unavailability of such BPs, the patient must be pre-medicated with diphenhydramine and corticoids and administered standard BPs with monitorization.

#### References:

<sup>1</sup>Steel C *et al.* *Anesth Analg* 2010; 110:1088-90.

<sup>2</sup>Chowdary P *et al.* *Blood Coagulation and Fibrinolysis* 2010, 21:764-765

**Learning points:** PCC is not contraindicated in IgAD with anti-IgA<sup>2</sup>, but this BP must be used carefully. Measure of IgA and anti-IgA is essential, since the presence of little amounts of IgA excludes the probability of anaphylactic reaction mediated by anti-IgA<sup>1</sup>. Consequences of surgery delay and risk of an anaphylactic reaction must be balanced. In emergency situations, standard BPs may be used and pre-treatment care must be ensured<sup>1</sup>.

## Neurosciences

### 7AP1-1

#### The changes of regional cerebral oxygenation in the beach chair position for shoulder arthroscopy: desflurane vs propofol

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**Background and Goal of Study:** Shoulder surgeries in the sitting position pose an increased risk of cerebral ischaemia under general anaesthesia. Desflurane can be considered for surgeries in the sitting position since this agent decreases the cerebral metabolic rate and increases cerebral blood flow. However, volatile anaesthetics have been reported to impair cerebral autoregulation more than propofol. The purpose of the current study was to investigate the effects of desflurane and propofol on regional cerebral oxygenation (rSO<sub>2</sub>) in the sitting position during these procedures.

**Materials and Methods:** Forty patients were randomly allocated to the desflurane group (n=20) or the propofol group (n=20). Anaesthetic agents were maintained and adjusted with the effect-site concentration of propofol (2-3.5 µg ml<sup>-1</sup>) or desflurane (4-7%) to obtain a bispectral index (BIS) of 40-50. The haemodynamic variables, end-tidal carbon dioxide tension (ETCO<sub>2</sub>) and rSO<sub>2</sub> were measured and evaluated before (pre-induction values) and 5 min after induction of anaesthesia (baseline values), and 1, 3, 5, 7 and 9 min after raising the patient to a 70° sitting position (T1, T3, T5, T7 and T9, respectively).

**Results and Discussion:** There were no differences in BIS, haemodynamic variables and ETCO<sub>2</sub> between the groups. After the sitting position, the rSO<sub>2</sub> decreased significantly at T3, T5, T7 and T9, respectively, in both groups when compared with the values in the supine position within the group. The rSO<sub>2</sub> values in the desflurane group were higher compared to the propofol group at T3, T5, T7 and T9 (P = 0.031, 0.047, 0.025 and 0.034, respectively).

**Conclusion(s):** When anaesthetized patients were raised to the sitting position, desflurane preserved cerebral oxygenation better than propofol at equipotent concentrations in terms of BIS. Therefore, desflurane should be considered during surgeries in the sitting position especially in patients with increased risk of cerebral ischaemia.

#### References:

1. Murphy GS, Szokol JW, Marymont JH, *et al.* Cerebral oxygen desaturation events assessed by near-infrared spectroscopy during shoulder arthroscopy in the beach chair and lateral decubitus positions. *Anesth Analg* 2010;111:496-505.

### 7AP1-2

#### Sugammadex administration improves neuromonitoring (baseline response) in spinal cord surgery patients anaesthetized with TIVA

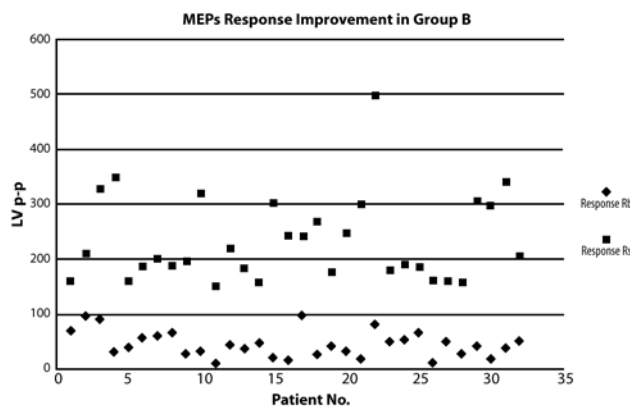
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Aim is to find a suitable anaesthetic protocol for neuromonitoring. It has been shown that MEPs and SSEPs used in spinal cord and brain surgery reduce neurological complications.

**Method:** 47 patients ASA I-III, with no neuromuscular congenital disease. Basic monitoring was placed and induction to anaesthesia was performed with Fentanyl, Xylocaine, Propofol and Rocuronium. Patients were intubated with cuffed RF ETT, ventilated and maintained anaesthetized with TIVA (Remifentanyl 0,3-0,8µg/Kg/min and Propofol 6-10 mg/Kg/h). After applying the

electrodes for MEPs and SSEPs, patients were returned prone (38-50 min after intubation). Before any surgical intervention began, baseline MEPs were performed with: Current 220mA, train of 7, pulse wide 300-500, ISI 4msec. Response was recorded and evaluated. Out of 47 patients, 11 had no response at all, whereas 32 had bad response. These patients (32+11= 43) received sugammadex 2mg/kg. Another set of MEPs was performed 3 minutes later and this response R<sub>s</sub> was recorded and compared to the base line response R<sub>b</sub> of each patient. The second response of the motor evoked potentials was increased between 18% and 35% (mean increase was 27%), of the base line value in 42 out of the 43 patients. Values were compared by using paired t-test. A significant statistical difference between responses of each patient was recorded. (p < 0.005).



[MEPs Response Improvement in Group B]

**Conclusion:** When neuromonitoring is used, baseline MEPs are important because by comparing them with all motor responses that follow, we can identify neurological problems. Patients should be completely reversed from muscle relaxation in order to perform accurate neuromonitoring (MEPs) from the beginning of surgery. Even 50 mins after rocuronium administration there was a decreased response to MEPs for some patients. Sugammadex is a drug that provides good conditions to do that when using rocuronium.

#### Reference:

Masui.2011 Aug;60(8):968-71 Recovery from rocuronium by sugammadex does not affect evoked potentials. Hashimoto

### 7AP1-3

#### Event related potential technique during general volatile anaesthesia

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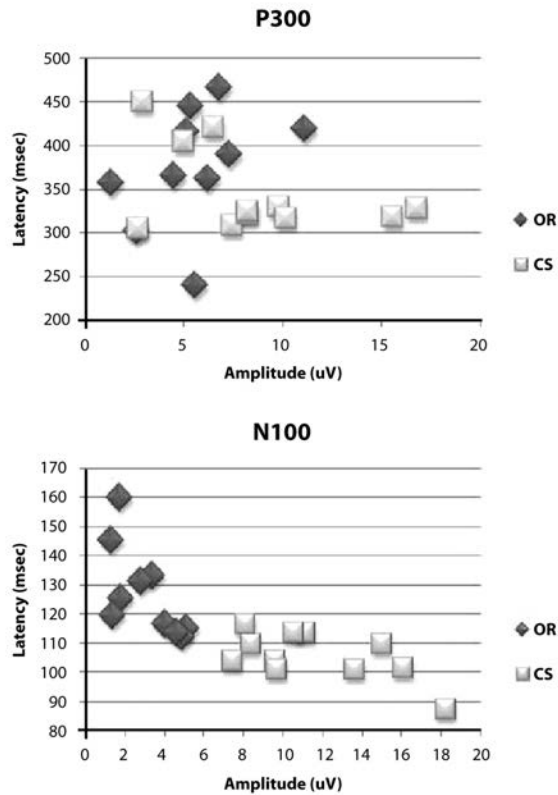
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**Background and Goal of Study:** An event-related potential (ERP) is any measured brain response that is directly the result of a thought or perception. More formally, it is any stereotyped electrophysiological response to an internal or external stimulus. Experimental psychologists and neuroscientists have discovered many different stimuli that elicit reliable ERPs from participants. The timing of these responses is thought to provide a measure of the timing of the brain's communication or time of information processing. The analysis

and alterations of these responses during general anesthesia have been only partially investigated.

**Materials and Methods:** Auditory ERP were obtained from 20 subjects (OR=10 undergoing general sevoflurane anesthesia and CS=10 during waking rest): N100 and P300 (auditory oddball paradigm) latency and amplitude have been calculated.

**Results and Discussion:** Interestingly N100 amplitude in OR didn't exceed 6 uV whereas CS never demonstrated an amplitude less than 7 uV (Fig.2) showing how N100 could be useful in the distinction between these two state of consciousness. P300 response is unpredictable, as demonstrated by an overlap of values between OR and CS (Fig.1).



[Figure 1 and 2]

N100 has been also demonstrated to be correlated with the level of sedation during propofol infusion<sup>1</sup>, thus this study demonstrates its usefulness also during sevoflurane anesthesia. More controversial is the role of P300; a previous study using nitrous oxide also showed the permanence of this positive-going wave during deepest stages of sedation<sup>2</sup> indicating that auditory information processing was not suppressed completely.

**Conclusion:** The present trial confirms the usefulness of auditory ERP as a tool for better understanding the alteration of consciousness. However the P300 merits further investigation as a tool for studying conscious awareness under anaesthesia.

**References:**

- 1.Yppärilä et al. Critical Care 2004, 8:R483-R490
- 2.Jessop et al. Br. J. Anaesth. (1991) 67 (5): 524-531

**7AP1-4**

**Changing position changes cerebral oxygen saturation in spine surgery**

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**Background and Goal of Study:** Postural change from supine to prone during general anaesthesia can cause severe hypotension and cerebral hypoperfusion, but no previous clinical trials have assessed changes in cerebral oxygen saturation in this patient population. The aim of this study was to determine the incidence of cerebral desaturation and assess its correlation with preoperative respiratory function and intraoperative cardiorespiratory variables.

**Materials and Methods:** 17 patients (ASA I - II), scheduled for elective spinal surgery were prospectively enrolled. Regional cerebral oxygen saturation (rSO<sub>2</sub>) was continuously monitored, using near-infrared spectroscopy (INVOS

5100, Somanetics). General anaesthesia was induced and maintained with remifentanyl and propofol. Cardiac output (CO) and stroke volume variation (SVV) were calculated by the Vigileo-FloTrac system (Edwards Lifescience). rSO<sub>2</sub>, hemodynamic variables and arterial blood gases were measured before and after patient positioning. Multiple regression analysis was used to identify the factors affecting changes in rSO<sub>2</sub>. Data distribution is expressed as mean±SD. A P - value less than 0.05 was considered significant.

**Results and Discussion:** In 12 patients (70%), the minimum rSO<sub>2</sub> value during prone position was lower than the baseline value (baseline rSO<sub>2</sub>, 67±5.3%; minimum rSO<sub>2</sub> 61±7.0%). The percent change of rSO<sub>2</sub> after turning to the prone position was -9.4±10%. Multiple regression analysis with stepwise variable selection revealed independent, significant predictors for changes in rSO<sub>2</sub>, hemoglobin concentration, heart rate, SVV>13% and preoperative respiratory function, percent forced expiratory volume in 1 second(FEV<sub>1,0</sub>) (Table 1).

Significant Factors	Multiple Regression Coefficient	Standardized Coefficient	P-value
	0.85		<0.001
Hemoglobin Concentration		0.625	0.003
Heart Rate		-0.513	0.004
SVV>13%		-0.498	0.013
FEV1.0		-0.468	0.001

[Table 1]

We indicated that cerebral desaturation by prone position were found in patients with hypovolemic state. These might be associated with the effect of reduction in the venous return to the heart and ventricular compliance linked to prone position.

**Conclusion:** Changes in prone posture seems to be correlated with a significant decrease of rSO<sub>2</sub>. Adequate fluid replacement before changing position may contribute to preventing a significant cerebral oxygen desaturation.

**7AP1-5**

**Xenon anaesthesia effect on cerebral blood flow in neurosurgical patients without intracranial hypertension**

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**Background and Goal of Study:** Xenon has excellent anesthetic properties but data on its effect upon cerebral blood flow is controversial limiting its use in neurosurgery. The aim is to evaluate the effect of xenon anaesthesia on cerebral blood flow in neurosurgical patients.

**Materials and Methods:** After local ethical committee approval 20 anaesthesias were carried with TAEMA Felix Dual station (Air Liquide Medical Systems, France) for transnasal skull base tumor removal. The patients had no intracranial hypertension, no significant cerebral blood flow disturbances and no anemia. After induction and intubation with midazolam 2,5-5 mg, propofol 1-2 mg/kg and fentanyl 3-5 mkg/kg a 10-min denitrogenation was hold, then xenon delivery was started to reach the target concentration of 65%. From induction till xenon accumulation (24 ± 3 min) no anaesthetic was added. Flow velocity was assessed in the right middle cerebral artery with transcranial Doppler monitor (Angiodin, Bioss, Russia) at 4 stages: 1) after denitrogenation (intravenous anaesthesia), 2) at 50% of xenon (minimal xenon concentration for monoanaesthesia), 3) at 65% of xenon (1 MAC anaesthesia), 4) after 3 min hyperventilation with an 8-10 mm Hg decrease in EtCO<sub>2</sub> (cerebral vascular reactivity testing). Due to a high monitor noise sensitivity the study was hold before the beginning of the operation. Statistical analysis was done with SPSS 9.0 software with Wilcoxon Signed Ranks Test.

**Results and Discussion:** The results are shown in the table 1. Passing from intravenous to 50% xenon anaesthesia no change was observed in mean flow velocity (p > 0.05). Reaching 65% of xenon, an insignificant increase in mean flow velocity appeared. Hyperventilation induced mean flow velocity decrease (p < 0.05) proving cerebral vascular reactivity preservation.

**Conclusion:** Comparing to intravenous anaesthesia xenon doesn't seem to induce changes in cerebral blood flow and preserves cerebral vascular reactivity in patients without intracranial hypertension.

stage	mean flow velocity (cm/s)	mean arterial blood pressure (mmHg)
1	50 (45,3; 52)	88,3 (81,7; 107)
2	50 (47,7; 57)	93,3 (80; 107)
3	54 (44; 59)	90* (80; 95)
4	48,7* (43,3; 52,3)	90* (80; 103)

[Mean flow velocity and mean arterial pressure]

\*p< 0,05 compared to previous stage

## 7AP1-6

### Jugular bulb oxymetry during xenon-sevoflurane anaesthesia

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**Background and Goal of Study:** Xenon gas has shown a great promise as a neuroprotector. This may be useful during neurosurgery. Up to date not much is known about the influence of Xe on CBF and ICP. Jugular venous oximetry is a method of analyzing the balance between oxygen supply and demand to the brain. This parameter allows to make estimation about the condition of autoregulation of CBF during Xe anaesthesia.

**Materials and Methods:** After LEC approval 40 pts. were randomly divided into two groups depending on anaesthesia: I (n=20, M-9, F-11, aged 46.8±14.6, ASA II-III) - after trepanation and until the haemostasis the anaesthesia was maintained with Xe 50% and Sevo (0,2-0,3 MAC); II (n=20, M-11, F-9, aged 49.7±12.8, ASA-II-III) - balanced anaesthesia with Sevo (0.8-1 MAC). Haemodynamic, gas and metabolic monitoring was performed. Anaesthesia was maintained using a closed-circuit anaesthesia system Axoema™ (Alfa-Impex Oy, Finland). Jugular bulb blood samples were aspirated after induction of anaesthesia, before the main stage of the operation and every next hour.

**Results and Discussion:** Phentanyl consumption was equal in both groups (0.99±0.76 vs 0.91±0.5 µg/kg\*h, p>0,05). Sympathomimetics were used during Sevo period of anaesthesia in both groups (40% and 35%, cons.) and after Xe delivery started their dosages remained stable. All pts had initial SjVO<sub>2</sub> on normal level (67.8±0.8 и 69.9±0.5). SjVO<sub>2</sub> was normal during three hours of the main operation stage (69.6±0.5, 69.9±0.5, 71.2±0.6 и 71.3±0.4, 71.5±0.5, 72.4±0.4, cons., p>0,05).

**Conclusion(s):** The acquired data showed the stability of CBF autoregulation during Xe and Sevo anaesthesia. We think that previous information about haemodynamic stability during Xe anaesthesia could be results of superficial anaesthesia. A method to evaluate the expected neuroprotective effects of Xenon should also be considered in the future studies.

## 7AP1-8

### The peculiarities EEG during of xenon anaesthesia

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**Background and Goal of Study:** One of the basic problems of introduction of xenon in a clinical practice as an anesthetic means is the insufficient level of study of its influence on the central nervous system, on the level of consciousness during anaesthesia, or "depth of anaesthesia".

**Materials and Methods:** The dynamics of basic rhythms in EEG during anaesthesia of xenon at performance of radical surgical interventions was studied on the cancer breast patients.

The research included 30 women operated under Xe or N<sub>2</sub>O by anaesthesia. (15+15). Electrodes EEG were placed under the standard scheme "10/20". Record background EEG spent prior to the beginning of a narcosis in position of the patient laying blindly within 5 minutes and after that carried out continuous registration of EEG up to the end of operation. The processing of EEG was fulfilled with use of specialized package eeglab versions 6.01 in Matlab environment.

**Results and Discussion:** At achievement of a surgical stage of a narcosis in both groups it was registered the expressed reduction in bioelectric activity of cortex of a brain. Relative power of low-frequency components of EEG increased in 3-6 times, 0,5-3 Hz and 4-6 Hz (δ- or θ- ranges). The common capacity of spectrum EEG achieved in both groups 3·10<sup>4</sup>µкВ<sup>2</sup>/Hz. However, distinctive feature of EEG at anaesthesia of xenon is preservation an α-activity in frontal and parietal areas of both hemispheres cortex of a brain on a background of its expressed functional oppression - occurrence of waves by frequency of 8-13 Hz and amplitude 15-20 мкВ.

**Acknowledgements:** It is possible to explain preservation of a high level of bioelectric activity of sub cortex structures of a brain at anaesthesia of xenon.

## 7AP1-9

### Increased serum levels of S100B protein and neuron-specific enolase (NSE) in patients after CABG surgery: is there any correlation with postoperative cognitive dysfunction?

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**Background and Goal of Study:** The systemic inflammatory response after cardiac surgery may cause damage to the central nervous system and elevated markers of brain injury in peripheral blood. This event may be potentially related to the development of postoperative cognitive dysfunction (POCD), with incidences varying from 20 to 83% (1). This study aims to measure levels of S100B protein and neuron-specific enolase (NSE) following coronary artery bypass graft (CABG) surgery and their potential correlation to early POCD.

**Materials and Methods:** We investigated 40 patients aged between 45 and 70 yrs undergoing elective CABG surgery. Cognitive function was measured preoperatively and 7 days postoperatively. S-100B protein and NSE serum levels were evaluated preoperatively, after anesthesia induction, at the end of surgery, 6 and 24h after surgery. Comparison of S100B and NSE serum levels was made using Repeated Measures ANOVA followed by Bonferroni test. Correlation between S100B/NSE levels and POCD was performed by Pearson's or Spearman's coefficient.

**Results and Discussion:** Serum S100B (0.56 mg/L) and NSE (6.42 mg/L) levels were higher at the end of surgery as compared to the baseline (0.17 mg/L and 3.92 mg/L, respectively, P < 0.01). This effect was maintained 6 and 24h after surgery. No changes were observed immediately after anesthesia induction. Interestingly, after a subgroup analysis, the same effect in S100B but not in NSE levels was observed in patients submitted to off-pump CABG. The incidence of POCD was estimated in 26%. However, S100B and NSE levels were not significantly correlated with POCD and postoperative values for S-100B and NSE were not statistically different in patients with POCD and without POCD.

**Conclusions:** In this small group of patients submitted to CABG surgery, a significant increase of S100B and NSE levels was observed postoperatively. This effect was significantly maintained throughout the first 24hs after surgery. However, although this procedure is significantly related to POCD and S100B/NSE levels increase, these postoperative markers of brain damage were not associated with POCD. These findings will need to be confirmed in a larger group of patients, with a longer postoperative follow-up. We are currently working in a more accurate protocol that may confirm the present data.

#### Reference:

1. Rev Bras Cir Cardiovasc 2008 23(2): 245-255.

**Acknowledgement:** Supported by FAPESP

## 7AP1-10

### Mild hyperventilation during intravenous anaesthesia increases cerebral metabolic rate of lactate in patients under intravenous anaesthesia

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**Background and Goal of Study:** We hypothesized that even under mild hyperventilation cerebral blood flow (CBF) and thus cerebral oxygen delivery (cDO<sub>2</sub>) would be impaired and would induce changes in cerebral metabolism in patients under intravenous anaesthesia.

**Materials and Methods:** After obtaining Research Ethics Board approval and informed consent, we measured 30 male patients under intravenous general anaesthesia (fentanyl, midazolam) before open coronary revascularisation. CBF has been measured with Kety-Schmid-technique (argon). Cerebral metabolic rates of oxygen (CMRO<sub>2</sub>), glucose (CMR-gluc) and lactate (CMR-lac) have been calculated as the product of CBF and their arterio-jugular differences. cDO<sub>2</sub> was the product of CBF and arterial oxygen content. The velocity of the mean cerebral artery (Vmca) was measured with transcranial Doppler-sonography. Zero flow pressure (ZFP) was extrapolated by regression analysis of arterial pressure/Vmca relationships. Cerebral perfusion pressure (CPP) and cerebrovascular resistance (CVR) were defined as CPP=MAP-ZFP and CVR=CPP/CBF. Measurements have been done under PaCO<sub>2</sub>-levels of 30 and 50 mmHg. Data were presented as mean and standard deviation. Statistical analysis was performed using paired t-tests or a Wilcoxon Signed-rank test, if appropriate.



**Results and Discussion:**

Parameter (n=30)	Hypocapnia mean (SD)	Hypercapnia mean (SD)	p
PaCO <sub>2</sub> (mmHg)	31 (3)	51 (3)	<0,001
CBF (ml/min/100g)	27 (5)	68 (24)	<0,001
ZFP (mmHg)	24 (9)	11 (11)	<0,001
CPP (mmHg)	51 (10)	59 (14)	<0,001
CVR (mmHg/ml/min/100g)	1,93 (0,52)	0,95 (0,32)	<0,001
cDO <sub>2</sub> (ml/min/100g)	4,51 (0,80)	10,84 (3,93)	<0,001
CMR-O <sub>2</sub> (ml/min/100g)	2,59 (0,65)	2,45 (0,76)	0,255
CMR-Gluc (μmol/min/100g)	3,10 (1,21)	3,56 (1,49)	0,188
CMR-Lac (μmol/min/100g)	2,38 (2,39)	-0,37 (2,18)	<0,001

[Table 1]

Changing PaCO<sub>2</sub> from 50 to 30 mmHg in our patients under intravenous anaesthesia showed an increase of ZFP and CVR and a decrease of CBF and cDO<sub>2</sub>. CMRO<sub>2</sub> and CMR-gluc remained nearly constant due to a proportional reduction of CBF and their arterio-jugular differences. However, mild hyperventilation resulted a significant increase of CMR-lac. This could be a sign that the cDO<sub>2</sub> reduction due to mild hyperventilation was severe and the brain was already changing its metabolic pathways.

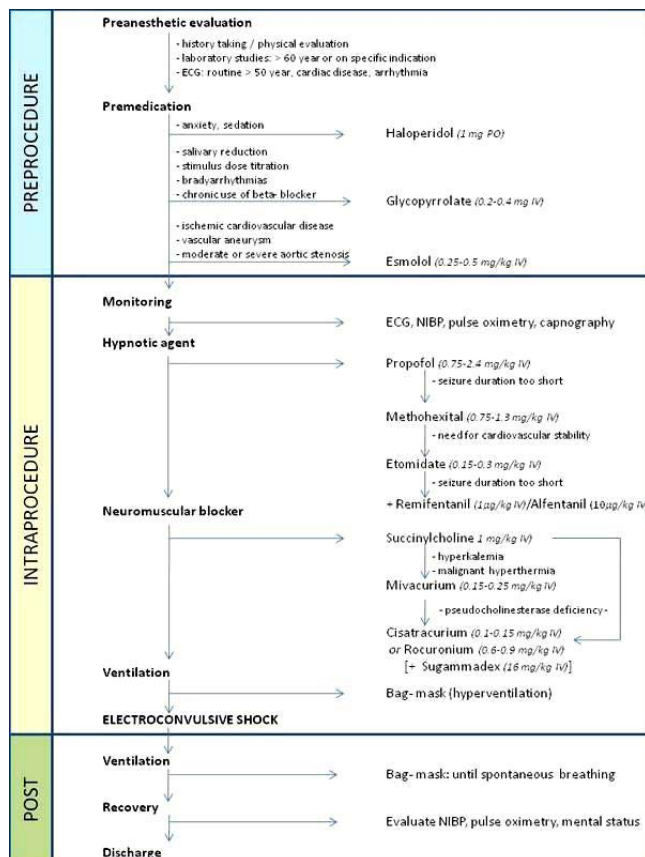
**Conclusion(s):** Even mild hyperventilation in patients under intravenous anaesthesia leads to a severe CBF- and cDO<sub>2</sub> reduction with an increase in CMR-lac.

**7AP1-11**

**Anesthesia for electroconvulsive therapy: guidelines for daily practice**

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**Background and Goal of Study:** Electroconvulsive therapy (ECT) is the electrical induction of seizures for the treatment of specific psychiatric disorders. ECT is associated with typical changes in cardiovascular and neurological physiology. Since the anesthesia for ECT will directly interfere with the treatment, the anesthesiologist should be aware of the current opinion in anesthesia for ECT.



[Overview\_ECT]

**Materials and Methods:** We searched Medline and selected the relevant articles about pre-, peri- and postprocedure care for ECT. Based on our findings we made a critical review of the literature and worked out a schematic overview with guidelines for daily practice.

**Results and Discussion:** Our search through literature revealed some important insights for ECT- anesthesia. The use of a benzodiazepines as premedication must be avoided, because they will shorten the seizure duration. As induction agent we will prefer propofol as it reduces side-effects and usually provides sufficient duration of convulsion. Alternatives are methohexital (when longer seizure duration is indicated) or etomidate (when cardiovascular stability has to be obtained). Succinylcholine remains the agent of choice to provide the necessary muscular paralysis. When patients are at risk for hyperkalemia or malignant hyperthermia, mivacurium is the agent of choice. For patients with known or suspected pseudocholinesterase deficiency, cisatracurium or rocuronium must be used. We could not find evidence for the routine use of adjuvantia during anesthesia for ECT. Their use is only indicated on specific, individual base. When bradycardia must be avoided the agent of choice is glycopyrrolate, hypertension can be avoided by using esmolol.

**Conclusion(s):** Based on the current literature we provide guidelines about the anesthetic management for ECT, by presenting the first schematic protocol for daily clinical use.

**7AP2-1**

**Hypothermia-induced neuroprotection in rats: evidence of a blood glutamate scavenging mechanism**

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**Background and Goal of Study:** In animal models of traumatic brain injury, stroke and global ischemia, hypothermia has been shown to be an effective treatment modality.

However, the exact mechanism of hypothermia-induced neuroprotection has yet to be determined. We hypothesized that it may be mediated by a blood glutamate scavenging effect, given the well established role of blood and brain glutamate levels on neurological outcome. Here, we examine the effect of hypothermia (mild, moderate and severe) on blood glutamate levels in naive rats. To identify the mechanism hypothermia-induced glutamate reduction, we also measured concentrations of glutamate oxaloacetate transaminase (GOT) and glutamate pyruvate transaminase (GPT), the primary regulators of glutamate concentration in blood.

**Materials and Methods:** Rats were anesthetized with Isoflurane and their core temperature was kept at either 36-37°C, 33-36°C, 30-32°C, 12-22°C, or not maintained artificially for 6 consequent hours. There were 12 rats in each group for a total of 60 rats. Blood samples were subsequently drawn at 0, 3, 6, 12, 24 and 48 hours for the determination of blood glutamate, GOT and GPT.

**Results and Discussion:** Mild and moderate hypothermia led to reduced blood glutamate levels (p < 0.001). A strong correlation between body temperature and blood glutamate levels was demonstrated (p < 0.001). Severe hypothermia was associated with significant elevations in blood glutamate levels (p < 0.001). Hypothermia, irrespective of the degree, led to elevations in GOT in plasma (p < 0.001).

**Conclusions:** Mild and moderate hypothermia led to a reduction in blood glutamate levels in rats, while severe hypothermia, in contrast, was associated with a significant elevation in blood glutamate levels.

We further demonstrated an elevation of GOT and GPT levels, supporting their involvement in reducing blood glutamate via the conversion of glutamate to 2-ketoglutarate.

We suggest that the neuroprotective properties of mild hypothermia may be partially due to a blood glutamate scavenging mechanism. In contrast, severe hypothermia which has been shown to deteriorate neurological outcome may be determined by blood glutamate elevating effects.

**7AP2-2**

**Influence of statin treatment on delayed ischemic neurologic deficit and acute functional outcome after aneurismatic subarachnoid hemorrhage**

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**Background and Goal of Study:** Delayed ischemic neurologic deficit (DIND) is a serious and poorly controllable complication of aneurysmal subarachnoid hemorrhage (aSAH) with high rates of mortality and morbidity. Statins are

assumed to exert pleiotropic neuroprotective effects which can be potentially beneficial for DIND prevention and treatment.

Goals of this study were to compare acute atorvastatin therapy with conventional nimodipine for aSAH in terms of frequency of DIND and short-term functional outcome as well as to explore relationship between cerebral vasospasm and DIND occurrence.

**Materials and Methods:** After institutional approval 90 adult patients (21-65 years of age) with aSAH were prospectively randomized to receive either atorvastatin 80 mg/day (n=35) or nimodipine 240mg/day (n=55) for 21 days within first 48 h. after the incident.

Groups were identical in demographics, care access time and severity of aSAH. Cerebral vasospasm in middle cerebral artery (MCA) was assessed by daily transcranial Doppler ultrasound. DIND was defined as a new hypodense area on CT scan or appearance of focal neurological deficit. Acute functional outcome was assessed by Rankine score (Rs) upon discharge from ICU. Repeated measurements were analysed by Friedman's chi square with subsequent Wilcoxon sign test. Between groups variables were analysed using Mann-Whitney U test. All p values were two sided. Velocities are presented as median (interquartile range).

**Results and Discussion:** Groups did not differ by mean MCA velocities: 1.54 (41.80) vs. 1.71 (63.51) in atorvastatin and nimodipine patients respectively (p=0.375).

There was also no difference in DIND frequency between groups - 44% vs. 41% (p=0.122) as well as mean Rs values: 2.25 vs 2.66 (p=0.085). We didn't detect significant relationship between severe vasospasm (MCA blood flow velocity  $\geq 180$ cm/sec) and DIND occurrence for both groups (p=0.115).

**Conclusion(s):** Acute treatment with atorvastatin was comparable to nimodipine in prevention of DIND and short term functional recovery after aSAH. Cerebral vasospasm should be considered as only one of potential determinants of DIND.

## 7AP2-3

### A protective effect of new vitamin E derivative ETS-GS in rat spinal cord injury model

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**Background:** Spinal cord injury is initiated by local mechanical damage such as fracture, and a complex cascade of pathophysiological process produces severe extensive damage beyond primary lesion. Although it is very difficult to recover mechanical disruption of the nerve axons in spinal cord, changes in secondary injury are susceptible to therapeutic intervention.

Therefore control of this secondary injury is a main concern of clinical intervention, and many reports of therapies have been emerged from various laboratories in animals or as human clinical trials. ETS-GS is a new vitamin E derivative synthesized in our laboratory and we have been reported its anti-oxidant effect or antiinflammatory effect (1, 2).

We investigated whether ETS-GS had therapeutical effects in spinal cord injury in this study.

**Materials and Methods:** Adult male Sprague-Dawley rats (SD rats) weighing 250 g - 350 g were used in this study. Rats were divided into sham group (sham operation and intramuscular injection of saline), control group (induced spinal cord injury and intramuscular injection of saline) and ETS-GS group (induced spinal cord injury and intramuscular injection of 10 mg/kg ETS-GS). Rats were anesthetized with 4% sevoflurane inhalation and laminectomy was performed aseptically at the Th11-12 level. Spinal cord injury was produced by dropping 10 g rod from a height of 25 mm to the exposed dorsal surface at the Th11 level. ETS-GS was injected intramuscularly once a day for three days.

First administration was performed just after operation. Rats were sacrificed at 3 post operative day and their spinal cord tissues were obtained for the biochemical (Malondialdehyde, as a biomarker of oxidative stress, Myeloperoxidase, as a marker of neutrophils infiltration, caspase 3 and TUNEL staining, as a marker of apoptosis) and histological analysis.

**Results:** Malondialdehyde was suppressed by ETS-GS administration. Myeloperoxidase and activation of caspase 3 was also suppressed in ETS-GS group. In histological examination, TUNEL-positive cells were decreased by ETS-GS administration.

**Conclusion:** New vitamin E derivative ETS-GS has a protective effect in spinal cord injury through anti-oxidative and anti-apoptotic effect.

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2. Koga H et al. Inflammation. 2011 [in press]

## 7AP2-4

### Propofol enhances the field excitatory postsynaptic potentials in CA1 hippocampal slices of young and aged mice

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**Introduction:** Propofol is a widely used intravenous anesthetic. Increasing age was shown to decrease the requirements for general anesthetics[1]. For propofol induction in adult, age significantly affects BIS, SE, and RE indices of LOC[2]. However, the mechanisms of ageing-induced potentiation of anesthetic actions have not been clearly explored. It has been reported in an animal study, that isoflurane enhanced suppression of excitatory synaptic transmission in the aged rat hippocampus. But the data from animals undergoing propofol anaesthesia are lacking. The aim of this study is to compare the effects of propofol on the field excitatory postsynaptic potentials (fEPSPs) in hippocampal slices of young and aged mouse.

**Methods:** Studies were approved by the local Animal Care Committee. Brain slices were prepared from C57BL6 male young (8-16 weeks) and ageing (>12months) mouse. The dendritic fEPSP was recorded from the CA1 stratum radiatum using patch clamp electrophysiological methods. A bipolar concentric stimulating electrode was placed along the Schaffer collateral for orthodromic stimulation.

The effects of clinically-relevant concentrations of propofol were studied in the young and ageing mouse slices. Data are presented as mean  $\pm$  SEM. Results :

**Results:** In slices from young mice, a clinically relevant concentration (10  $\mu$ M) of propofol increased the peak amplitude and area under the curve of fEPSP, but there were no effects on the half-width and decay. As for the peak amplitude of fEPSP, the potentiation effects of propofol occurred in a dose-dependent manner. In aging mouse slices, 10  $\mu$ M propofol enhanced the peak amplitude and area under the curve of the fEPSP. 10  $\mu$ M propofol prolonged the half-width but had no effects on the decay of fEPSP. The potentiations of peak amplitude and the area under the curve of the fEPSP in young mice are significantly greater than that in aging mice, while there is no difference in half-width and decay between young and aging mouse. Furthermore 10  $\mu$ M propofol increased the pre-axonal potential in young hippocampal slices.

**Conclusion:** The fEPSP of slices from aging mice demonstrates diminished sensitivity to the enhancing actions of propofol on the amplitude and area under the curve

These data might provide a partial explanation as to why aging patients are prone to develop the adverse reactions from clinical propofol anesthesia.

#### References:

1. Anesthesiology 2000;92:55. 2. Br J Anaesth. 2009;103(3):387-93

## 7AP2-5

### Xenon enhances excitability of inhibitory reticular thalamic nucleus neurons

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**Background and Goal of Study:** The mechanisms how the anesthetic xenon (Xe) evokes loss of consciousness are still unknown. The thalamic reticular nucleus (RTN) consists of GABAergic neurons and provides the major source of inhibitory input to thalamocortical relay neurons (TC) in the ventrobasal nucleus (VB; 1). Hence, RTN neurons influence the transfer of sensory information through the thalamus. RTN has been described to play a pivotal role in switching between awake and sleep states (2). An enhanced neuronal excitability within RTN would consequently lead to increased GABAergic inhibition of VB neurons. We investigated the effect of Xe on RTN neurons *in vitro* in murine brain slices.

**Materials and Methods:** Acute horizontal brain slices (300  $\mu$ m) were prepared from male C57BL/6 mice. RTN neurons were accessed using infrared videomicroscopy. Experiments were performed in Voltage Clamp Controlled Current Clamp mode with the holding potential set to -65mV. Repolarization after a hyperpolarizing current step leads to low-threshold  $Ca^{2+}$  spike bursts with a characteristic after-hyperpolarization. Rebound delay was measured as the time course from start of repolarization to peak of the first action potential. Current-voltage dependency of the cells and frequency of APs was obtained by current steps of increasing amplitude (DI=10pA; -90pA to +130pA). Under control conditions slices were kept in carbogenated artificial cerebro-spinal fluid (ACSF). For Xe application, ACSF was additionally saturated with 65%Xe.

**Results:** Application of Xe did neither affect current-voltage relationship nor resting membrane potential in RTN neurons (84.3 $\pm$ 4.0 vs 86.0 $\pm$ 3.7mV; n=10; p>0.05). Rebound delay was significantly reduced to 88.2 $\pm$ 3.3% of control (n=10; p< 0.05) demonstrating enhancement of neuronal excitability.

Consequently AP-frequency was significantly increased from  $62.9 \pm 4.0$  Hz to  $69.0 \pm 4.0$  Hz ( $n=5$ ;  $p < 0.05$ ).

**Conclusion(s):** In this study we could show that Xe enhances excitability of RTN neurons which are the major source of inhibitory input to TC neurons. TC neurons in the VB gather somatosensory information from the periphery and project to the cortex (3). An inhibition of TC neurons could disrupt the passage to the cortex and this might be a mechanism how Xe induces the anaesthetic state.

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2. Steriade M, *J Neurophysiol*. 2001 Jul;86(1):1-39
3. Huguenard JR et al., *Trends Neurosci*. 2007 Jul;30(7):350-6

## 7AP2-6

### Xenon reduces excitability in thalamocortical relay neurons in a cyclic adenosine monophosphate (cAMP)-dependent manner

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**Background and Goal of Study:** The mechanisms, how the anaesthetic xenon (Xe) mediates its hypnotic properties are not fully understood. The thalamus is the major gateway for the passage of somatosensory information to the cortex. Hyperpolarization-activated cyclic nucleotide-gated (HCN) channels regulate neuronal excitability and are highly expressed in thalamocortical (TC) neurons (1). HCN channels are gated voltage-dependent and binding of cAMP facilitates channel activation (2). We investigated the effects of Xe on HCN channel currents ( $I_h$ ) in acute brain slices.

**Materials and Methods:** Horizontal slices were prepared from male C57BL/6 mice.  $I_h$  currents were recorded from TC neurons using the patch-clamp technique.  $I_h$  was activated by hyperpolarizing steps of increasing amplitude ( $\Delta V = -10$  mV) to  $-133$  mV. Rebound bursts were elicited by a hyperpolarizing current step and rebound delay was measured (time course from start of repolarization to the first action potential). In a subset of experiments, intracellular cAMP level was increased by adding  $30 \mu\text{M}$  cAMP to the pipette solution. Slices were kept in carbogenated artificial cerebro-spinal fluid (ACSF). For Xe application, ACSF was additionally saturated with 65% Xe.

**Results:** The Xe-mediated reduction of  $I_h$  current amplitudes ranged from  $11.0 \pm 3.3\%$  to  $31.9 \pm 12.9\%$  ( $n=7$ ;  $p < 0.05$ ) depending on the voltage step. Half-maximum activation ( $V_{1/2}$ ) of HCN channels was shifted to  $-108.1 \pm 3.6$  mV under Xe ( $n=8$ ; control:  $-99.4 \pm 1.5$  mV;  $p < 0.05$ ).  $30 \mu\text{M}$  cAMP in the pipette solution shifted  $V_{1/2}$  to more depolarized levels ( $-87.3 \pm 1.6$  mV). With cAMP, Xe did neither affect  $I_h$  current amplitude nor  $V_{1/2}$  ( $n=5$ ;  $p > 0.05$ ). Xe prolonged rebound burst delay to  $139.5 \pm 8.8\%$  of control ( $n=5$ ;  $p < 0.05$ ) whereas no effect could be seen when cAMP was added intracellularly ( $99.9 \pm 2.5\%$  of control;  $n=5$ ;  $p > 0.05$ ).

**Conclusion(s):** In TC neurons Xe reduces  $I_h$  current amplitudes dependent on intracellular cAMP. This led to a decreased neuronal excitability resulting in a prolonged rebound delay. When cAMP was added intracellularly, Xe did not affect neuronal excitability. Thus, the effect of Xe on HCN channels in TC neurons might be mediated by a Xe-induced reduction of intracellular cAMP levels. A reduction of TC neuron excitability by HCN channel modulation might be a mechanism how Xe induces loss of consciousness.

#### References:

1. Postea O et al., *Nat Rev Drug Discov*. 2011 Nov 18;10(12):903-14
2. Wainger BJ et al., *Nature*. 2001 Jun 14;411(6839):805-10

## 7AP2-7

### The toxic effect of ketamine on the central nervous system - potential hazard or safe to use?

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**Background and Goal of Study:** Increasing evidence points to a potential neurotoxic effect of the NMDA receptor antagonist ketamine when administered systemically and/or neuraxially. We present an overview on recent pre-clinical and clinical literature investigating the neurotoxic potential of the sole use of ketamine on nerve or brain tissue.

**Materials and Methods:** We searched Pubmed (1970 to 2011) and Embase (1988 to 2011). For data extraction, we followed the Prisma Statement in its current version.

**Results and Discussion:** From 1013 primary hits, 63 records were included into this systematic review. *Animal studies:* Out of 35 studies, 28 studies showed a dose-dependent neurotoxicity in doses ranging from 5-75 mg/kg

systemically, and 0.25-10 mg/kg intrathecally (i.th.). Additionally, the younger the animal, the more vulnerable were cells in even lower doses. Eight studies failed to show neurotoxicity.

*Cell lines:* Out of 17 studies, 13 studies observed neurotoxicity in neuronal cells of young animals in doses ranging from 0.002-3 mM and incubation time varying from 1-96 h. In most studies, either a dose or time dependent relation was reported, in some even both. Three articles revealed neurotoxicity in human cell lines. A dose dependent increase of apoptosis was reported after 24 h of incubation with 0.5-12 mM S(+)-ketamine, or of 48 h with 100-2500  $\mu\text{g/ml}$  ketamine respectively. Five studies failed to present neurotoxicity after incubation for up to 24 h in doses from 10-100  $\mu\text{M}$ , and 1-20  $\mu\text{g/ml}$ , respectively. *Human data:* Four case reports described neuropathological findings after i.th. administration of ketamine in dose ranges of

- (1) 5 mg/d for 3 weeks,
  - (2) 7 days with 67,2 mg (mean daily dose),
  - (3) 28 days of S(+)-ketamine (peak dose: 50 mg/kg),
  - (4) 2 mg/kg as a bolus, up to 7,5 mg/kg/h titrating for the first 48-72 hours.
- One randomized controlled clinical trial presented no neurotoxicity of 2 mg/kg ketamine in children.

Ketamine can exert neurotoxicity in animals and humans when administered systemically or neuraxially. Neurotoxic events depended on ketamine dose, exposure time and the developmental age of the central nervous system, indicating that young mammals are more susceptible to ketamine toxicity than older. Interestingly, 53 articles reported neuroprotective effects of ketamine when added to chemically or ischaemically injured neuronal tissue underlying its potential in particular clinical conditions. Further research needs to answer this question.

## 7AP2-8

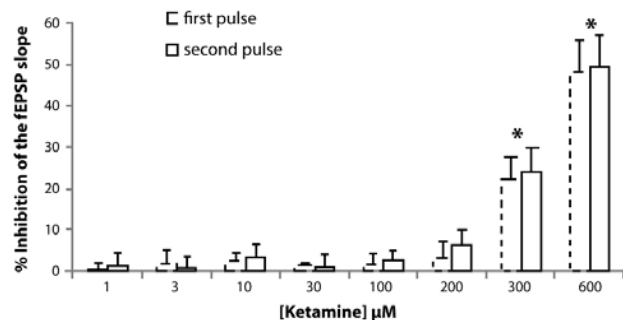
### Ketamine affects basal synaptic transmission and long-term potentiation without affect pair-pulse facilitation in hippocampal slices of adult mice

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**Background and Goal of Study:** Ketamine, an anesthetic and analgesic drug, has been associated with disruption on learning and psychotic effects. Alterations in synaptic efficacy in glutamatergic pathways are documented to play a key role in psychopathology. Therefore we investigated the effects of different concentrations of ketamine on basal synaptic transmission (BST) and on synaptic plasticity (paired-pulse facilitation (PPF) and long-term potentiation (LTP)).

**Materials and Methods:** Evoked field excitatory postsynaptic potentials (fEPSP) were recorded in Schaffer collateral in CA1 stratum radiatum, from mouse hippocampal slices. Four slices per group and type of experiment were used. For BST and PPF consecutive applications of increasing concentrations of ketamine (1, 3, 10, 30, 100, 200, 300 and 600  $\mu\text{M}$ ) were used and for LTP individual slices were used for each concentration. High-frequency stimulation (HFS) conditioning pulses were applied for LTP induction (100 pulses at 100 Hz). The slope of the fEPSP was measured and its % of inhibition was calculated. To access PPF, a ratio of second pulse slope was divided by the first pulse slope. LTP potentiation was analyzed 60 minutes after HFS. Statistical analysis was performed using univariate ANOVA.

**Results and Discussion:** Ketamine attenuated LTP induction and LTP potentiation in a concentration dependent manner. BST was not affected by lower concentrations of ketamine (1, 3, 10, 30, 100 and 200  $\mu\text{M}$ ) but higher concentrations of ketamine decreased (300 and 600  $\mu\text{M}$ ) the BST (figure 1). Ketamine did not affect PPF.



[Figure 1]

**Conclusions:** Ketamine impairs BST and LTP in CA1 region of the mouse hippocampus without affect PPF, suggesting the importance of the postsynaptic mechanisms in detriment of the presynaptic mechanisms for ketamine induce deficits in memory.

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### 7AP3-1

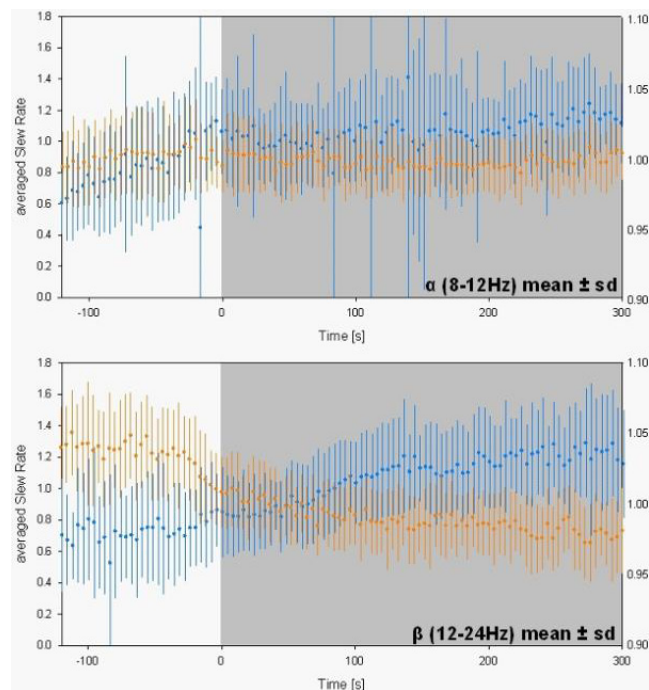
#### Permutation does not react to the paradoxical EEG activation during propofol induction

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**Background and Goal of Study:** Propofol is supposed to have a biphasic effect on EEG during induction.<sup>1,2</sup> This paradoxical behaviour is most prominent in the  $\alpha$ - and  $\beta$ -range.<sup>1</sup> EEG activation might have a negative effect on EEG anaesthesia monitors based on spectral analysis methods, i.e., high index values at unconscious patients<sup>3</sup> during transition. Nonlinear measures, e.g., permutation entropy PeEn proved to be better in reflecting the anaesthetic level compared to spectral approaches. This abstract raises the question if PeEn is also activated during transition period in the  $\alpha$ - and  $\beta$ -band like spectral parameters do.

**Materials and Methods:** 39 EEG segments recorded during propofol induction were analysed. Loss of consciousness LOC was defined when the subject failed to respond to a repeated command to squeeze the hand. The segments were band pass filtered to the  $\alpha$ - (8-12Hz) and the  $\beta$ - (12-24Hz) band using zero phase shift filtering routine and down sampled to 100Hz. PeEn and slew rate were calculated from non-overlapping, 4s EEG segments. The slew rate characterizes frequency and amplitude of the waveform. Each parameter series was normalized by division through its mean.

**Results and Discussion:** The course of slew rate and PeEn is displayed in figure 1.



[Figure 1: slew rate: blue; PeEn: orange]

Slew rate reflects activation in the  $\alpha$ - and  $\beta$ -band and increases, whereas PeEn follows deepening of anaesthesia and decreases with time. The results suggest that PeEn is able to reflect the anesthetic level during LOC, whereas spectral parameters show a biphasic course around LOC. The decreasing trend of PeEn also bears valuable information regarding possible cortical mechanisms during LOC.

**Conclusion:** Although  $\alpha$ - and  $\beta$ -frequencies are activated, signal complexity and hence their information content decreases.

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- <sup>2</sup>Anesthesiology 1996; 84:52-63,
- <sup>3</sup>BJA 1999; 82:666-671,

### 7AP3-2

#### Analysis of analgesic effect of propofol by in-vivo patch clamp recordings from the somatosensory cortex of rats

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**Background and Goal of Study:** Although propofol is in general considered to have a poor analgesic potency, several electrophysiological studies have reported that clinical dosage of propofol depressed nociceptive transmission in the spinal cord.

To address this conflict, we examined whether propofol affects the response of tactile stimuli to the skin in the primary somatosensory cortex (SI) which is thought to play important roles in the pain perception.

**Materials and Methods:** Sprague-Dawley rats (3-4 weeks old) were anesthetized with urethane (1.5 g/kg). In vivo whole-cell patch-clamp recordings were performed from SI neurons which responded to the mechanical stimuli to the receptive field of the hind paw area. Propofol (5mg / kg) was administered intravenously to the rat after starting recordings. We analyzed the responses evoked by pinch stimuli to the hind paw on the contralateral side before and after administration of propofol.

**Results and Discussion:** In the current clamp mode, propofol didn't change the baseline membrane potential of SI neurons, but significantly inhibited the firing of action potentials evoked by the pinch stimuli. In the voltage clamp mode, the barrage of excitatory postsynaptic currents (EPSCs) evoked by the stimuli was depressed, but the baseline holding current was not significantly changed.

These results reveal that propofol directly and/or indirectly inhibits the pain perception in the SI.

**Conclusion(s):** This study strongly suggests that propofol inhibits the nociceptive transmission in the central nervous system including the spinal cord and has antinociceptive effects.

### 7AP3-3

#### Inhibitory effect of intrathecal EGCG on mechanical allodynia and nitric oxide synthase expression in spinal cord in neuropathic pain of rat

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**Background and Goal of Study:** Epigallocatechin-3-gallate (EGCG), the major catechin in green tea, is known to have antioxidant activity against nitric oxide (NO) by scavenging free radicals, chelating metal ions, and inducing endogenous antioxidant enzymes, which contributes to the neuroprotective effects of EGCG. NO generated by nitric oxide synthase (NOS) is also one of the key players in nociceptive processing. We examined the effect of intrathecal EGCG on mechanical allodynia and NOS expression in spinal nerve ligation of rat.

**Materials and Methods:** Mechanical allodynia was induced by L5,6 spinal nerve ligation of male Sprague-Dawley rat. Effect of intrathecally administered EGCG (1,3,10,30 $\mu$ g) or L-arginine (100  $\mu$ g; NO precursor) on mechanical allodynia was measured using von Frey test, in which rats were randomly assigned into 4 groups; saline/saline, saline/EGCG, L-arginine/EGCG, L-arginine/saline.

To examine dose-responsiveness, maximal possible effect (MPE, %) was calculated as follows: (PWT[paw withdrawal threshold] after experiment drug - PWT of baseline) / cut-off threshold [15 g] - PWT of baseline  $\times$  100(%). Change in the expression of nitric oxide synthase of spinal cord was compared using Western blotting among rats with sham operation, SNL, or SNL+EGCG.

**Results and Discussion:** Intrathecal EGCG attenuated mechanical allodynia in rats with SNL, compared to sham-operated rats, with MPE of 69.2%. This antinociceptive effect was reversed by intrathecal pretreatment with L-arginine (L-arginine/EGCG). Intrathecal EGCG also blocked the increase in neuronal NOS (nNOS) expression in the spinal cord of SNL rats, but inducible NOS (iNOS) expression was not significantly suppressed.

**Conclusion(s):** Intrathecal EGCG produced an antiallodynic effect against spinal nerve ligation-induced neuropathic pain, mediated by blockade of nNOS protein expression and possibly by inhibition of the pronociceptive effects of NO.

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1. Catechin polyphenols: neurodegeneration and neuroprotection in neurodegenerative diseases, *Free Radic. Biol. Med.* 37 (2004) 304-317.
2. Green tea pain modulating effect in sciatic nerve chronic constriction injury rat model, *Nutr. Neurosci.* 9 (2006) 41-47.

## 7AP3-4

### Expression of microRNAs in the dorsal root ganglion after chronic constriction injury of the sciatic nerve in rats

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**Background and Goal of study:** Micro-RNAs (miRs) are small non-coding RNAs that regulate protein expression by interacting with messenger RNAs. MiRs are involved in numerous biological processes and increasing evidence suggests a role for miRs in neuronal plasticity in the context of neuropathic pain. While in experimental neuropathic pain, miRs are not significantly regulated in the spinal cord, several miRs are differentially expressed in the dorsal root ganglion (DRG) [1,2].

Aim of the present study was to further elucidate the role of miRs in rat DRG in the development of neuropathic pain.

**Materials and Methods:** After approval of the local government, male Wistar rats were randomized into a treatment and a sham group: 1. Treatment: The left sciatic nerve was ligated to induce a chronic constriction injury (CCI) as a model of neuropathic pain. 2. Sham: Sham-operated animals served as controls. Mechanical allodynia was assessed with modified von Frey hairs before CCI and at every time point before tissue extraction. DRG (L4-L6) were harvested after 4 h, 1 d, 6 d and 12 d after CCI or sham operation (n=6 each). Total RNA was isolated and relative miR expression levels were analyzed with Agilent microRNA microarrays (mirBase v. 16.0) and real time quantitative PCR. Statistics: t-test,  $p < 0.05$ .

**Results and Discussion:** Mechanical allodynia developed within 6 days after CCI. MiR-arrays (n = 4 / group) revealed the differential expression of 47 miRs after 4 h, of 3 miRs after 1 d, of 26 miRs after 6 d and of 27 miRs after 12 d in the CCI group versus Sham. Two miRs that are highly abundant in the DRG (miR-34a, let-7c) were further evaluated by qPCR. Downregulation of let-7c was verified by qPCR as early as 4 hours after CCI, while significant downregulation of miR-34a was verified 12 days after CCI. Bioinformatic prediction (Target Scan) revealed pain relevant proteins as targets, such as nerve growth factor NGF (let-7c) or various ion channels including SCN2b, KCNK3 or CACNA1E (miR34a).

**Conclusion(s):** CCI of the sciatic nerve leads to significant alterations in miR expression levels in the rat DRG. Further research will have to elucidate the precise mechanism by which miRs modulate the expression of pain associated proteins, and whether these are principally prone to therapeutic interventions.

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## 7AP3-5

### Addition of low dose dexmedetomidine inhibits intrathecal morphine infusion-induced tolerance and granuloma formation in rats

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**Background and Goal of Study:** Recently patients with chronic pain have benefited from intrathecal (IT) morphine therapy. However, it has been shown that chronic IT administration of morphine results in tolerance and intradural granulation tissue. IT administration of alpha 2 agonists can produce a potent analgesia though the activation of the spinal receptor. Some reports have shown that alpha 2 agonists suppress the development of tolerance to morphine analgesia and dexmedetomidine (DEX) has neuroprotective effects. We aimed to investigate IT DEX suppresses IT chronic morphine induced the tolerance and the granuloma formation followed by motor impairment.

**Materials and Methods:** Male SD rats were implanted with IT catheters connected to osmotic mini-pumps to receive IT DEX (2.5, 5, 10 nmol/0.5ul/hr), morphine (40 nmol/0.5ul/hr), saline(0.5ul/hr) or IT DEX (2.5 nmol/0.5ul/hr) + IT morphine (40 nmol/hr) for 13 days. To determine the development of tolerance and the motor impairment, thermal escape latencies and behavior (arousal, motor coordination and motor tone) were evaluated on days 0-13 (every other day). On day 13, animals were perfusion-fixed and the spinal cords were harvested for pathology.

**Results and Discussion:** Analgesic doses of IT morphine and IT DEX infusion produce tolerance. Co-administration of low doses of IT DEX with IT morphine has significant analgesia without tolerance. Severe impression of the spinal cord along the course of the catheter indicating granuloma formation could be seen in morphine infusion animals but not in saline and DEX infusion animals. Addition of low dose of IT DEX inhibits IT morphine infusion-induced granu-

loma formation followed by motor impairment.

**Conclusion(s):** Development of tolerance and granuloma formation followed by motor impairment induced by chronic IT morphine were inhibited by addition of DEX. Combination of IT morphine and DEX may contribute to patients with chronic pain to avoid side effects.

## 7AP3-6

### Effects of propofol and remifentanyl on cortical information transfer during painful heat stimulation

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**Background and Goal of Study:** Cortical networks and their connectivity are in the focus of current studies using fMRI and EEG [1, 2]. In the present study symbolic transfer entropy (STEn) [3] is used to analyse effective connectivity between cortical areas during painful heat stimulation without drugs and under the influence of subanaesthetic concentrations of propofol and remifentanyl.

**Materials and Methods:** Approved by the university's ethics committee, 30 healthy male volunteers participated. Standard monitoring parameters and 32 channel electroencephalogram were recorded. Heat pain was applied at the forearm by a contact probe (CHEPS® Medoc). At baseline (BL), contact heat evoked potentials were recorded without drug, then under either propofol target controlled infusion (TCI: 1.0 µg/ml) or remifentanyl infusion (0.15 µg/kg/min). Drug-induced changes of cortical information transfer were analysed by non-parametric STEn, which quantifies the mutual information flow between two signals. It was computed over all EEG channel pair combinations (10 s length, 0.5-30 Hz total bandwidth, 100 ms time delay). 95% confidence intervals (CI) based on the area under the curve indicate drug effects.

**Results and Discussion:** Localising the arrival of heat pain in the parietal lobe (SI) and its conscious processing in the frontal lobe, the fronto-parietal connectivity is focused here. At BL, there is a unidirectional information exchange from parietal to frontal areas. Propofol does not affect this exchange (CI: 0.15-0.58), whereas it is reduced significantly under remifentanyl (0.06-0.41). Considering the fronto-parietal default mode network (DMN), the current results indicate dominant effects of remifentanyl on feedforward connectivity in the sense of analgesic effects. Subanaesthetic concentrations of propofol do not affect loops of the DMN in contrast to anaesthetic concentrations [1].

**Conclusion(s):** During painful heat stimulation, remifentanyl reduces fronto-parietal connectivity, whereas connectivity is maintained under subanaesthetic concentrations of propofol.

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## 7AP3-7

### Higher prolactin levels are associated with implicit memory occurrence under general anaesthesia

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**Background and Goal of Study:** The mechanisms for incomplete abolition of memory function during anesthesia remain unclear. To verify the hypothesis that surgical stress play a role as a determinant of memory occurrence for verbal material presented under anaesthesia, this study was aimed at comparing stress-related hormones levels in patients with and without implicit memory (IM).

**Materials and Methods:** After Ethical Committee approval, 54 patients, aged 18-70 years, with ASA physical status I-III, undergoing laparoscopic cholecystectomy were enrolled. Anaesthesia was induced with propofol 2 mg/kg, cis-atracurium 0.15 mg/kg and remifentanyl (0.25 mcg/kg/min). Maintenance was performed by sevoflurane (1 MAC) and remifentanyl at a variable infusion rate (0.1-0.4 mg/kg/min) so as to maintain non invasive arterial pressure and heart rate in the range of 20% compared to baseline values. One of two recordings was played to patients in a randomized double-blind manner immediately after surgical incision. Each recording contained a passage of a story and four keywords related to each story. Bispectral Index was continuously monitored during anaesthesia. Venous blood samples were collected before anaesthesia induction (T0) and 5 minutes after reaching pneumoperitoneum pressure of 12 mmHg (T1). Commercially available chemiluminescence assay kits were used to measure serum levels of prolactin (PROL) and cortisol (CORT). IM test, conducted 24 hours after awakening, proved to be positive when patients, after listening to one keyword related to a story heard during

anaesthesia, retold something about it without conscious recall of intraoperative listening. ANOVA test was used for statistical analysis.  $p < 0.05$  was considered statistically significant.

**Results and Discussion:** No differences were found in demographic characteristics, anesthesia-related variables (including remifentanyl amount and BIS values) and T0 hormones levels between patients with IM ( $n=3$ ) and those without it ( $n=51$ ). In both groups, significant changes in CORT (decrease) and PROL (increase) values were detected at T1 vs T0. PROL levels at T1 were greater in patients with IM compared those without it ( $p < 0.001$ ). CORT values were comparable in the two groups at T1.

**Conclusions:** PROL increase is associated with IM occurrence regardless of anaesthesia depth and analgesic requests. Memory under anaesthesia may be affected by PROL, a neuro-peptide which appears to be independent from anaesthetic drug effects.

## 7AP3-8

### Spurious index drop due to large amplitude delta waves in sevoflurane induction with VCRII protocol

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**Background and Goal of Study:** Several measures of anesthetic depth obtained by quantifying the properties of the EEG signal have been introduced during the past decade. Several conditions causing the EEG-based indexes to fail have been pointed out.

We show that rapid induction with sevoflurane can induce high amplitude delta waves in the EEG causing the index values to drop to the levels usually observed in burst suppression.

**Materials and Methods:** 14 patients were anesthetized using the Vital Capacity Rapid Inhalation Induction (VCRII) with SEV. When the eyelash reflex disappeared, vecuronium 0.08-0.1 mg/kg was administered for the laryngeal mask insertion. Anesthesia was maintained with the mixture of oxygen, air and SEV. The low-flow anesthesia was used, with 0.5-1.0 l/min of fresh gas flow. The end-tidal concentration of SEV was initially 0.6 MAC, then increased by 0.2 MAC every 5-10 minutes until reached 2.0 MAC or the Burst Suppression Ratio 100%. The following depth-of-anesthesia indexes were simultaneously obtained: BIS, RE (Response Entropy), SE (State Entropy) and AEP. The raw EEG signal was recorded from the M-Entropy module of the S/5 (GE Healthcare).

**Results and Discussion:** In the Figure patterns of 7 pt. are demonstrated. After VCRII with SEV, high amplitude delta activity appeared in the EEG signal. The SE and RE indexes dropped below 20. The BIS index also dropped to values usually seen in burst suppression. After several minutes the EEG decreased in amplitude causing the indexes to rebound. As anesthesia gets deeper, the proportion of delta activity increases until the burst suppression occurs. In 5 recordings, suppression segments appeared in the EEG within 10 minutes from the induction. In 2 patients no significant index drop was observed immediately after induction.

**Conclusion(s):** The large amplitude delta waves seen after the VCRII induction with SEV differ from the delta activity seen in deep anesthesia. It resembles the delta arousal pattern consisting of relatively rhythmic delta activity with simultaneous suppression of higher frequencies<sup>1</sup>.

We suggest that the drop of the depth-of-anesthesia indexes to the level usually seen in burst suppression does not in this case adequately indicate the state of the patient. The phenomenon is asymmetrical - similar kind of delta activity is not observed when anesthesia is stopped.

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## 7AP4-1

### Post-operative delirium in a post anesthetic unit

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**Background:** Postoperative Delirium (POD) is a frequent complication that can occur after surgery. It is associated with an increase in mortality and poor patient outcomes. POD is a complex disorder with multiple risk factors such as pre-existing patient conditions and perioperative conditions. The aim of this study was to evaluate the incidence of POD and identify risk factors for the development of POD in the PACU.

**Methods:** A total of 97 adult patients admitted at Post-Anesthesia Care Unit (PACU) during a 5 days period after 6 September 2010 were enrolled in the study. Patients' demographics, intra and postoperative data were collected. Patients were followed for the development of delirium using Intensive Care Delirium Screening Checklist. Descriptive analyses of variables were used to summarize data and the Mann-Whitney U test was used to compare continu-

ous variables; Chi-square or Fisher's exact test were used for comparisons. A univariate analysis was performed using simple binary logistic regression with an odds ratio (OR) and its 95% confidence interval (CI). The significance level for multiple comparisons was controlled applying the Bonferroni's correction for multiple comparisons and all variables were deemed to be significant if  $P \leq 0.0025$ .

**Results:** Six percent of patients developed POD. Patients that developed POD were older, were more likely to have higher ASA physical status (83% versus 22% for ASA III/IV,  $p=0.004$ ), had more frequently congestive heart failure (50% versus 3%,  $p=0.003$ ), and higher Revised Cardiac Risk Index (33% versus 6% at RCRI $\geq 2$ ,  $p=0.039$ ). They also had longer duration of anesthesia and received a greater volume of crystalloids, colloids and erythrocytes during surgery. Simple binary logistic regressions were used to examine covariate effects of each factor on postoperative delirium development using a significance level of  $P \leq 0.0025$ .

This analysis showed that congestive heart disease was an independent risk factor for POD (OR 29.3, 95% CI 4.1-210.6,  $p < 0.001$ ). Patients that developed POD had higher hospital mortality and longer PACU and hospital length of stay.

**Conclusions:** patients that developed POD had longer hospital and PACU length of stay and had higher hospital mortality rates. Congestive heart disease were considered and independent risk factor for the occurrence of POD.

## 7AP4-2

### The role of monitoring autonomic nervous system in prognosis of brain trauma

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**Background and Goal of Study:** The purpose of our study - to determine the possibility of altered HRV to reflect the degree of damage to the autonomic nervous system (ANS) and predict outcomes in patients with traumatic brain injury (TBI) in the acute period.

**Materials and Methods:** 35 patients with TBI (30 men and 5 women) with an initial GCS score  $\leq 8$  were included in a prospective study. The mean age was  $34.7 \pm 8.2$  years. All examined patients were divided into 3 groups: I group - patients with fatal outcome - 9 patients (3-5 points on GCS), II group - 18 patients survived with good outcome (GCS  $\geq 10$  points) and group III - 8 patients with worse neurological status (GCS  $< 10$  points). Performed invasive monitoring of intracranial pressure (ICP). Heart rate variability (HRV) analysis was performed in two methods: temporal and spectral analysis. Statistical analysis was carried out in heart rate, ICP, CPP, pNN 50, rMSSD, TP, LnHF, LnLF and LFHF

We have compared the data of patients with HRS who died with HRV indices in the surviving patients on the day after the injury. To assess the impact of neurological disorders identified in the ANS, we compared the rates studied patients who survived with good outcome (GCS  $\geq 10$  points) and in patients with a worse neurological status (GCS  $< 10$  points).

**Results and Discussion:** The day after the injury showed a significant difference in parameters of HRV in patients who died with progressive brain edema regarding survivors. In the group who died there was a significant parasympathetic efferent hyperactivity and a tendency to decrease throughout the HRV. The group with poor recovery had a tendency towards low heart rate variability, suggesting a lower parasympathetic efferent activity. Some differences were greater (pNN 50, rMSSD, and LnHF indicators). Hemodynamic parameters were not different between groups. When comparing patients who died within 5 days after injury with those surviving the next day after receiving head trauma, significant increase in heart rate variability was associated with a significantly increased parasympathetic tone, relative to healthy subjects.

In our study, the rate decreased LnLF below physiological values, and these changes were similar in all groups. Because of the tendency to a lower level of the ratio LFHF in the group died, we hypothesized that the relatively high LnLF observed in this group was associated with increased parasympathetic tone. Overall HRV differed significantly between the groups of survivors. Overall HRV was normal in patients with a GCS score of  $\geq 10$  and significantly decreased in patients with GCS  $< 10$ .

#### Conclusion(s):

- 1) Changes in heart rate variability may reflect the degree of damage to cerebral function.
- 2) Reduced heart rate variability is associated with a worse clinical outcome and severe cerebral lesions.

### 7AP4-3

#### Successful treatment of paroxysmal sympathetic hyperactivity after severe traumatic brain injury with a cervical vago-sympathetic blockade: case report

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**Background:** Paroxysmal sympathetic hyperactivity (PSH) in patients with severe brain injury is associated with poor outcomes [1]. Efficacy of pharmacological treatment of PSH frequently incomplete. We report a case with PSH and the successful treatment by a cervical vago-sympathetic blockade (CVSB).

**Case report:** A 18-year-old unconscious with diagnosis: Severe brain contusion, Traumatic subarachnoid/intraventricular hemorrhage. During 1-10 days the analgesedation (fentanyl and propofol) was performed, level of conscious - 9-10 point Glasgow Coma Scale. There were attacks of intractable severe fever, chill, acrocyanosis, hypertension and tachycardia. During 10-16 days - signs of conscious, attacks of hyperkinesia with severe hypertension and tachycardia: diagnosis of sympathetic hyperactivity (PSH) was determined. Baseline pharmacological treatment: Baclofen, Metoprolol. In case of PSH - Sodium thiopental and fentanyl infusion. During 16-26 days the frequency and intensity of PSH were increased in spite of increase baseline pharmacologic therapy up to maximal doses.

In case of PSH attack only Sodium thiopental and Chlorpromazine were effective. On day 27 CVSB was performed. 26G spinal needle was introduced through left lateral surface of the neck in the line of C5 vertebral body up to contact with its posterior surface and with repeated aspirating tests 40 ml 0,25% Lidocaine was injected. During 5 min pulse rate decreased from 125 to 75-80 per min, hyperhidrosis and fever were resolved but also hypotension (70/40 mm Hg), bradypnea and miosis were marked. Hypotension was resolved by infusion 500 ml 6%HAES, bradypnea - with Pressure Support Ventilation. In 30 min the patient condition was stabilized.

From the moment of blockade there were no attacks of PSH, but during 2 days one-sides hyperhidrosis of face were marked. There were no needs in sedation - patient became conscious. On Day 56 patient was transferred to rehabilitation center in stable good condition.

**Discussion:** There is no evidence of use CVSB in patients with PSH. In the past CVSB was indicated in patient with pleura-pulmonary shock and severe chest trauma. Our experience demonstrated that CVSB can help in intractable PSH.

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**Learning points:** Along with standart therapy (opiats, Beta blockers, Central Muscle relaxants) CVSB may be effective in patients with PSH.

### 7AP4-4

#### Strict glycemic control in patients with intracranial hemorrhage, a preliminary report

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**Background and Goal of Study:** Intracranial (subarachnoid or intraparenchymal) hemorrhage can result in death or disabilities associated with considerable loss of productivity. Worse outcome has been associated with hyperglycemia in this patient population.

We tested the hypothesis that tight glucose control (80-110 mg/dl vs. 150-170 mg/dl) improves neurological outcome in patients with non-traumatic subarachnoid hemorrhage and non-traumatic intraparenchymal hemorrhage with an admission Glasgow Coma Scale (GCS) in the range of 6 to 14.

**Materials and Methods:** The primary outcome measure was the degree of morbidity measured by Karnovsky outcome scale at a three month follow up. Secondary end point was mortality. A total of 44 patients were randomly assigned either to conventional insulin therapy at a range of 150-170 mg/dl or to intensive insulin therapy at a range of 80-110 mg/dl (24 and 20 patients, respectively).

**Results and Discussion:** Patients in the conventional group had an average blood glucose of 138+/-20 mg/dl compared to the intensive insulin group with an average blood glucose of 99+/- 9. There was no difference in the scores of the Karnovsky scale between the two patients groups (53+/-55vs. 60+/-25; P=0.49).

However, in a subgroup analysis on patients with an admission GCS between 13 and 14 there was a trend towards a better outcome in the intensive therapy group compared to the conventional group (50+/-28 vs. 78+/-18, p= 0.07).

Overall mortality rates at 3 months were similar in the 2 groups (5 patients in each group).

**Conclusion(s):** Intensive insulin therapy in patients with acute subarachnoid or intracerebral hemorrhage did not reduce morbidity as measured by Karnovsky scale compared to conventional treatment. There may be a benefit of strict glycemic control on outcome in patients with relatively minor neurologic injuries. Mortality does not seem to be affected by intensive insulin therapy.

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### 7AP4-5

#### Risk factors for death in stroke patients with supranormal level of uric acid in blood and / or cerebrospinal fluid

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**Background:** hyperuricemia is a strong risk factor for brain ischaemia and stroke. It is known that exogenous administration of uric acid, shows obvious antiradical, antioxidant and neuroprotective effects whereas endogenous increased its production, with a side of xanthine oxidase synthesis of oxygen free radicals, reflecting the severity of brain ischemia and reperfusion injury.

**Goal of Study:** explore the risk factors of death in patients with brain ischaemia in the acutest period of stroke with supranormal uric acid levels in venous blood and / or cerebrospinal fluid (CSF) in the debut of the disease.

**Materials and Methods:** In 293 adult patients (in first 7 day of stroke - "acutest" period) of the neurointensive care unit with hyperuricemia and / or hyperuricorrhahia 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, uric acid, corticosteroid and thyroid hormones.

**Results:** Significantly associated (Generalized Yule Coefficient above 0,6) with followed by the onset of death elevated cortisol (0.79), guanine (0.63), xanthine (0.65) and uric acid (0.86) in blood serum on 3rd day of stroke. The relative risk (RR) of occurrence of death is high in the identification on the 3rd day of stroke increased serum concentrations of cortisol (RR = 6.3), uric acid (RR = 3.3), xanthine (RR = 3.1), and also initially high concentration of cortisol in the blood serum (RR = 3.3).

The highest chances of fatal complications of a stroke at the found on 3rd day of stroke increased concentrations of serum cortisol (OR = 8.4), uric acid (OR = 13.7).

**Discussion:** Continuing in the acutest period of stroke increased levels of uric acid in the blood and / or CSF should at least be considered a poor prognostic factor in initially hyperuricemic patients.

**Conclusion:** In patients with hyperuricemia and / or hyperuricorrhahia in the initial period of the stroke parameters of purine metabolism and hormonal status in the course of the disease are highly informative predictors of death. The most prognostic powerful metabolic parameters are the blood levels of uric acid and cortisol.

### 7AP4-6

#### Randomized trial to compare the effect of a single dose of dexmedetomidine and continuous infusion of remifentanyl on airway reflex and hemodynamic response during emergence in patients undergoing cerebral aneurysm clipping

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**Background and Goal of Study:** The anesthetic method for intracranial neurosurgery must provide hemodynamic stability at emergence and allow early evaluation of the neurological status.

In this prospective double blinded study, we compared the beneficial effect of target-controlled infusion of remifentanyl and dexmedetomidine on smooth emergence and early recovery, which are major concerns in neurosurgical patients. We hypothesized that the use of a single dose of dexmedetomidine during emergence provides smooth emergence with hemodynamic stability in patients undergoing cerebral aneurysm clipping.

**Material and Methods:** Seventy-four ASA I-II patients, aged between 20 and 65yr, undergoing elective clipping of unruptured cerebral aneurysm were

randomly allocated to Dex and Remi groups. Anesthetic technique was standardized. Sevoflurane and remifentanyl were used for maintenance of anesthesia. In the Dex group, dexmedetomidine 0.5 mcg kg<sup>-1</sup> was administered intravenously during 5 min at the end of the surgery. The Remi infusion was stopped in Dex group and maintained in Remi group at an effect site concentration of 1.5 ng ml<sup>-1</sup> until extubation. The occurrence of cough reflex, hemodynamic parameters, and recovery profiles were evaluated during emergence in both groups.

**Results and Discussion:** There were no significant differences in the incidence and severity of cough response during the emergence period between two groups (Table 1). There were no significant differences in the time taken to awake and extubate between two groups. Respiration rate at 2 min and sedation grade at 5 min after extubation in the Dex group were significantly higher than those of the Remi group ( $p = 0.02$  and  $p < 0.001$ , respectively). In the Dex group, diastolic pressure at 5 min before the end of surgery and at the end of surgery were significantly higher ( $p = 0.032$  and  $p = 0.33$ , respectively) and heart rate at 10 min after admission in the recovery unit was significantly lower ( $p = 0.032$ ).

**Conclusion:** A single dose of dexmedetomidine (0.5 mcg kg<sup>-1</sup>) during emergence provided smooth emergence with hemodynamic stability in patients undergoing cerebral aneurysm clipping. Furthermore, respiratory function during the recovery period could be preserved without respiratory depression caused by opioids.

## 7AP4-7

### Efficacy of cerebrospinal fluid drainage for delayed-onset postoperative paraplegia and paraparesis after thoracic or thoracoabdominal aortic aneurysm repair: a case series of 8 patients

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**Background:** Delayed-onset postoperative paraplegia and paraparesis are uncommon but devastating complications after thoracic aortic aneurysm (TAA) and thoracoabdominal aortic aneurysm (TAAA) repair. We evaluated the efficacy of cerebrospinal fluid drainage (CSFD) in 8 patients with delayed-onset paraplegia or paraparesis after TAA or TAAA repair.

**Materials and Methods:** The medical records of 249 consecutive patients who underwent elective TAA or TAAA repair via thoracotomy between January 2009 and November 2011 at our institution were retrospectively reviewed. We included all cases of postoperative paraplegia or paraparesis, and analyzed the therapeutic procedures.

**Results:** Six patients (2.4%) exhibited paraplegia and 4 (1.6%) exhibited paraparesis on awakening. Delayed-onset paraplegia or paraparesis occurred in 8 patients (2.8%): 4 patients, surgical repair of Crawford type II TAAA; 1, type III TAAA; 1, type V TAAA; and 2, surgical repair of TAA.

Four of these 8 patients had delayed-onset paraplegia or paraparesis despite continuing with CSFD. In contrast, 1 patient developed paraplegia after postoperative removal of the CSFD catheter.

Three patients without CSFD catheters underwent emergency CSFD, but 1 patient could not undergo because of continuing anticoagulant therapy.

Four of the 8 patients with delayed-onset paraplegia or paraparesis achieved full recovery, and 1 patient achieved partial recovery from paraparesis. These 5 patients with full or partial recovery had CSFD catheters.

However, 3 of the 8 patients did not recover neurologic function; they had other complications, i.e., cerebral infarction, arterial occlusion in the leg, or cardiac arrest before or at the time of paraplegia onset. In 1 of the 3 patients, the CSFD catheter was inserted after recovery from the complication but the treatment was unsuccessful.

**Discussion and conclusions:** Therapy for delayed-onset paraplegia and paraparesis has not yet been established because of their low incidence. Therefore, therapeutic CSFD indications are controversial because of unknown risk-to-benefit ratios.

This study showed the therapeutic efficacy of CSFD for these conditions, without the occurrence of other serious complications.

In conclusion, CSFD should be considered as an effective therapeutic option for delayed-onset paraplegia and paraparesis in the absence of procedural contraindications.

## 7AP4-8

### First steps towards the patient safety: “complications” or sentinel events in trauma brain injured patients in Uzbekistan?

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**Background and Goal of Study:** There were compared the death rates in trauma brain injured (TBI) patients in developed and developing/emerging countries. But specified causes of death and the adverse events rates in these patients have not been identified yet.

The aim of this study was to exam the causes of death in TBI patients and rate of adverse events in order to find the ways to decrease the death rate and rate of preventable sentinel events in TBI patients in the Uzbekistan National Research Centre of Emergency Medicine (NRCCEM).

**Materials and Methods:** Over the 2008 to 2009 period 362 patients with the diagnosis “severe traumatic brain injury” (STBI) were hospitalized in the NRCCEM. The mean age of the patients was 34±2 years and 79.5% (285) were male. The mechanisms of injury included MVA in 48.3%, auto-pedestrian accident in 13.3%, fall from height - 18.2%, assault - 15.5%, and unknown - 4.7%. The alcohol level on presentation was documented in 21% of patients. The length of stay in hospital was from 40 minutes up to 90 days (mean length - 23.3± 9.5 days). Mean Glasgow coma scale (GCS) was 5±1 points.

**Results and Discussion:** The hospital mortality rate was 15.2% (55). By the time of death and pathology data all death cases were divided into 3 groups: 1st group - deaths in first 24 hours - 12 (21.8%) mostly cause - brain edema and dislocation; the 2nd group - within 7 days after admission 45.5% (25) patients, the main cause of death was ventilated associated pneumonia (VAP) - and other respiratory complications; the 3rd group - over 7 days 18 patients (32.7%) died because of other healthcare associated infections (HAIs), such as tracheal bronchitis, catheter related bloodstream infections (CRBSI) and etc.

#### Conclusion(s):

- 1) Almost half of the patients had two or more adverse events, associated with prolonged mechanical ventilation, vascular thrombosis and embolism, and multiple organ failure.
- 2) Most of described above “complications” in the developed countries, implemented the culture of Patient Safety, are considered as the preventable sentinel events.

The first step towards Patient safety for Uzbekistan healthcare system should be establishing of errors and near misses reporting system as well the Root Cause Analysis (RCA) to help identify the causes of errors for further improvements.

## 7AP4-9

### High compliance to computerized tests for assessment of postoperative cognitive dysfunction

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**Background and Goal of Study:** After cardiac surgery many patients experience postoperative cognitive dysfunction (POCD), usually comprising impaired concentration, attention, working memory and executive function. These sometimes subtle defects are usually assessed by neuropsychological examination, but this is time-consuming and associated with relatively high rates of non-compliance or completion caused by fatigue or impaired attention intrinsic to the disorder.

We are studying POCD in patients undergoing cardiac surgery using a newer set of computerized tests (Cogstate, Australia) that may be more sensitive to detect cognitive decline than paper-and-pencil tests<sup>1</sup>.

We present here an interim analysis of compliance with this test battery.

**Materials and Methods:** In this ethical committee approved study, cognitive function before and after coronary artery revascularization was assessed in consenting patients using the CogState battery of tests.

Assessments take the form of card games, which makes them culture-neutral and independent of educational level. The following 4 tasks were used:

- 1) detection task, 2) identification task, 3) one card learning task, and 4) one back task, assessing reaction time, psychomotor function, working memory, and attention respectively. POCD was defined as a composite score decrease of more than 2 Z-scores, or by a standardized change score decrease of  $\geq 2$  Z-scores in  $\geq 2$  tasks.

**Results and Discussion:** We have included 32 patients so far. The incidence of POCD after 5.3 ± 2.1 days was 45%. All patients were able to perform detection and identification tasks after surgery. One did not complete the one card learning task and one back task. This patient fulfilled the criteria for POCD



based on the first 2 tasks. We estimate that the tests took on average 15 minutes in total to complete. In our experience so far, test compliance is 97-100%, similar to that reported by Padmanabhan (97-99%)<sup>2</sup>. Paper-and-pencil tests have a lower compliance record - Rasmussen reported a mean rate of 83.9% in a review of 13 studies<sup>3</sup>.

**Conclusion(s):** We conclude that in addition to being a highly sensitive tool to establish POCD, the CogState test battery is quick to perform, and associated with high compliance rates.

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## 7AP4-10

### A randomized, double-blind, placebo-controlled trial to assess the efficacy and safety of pregabalin in reducing the incidence of postoperative delirium and improving acute postoperative pain in patients undergoing major orthopedic and vascular surgery

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**Background:** Delirium is a common complication in the postoperative period. Gabapentinoids are effective in the management of acute postoperative pain<sup>1</sup> and in a small pilot trial gabapentin decreased the incidence of postoperative delirium.<sup>2</sup> The primary outcome of this RCT was to determine whether pregabalin administration in the perioperative period reduced the incidence of delirium in the first 3 postoperative days.

Secondary outcomes included effects of pregabalin on pain, sleep, opioid consumption, opioid-related side effects, quality of recovery and length of stay.

**Materials and Methods:** After receiving Research Ethics Board approval, 240 patients aged  $\geq 65$  years scheduled to undergo major orthopedic or vascular surgery were randomized to receive placebo or pregabalin 75 mg preoperatively and 25 or 50 mg 3 times daily for 3 days postoperatively, based on renal function. Anesthetic type was at the discretion of the attending anesthetist. Patients received multimodal analgesia and PCA hydromorphone postoperatively. Delirium was assessed by using CAM-ICU, by interview with patient, family and caregivers, and by chart review; pain was assessed using NRS and BPI; recovery was assessed using QoR; sleep was assessed using MOS sleep scale; and opioid side effects were rated using the ORSDS. Assuming a baseline rate of delirium of 30%, the study had 80% power to detect a 50% RRR in the rate of delirium.

**Results and Discussion:** The chart review for assessment of delirium is ongoing. Opioid consumption is being analyzed. Results will be presented at the meeting. Pregabalin treated patients had better sleep adequacy ( $p=0.0408$ ) and a trend to more optimal sleep on postoperative day (POD) 3 ( $p=0.0518$ ), less itchiness on POD2 ( $p=0.0011$ ) and POD3 ( $p=0.0286$ ), less diarrhea on POD2 ( $p=0.0221$ ), but increased dizziness on POD2 ( $p=0.0431$ ). No differences were seen in pain by NRS or by BPI, quality of recovery or length of stay.

**Conclusions:** Pregabalin use resulted in better sleep and less itchiness and diarrhea but also caused more dizziness. Pain outcomes were unchanged, but data on opioid consumption is still forthcoming. Data on incidence of delirium is still being analyzed and will be presented at the meeting.

**References:**

1. Engelman et al. *Acta Anaesthesiol Scand* 2011;55:927-43;
2. Leung et al. *Neurology* 2006;67:1251-3

**Acknowledgements:** Study was funded by a grant from Physician Services Incorporated. Study drug was supplied by Pfizer Canada.

## 7AP4-11

### Hypertension during emergence from anaesthesia in patients undergoing transsphenoidal resections of pituitary tumours - is it really an issue and how should it be treated?

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**Background/Aim:** It is assumed that transsphenoidal resections of pituitary (TRP) tumours are often complicated by hypertension (HT) on emergence. This is commonly associated with surgical intervention within a hormonally active site, duration of surgery, choice of opioid or preexistent hypertension. The aim of this retrospective analysis was to assess the objective frequency

of HT during emergence after TRP tumours; to perform a statistical analysis of risk factors of HT on emergence and to analyse the choice and efficacy of administered antihypertensives in view of the fact that labetalol is the recommended drug for the treatment of HT in neurological and neurosurgical pts.

**Material/Methods:** 221 ASA I-III pts (119K, 102M); median age: 49 yrs (range: 16-87) operated at one institution between Jan.2010-Nov.2011; median duration of surgery: 80 min (range: 15-570 min). Monitoring: ECG, SpO<sub>2</sub>, invasive ABP; TOF; hourly diuresis.

**Anaesthesia:** Premed./Ind.: midazolam 2mg; FNT 0.2mg/SFNT 0.5 $\mu$ g/kg; propofol 2mg/kg; rocuronium 0.6mg/kg; maintenance: sevoflurane 1.5-2.0 MAC; rocuronium infusion 10  $\mu$ g/kg/min; infusion of FNT 0.15 mg/h or SFNT 15  $\mu$ g/h. **Analysed parameters:** age, weight, gender, history of HT, duration of anaesthesia/surgery, fluid therapy, type of opioid used, antihypertensives administered (labetalol [L], urapidil[U], regitine[R])

**Results:** SBP $\geq 150$  mmHg et emergence: 36/221 (11/36 transferred to ICU); U. administered to 34/221 pts L - 27/221; R - 6/221 U+L -20/221 (+R - 6/20). Statistically (ANOVA) the sole confirmed risk factor of HT on emergence was history of HT ( $p < 0.01$ ); BP decrease: 12-15 sec. after U; 8-10 sec. after L i.e. L showed a more rapid onset. In pts undergoing TRP tumours HT on emergence is observed in 16.3% of pts; 4.9% of pts require hospitalisation in the ICU for aggressive treatment of hypertension (L and U i.v. in constant infusion 120 mg/h each). Labetalol shows a more rapid onset than urapidil.

**Conclusions:** HT requiring treatment is not as common as it is assumed during emergence from anaesthesia after TRP tumours. In Poland urapidil is more popular than labetalol despite recommendations. This may, probably, be explained by its registration policy and availability.

**References:**

1. Laws ER, Sakamoto GT, Shuer ML et al. Transsphenoidal resection of pituitary tumour. In: Jaffe RA, Samuels SI (eds.) *Anesthesiologist's Manual of Surgical Procedures*. Lippincott Williams & Wilkins Philadelphia, 2004: 52-56

## 7AP5-2

### Ketamine and pentobarbital administered at day or night differentially affect the circadian rhythms of pineal melatonin secretion and locomotor activity in rats

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**Background and Goal of Study:** General anesthesia with surgery disturbs physiological circadian rhythms, which may lead to postoperative sleep disorders and delirium.

However, it is unclear how circadian rhythms are affected by different anesthetics at different times during the rest-activity cycle. We examined the effects of ketamine (an NMDA receptor antagonist) and pentobarbital (a GABA receptor agonist) administered at resting/day or active/night phase on the pineal melatonin secretion and locomotor activity rhythms of rats.

**Materials and Methods:** Rats were divided into 4 groups according to the anesthetic administered and the timing of intraperitoneal administration. Using on-line pineal microdialysis, we analyzed pineal melatonin secretion and locomotor activity rhythms in rats under a light/dark (12h/12h) cycle for 5 days after anesthesia and microdialysis catheter implantation. The data was analyzed for rhythmicity by cosinor analysis.

**Results and Discussion:** Ketamine administered during the resting phase produced 65- and 153-minute phase advances, respectively, in melatonin secretion and locomotor activity rhythms on the first day after anesthesia. In contrast, ketamine administered during the active phase produced 43- and 235-minute phase delays. Pentobarbital had no effect on the phase of either melatonin secretion or locomotor activity, irrespective of the timing of administration. When administered during the active phase, both anesthetics decreased the amplitude of melatonin secretion on the day after anesthesia; when administered during the resting phase, however, neither anesthetic affected the amplitude.

We postulate that the NMDA-antagonistic properties of ketamine may be involved in the demonstrated time-dependent shifts. This is because the effects of ketamine are quite similar to those of dark pulses.

It is well known that light exerts phase-shifting effects on circadian rhythms via activation of NMDA receptors; thus, dark pulses may be regarded as functioning like NMDA antagonists to the extent that both diminish the activation of NMDA receptors.

**Conclusions:** Ketamine has opposite phase-shifting effects on circadian rhythms according to the time of administration, whereas pentobarbital has no effect.

Furthermore, both anesthetics decrease the postoperative amount of pineal melatonin secretion if administered during the active - but not the resting - phase of the 24-hour rest-activity cycle.

## 7AP5-4

### Sepsis induces an early impairment of cerebral metabolism in a model of traumatic brain injury (TBI): a morpho-functional study with micro-PET in rat

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**Background and Goal of Study:** The development of sepsis in patient suffering from TBI represents a frequent complication that has been associated with worsened global and neurological outcome. In order to better characterize the influence of sepsis following TBI, we developed an *in vivo* model of combined TBI and sepsis in the rat. In this model we observed a worsening of post-injury mortality and weight loss, a significant exacerbation of post-injury motor deficit and cognitive impairments, and an exacerbation of neuronal cell death [1]. The aim of this study was to evaluate the *in vivo* alterations induced by sepsis on the evolution of post-traumatic damage by using microimaging techniques: Computerized Tomography (CT) and Positron Emission Tomography (PET).

**Materials and Methods:** TBI was induced by Controlled Cortical Impact (CCI, n=3), sepsis was induced by Cecal Ligation and Puncture (CCI+CLP, n=3), control animals (CTRL, n=3) underwent craniotomy and laparotomy only. At 24, 48 and 72 hours after surgery, neuroimaging was performed by CT, in order to evaluate cerebral morphological changes, and by PET using FDG as tracer, in order to evaluate variations in cerebral metabolism. After the last imaging (72h), animals were sacrificed and brains collected for histological assessment of lesion volume.

**Results and Discussion:** No CT differences were found between CCI and CCI+CLP at 24, 48 and 72 hours after surgery; similarly, no difference was observed for the lesion volume. On the contrary, FDG-PET documented a dramatic decrease in cerebral metabolism in the perilesional area in CCI+CLP rats as compared to CCI animals at all the experimental time points.

**Conclusion(s):** FDG-PET, but not CT and histology, was able to discover early difference between uncomplicated CCI and CCI complicated by sepsis. The major impairment in cerebral metabolism in perilesional area in rat affected by TBI and sepsis might contribute to explain the worse neurological and global outcome observed in rats undergoing the combined injury.

#### References:

1. Venturi L, Miranda M, Selmi V et al. J Neurotrauma. 2009;26:1547-56.

## 7AP5-5

### The two-pore domain K<sup>+</sup> channel, TRESK, is decrease by spinal nerve injury

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**Background and Goal of Study:** Two-pore-domain potassium(K<sup>+</sup>) ion channels (K2p, KCNK) contribute to background (leak) potassium currents maintaining the resting membran potential to play an important role in regulating neuronal excitability. TRESK (TWIK Related Spinally-expressed K channel) was the recent identified member of K2p channel family and expression in spinal nervous system by immunohistochemistry. A few researches report that TRESK channels are play active roles in neuropathic pain.

#### Materials and Methods:

**Group and Pain models (Spinal nerve ligation model, Jung's model):** Animals were divided into a control group (sham operation N=3) and a experimental groups (spinal nerve ligation, SNL, N=3). Rat spinal nerve (L5, L6) of SNL group was ligated. SNL operation with performed on the left side and no surgical procedure was done on the right side. Sham group was not ligated. To quantify the mechanical sensitivity of the foot, the occurrence of hind foot lift following repeated applications of von Frey filaments was tested at 3, 7, 10 and 14 days postoperatively

**Immunohistochemistry:** Immunohistostaining was performed after postoperative 14 days. rats were anesthetized with sodium pentobarbital and perfused transcardially with heparinized phosphate-buffered saline which was followed by perfusion with 4% paraformaldehyde. Lumbar enlargement regions of the spinal cords were removed and was immunostained.

#### Results and Discussion:

**Mechanical allodynia:** Spinal nerve ligation induce an exquisite sensitivity of the hind paw to innocuous mechanical stimuli. But Sham group does not decrease mechanical threshold.

**Distribution of TRESK immunostaining in the spinal lumbar enlargement:** TRESK is expressed in the grey matter with a highest density in the dorsal horn region, especially the superficial lamina I and II, and with a medium density in the ventral horn region of all spinal levels. TRESK expression is higher in

spinal cord dorsal horn of SNL group than Sham group and at the SNL group, TRESK expression is higher in Superficial Dorsal Horn (laminae I-II) than Nucleus of Proprius (laminae III-IV). Suggesting that reduced TRESK expression may have a greater effect on decrease mechanical threshold.

**Conclusion(s):** We show that spinal nerve ligation downregulates TRESK expression, which may contribute to enhanced excitability after nerve injury. It is supporting an important role for TRESK in nociception and neuropathic pain.

## 7AP5-6

### MRT and CT images of brain in parturients with neurological complications of eclampsia: data structuring and frequency analysis

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**Background and Goal of Study:** The goal of the study was to classify protocol data recorded during magnetic-resonance tomography (MRT) and computer tomography (CT) examinations of brain in patients with neurological complications of eclampsia; to define the MRT/CT examination data structure; to perform frequency analysis of main MRT/CT characteristics and estimate their frequency distributions defined by studied pathology. The data included into the study was reported in medical journals and met definite criteria of inclusion.

**Materials and Methods:** We collected cases of neurological complications of eclampsia reported in English-language medical journals from 1980 to 2008. The study methods include structural and frequency analysis of brain MRT/CT image protocols.

**Results and Discussion:** Analyzed sample included 77 cases of neurological complications of eclampsia. We extracted the following positions from the plain texts of MRT/CT descriptions: brain injury areas (occipital, temporal, parietal and frontal lobes); injury depth (cortical and/or subcortical matter); brain structures undergone injury (classification was too complicated); injury nature (vasogenic/ischemic edema, hemorrhage). Abnormalities in occipital (84.6%) and parietal (70.7%) lobes were the most frequent, injuries in temporal lobes were quite rare (26.9%), but the damages in frontal lobes were the most uncommon (24.4%). Combined injury in occipital and parietal lobes was recorded in more that 2/3 of cases (72.4%). Combined injury in occipital-frontal lobes (29.3%) and occipital - temporal (27.6%) lobes were observed in almost 1/3 of patients. Synchronous injury in temporal and frontal lobes was the least common (6.9%). Simultaneous damage of 3 and more lobes was observed quite rarely (14.6%). Most of abnormalities were bilateral with frequency not less than 78.0%. Unsymmetrical injury observed in some patients was located in right lobe in most cases. All analyzed cases include only 7.1% of single left injury and all of them were located in occipital lobe. Vasogenic edema occurred in 83.5% of cases, while ischemic damage was observed in 10.4%. The incidence of hemorrhage was 6.1%.

**Conclusion(s):** The analysis allows revealing a general picture of the most distinctive features of brain damage following neurological complications of eclampsia.

## 7AP5-7

### Reducing the volume and dose of local anaesthetics for awake craniotomies - a modified technique of local anaesthesia

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**Background/Aim:** The local anaesthetic dose administered for awake craniotomies remains one of the main problems of this technique. Most authors advise scalp blocks using of 40 to 50 ml of local anaesthetic [1, 2, 3]. We have developed and present a modified method, which limits the necessary volume of local anaesthetic to 30 mls (i.e. 75 mg of bupivacaine).

**Material and method:** 20 consecutive patients (13W, 7M; mean age 27; range 21- 40 yrs) undergoing resections of gliomas of the eloquent cortex with intraoperative mapping subjected to the "asleep-awake-asleep" protocol for awake craniotomies. All received i.v. drugs acc. to a typical "awake craniotomy" regimen: omeprazole 40 mg, ondansetron 4 mg, atropine 1 mg, fentanyl 25 µg and a propofol infusion of 3-6 mg/kg/h i.v. After inducing sedation we performed local anaesthesia with 0.25% bupivacaine with adrenalin (i.e 2.5 mg bupivacaine and 0.0025 adrenalin/1 ml solution) injecting 2 mls at every site of the head-holder pins, 2 mls 1 cm above the ipsilateral eyebrow to anaesthetize the supraorbital/supratrochlear nerve and 2 mls directly in front of the ipsilateral ear to anaesthetize the auriculotemporal nerve. 20 mls of the drug were used to infiltrate the incision site and to infiltrate and "lift"

the designed flap (between the incision site and the ipsilateral eyebrow i.e. resembling a fan).

**Results:** Having limited the volume of the local anaesthetic to 30 mls (i.e. the dose to 75 mg) we achieved very good anaesthesia of the surgical site. The pts reported no pain throughout the awake mapping period (which lasted from 80 to 200 minutes). 8/20 patients requested to remain awake for skull closure and were pain-free during the entire procedure.

**Conclusion:** Local anaesthesia limited to three sites of head-holder pins, two ipsilateral nerve blocks and skin flap infiltration, as opposed to complete scalp

block, limits the volume/dose of local anaesthetic used for awake craniotomy and provides adequate analgesia.

#### References:

- Costello TG, Cormack JR, Mather LE et al. Plasma levobupivacaine concentrations following scalp block in patients undergoing awake craniotomy. *BJA* (2005); 94(6):848-851
- Costello TG, Cormack JR. Anaesthesia for awake craniotomy: a modern approach. *J Clin Neuroscience* (2004) 11(1) 16-19
- Sinha PK, Koshy T, Gayatri P et al. Anesthesia for awake craniotomy: A retrospective study. *Neurology India* (2007) 5(4):376-381

## Regional Anaesthesia

### 8AP1-1

#### Intrathecal morphine is a valid alternative to epidural analgesia for major Hepato-Pancreatico-Biliary (HPB) surgery in a pilot study of 38 patients: a step in the right direction for fast-track recovery

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**Background/Goal of Study:** Thoracic Epidural analgesia is the gold standard for major HPB surgery. However, failure and complication rates are problematic and include mobilization delays and prolonged vasopressor use. ITM has been shown to provide effective analgesia<sup>1</sup> for up to 48h and is more time- and cost-effective, but there are concerns about delayed respiratory depression. The addition of intrathecal bupivacaine to ITM may be synergistic and help attenuate the stress response. We carried out a prospective pilot study in our institution to compare analgesia.

**Materials and Methods:** Between Aug and Oct 2011, 20 patients undergoing HPB surgery were selected to receive 400mcg ITM and a variable dose of hyperbaric 0.5% Bupivacaine with a Fentanyl PCA post-operatively. Another 18 patients were selected to receive a T8-T11 epidural with 0.125% bupivacaine and 4mcg/ml fentanyl infusion. All patients were followed up for 48h and data is quoted as median (range) or percentage and Mann-Whitney test was used for continuous variables.

**Results/Discussion:** Demographics, operation duration and estimated blood loss were similar in both groups but more patients in the epidural (EPI) group underwent major hepatectomy (33.3% vs 15%). Pain scores were not significantly different at any time points up to and including 48h. Intra-operative colloid use was significantly higher in the EPI group (1000mls (500-5000) vs 500mls (0-2000);  $p = 0.005$ ) and more EPI patients required vasopressor intra-op (50% vs 15%). Post-operative fluid requirements were higher in the EPI group but not statistically significant. Hospital Length of Stay (LOS) was longer in the EPI group (13 days (6-38) vs 9 (5-27)  $p = 0.06$ ). Times to first oral intake and mobilization were longer in the EPI group but not statistically significant. Episodes of respiratory depression and hypotension were the same in both groups but there were more pneumonias in the EPI group (7 vs 3 episodes).

**Conclusions:** ITM with bupivacaine and PCA is a valid alternative to thoracic epidural for analgesia in HPB surgery and is associated with less intravenous fluid and vasopressor use and shorter LOS. Safety profiles were similar but there were more pneumonias in the EPI group. In an era of enhanced recovery, ITM may be more suitable in selected patients.

#### References:

- Sakowska M et al : A change in practice from epidural to intrathecal morphine analgesia for hepato-pancreato-biliary surgery. *World J Surg* 2009; 33: 1802-8

### 8AP1-2

#### The effects of epidural anaesthesia on the bioavailability of nitric oxide and renal function in patients undergoing laparoscopic surgery

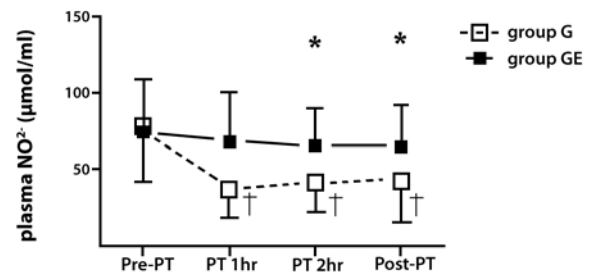
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**Background and Goal of Study:** The aim of this study was to investigate whether epidural anaesthesia could reduce renal dysfunction after laparoscopic surgery by preservation of nitric oxide (NO) bioavailability and also reduce oxygen stress by suppressing sympathetic nervous system activation in patients undergoing laparoscopic radical prostatectomy.

**Materials and Methods:** 44 patients undergoing robot-assisted laparoscopic radical prostatectomy were randomly allocated to either the general anaes-

thesia group (group G, n=22) or the combined general/epidural anaesthesia group (group GE, n=22). During surgery, the ratio of sympathetic/parasympathetic nervous system activity was evaluated by measuring heart rate variability and plasma NO and malondialdehyde(MDA), the final products of lipid peroxidation, were measured before pneumoperitoneum (T1), 1 hour (T2) and 2 hours (T3) after induction of pneumoperitoneum and Trendelenburg position, and 10 minutes (T4) after pneumoperitoneum was released. For the evaluation of postoperative renal function, 24 hr urine output and 24 hr creatinine clearance were measured on postoperative days (POD) 1 and 2.

**Results and Discussion:** After induction of pneumoperitoneum and the Trendelenburg position, the ratio of sympathetic/parasympathetic nervous system activity and plasma MDA were significantly lower in group GE. Also, plasma NO was significantly higher in group GE compared with group G (\*:  $P < 0.05$  compared with the other group).



[Plasma NO concentration]

24 hr urine output ( $2205 \pm 635$  ml vs.  $1713 \pm 471$  ml,  $p=0.010$ ) and 24 hr creatinine clearance ( $105.5 \pm 22.0$  ml/min/1.73 m<sup>2</sup> vs  $87.3 \pm 22.4$  ml/min/1.73 m<sup>2</sup>  $p=0.018$ ) were significantly higher in group GE than group G on POD1, but were not different between two groups on POD 2.

**Conclusion:** We concluded that epidural anaesthesia can effectively suppress the activation of the sympathetic nervous system thus preserving the bioavailability of NO, eventually helping to preserve renal function after laparoscopic surgery.

### 8AP1-3

#### Confirmation of epidural catheter position by using the epidural Queckenstedt test (E-QST) method

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**Background and Goal of Study:** Epidural anesthesia is an important factor in perioperative pain management. The loss of resistance technique is widely used for confirming epidural puncture. However, this method recognizes only pressure alternation; therefore, it cannot confirm the epidural puncture itself. We developed a new method to confirm epidural puncture by assessing indirect changes in epidural pressure by using the Queckenstedt-test procedure, which increases subarachnoid pressure by compressing the internal jugular veins (E-QST method) [1]. In this study, we investigated whether the E-QST method could confirm epidural catheter position.

**Material and Methods:** We enrolled patients who underwent thoracic epidural anesthesia. Epidural punctures were performed by 1 resident. Epidural or interspinous ligament pressure monitoring was performed by a three-way stopcock connected to a Tuohy needle or the catheter and an extension tube filled with normal saline. The pressure was monitored using a pressure transducer. First, the Tuohy needle was inserted into the interspinous ligament, and pressure was monitored via the Tuohy needle (first trial). E-QST positive

was defined as the condition in which the pressure increased during internal jugular vein compression and decreased after decompression. Second, after epidural puncture using the loss of resistance technique, pressure was monitored via the Tuohy needle (second trial). Finally, after catheter insertion into the epidural space, we monitored pressure via the catheter (third trial). Catheter insertion was also confirmed by a cold test.

**Results and Discussion:** Twenty-one patients were enrolled (age,  $68 \pm 10$  years; BMI,  $22 \pm 3$  kg/m<sup>2</sup>). The loss of resistance technique was clear in 18 patients, but it was unclear in 3 patients. In the E-QST method, the pressure did not change in any patient on first trial. However, all patients tested E-QST positive on the second and third trials. In all patients, catheter insertion into the epidural space was confirmed by the cold test. The sensitivity of the E-QST method was 100% and that of the loss of resistance technique was 86%. The specificity of the E-QST method was also 100%.

**Conclusion:** The E-QST method is useful for confirming epidural catheter position. This method improves patient safety, particularly when the loss of resistance technique is unsuccessful.

#### References:

1. Yokoyama T, et al. *Acta Anaesthesiol Scand.* 2008;52:256-61.

## 8AP1-4

### Epidural catheter connectors: a laboratory-based comparison of the Portex Tuohy-Borst and EpiFuse designs

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**Background and Goal of Study:** Disconnection of an epidural catheter from its connector may result in patient harm and usually requires resiting of the epidural. Clamp connectors such as the novel EpiFuse (Smiths Medical, Kent, UK) may offer a superior safety profile to screw-cap designs, but comparative studies are limited<sup>1</sup>. We compared the tensile strength of EpiFuse and Tuohy-Borst connectors under controlled laboratory conditions. We also tested whether a form of operator modification during preparation adversely affects patency of the EpiFuse lumen or strength of its locking mechanism.

**Materials and Methods:** After gaining institutional approval, we recruited 20 anaesthetists who routinely insert epidurals to assemble three epidural sets in randomised order. Tuohy-Borst and Standard EpiFuse sets were assembled as per usual clinical practice, but Modified EpiFuse sets required participants to forcibly snap open the connector wings prior to assembly. All sets were independently tested via standardised protocol using closed-loop feedback servo-control machinery (Instron 3345, High Wycombe, UK). Compliance with British Standard specifications, peak force required to induce disconnection and pairwise comparisons were analysed using SPSS v18.

**Results and Discussion:** All catheters were patent to air. Comparative findings are shown in Tables 1 and 2. Data are median [IQR] or number (proportion).

	Tuohy-Borst (n=20)	Standard EpiFuse (n=20)	Modified EpiFuse (n=20)	p value
Peak force (N)	8.0 [4.1-12.8]	16.4 [15.2-17.7]	15.9 [15.0-16.9]	0.0001
Passed British Standard	13 (65%)	19 (95%)	20 (100%)	0.002
Peak force (N) for those that passed	11.4 [10.3-15.0]	16.6 [15.5-17.7]	15.9 [15.0-16.9]	0.011

[Table 1: Tuohy-Borst v Standard & Modified EpiFuse]

	Tuohy-Borst vs Standard EpiFuse	Standard vs Modified EpiFuse
Peak force	p = 0.0002	p = 0.36
Passed British Standard	p = 0.044	p = 1.00
Peak force for those that passed	p = 0.005	p = 0.22

[Table 2: Pairwise comparisons]

Performance of the EpiFuse connector was superior to that of the Tuohy-Borst connector. The EpiFuse binary locking mechanism compensates for variation in operator performance by providing a clear connection end-point<sup>2</sup>. Operator modification of the EpiFuse, although not recommended, did not affect lumen patency or connection strength. Our use of precision industrial machinery under controlled conditions allowed more accurate evaluation of connection strength than previous studies.

**Conclusion:** In laboratory testing EpiFuse connectors are superior to Tuohy-Borst connectors.

#### References:

1. Doyle A et al, *IJOA* 2011; 20(1): 34-7
2. Richardson PB et al, *Anaesthesia* 2011; 66: 948-9

## 8AP1-5

### Influence of fixation techniques of thoracic epidural catheters on dislocation and bacterial contamination

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**Background and Goal of Study:** Fixation of thoracic epidural catheters (TEC) can be performed in various ways. However it is unknown what influence this has on the incidence of catheter dislocation. Thus we tested the hypothesis that tunnelling and suturing of TEC reduces the incidence of catheter dislocation.

**Materials and Methods:** After IRB approval (No. 3433, 28/07/2010), registration of the clinical trial ([www.clinicaltrials.gov](http://www.clinicaltrials.gov), NCT01402778) and informed consent, 120 consecutive patients scheduled for major abdominal or thoracic surgery under general anesthesia and thoracic epidural analgesia, were prospectively randomized in 2 groups. TEC were either tunnelled for a minimum of 2 cm and sutured (TS) or fixed with adhesive tape (AT). To quantify the extent of catheter dislocation, the difference of TEC length at skin surface level immediately after insertion and before removal was determined and the absolute values averaged. In addition, catheter tips were screened microbiologically.

Statistics: Mean  $\pm$  standard deviation, t-test and Fisher's exact test,  $p < 0.05$ .

**Results and Discussion:** Both groups did not differ with respect to patient age (TS: 57 years  $\pm$ 16, AT: 58  $\pm$ 16) and duration of catheterization (TS: 109 hours  $\pm$ 46, AT: 97 $\pm$ 37). TS significantly reduced extent (TS: 3 mm  $\pm$ 7, AT: 10 $\pm$ 18) as well as incidence of clinically relevant catheter dislocation (>20mm: TS: 1/60, AT: 9/60). Catheter-associated bacterial contamination showed a tendency to be lower in patients with TS (8/59, AT: 13/53,  $p = 0.2$ ).

**Conclusion(s):** Accurate tunnelling and suturing of TEC reduces extent and incidence catheter dislocation and potentially that of bacterial contamination. Based on these results TEC fixation will be standardized by tunnelling and suturing in our institution.

## 8AP1-6

### Thoracic epidurally administered bupivacaine significantly impairs voiding function and adding fentanyl enhances this effect: a randomized controlled trial

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**Background & Goal of the Study:** In a previous study we found, contrary to our hypothesis, that thoracic epidural analgesia (TEA) after open renal surgery impairs voiding function<sup>1</sup>. The goal of this study is to exclude surgery itself as a cause and determine which epidurally administered drugs (bupivacaine or bupivacaine/fentanyl) are behind the changes in lower urinary tract function.

**Material and Methods:** In a randomized, controlled, double blinded study, 40 patients with no pre-existing lower urinary tract symptoms were equally randomized to receive an epidural regimen with bupivacaine 0.125% or bupivacaine 0.125% with fentanyl 2mcg/ml. All patients underwent urodynamic investigations before placement of the epidural catheter at level T8/9, after activating the TEA before surgery and 2 days after open renal surgery under TEA with a segmental blockade from T4 to T12. Primary outcome was the difference in postvoid residual between the bupivacaine group and bupivacaine-fentanyl group after surgery. All urodynamic parameters of storage and voiding phases were assessed according to the guidelines of the International Continence Society.

**Results and Discussion:** In both group a significant increase in postvoid residuals from 15ml [range: 0-95] to 200ml [0-695],  $P < 0.001$  in the bupivacaine group and from 20ml [0-90] to 450ml [70-850],  $P < 0.001$  in the bupivacaine/fentanyl group was observed after activation of the TEA. This was more pronounced in the group receiving fentanyl ( $P=0.041$ ). These changes did not differ significantly before and after surgery. Maximum detrusor pressure, detrusor pressure at maximum flow rate and maximum flow rate were significantly reduced in both groups but did not worsen after surgery.

**Conclusions:** Thoracic epidurally administered bupivacaine 0.125% with a segmental blockade T4 to T12 resulted in clinically relevant postvoid residuals necessitating catheterization. The addition of fentanyl seems to enhance this effect. Based on this observation removal of the transurethral catheter in patients with TEA warrants close monitoring of the postvoid residual.

#### Reference:

1. Wuethrich P, Kessler T, Panicker J, Curatolo M, Burkhard F: Detrusor activity is impaired during thoracic epidural analgesia after open renal surgery. *Anesthesiology* 2010; 112: 1345-9

## 8AP1-7

### Intrathecal blood spread after epidural blood patch: can it give arachnoiditis?

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**Background:** Arachnoiditis after epidural blood patch (EBP) has been described and associated to the presence of intrathecal blood. Typical symptoms are: lower back pain, foot burn, peripheral sensory and motor deficits and rigor nuchalis.

Its genesis is to date controversial but it can give serious and long-term clinical complications.

**Materials and Methods:** EBP for intracranial hypotension syndrome not responsive to conservative treatment was carried out in 94 patients from the year 2003 to 2011. The procedure was performed by an experienced anaesthetist using 20 to 35 ml of autologous blood. The last 40 cases were performed on prone position under fluoroscopy guidance with 5 ml lopamidol to localize the epidural space and confirm the correct site of injection. A lumbar CT scan was carried out in all patients 30 minutes after the procedure.

**Results:** 89/94 cases had resolution of symptoms after one EBP while 5 patients required a second treatment. We had a single case of accidental dural puncture. All patients reported lower back pain that resolved in all cases in 1-3 days sometimes requiring acetaminophen treatment.

In 9/94 cases (including the patient with dural puncture) traces of blood could be seen in the liquor space in the post-procedural CT scan.

We report no cases of arachnoiditis as confirmed clinically and instrumentally. The follow up at 6 month and 2 years reported no recurrence of symptoms.

**Discussion:** Our data confirm the efficacy of lumbar autologous EBP in the SIH. The only side effect reported was lower back pain most probably related to direct puncture trauma. Intrathecal blood was present in 9 patients but none reported signs nor symptoms of arachnoiditis.

Presence of blood in the liquor space in the absence of dural puncture could be explained by the high pressure gradient created by insufflation and seems not to have negative consequences and resolve spontaneously.

Arachnoiditis in our casistic cannot be correlated to the presence of intrathecal autologous blood.

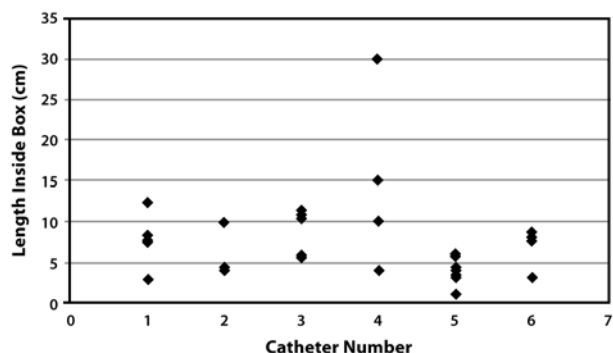
## 8AP1-8

### A study to examine accuracy of the assessment of epidural catheter length inside the body (length at skin)

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**Background and Goal of Study:** Anaesthetists routinely document the length of epidural catheters inside the human body with a varying degree of accuracy. Accurate measurement of the length of epidural catheter at skin is important where subsequent manipulations of that catheter are likely or just to assess what is the catheter length inside the epidural space.

**Materials and Methods:** We developed a model with six (1 - 6) Portex epidural catheters threaded in a box to allow us to assess the accuracy of measurement of epidural catheter depth („length at skin“). The catheters were fixed on the inside of the box so no displacement was possible. 70 anaesthetists of differing grades (at least 3 years of training) were asked to calculate the length of each catheter inside the box as they would do in their routine practice when estimating epidural catheters length at skin. The measured lengths were compared with actual lengths as measured by a ruler. A total of 420 measurements (estimations) were recorded.



[Fig 1]

**Results and Discussion:** The actual length inside ranged between 4 and 15 cm. As demonstrated in the graph below, there were wide variations in the estimated length. The standard deviations of the measurements ranged between 0.51 cm and 2.39 cm. Overall the coefficient of variation for the measurements for all catheters was 10% and the precision of measurement was 20% (1.9 cm). In other words the true length could vary by 20% of the estimated or 1.9 cm of the true value on average.

Using this simple model we were able to demonstrate a variation in accuracy of epidural catheter depth assessment. This may have implications for the subsequent management of epidurals once inserted. The question to be answered is “Were the variations result of lack of focus, lack of training or lack of regular practice?”

**Conclusion(s):** Caution should be exercised when referring to epidural catheter length inside the body as documented by other clinicians.

## 8AP1-9

### Perioperative management of thoracic epidural anaesthesia for awake thoracic surgery in dyspneic patients excluded from general anaesthesia

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**Background:** When thoracic surgery remains the only option to improve the patient and if risks of general anaesthesia (GA) outweigh benefits, thoracic epidural anaesthesia for awake thoracic surgery (TEATS) is the sole option. This observational study analyzed indications, perioperative management and outcome of high risk patients excluded from GA undergoing thoracotomy and thoracoscopy with TEATS.

**Methods:** From February to October 2011, 660 patients required thoracic surgery, 8 of them had maximum grade 5 of the Modified Medical Research Council dyspnea scale (MMRC) and were excluded from GA. They were selected to have TEATS. Epidural punctures levels were between T4 and T7. Lidocaine 20mg/ml or ropivacaine 7.5mg/ml was titrated to achieve an anaesthesia level from T2 to T12. Post-operative pain was controlled with patient controlled epidural analgesia.

**Results:** Female- male ratio was 1:1, age range 19 to 76 years and all had ASA score 4. Underlying respiratory diseases were advanced pulmonary fibrosis (n=2), multiple bilateral pulmonary metastases (n=3), severe COPD (n=1), inflammatory alveolitis (n=1) and advanced myopathy (n=1). Surgical indications were: 5 thoracotomies for pleurectomies, pleurostomy, emphysema surgery, pleural symphysis and 3 thoracoscopies for pleural and lung biopsies. Time of surgery ranged from 106 min to 219 min. No patient required GA, 7 of 8 patients had complementary light sedation with target controlled infusion anaesthesia (propofol (0.5-2µg/ml), remifentanyl (0.5-3ng/ml) or both). Phenylephrine or ephedrine was used in 50% of cases to maintain a mean arterial pressure above 65mmHg. Length of stay in intensive care ranged from 0 to 8 days. In one patient with pulmonary fibrosis, acute respiratory distress appeared after 7 days and he died of intestinal bleeding 25 days after surgery. There were neither respiratory nor surgical complications for the other patients. Hospital discharge was 5 to 40 days after surgery.

**Conclusion:** TEATS with or without sedation is an alternative to GA for thoracotomy and thoracoscopy in MMRC grade 5 patients. In this small series of very high risk patients postoperative recovery was complete and without sequelae for 7 of 8 patients.

#### Reference:

- Guarracino F et al. Awake palliative thoracic surgery in a high-risk patient: one-lung, non-invasive ventilation combined with epidural blockade. *Anaesthesia*. 2008 Jul;63(7):761-3. Epub 2008 Feb 12.

## 8AP2-1

### Ultrasound-guided continuous paravertebral block in isolated thoracic trauma - providing sufficient analgesia for weaning and non-invasive-ventilation (NIV) on ICU for a 46 year old patient after high-speed trauma

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**Background:** After acute high-velocity injury it is desirable to avoid thoracic epidural analgesia to provide neurological examination of the spinal cord function. Systemic analgesia is often insufficient to tolerate non-invasive ventilation (NIV) in massive thoracic trauma and often leads to reintubation and subsequent dilation tracheotomy.

**Case report:** A 46 year old Pat. (ASA I) suffered from a high speed injury

with prolonged extrication, during which he required intubation and a thoracic drain. Following the standard trauma diagnostic in our institution (FAST & hole-body-trauma-CT) only a massive left sided thoraxtrauma (Rib fractures I - XI, haematopneumothorax and dorsal lung consolidation) could be revealed. The patient was scheduled for extubation and NIV. After reaching normothermia on ICU and good blood gas values in prone position (left side up) a continuous paravertebral block (cPVB) was placed in the 5th intercostal space using ultrasound-guided (LAX - in-plane) technique (1) under sterile conditions and tunneling (2). After a bolus of 10ml Ropivacaine 0,375% the patient was turned on his back and successfully extubated 45 Minutes later and NIV could be supplied immediately (VAS < 4). The spread of hypaesthesia covered the segments Th2 - Th7. The continuous infusion of Ropivacain 0,33% (8ml/h) was gradually reduced. After 5 days extensive NIV on ICU the catheter was paused and on the sixth day removed. The patient was then transferred to a normal ward.

**Discussion:** The placement of a cPVB provided good analgesia for an acute isolated thorax trauma. This finding is comparable to results derived from elective thoracic surgery (3). The spread of analgesia was comparable to recent findings in cadaver studies (4) and in preliminary clinical studies (5) as well.

#### References:

1. Ben-Ari et al.; *Anesth Analg* 2009; 109: 1691-4
2. Reisig et al.; *Anaesthesist* 2011; 60: 942-945
3. Agnoletti et al.; *Br J Anaesth* 2011; 106: 916-7
4. Lyet et al.; *Br J Anaesth*. 2011; 106: 246-54
5. Rens et al.; *Reg Anesth Pain Med*. 2010; 35:212-6.

**Learning points:** Ultrasound guided continuous paravertebral analgesia in the hands of the experienced sonographer is an excellent alternative for cases where thoracic epidural should be avoided.

## 8AP2-2

### Sonoanatomy of arteries around the brachial plexus

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**Background:** Anatomical variations of the arteries of the head and neck are very diverse. Studies on the distribution of arteries around the brachial plexus are scarce. The aim of this study was to investigate the distributions of arteries around the brachial plexus down to the clavicle by ultrasonography.

**Patients and methods:** One hundred three patients (206 necks) scheduled for elective orthopedic surgery who underwent peripherally nerve block without interscalene and supraclavicular brachial plexus block gave their written informed consent to participate in this study.

Patients were placed in the supine position, with the head facing away from the side to be observed. The brachial plexus were observed from the level of C5 vertebra to the supraclavicular fossa. Color Doppler studies were performed to assess vascular structures and their relationship to the components of brachial plexus.

Distributions of arteries were defined as follow.

Artery 1: The artery runs medial side in the interscalene groove

Artery 2: The artery runs into the brachial plexus in the interscalene groove

Artery 3: The artery runs anterior side of the brachial plexus

Artery 4: The artery runs into or dorsal side of the supraclavicular fossa

**Result:** At least one artery close to the brachial plexus was identified in over 60% of subjects (Table 1). The artery runs anterior side of the brachial plexus was most frequent. In over 30% of patients, more than two arteries were observed within the brachial plexus.

Seventy-four patients (72 %) had arteries around the brachial plexus on both sides.

	Left	Right	Total
Location of arteries			
Artery1	35 (34%)	44 (43%)	79 (38%)
Artery2	2 (2%)	10 (10%)	12 (6%)
Artery3	67 (65%)	63 (61%)	130 (63%)
Artery4	24 (23%)	15 (15%)	39 (19%)
Number of arteries seen			
one	68 (66%)	59 (57%)	127 (62%)
two	30 (29%)	43 (42%)	73 (35%)
three	5 (5%)	1 (1%)	6 (3%)

[Summary of results]

**Conclusion:** More than 60% patients had arteries around the brachial plexus. Color Doppler ultrasonography should be adopted to locate the brachial plexus because it can clearly differentiate nerves from vessels. It is important to the safety that Color Doppler should enable to identify arteries associated with the brachial plexus.

## 8AP2-3

### Use of ultrasound to determine the level of lumbar puncture in orthopaedic patients

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**Background and Goal of Study:** The anatomical landmark which is used to identify the correct level for performing spinal anaesthesia is the line connecting both iliac crests. It crosses vertebral column at the level of L4-L5 intervertebral space or L4 vertebra. It could be inaccurate or difficult to determine in a group of orthopedic patients due to chronic orthopedic disorders, chronic pain, obesity or difficulties with positioning for lumbar puncture.

The objective of the study was to determine if identification of intervertebral space by physical exam differs from that of the ultrasound assessment.

**Materials and Methods:** Adult patients undergoing lower limb surgery under spinal block were enrolled in this study. The intervertebral space suitable for lumbar puncture was determined by physical exam by anaesthetist in the sitting or lateral position of the patient. This was followed by a lumbar ultrasound. Primarily the transducer was placed in paramedian sagittal view followed by transverse interlaminar view for confirmation to identify the interlaminar spaces. "Counting-up" approach starting with L5-S1 space was applied.

**Results and Discussion:** One hundred and twenty two patients (122) were included in this study.

Lumbar intervertebral spaces were identified by ultrasound in all cases.

The concordance of intervertebral space identification (between clinical and ultrasound examination) was noted in 78 cases (64%).

Mean deviation of inaccuracy was 1 intervertebral space with no statistical difference among cephalad and caudal direction. There was no statistical difference found in demographic data (sex, age, height, weight, BMI), positioning for lumbar puncture or intravertebral space chosen for the puncture among concordant and nonconcordant identification groups. The only statistical difference found was the difference among the years of professional experience of anaesthetist performing clinical assessment and puncture.

**Conclusion(s):** The concordance rate between clinical examination and ultrasound assessment of intervertebral space identification for lumbar puncture was 64% in group of patients undergoing lower limb surgery.

No special parameters were found which could aware the anaesthetist that the patient is at higher risk of inadequate intravertebral space level assessment.

Spinal ultrasound can reduce the incidence of inappropriate lumbar puncture level in orthopedic patients.

## 8AP2-4

### Axillary block in obese and non-obese patients: a comparative sono-anatomic study

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**Background and Goal:** The axillary block is challenging in obese, leading to an increased rate of complications [1]. The mechanisms are however poorly investigated. Therefore, we carried out an ultrasound study to compare anatomic variations between obese (BMI > 30 kg/m<sup>2</sup>) and non-obese (BMI ≤ 30kg/m<sup>2</sup>) patients.

**Material and Methods:** After institutional approval, 18 obese and 43 non-obese patients were consecutively included. The following sono-anatomic parameters were measured at the axilla: distance between the axillary artery center and the skin (Sax), the center of median (Max), ulnar (UAX), musculocutaneous (MCAx) and radial (RAX) nerves. Distance between the skin and the radial nerve center (SR).

The echographic image quality (EQ) was assessed by a numerical scale (0 to 10; 10 being the best quality). Variables were expressed as median [IQR] and compared with a Mann-Whitney U test. A P value < 0.05 was considered significant.

**Results and Discussion:** Results are summarized in Table 1

	Obese (n=18)	Non-obese (n=43)	P value
SAX (mm)	24 [8]	12 [5]	< 0.001
UAX (mm)	6 [3]	6 [1]	0.180
MAX (mm)	6 [3]	5 [2]	0.100
RAX (mm)	5 [1]	5 [1]	0.740
MCAx (mm)	15 [5]	13 [5]	0.050
SR (mm)	29 [8]	16 [4]	< 0.001
EQ	8 [1]	10 [1]	< 0.001

[Table 1]

SAx is significantly increased in obese. A deeper axillary artery probably explain the difficulty to precisely locate it and safely perform the block. SR and MCAx were also significantly increased in obese. These findings would advocate for the use of a longer needle than the commonly 50mm used for this purpose. Distances between other nerves and the axillary artery were similar in obese and non-obese patients, suggesting that difficulties in obese are not related to an unusual anatomic distribution of these nerves. EQ was significantly lower in obese.

**Conclusion:** Both the axillary artery and the radial nerve are deeper in obese than in non-obese patients and the musculocutaneous nerve is less close to the axillary artery. This sono-anatomic study provides a new insight on potential technical difficulties when performing an axillary block in obese and advocates for the use of longer needles in this setting.

#### References:

1. Hanouz J.L. et al. *Multiple injection axillary brachial plexus block: influence of obesity on failure rate and incidence of acute complications*, *Anesth Analg* 2010;11-1.

## 8AP2-5

### An unusual appearance of the three brachial plexus cords on the ultrasound view in the infraclavicular fossa

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**Background:** Anatomical variations of the brachial plexus cords in the infraclavicular level have been reported in the ultrasound studies and also were reviewed with the magnetic resonance imaging<sup>1,2</sup>. We present another rare anatomical variation of the cords position in their relation to the blood vessels. **Case report:** Ultrasound guided infraclavicular brachial plexus block was performed in 76 years old, ASA III, male patient scheduled for the vascular access surgery for the hemodialysis. As seen on the ultrasound view (Pic.1), the lateral and the posterior cords of the brachial plexus are "displaced" toward the medial part of the axillary artery- so, that together with the medial cord, they form "three leaflet flower", positioned between the artery and the vein. The image was captured after the injection of the local anesthetic solution.

**Discussion:** During the 4 years period (from October 2007 to October 2011) in our hospital we have performed more than 2500 ultrasound guided infraclavicular brachial plexus blocks. During several years before that we performed more than 4000 infraclavicular brachial plexus blocks using electric nerve stimulation technique. Performing coracoid approach to the brachial plexus with the aid of the nerve stimulator in very rare cases we saw all the variety of motor responses (electric current- 0.2 mA) appropriated to each of the three cords of the brachial plexus at the same needle position with slight deviation of the needle tip by tilting its proximal end. We can speculate that this stimulating pattern may be explained by the anatomical variation presented above, assuming that the needle tip was positioned in closed proximity to all three cords.

#### References:

1. Axel R. Sauter, Hans-Jørgen Smith, Audun Stubhaug, Michael S. Dodgson, and Øivind Klaastad

Use of Magnetic Resonance Imaging to Define the Anatomical Location Closest to All Three Cords of the Infraclavicular Brachial Plexus.

*AnesthAnalg* 2006; 103:1574-76

2. Øivind Klaastad, Finn G. Lilleås, Jan S. Rotnes, Harald Breivik and Erik Fosse

A Magnetic Resonance Imaging Study of Modifications to the Infraclavicular Brachial Plexus Block

*AnesthAnalg* 2000; 91:929 -33

**Learning points:** Recognition of the anatomical variations is one of the distinct advantages of the ultrasound guidance that can improve the accuracy of the local anesthetic injection and, as a result, the quality of the peripheral nerve block.

## 8AP2-6

### Ultrasound guided sciatic nerve block, in comparison of the neurostimulation during the popliteal sciatic nerve block: a randomized clinical trail

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**Background and Goal of Study:** We tested the hypothesis that ultrasound (US) guidance may be more accurate in localization and reduce the minimum effective anesthetic volume (MEAV50) of 0.5% ropivacaine required to block the sciatic nerve with a popliteal approach compared with neurostimulation (NS).

**Materials and Methods:** 60 ASA1-2 patients undergoing foot and ankle surgeries were randomly allocated to receive a popliteal sciatic nerve block with

either NS (n=30,group A) or US (n=30,group B). In the group A, the sciatic nerve was localized by ultrasound guidance between the tibial nervus and the common peroneal nerve with a popliteal approach. In the group B, the appropriate muscular response (foot plantar flexion or inversion) was elicited (1.0 mA, 2 Hz, 0.1 ms) and maintained to 0.3 mA. 0.5% ropivacaine was injected after localization, the times of puncture was recorded. The volume of the injected local anesthetic was varied for consecutive patients based on an up-and-down method, according to the response of the previous patient. The initial volume was 18 mL.

**Results and Discussion:** The MEAV50 of 0.5% ropivacaine for popliteal sciatic nerve block was 13.0 mL (95% confidence interval [CI], 11.3-14.9 mL) in Group A and 33.0 mL (95% CI, 31.4-34.7 mL) in Group B (P < 0.005). The times of puncture was (1.5+0.63) in Group A and (2.9+1.19) in Group B (P > 0.05). VAS score during puncture was (1.6+0.72) in Group A and (2.87+0.78) in Group B, there was no significant difference.

**Conclusion(s):** US provided a reduction in the MEAV50 of 0.5% ropivacaine and the times of puncture required to block the popliteal sciatic nerve compared with NS. There was no significant difference in the incidence of intraneural injection and pain of puncture.

## 8AP2-8

### Effects and complications of local anesthetic spread pattern during ultrasound-guided subgluteal sciatic nerve block: a prospective, randomized, double-blind study

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**Background and Goal of Study:** It is believed that local anesthetic (LA) injected to obtain circumferential spread around nerves produces a more rapid onset and successful blockade after ultrasound-guided peripheral nerve blocks. However, little evidence exists to demonstrate this point. In addition, there is concern regarding an increase in the possibility of causing nerve injury, especially when circumferential LA spread is aimed at blocking deep nerves. This is because the ultrasound images of these nerves are not always clear and the number of needle passes often increases. We conducted the present study to examine whether multiple injection of LA to make circumferential spread results in a more rapid onset and/or higher occurrence of complications after ultrasound-guided subgluteal sciatic nerve block as compared with a single injection technique.

**Materials and Methods:** Patients scheduled for knee surgery were enrolled in the study and were randomly divided into two groups to receive the ultrasound-guided subgluteal approach to the sciatic nerve block. In group M, 20 mL of 1.5% mepivacaine with epinephrine was injected to create circumferential spread around the sciatic nerve, for which there was no limitation on the number of needle passes. In group S, the number of needle passes was limited to one, and 20 mL of the LA solution was injected to create spread along the dorsal surface of the sciatic nerve. Sensory and motor blockade was assessed by double-blind fashion for 30 min after completion of the block. Complications were examined the next day and a month after the surgery.

**Results and Discussion:** Data from 40 patients were analyzed: 19 and 21 patients were in groups M and S, respectively. Patients in group M had a tendency to develop sensory and motor blockade more rapidly than those in group S on most of the aspects tested. For postlateral lower leg, the percentage of sensory blockade obtained in group M was significantly higher than that in group S 20 minutes after the block (p=0.021). No complication related to the nerve block was observed in either group.

**Conclusion:** When ultrasound-guided subgluteal sciatic nerve block is conducted, multiple injection of LA to make a circumferential spread around the sciatic nerve results in a more rapid onset of sensory blockade as compared with a single injection technique. The present study was unable to find any significant difference in complication rates between the two groups.

## 8AP2-10

### Postoperative neurologic symptoms analysis of ultrasound guided interscalene block for shoulder and upper extremity elective surgery

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**Background:** The incidences of postoperative neurological deficits after performing interscalene block (IEB) are 4% to 16% depending on the series. The objective of our study was to determine its incidence after ultrasound IEB localization.

**Material and Methods:** Since July 2009 all patients scheduled for elective shoulder surgery were followed up. After sonographic visualization of the

nerve trunks (C5-C6-C7) a 50 mm needle was inserted through-plane approach. Local anesthetic was administered under direct visualization of the distribution.

Data recorded were surgery characteristics and anesthetic incidences (paresthesia, pain on injection, intraneural spread, and intravascular injection). All patients were asked for neurological deficits at 7 days and at 3 months if positive. When symptoms persisted after 12 months a conducted neurological study was made to assess the degree of nerve damage.

**Results:** Data registered are shown in the table; 12 of 122 patients (9.8%) referred neurological symptoms at day 7 after surgery. Spontaneous resolution occurred in 8 patients, while symptoms persisted in 4 patients (3.2%) 12 months after surgery. The symptoms reported were a "tingling" sensation in the fingers and "numbness" in the hand and forearm. No patient had motor deficits or other symptoms of greater severity.

**Conclusions:** In comparison with published series the use of ultrasound for IEB doesn't decrease the incidence of neurological symptoms.

LEVEL OF BLOCK		TYPE SURGERY		CATHETER		ANESTHETIC INCIDENCES	
SUPRACLAVICULAR: 26 (21%)	INTERSCALE: 96 (79%)	ARTHROSCOPY 41 (34%)	OPEN SURGERY 81 (67%)	YES: 23 (19%)	NO: 99 (81%)	YES: 29 (24%)	NO: 93 (76%)
-Post- Approach: 78 (81%)							
-Ant-Approach: 16 (17%)							
-Others: 2 (2%)							

[Table 1]

## 8AP2-11

### Needle visibility in ultrasound guided regional anesthesia: a subjective and objective comparison of different regional block needles in two model tissue phantoms

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**Background and Objectives:** Visibility of Ultrasound (US) needles while performing a regional block is crucial to minimize complications associated with the procedure, which becomes more probable at steeper angles. The aim of the study was to compare the ultrasonic image of various commercially available needles at angles of 30°, 45° and 60° degrees in two different tissue equivalent phantoms, in an attempt to determine the more echogenic needles and therefore better visualized with the ultrasound device.

**Materials and Methods:** We tested needles commonly used in our everyday work for regional block procedures as well as lumbar puncture needles between 18-22G. Two different media were used, a Blue phantom and a Cadaveric phantom. At different degree angles (30°-45°-60°) for all needles and the bevel facing the transducer, images were obtained using a Sonosite S Series™ ultrasound device.

Afterwards we used the Sonosite Enhanced Needle Vision Software, which allowed us to improve needle echogenicity while performing the procedure (software also available for clinical use). Quality of the needles visibility before and after the enhanced software were compared using a Visual Scale from 0 to 3 (subjectively) and by measuring with a computer Photoshop software (objectively) pixel intensity of the needle and the immediate surrounding. Indirect echo graphic signs (artefacts, shadows) were also taken into account when subjectively comparing needles.

**Results:** Echogenicity of needles was significantly increased (subjectively and objectively) in the Blue phantom and at shallow angles for all needles tested. Images obtained with a cadaveric phantom resembled those in live human tissue.

However, quality of the image was lower and needle visibility worsened at steeper angles (45° or more) as well as in the cadaveric tissue model, when compared to the images obtained at shallow angles.

Even so, we were able to describe echogenic differences among the different needles. When the Sonosite Enhanced Software was used, needle echogenicity improved substantially, both subjectively and objectively, for all needles and at every angle.

**Conclusion:** Quality of the needle and its echogenicity at steeper angles are crucial at the time of the procedure. We were able to establish that for most needles, the deeper the angle the more hypoechoic they become. For this reason, we believe that needle echogenicity still needs to be optimized to improve success and minimize related complications.

## 8AP3-1

### Comparison of unilateral spinal anaesthesia and popliteal sciatic nerve block in the elderly undergoing transmetatarsal amputation

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**Background and Goal of Study:** Both unilateral spinal anaesthesia (USA) and popliteal sciatic nerve block (PB) are effective anaesthetic techniques for ankle and foot surgery. In this study we compared hemodynamic data, pain scores and side-effects of USA and PB in elderly patients undergoing transmetatarsal amputation.

**Materials and Methods:** Thirty ASA II-III randomly assigned patients (70-86 years) received either USA (n=15) or PB (n=15), each under standardized protocols. USA was performed in the lateral position with operative side down maintained for 15 minutes following spinal injection of 6 mg of hyperbaric bupivacaine (0.5%). PB was performed in the prone position (posterior approach), using periferal nerve stimulator and 10 ml of lidocaine (2%) and 30 ml of levobupivacaine (0.5%) were administered following sciatic nerve localization with a current of 0.2 - 0.4 mA (0.1 ms). Postoperatively, rescue analgesic drug (tramadol 50 mg iv) was given on patient request or when VAS score was  $\geq 3$ . Hemodynamic data, pain scores (VAS 0-10) at 2, 4, 8, 12, 18 and 24 hours after surgery, time to first analgesic and side-effects were recorded. T-tests, Main-Whitney U test and Fisher's exact test were used,  $P < 0.05$  was considered statistically significant.

**Results and Discussion:** Demographic data, ASA status, operation time and start value of systolic arterial pressure (SAP) and heart rate (HR) were comparable between the groups. Surgical anaesthesia was achieved in all 30 patients. Maximum decrease of baseline SAP was  $21 \pm 9\%$  in USA and  $5 \pm 3\%$  in PB group,  $P < 0.01$  and of HR  $12 \pm 7\%$  and  $10 \pm 5\%$ ,  $P > 0.05$ , respectively. Pain scores at 2, 4 and 8 hours after surgery were 2 (0-6), 4 (1-8) and 5 (2-9) in USA group and 0 in PB group,  $P < 0.01$ . Pain scores at 12, 18 and 24 hours after surgery were 5 (1-8), 4 (0-7) and 4 (0-6) in USA group, and 3 (0-6), 4 (0-8) and 3 (0-5) in PB group, respectively,  $P > 0.05$ . Time to first analgesic was  $188 \pm 83$  min in USA and  $653 \pm 110$  min in PB group,  $P < 0.001$ . No postdural puncture headache, neurological complications or vomiting were noted.

**Conclusion(s):** Popliteal sciatic nerve block provided more stable hemodynamic profile and better postoperative pain control than unilateral spinal anaesthesia in elderly patients undergoing transmetatarsal amputation.

## 8AP3-2

### Combined spinal-epidural anaesthesia with sedation for orthoplastic free gracilis flap surgery with duration of over eight hours: review of 10 successful cases

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**Background:** Epidural blockade is advocated for free gracilis flap (FGF) surgery. Traditionally, long duration of orthoplastic surgery for lower limb osteomyelitis (LLOM) requiring FGF dictates addition of general anaesthesia (GA). Since 2007 we have performed these procedures under neuraxial anaesthesia and sedation (Sed) alone. We review cases over 8-hour duration performed under Combined Spinal-Epidural Anaesthesia (CSEA) + Sed.

**Case reports:** We identified 25 patients who were either offered or requested CSEA for LLOM +/- FGF 15 procedures took over 8hrs. Of those, one did not require a FGF and 4 required conversion to GA. Reasons for conversions included shivering in the anaesthetic room, incomplete epidural block, revealed when spinal anaesthesia wore off, and intraoperative bradycardia and hypertension. Medical records and perioperative interviews of the 10 successful CSEA patients were reviewed in detail. The median duration of the procedures was 555min (505-750min). 5 of them had risk factors for perioperative hypoxic events. Spinal anaesthesia was provided with bupivacaine with fentanyl, followed by epidural bupivacaine infusion and boluses when required. Sedation was provided with target-controlled infusion of propofol +/- ketamine, and increments of midazolam and/or fentanyl if required. Of the 10 patients, 3 required small boluses of ephedrine to treat hypotension. Acid-base physiology, monitored regularly by arterial sampling, was within normal limits for all patients.

There were no intraoperative hypoxic episodes or positional injuries. On arrival to the High-Dependency Unit, 8 patients had pain scores of 0 (Scale 0-10); no record was available on the other 2. Epidural analgesia was continued postoperatively. All flaps were successful. CSEA+Sed was well tolerated by patients, with positive intra- and postoperative feedback.



**Learning points:** CSEA+Sed for lower limb orthoplastic procedures can avoid a lengthy GA and GA-related adverse events compromising FGFs, and ensure patients' faster recovery. Need for GA can be reduced if epidural anaesthesia is used instead of CSEA. Close team work between patients, surgeons and anaesthetists is crucial for success.

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### 8AP3-3

#### Comparison of unilateral and conventional spinal anaesthesia during percutaneous nephrolithotomy

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**Background and Goal of Study:** Spinal anaesthesia is often used during percutaneous nephrolithotomy, it provides effective level of anaesthesia and a muscular relaxation. However the anaesthesia area at such operations is obviously superfluous. The arterial hypotension is almost inevitable at percutaneous nephrolithotomy as during action of sympathetic blockade there is a change of operational position from lithotomycal to prone position. At conservation of quality of anaesthesia, the unilateral technique is capable to reduce frequency of hemodynamic reactions. In this pilot study, we compared unilateral and conventional spinal anaesthesia during percutaneous nephrolithotomy.

**Materials and Methods:** 50 ASA I - III patients were randomized for 2 groups. The patients of the 1<sup>st</sup> group (n = 25) were spent Unilateral Spinal Anaesthesia by a hyperbaric solution bupivacaine (0.05 mg per 1 sm of height). The patients of the 2<sup>nd</sup> groups (n = 25) were spent conventional Spinal Anaesthesia by a hyperbaric solution of bupivacaine 12 - 18 mg. In the 1<sup>st</sup> group bupivacaine was entered in position on the operation side, such position remained within 15 minutes after anesthetic introduction. We estimated hemodynamic indicators, prevalence of the sensory block (pinprick), and expression of the motor block (Bromage scale). For an estimation of the patient satisfaction we used visual analog scale.

**Results and Discussion:** Groups were comparable on all parameters except anaesthesia. Mean level of sensory block T7 in the 1<sup>st</sup> group and T8 in the 2<sup>nd</sup> group. The difference in expression of the motor block was doubtful. Frequency of a hypotension was above in the 2<sup>nd</sup> group (32 % against 12 % in the 1<sup>st</sup> group) Necessity of introduction of vasopressors in the 2<sup>nd</sup> group was higher (20 % against 8 % in the 1<sup>st</sup> group).

**Conclusion(s):** Unilateral anaesthesia provides the sufficient sensory and motor block for percutaneous nephrolithotomy and accompanied by larger duration of anaesthesia and smaller frequency of an arterial hypotension.

### 8AP3-4

#### Complications of single-shot spinal anaesthesia: operator experience and patient anatomy

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**Background and Goal of the Study:** Spinal anaesthesia is a safe and effective anaesthetic technique. Major complications are rare, however, minor complications such as failed puncture, non-sufficient or ineffective spread of local anaesthetics, bloody taps and post-procedural headaches range between 1 and 17%.

In this clinical study we investigated the influence of operator experience and the individual patient's anatomy on the incidence of complications during spinal anaesthesia.

**Methods:** After approval by the Ethics Committee (University of Muenster; protocol 2009-459) patients undergoing elective procedures of the lower limb under spinal anaesthesia were prospectively included in the study. Individual anatomy was evaluated by an experienced anaesthesiologist based on landmark and "eyeballing" techniques. Operators were grouped according to their experience. Number of punctures, changes of spinal segments, bleeding from the introducer or spinal needle, amount of blood in cerebrospinal fluid as well as the duration of the procedure was noted.

Furthermore, paraesthesia, pain during puncture, haemodynamic changes as well as spread of spinal anaesthesia were investigated. All patients were followed up on day 1 and interviewed regarding their individual experience, pain, nausea and post puncture headaches.

**Results and Discussion:** 161 patients were included in the study. Operators with  $\leq 1$  year experience required significantly more time, number of punctures and changed spinal segments significantly more often than operators with  $\geq 5$  years experience. Total failure rate was 17% in the group of less experienced vs. 0 in the experienced operator group. If patients had a difficult anatomical habitus (e.g. landmarks difficult to palpate) the failure rate of spinal anaesthesia in the group of inexperienced operators increased to 48%. Furthermore, there were significantly more bloody taps in the inexperienced operator group. Haemodynamic changes were independent of operator experience. No major complications were observed during the study period.

**Conclusion:** Spinal anaesthesia is a safe and simple procedure and can be performed by trainees with a relative good safety and success rate. However, if the patient has a challenging anatomy (such as morbid obesity or scoliosis) the failure rates of the inexperienced operators increase significantly as compared to the group of experienced operators.

### 8AP3-5

#### Quality of intrathecal isobaric ropivacaine vs isobaric bupivacaine anaesthesia in elderly patients scheduled for orthopaedic surgery

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**Background and Goal of Study:** Data regarding intrathecal isobaric ropivacaine administration in elderly patients are still limited to date. One study showed that 15 mg ropivacaine was ineffective for lower urologic endoscopic procedures [1].

Aim of the present study was therefore to compare the efficacy and side-effects of intrathecal isobaric ropivacaine compared to isobaric bupivacaine in elderly patients.

**Materials and Methods:** Prospectively, 80 elderly patients, ASA II and III, scheduled for orthopaedic surgery, were randomly assigned to blindly receive either 15 mg of isobaric ropivacaine (n=40) or 10 mg of isobaric bupivacaine (n=40) over 30 s through a 25-G Quincke needle at the L4-5 level. Onset and duration of sensory anaesthesia, motor blockade, duration of post-operative analgesia and haemodynamics were recorded. Statistics was with one-way ANOVA and chi<sup>2</sup>, as appropriate.

**Results:** No early or delayed complications were detected. Data (means  $\pm$  SD) are shown in the table below.

Variable	15 mg Ropivacaine	10 mg Bupivacaine	P
Supplemental intra-operative analgesia (n)	4 /40	2 / 40	NS
Peak Sensory Level:	Th10 $\pm$ 1.7	Th8 $\pm$ 1.3	< 0.05
Time of sensory block to:			
(a)Th10 (min):	104.5 $\pm$ 11.7	152.6 $\pm$ 14.7	< 0.001
(b)Th12 (min):	116.3 $\pm$ 19.2	174.5 $\pm$ 12.1	< 0.001
Onset of motor block (min) Bromage-3:	18.1 $\pm$ 6.1	16.6 $\pm$ 4.3	NS
Duration of motor blockade (min):	84.7 $\pm$ 17.8	107.3 $\pm$ 13.2	< 0.001
Duration of post-op Analgesia (VAS:30 mm) (min):	158.7 $\pm$ 18.8	191.2 $\pm$ 13.4	< 0.001

[Characteristics of intrathecal anaesthesia]

**Conclusions:** Although no supplemental intrathecal opioids were administered together with isobaric ropivacaine or bupivacaine, the intra-operative quality of anaesthesia was good in this patient population. Furthermore, intrathecal ropivacaine in a dose 50% higher than bupivacaine, produced significant lower cephalad spread of sensory block, which might be of value in elderly patients undergoing orthopaedic procedures.

Additionally, we found that the duration of motor block after intrathecal isobaric ropivacaine was more than 60% less in this population compared to others [2]. However, intrathecal isobaric ropivacaine produced a shorter duration of sensory and motor block and postoperative analgesia, respectively.

Finally, and in contrast to previous findings [1], the quality of intra-operative anaesthesia in orthopaedic surgery was similar in both groups of elderly patients.

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### 8AP3-6

#### Effect of injection speed on hypotension associated with spinal anaesthesia for orthopedic surgery in elderly patients

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**Background and Goal of Study:** The purpose of this prospective, randomized study was to compare the influence of injection speed of local anesthetic on hemodynamic parameters in case of spinal anaesthesia in elderly patients.

**Materials and Methods:** Sixty-one patients, aged  $\geq 65$  years, II - III ASA status, undergoing orthopedic surgery under spinal anaesthesia were allocated randomly to three groups according to speed of intrathecal injection: group 1 (LS, 20 patients) - 150 ml/hour speed - low speed, group 2 (VLS, 20 patients) - 75 ml/hour speed - very low speed and group 3 (C, 21 patients) - control group.

In first two groups we use a syringe pumps for injection, using bolus function, adapted to the spinal needle; in the control group we injected manually. Time of injection in the LS group was between 72 and 96 seconds and in VLS group between 144 and 198 seconds. In the C group the mean injection time was 40 seconds. We use isobaric bupivacaine 0.5% with sufentanyl as anesthetic agent, in usual doses. We recorded blood pressure (BP) before spinal anaesthesia (baseline, after premedication) and 30 minutes after, every 5 minutes, and we defined a decrease of 30% of BP, in relation with baseline value, as hypotension. We excluded patients with previous hypotension (systolic BP at baseline below 120 mmHg).

**Results and Discussion:** Mean value of systolic BP before spinal anaesthesia in LS group was  $150.07 \pm 26.98$  mmHg (CI 95% - 13.1), in VLS group  $146.5 \pm 24$  mmHg (CI 95% - 13.99), and in C group  $150.8 \pm 19.4$  mmHg (CI 95% - 8.18). Mean value of systolic BP after spinal anaesthesia in LS group was  $115.07 \pm 20.58$  mmHg (CI 95%-10.42), in VLS group  $121.92 \pm 18.5$  mmHg (CI 95%-10.47), and in C group  $103.47 \pm 16.16$  mmHg (CI 95%-9.86). In the first two groups we had 8 episodes of hypotension (40%), respectively 3 episodes (15%). Mean ephedrine use was 6 mg/ patient in the first group, respectively 4 mg/ patient. In C group we had 11 episodes of hypotension (52.5%), with a significant higher use of vasopressor - 16.2 mg ephedrine/patient (all patients required ephedrine between 10 to 30 mg; p value - 0.00036).

**Conclusion:** Low speed of injection reduces the incidence and severity of hypotension during orthopedic surgery under spinal anaesthesia and the need of vasopressor agent. The use of syringe pumps for injection in this setting is relatively complicated in usual practice, but allows very low speed of injection, with constant rate of local anesthetic administration.

### 8AP3-7

#### Peripheral neuronal blockade versus spinal anaesthesia in lower limb surgery: patients' perspective

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**Background and Goal of Study:** No clear consensus exists with regards to the superiority of one over other loco-regional anaesthesia techniques for lower limb surgery. Patient satisfaction, an important outcome measurement to improve our anaesthesia care, may influence the decision to adopt a certain technique. The aim of our prospective study was to investigate the patients' preferred method for locoregional anaesthesia.

**Materials and Methods:** Over three years period, we studied patients who experienced both types of regional anaesthesia: spinal anaesthesia (SA) and lower limb peripheral neuronal blockade (PNB) for lower limb surgery procedures (orthopedic, plastic and vascular). All the patients full field a questionnaire which included: preoperative anxiety, discomfort during the anaesthesia procedure, intraoperative discomfort, early and late postoperative pain, postoperative nausea and vomiting, early mobilization, drug related adverse effects, quality of perioperative care, choice of future anaesthesia in case of a new surgery, overall satisfaction. The results were statistically analyzed.

**Results and Discussion:** We collected data from 132 patients with 25 patients (19%) having more than two regional anaesthesia. We found no difference between SA and PNB for the level of preoperative anxiety (higher for the first intervention no matter the type of anaesthesia), quality of perioperative care, perioperative discomfort, early postoperative pain, postoperative nausea and vomiting, drug related adverse effects, overall good level of satisfaction. PNB was superior to SA for late postoperative pain control ( $p < 0.05$ ). In case of new intervention, 80 (60%) patients will choose PNB instead of SA.

**Conclusion(s):** Although both types of anaesthesia provide excellent patient satisfaction, patients who require multiple lower limb surgery are in favor for PNB. Factors predictive for this choice are the experience of better pain con-

trol. Supplementing SA with analgesic nerve blocks we may improve the quality of pain control.

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### 8AP3-8

#### The effect of lateral table tilt on lumbar interspinous distance width during sitting posing for spinal anaesthesia

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**Background and Goal of Study:** To identify the anatomical landmarks for successful spinal block, it may be a challenge and inaccurate in some patients. Therefore, this case-control clinical study was conducted. The ultrasound imaging was used to compare between the maximum spinal processes interspace width during the sitting position on either a flat operating table or after inducing 30° lateral tilt towards the operating anaesthetist.

**Materials and Methods:** Thirty four adult volunteers were enrolled in this study. Exclusion criteria were participants under 18 years, pregnancy, body mass index less than 25 and inability to maintain sitting position for spinal anaesthesia. The maximum interspinous space width at L4-L5 and L5-S1 levels (the distant between the relevant two successive spinous processes) was measured during the sitting position while the operating table was manipulated to be either in the flat classical pose or inducing 30 degrees lateral tilt towards the anaesthetist. The measurement was performed using the Sonosite ultrasound machine in mms. All ultrasound images were reviewed and confirmed with an experienced radiologist.

**Results and Discussion:** There were significant increases in the spaces between L5-S1 and L4-L5 spinous processes ( $P < 0.001$ ); with a mean change of 21% at L5-S1 and 35.4% at L4-L5 spaces. This increase had a strong positive correlation to the independent space itself ( $P < 0.001$  with L5-S1 and 0.002 with L4-L5 spaces). The amount of changes at each level was not significantly correlated to the height and waist circumference of the participants. In the present study, the authors focused on changing the table position and not patient's position by tilting the table 30 degree towards the anaesthetist while the patient is in sitting position which pushed the patient to lean forward involuntarily to protect himself from falling; (patient was supported by an assistant and protected from falling); and this action lead to widening of the lower lumbar vertebral interspace and relaxed the para-spinal muscles.

**Conclusion(s):** Thirty degrees lateral tilt of the operating table towards the anaesthetist during sitting positioning for spinal anaesthesia is a feasible technique to widen the intervertebral space which may ease the access to epidural and subarachnoid space.

### 8AP3-9

#### The continuous spinal - an effective technique for major surgery?

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**Background and Goal of Study:** There are an increasing number of patients with serious morbidities who undergo major surgery. There are concerns with both their intra-operative stability and post-operative care, especially with the pressure on level 3 beds in our hospitals increasing. It is often the anaesthetist who must look to their techniques to aid their surgical colleagues to provide stability and early recovery. The prospective audit was carried out to evaluate the efficacy and side effect profile of the continuous spinal block technique in vascular and non-vascular surgery.

**Materials and Methods:** 105 completed audit forms were analysed, evaluating the type of surgery, ASA grading, length of catheter in the sub-arachnoid space, volume of local anaesthetic given, sensory level achieved, cardiovascular stability and the incidence and management of post dural puncture headache. All patients were followed for two days post-op.

18G Tuohy needle was use to detect epidural space and to place 20G spinal catheter in the lumbar subarachnoid space. Loss of resistance to air was use to detect epidural space. One ml syringe was use to puncture dura to minimise loss of cerebrospinal fluid. A maximum of 25mcg of fentanyl and 1.5mls of heavy 0.5% bupivacaine was injected into the space. All patients were given infusion of propofol and remifentanyl for sedation.

**Results and Discussion:** 80% of the cases involved major vascular surgery. Six of the patients had severe aortic stenosis. 5 patients required spinal top-

ups varying from 0.25 - 0.5ml of 0.5% bupivacaine. 2 patients suffered with PDPH and these resolved with conservative management.

**Conclusion(s):** It was noted on scrutiny of the data that all patients remained haemodynamically stable, other than the 2 PDPH cases there were no significant side-effects noted. Patients were sedated with a propofol and remifentanyl infusion and this meant that even long procedures were well tolerated.

## 8AP4-1

### Long thoracic nerve block in video assisted thoracoscopic surgery (VATS) for pneumothorax wedge resection

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**Background and Goal of Study:** Contraction of serratus anterior muscle (SAM) irritates damaged intercostal muscles and itself, and aggravates the pain after video assisted thoracoscopic surgery (VATS). We hypothesized that the relaxation of SAM by long thoracic nerve (LTN) block could help the pain relief after VATS for pneumothorax wedge resection.

**Materials and Methods:** The patients were randomly assigned to control group or block group from among patients undergoing VATS for pneumothorax wedge resection. Before anaesthesia induction, the patients in block group received a single injection of LTN block. The pain were evaluated using visual analogue scale (VAS) at before anaesthesia induction (T0), arrival at postanesthetic care unit (PACU) (T1), every 10 minutes after arrival at PACU for 30 minutes (T2, T3 and T4), and 1 hr and 24 hr after discharge from PACU (T5 and T6). PACU stay and total amounts of the bolus dose of patient controlled analgesia (PCA) were measured.

**Results:** VAS at T0 and T6 was similar between two groups but VAS from T1 to T5 in block group was significantly lower than control group (T1: 36 ± 11 versus 48 ± 14, T2: 36 ± 11 versus 51 ± 15, T3: 35 ± 10 versus 52 ± 15, T4: 30 ± 7 versus 45 ± 17 and T5: 26 ± 5 versus 32 ± 5). PACU stay in block group was significantly shorter than control group (30 ± 14 minutes versus 54 ± 23 minutes). Total amounts of the bolus dose of PCA during PACU (1.6 ± 1.2 ml versus 3.9 ± 2.0 ml) and during 1 hr after discharge from PACU (0.5 ± 0.8 ml versus 1.7 ± 1.2 ml) in block group were significantly lower than control group but total amounts of the bolus dose of PCA from 1 hr after discharge from PACU to 24 hr after discharge from PACU (1.6 ± 1.4 ml versus 1.1 ± 1.3 ml) were similar in two groups.

**Conclusion(s):** LTN block could reduce the pain after VATS for pneumothorax wedge resection and PACU stay.

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## 8AP4-2

### Stand-alone regional anesthesia service increases nerve block procedural volume in an academic hospital

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**Background and Goal of Study:** Successfully placing peripheral nerve blocks without delays in operating room turnover time is imperative. A successful regional anesthesia (RA) service requires faculty with advanced RA and ultrasound training and improves postoperative analgesia and reduces post anesthesia recovery time and length of hospital stay. Hospitals are constrained to improve productivity and efficiency while maintaining high levels of patient safety and satisfaction. Parallel processing of ambulatory surgical patients reduces anesthesia induction and room turnover times allowing an increase in case load without expanding hospital budgets. We report a stand alone RA service functioning parallel to the operating room increases RA procedural volume in an academic center.

**Materials and Methods:** Monthly upper and lower extremity nerve block procedural volumes were audited over a 7 month period from September 2010 to March 2011. The monthly total and individual nerve block procedures performed during intervals before and after the RA service began operation were compared.

**Results and Discussion:** The total number of nerve blocks performed in the 4 month period prior to operation of the RA service and in the following 3 month period increased from 327 to 702. Upper extremity nerve blocks increased from 40 to 144 and lower extremity nerve blocks increased from 266 to 422. Uncategorized nerve blocks increased from 21 to 144.

**Conclusion(s):** The increased volume of nerve block procedures performed in the presence of an RA service can be due to several reasons. Increased operating room personnel dedicated to RA and increased preoperative patient

counseling regarding RA is one possibility. Sampling error due to reduced seasonal surgical caseload may explain the lower volume of RA procedures in the interval prior to the RA service operation. Lack of adequate documentation for other uncategorized nerve blocks prevented these procedures from being attributed to either upper or lower extremity categories.

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## 8AP4-3

### Use of propofol sedation for peribulbar anaesthesia - recall evaluation and safety

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**Background and Goal of Study:** In our hospital, we routinely use peribulbar block (BPB) for cataract surgery. The main patients concern is the injection site, and many types of sedation are used to reduce anxiety and improve acceptance of this technique. The use of a small dose of propofol, combining the advantages of adequate sedation, postoperative amnesia, antiemetic properties and rapid emergence, allows its use in short procedures. It has the additional benefit of lowering intraocular pressure. Our goal was to evaluate the efficacy and safety of a sub-anaesthetic dose of propofol in reducing patient recall of the BPB.

**Materials and Methods:** A prospective analysis of 64 patients scheduled for cataract extraction submitted to BPB anaesthesia. It's our current practice to use 1mg of midazolam and 1g of paracetamol 10 minutes before the BPB. Patient's vital signs were monitored with pulse oximetry and blood pressure measurements.

We divided them in 2 groups: Group 1 - using an IV bolus of 20mg propofol to provide extra sedation during the BPB and Group 2 - using only our usual sedation protocol. After the surgery, we assessed the efficacy of the sedation on patient's recall of the BPB performed earlier.

#### Results and Discussion:

	Group 1	Group 2
Number of patients	41	43
Age (years) *	78,7 (14)	76,2 (12)
Weight (kgs) *	67,1 (20)	64,3 (18)
Male:Female (in number)	17:24	20:23
ASA's physical status (II:III) (in number)	26:15	24:17
Pain reported during BPB (%)	0	12
Recall (%)	34,1	69,8
Willing to repeat the anaesthesia in future (%)	92,7	86,0
PACU-discharge time (in min) *	52 (8)	62 (6)

[Demographic Data and Results]

\* - results expressed as mean (SD)

There were no demographic differences between groups. Our results show that with the addition of propofol, there's less recall and pain associated with the anaesthesia, with faster discharge time. This technique was very satisfactory, as 93% of the patients would repeat the anaesthesia if they had to be operated again (versus only 86% in the group 2).

**Conclusion(s):** The efficacy and safety of our method was excellent, as our results show that a sub-anaesthetic dose of propofol before the BPB is effective in reducing recall with reduced pain and discomfort during the technique, with a faster discharge time; an extra advantage, is that many of these patients are likely to return for surgery in the other eye.

## 8AP4-4

### Meralgia paresthetica after total hip arthroplasty in supine position: what an anesthesiologist should know

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**Background:** Meralgia paresthetica is a mononeuropathy often caused by compression of the lateral femoral cutaneous nerve (LFCN) as it crosses between the anterior superior iliac spine (ASIS) and the inguinal ligament. Only a few cases are reported in the literature related to prone<sup>1</sup> and lateral<sup>2</sup> decubitus position during surgery. To our knowledge, there are no reported cases in supine position related to stops or supports placed to prevent the movement

of patients on the operating table.

**Case report:** We present the case of a 63 year-old woman who underwent a right-hip surgery under spinal anaesthesia without incidents. After two hours of surgery she was transferred to the resuscitation unit. Postoperative period was uneventful except for unpleasant paresthesia and a burning sensation over the anterolateral left thigh innervated by the LFCN.

**Discussion:** Diagnosis of meralgia paresthetica is based on an appropriate clinical examination. The patient's symptoms were typical. It was important to exclude a neurological complication caused by spinal anaesthesia which often manifests itself as a radiculopathy. Pain in radiculopathy often follows the dermatome distribution of the affected nerve root with sensory disturbance, paresis or plegia and hypo-or areflexia.

In our case, the electromyography studies revealed no reflex or motor deficit indicative of the involvement of other nerves. The surgical procedure could not be the cause because the affected side was the opposite to the one operated on. The patient was diagnosed with the LFCN entrapment neuropathy, possibly caused by the pelvic bolster or support placed on the left side during surgery in supine position to avoid movement on the operating table.

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**Learning points:** The position-related meralgia paresthetica is not uncommon and the anaesthesiologist should be aware of its existence. Careful positioning is required to avoid pressure over the ASIS intraoperatively. This includes correct position of points of support and cushioning. An exhaustive clinical and neurological examination is important to exclude any neurological complications due to regional anaesthesia or the surgery performed.

## 8AP4-5

### Regional analgesia in the emergency department for hip fractures: survey of current UK practice and its impact on developing the service in a teaching hospital

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**Background and Goal of Study:** Whilst the benefits of regional analgesia (RA) for preoperative pain relief in hip fracture (HF) in elderly patients are well recognised, this service is yet to be established in many UK Emergency Departments (EDs). To facilitate its development in our teaching hospital with approximately 500 HF admissions per year, we set out to discover how widely RA is adopted in the UK EDs.

**Materials and Methods:** In April-July 2010, prior to the UK guidelines<sup>1</sup>, we conducted a postal survey of 218 UK EDs, followed up with fax reminders for non-respondents.

**Results and Discussion:** A total of 147 (67%) EDs completed the survey. 65 (44%) of respondents reported use of RA blocks for HF. The commonest stated reasons for not using RA were lack of trained staff (36%) or appropriate equipment (22%). In 64 (84%) EDs RA blocks were performed by ED doctors, in 7 (11%) - by anaesthetists and only in 4 (5%) - by non-physicians. RA users practiced femoral nerve block most widely (60% of EDs), fascia iliaca block (22%) or both (12%) & 3 in 1 block (6%). The landmark technique was most popular, used in 43 (66%) EDs; landmark +/- PNS was used in another 7 EDs (11%); ultrasound +/- peripheral nerve stimulator - in 28 ED (43%). A mixture of lignocaine and bupivacaine was used in 38 (58%) EDs, bupivacaine in 20 (31%) and levobupivacaine in 7 (11%). 100% of current RA users replied that they intended to continue using RA for the foreseeable future.

It is more a lack of trained staff and suitable equipment that prevents RA blocks being widely adopted. Fascia iliaca compartment block (FICB) is advocated in HF patients<sup>2</sup>, and can be a safer and easier landmark-based block to perform for ED doctors.

Our survey instrumented multidisciplinary consultation and development of a protocol for preoperative FICB in HFs in our hospital ED, followed by a period of training and competency attainment amongst senior ED doctors in order to provide better care for patients.

**Conclusions:** The survey showed that RA for HFs is currently used only in 44% of UK EDs and the practice has to improve. The finding that RA blocks are performed by the ED medical staff in 84% of EDs was reassuring for developing the service in our hospital.

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## 8AP4-6

### Brachial plexus block provides better hemodynamic stability in hemodialysis patients undergoing arteriovenous shunt surgery

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**Background and Goal of Study:** Both regional blocks and general anaesthesia can be used in arteriovenous shunt surgery [1,2]. The purpose of this study is to determine how the anesthetic technique influence perioperative outcomes in arteriovenous (AV) shunt surgery.

**Materials and Methods:** Retrospective review anesthetic records of 60 hemodialysis patients undergoing AV shunt surgery. Patients were allocated into GA group (general anesthesia with volatile anesthetics) and RA group (regional anesthesia with ultrasound guided brachial plexus block). The demographic data, anesthetic parameters (intravenous, inhalational anesthetics, narcotics, inotropics), intraoperative hemodynamics (blood pressure, heart rate, oxygen saturation) and postoperative recovery were all recorded.

**Results and Discussion:** RA group depicted better hemodynamic profile than GA group. There was no significant difference in HR for each group during anesthesia. In each group MAP decreased after anesthesia. This decrease was significant in GA group from 5th minutes to end of surgery ( $p < 0.05$ ). In GA group, more patients required hemodynamic support with inotropic agent ( $p < 0.01$ ). Postoperative pain intensity was significantly lower in RA group than GA group ( $1.1 \pm 1.9$  vs.  $3.7 \pm 3.3$  in group R,  $p < 0.01$ ). Patients required postoperative analgesics less frequently in RA group than GA group (3/30, 10% vs. 12/30, 40%,  $p < 0.001$ ). Although whether regional block provides less early AV shunt failure than general anesthesia was still remained debate, the advantage in terms of perioperative hemodynamics and postoperative pain control was significant.

**Conclusion(s):** Ultrasound guided brachial plexus block provides better hemodynamic stability and reduces postoperative pain in hemodialysis patients undergoing arteriovenous shunt surgery than general anesthesia.

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## 8AP4-7

### Parsonage-Turner syndrome diagnosis after humerus orthopedic surgery and interescalenic block

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**Background:** The Parsonage-Turner Syndrome (PTS) is a brachial neuritis that has to be included in the differential diagnosis of any kind of sensitive and motor extended block.

**Case report:** A 56 years old male, without any pathological antecedent, was scheduled for humerus osteosynthesis. An interescalenic block was performed under ultrasound vision. 25milliliters of Bupivacain 0'375% have been administrated without incidences.

24hs after the surgery the patient still presented arm weakness and pain in the shoulder. A Magnetic Resonance Imaging carried out and it did not show any acute lesion; Instead, the Electromyography showed sensitive and motor involvement being compatible with brachial polyneuritis.

After 14 days of motor and sensitive weakness an immunologic study was performed coming out positive on anti-mitochondrial antibodies. Immunoglobulin treatment was started and clinical improvement was shown during following months.

**Discussion:** PTS is a rare illness with an unknown etiology and an immunological pathogenesis. Surgery, trauma or exhausting exercise could be predisposing factors.

The diagnosis is based on the appearance of a sudden and severe shoulder and upper arm pain, paralysis and amyotrophy. Radial nerve is the main affected.

In conclusion, it is interesting that anesthetists include the PTS in the differential diagnoses of brachial plexus neuropathies because it supposes a different diagnostic and clinical approach.

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## 8AP4-8

### An ultrasound-guided study with the infraclavicular block to determine the Minimal Local Anesthetic Volume (MLAV) of 2% lidocaine with epinephrine

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**Background and Goal of Study:** The use of ultrasound to realize regional anesthesia allows both direct visualization of neural and vascular structures with their close relationship and exact injection of the local anesthetic solution (LA), with reduction of the injected volume, increased safety and efficiency. The Minimal Local Anesthetic Volume (MLAV) is the minimal dose needed to submit 50% of patients to a surgical procedure. For a LA, it's considered as the ED<sub>50</sub> for intravenous agent. A similar analysis allows to determine the MLAV<sub>95</sub>, which is the minimal dose required to obtain efficient blockade in 95% of patients. Actually MLAV for a 2% lidocaine solution with 1:200000 epinephrine (2LidoE) is unknown for ultrasound-guided infraclavicular block (US-ICB). The aim of our study was to determine, using the "up and down" Dixon method, the MLAV for 2LidoE in the case of an US-ICB.

**Materials and Methods:** Thirty-one patients scheduled for day-case surgery of the upper extremity underwent an US-ICB after they gave their enlightened consent. We have collected epidemiologic, anesthetic and vital parameters, as well as the onset time of the US-ICB, the analgesic requirement time and the potential complications or side effects. The starting volume was 30ml of 2LidoE, with a decrease or an increase of 2ml for the following patient according to the successful or unsuccessful previous US-ICB. Results are expressed as mean ± SEM. The MLAV 50 and MLAV95 were respectively determined by linear and logistic regression. A  $p < 0,005$  was considered as statistically significant.

**Results and Discussion:** Results are expressed in the table below.

Parameters	Values (CI 95)
Age (years)	52±15 [33-84]
Sex ratio (M/F)	12/19
BMI (kg.m-2)	25.5±4.1 [17.0-38.1]
ASA status	I : 15 II : 13 III : 3
Onset time (min)	13±4 [5-20]
Side effects	9 (additional block) 1 (general anesthesia)

#### [Patients characteristics]

Using the Dixon method, the 2LidoE MLAV<sub>50</sub> for US-ICB is 10.54ml (9.30-11.78). Using the logistic regression analysis, both MLAV<sub>50</sub> and MLAV<sub>95</sub> are 9.32ml (2.61-19.23) and 19.34 (11.13-307.17) respectively.

**Conclusion(s):** The US-ICB is a really safe and efficient technique for regional anesthesia of the upper extremity. The use of ultrasound allows a decrease of LA injected volume, according to some published data. This can durably improve the patient safety without onset time impairment.

## 8AP4-9

### Effect of Adductor-Canal-Blockade versus placebo on established, severe postoperative pain after total knee arthroplasty

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**Background and Goal of Study:** Relieving pain without compromising motor function is a challenge in early postoperative pain treatment after total knee arthroplasty. In this proof-of-concept study we aimed to investigate the adjunctive effect of the almost pure sensory Adductor-Canal-Blockade on established pain in the early postoperative period after total knee arthroplasty. We hypothesised that the Adductor-Canal-Blockade would reduce pain during flexion of the knee (primary endpoint) and at rest, as well as reducing morphine consumption and morphine-related side effects (secondary outcomes) compared with placebo.

**Materials and Methods:** We included 41 patients scheduled for elective total knee arthroplasty in general anesthesia in this double blind, placebo-controlled, randomised study. The trial was approved by the local Regional Ethics Committee and the Danish Medicines Agency, and registered at www.clinicaltrials.gov (NCT01261897). All patients had a catheter placed in the adductor canal during general anesthesia. After obtaining pre-block pain scores and according to randomisation the patients received 30 ml of ropivacaine

0.75% (n=21) or saline (n=20) via the catheter. Supplemental analgesics consisted of paracetamol 1 G and ibuprofen 400 mg as premedication followed by patient-controlled analgesia with intravenous morphine postoperatively. Pain, morphine consumption, nausea, vomiting and sedation were assessed at 0.5, 1, 2, 3, 4, 5 and 6 h postoperatively.

**Results and Discussion:** Mean (SD) pain scores during flexion of the knee at 1 h postoperatively were 58 (22) mm and 67 (29) mm, ropivacaine and placebo group respectively ( $p = 0.23$ ), but was significantly reduced in the ropivacaine group when calculated as area under the curve for the interval 1-6 h ( $p = 0.02$ ). There were no statistically significant differences regarding pain at rest ( $p = 0.08$ ), nor morphine related side effects, apart from nausea ( $p = 0.04$ ). Morphine consumption was reduced by 37% in the ropivacaine group,  $18 \pm 11$  versus  $28 \pm 21$  mg, ropivacaine and placebo group respectively, but this did not meet statistical significance ( $p = 0.06$ ).

**Conclusion(s):** In conclusion, this proof-of-concept study shows promising results regarding the analgesic efficacy of Adductor-Canal-Blockade in postoperative pain treatment after total knee arthroplasty, with a significant reduction in pain during flexion of the knee in the early postoperative period, compared with placebo.

## 8AP4-10

### Evaluation of inflammatory reaction to ultrasound gel introduced into subarachnoid space during regional anesthesia in piglets

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**Background and Goal of Study:** As ultrasound guidance for nerve block has become a standard technique, ultrasound gel is routinely used as an acoustic coupling medium between transducer and skin to avoid acoustic drop off of the signal. The needle is guided through the skin "contaminated" by the ultrasound gel. While the gel is sterile and water based, concerns are being made over whether its injection into the nervous system via the lumen of the needle can lead to inflammatory reaction. We performed this experimental animal study to investigate whether a gel introduction into the subarachnoid space causes an acute CNS inflammatory reaction as evident by an increased CSF protein count.

**Materials and Methods:** Nine piglets (*Sus scrofa domestica*) were anaesthetized with 4% isoflurane in an air-oxygen mixture. Dura was punctured through a hiatus sacralis with a 22 G spinal needle and a few ml of CSF was withdrawn (control sample). After that, through the same needle, 0.25 mL of gel mixed with 1 mL of 0.9% NaCl was injected intrathecally.

72 hours later piglets were anaesthetized in the same way for CSF withdrawal (treated sample). All samples were analyzed for protein count. Statistical analysis was performed using a t-test.  $P < 0.05$  was considered as significant.

**Results:** CSF protein concentration was measured in nine samples before and after gel infiltration. The mean ± SE of the protein count in the control was  $2.3 \pm 1.0$  g/L and  $14.1 \pm 3.0$  g/L in the treated samples. A significant increase in CSF protein concentration was observed after gel infiltration ( $p < 0.01$ ).

**Conclusion:** This is the first study to evaluate the inflammatory response secondary to ultrasound gel injection into the intrathecal space, which demonstrated an acute CNS inflammation as evident from a significant increase in a protein count. However reasonable it is to assume that the amount of the gel used in our experiment can never be reached in practice, not even by accident, the important thing about it is that the potential risk involved has thereby been assessed.

## 8AP5-1

### Comparison of caudal anesthesia and in site local anesthetic infiltration for post operative pain management in pediatric inguinal hernia

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**Background and Goal of Study:** Post operative pain management is one of the most important aspects in pediatric surgery. Many variety of pain management approaches has suggested for this purpose. Each one of pain relief techniques has some advantages and some disadvantages whom strict its use. We have compared caudal anesthesia and in site local anesthetic infiltration in pediatric inguinal hernia

**Materials and Methods:** We evaluated 100 boys who have referred for elective inguinal herniorrhaphy. Their age was 18-24 month old. All patients had uni-

lateral inguinal hernia. There was no urgency conditions.

Study was double blind simple randomized clinical trial. We tried general anesthesia combined with caudal anesthesia (1ml/kg bupivacaine 0.5%) for 50 cases (group A) and general anesthesia combined in site local anesthetic infiltration (bupivacaine 3mg/kg) for others (group B). Induction and maintenance drugs for GA was similar in both groups. We evaluated their postoperative pain score by VAS at 2,4 and 6 hours after operation and at the discharging time. Scoring has done by one nurse who hasn't known about anesthetic approaches.

**Results and Discussion:** Pain score was significant (score > 4) in 11 cases and it was non significant (score < 3) in 89 cases. We found in re-evaluation of cases who had significant pain, multiple tries for peripheral vein cannulation as only different parameter, whereas just one try had done for cannulation in others. There is a consideration that in site local anesthetic infiltration makes transient tissue edema whom may rebound to difficult surgical site dissection. On the other hand its use is very easy in comparison with caudal block and it has no need to positioning for doing and unlike caudal block no needs to expert hands.

In our study since pain response to rectal acetaminophen may indicate that pain might be due to other causes than surgical stimulus etiology of postoperative pain in patients who experienced high score of pain probably refers to multiple punctures for venous cannulation.

**Conclusion:** We found that there is no differences in incisional pain between caudal anesthesia and in site local anesthetic infiltration, then since doing caudal technique is more difficult than local anesthetic infiltration and it needs to patient and staff preparation and expert anesthetist and due to avoidance of its potential complications we suggest to doing in site LA infiltration for post operative pain management

## 8AP5-2

### Effective prolonged transversus abdominis plane (TAP) block in patients undergoing total abdominal hysterectomy

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**Background and Goal of Study:** In gynecological practice, one of the most traumatic surgeries is an abdominal hysterectomy, in which significant postoperative discomfort and pain could be expected. We compared efficacy of prolonged transversus abdominis plane (TAP) block with systemic administration of opioids within postoperative period.

**Materials and Methods:** 45 women underwent abdominal hysterectomy have been evaluated. All patients were randomized into two groups. In the study group (n = 23), prolonged TAP block was used.

The control group (n = 22) received standard treatment with IV administration of morphine and dexketoprofen. TAP block was performed using epidural set. Each patient was evaluated following extubation and also 2, 4, 6, 12, and 24 hour after surgery.

**Results and Discussion:** In this study, the primary evaluation criterion was 24-hours consumption of morphine. Another results included: time to onset of the need in morphine and VAS score. In the patients of the main group, decrease of 24-hours morphine consumption, that was 20.4 95% CI (18.0, 22.8) mg vs. 38.2 95% CI (35.6, 40.8) mg, (p < 0.01) in the control group, respectively, has been observed.

In the TAP block group, the first administration of morphine was required after median (IQR) 4.8 (3.8-5.6) hours vs. 0.25 (0.2-0.3) hours (p=0.05) in the control group, respectively. In baseline evaluation of the postoperative pain intensity in rest and in motion using VAS, reliable intergroup differences were detected. In the study stages, i.e. after extubation and at 2, 4, and 6 hours of the postoperative period, the pain intensity in the TAP block group was lower than in the control one and according to evaluation using VAS in the rest, it was: in the main group - mean (sd) 14.7(9.5), 18.3 (7.8), 15.6(8.4), 18.3 (10.3), and in the control group - 54.5 (15), 50(9.2), 43.6 (20.1), 40.1(22.4) (p < 0.01) respectively. No differences in the VAS score in the rest at 12 and 24 hours after surgery between the groups were statistically significant.

When patients moved, significant increase of the VAS score in the control group, while in the TAP block group, the VAS score in the motion had no significant changes.

**Conclusion(s):** Use of prolonged TAP block within postoperative period following abdominal hysterectomy reliably increases efficacy of postoperative analgesia, improves patients' comfort, and decreases the need in opiates.

## 8AP5-3

### An unusual complication of a transversus abdominis plane block catheter

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**Background:** Infusions of local anesthetics via Transversus Abdominis Plane (TAP) catheters are being increasingly used to provide analgesia for abdominal surgery. We report an unusual complication of this practice.

**Case report:** A 69 year old lady was scheduled to undergo abdominoperineal resection of a rectal tumour. After induction of general anaesthesia and under ultrasound guidance, a Plexolong® 50mm Tuohy cannula was used to enter the TAP plane. The plane was dissected with 20 mls of 0.375% levobupivacaine and a Plexolong® 20G catheter was inserted on each side of the abdomen wall. Catheters were connected postop to a continuous infuser device (Baxter Folfusor®) and 0.125% bupivacaine was infused at 5mls/hr. Blocks were effective and catheters were removed 48 hours later. On the 3rd post-operative day, leakage of serous fluid was noticed from catheter insertion site lateral to the end - colostomy. A stoma bag was applied to this site and a total 600 mls of serous fluid was collected over a 48 hour period. Infective causes and ureteric damage were ruled out by biochemical analysis of this fluid which was similar to that of plasma. No further investigations were initiated as the patient remained clinically well. Drainage of fluid trailed off eventually stopping day 6 post-op.

A subsequent review of surgical notes revealed an alteration in the usual surgical technique wherein a porcine biological mesh was sutured onto the Transversus Abdominis (TA) muscle to reinforce abdominal wall around the end-colostomy.

**Discussion:** Biological meshes contain growth factors which attract adherence of inflammatory cells and can result in seroma formation. Stay sutures applied onto the TA muscle had provided a channel through which fluid generated by the mesh had tracked into the TA plane and leaked out from the TAP catheter insertion site. Serious complications such as mesh infection, abdominal sepsis or fistula formation were a possibility

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**Learning points:** Caution should be exercised with the use TAP catheters for postoperative analgesia especially in presence of a biological mesh.

## 8AP5-4

### A comparison of two different doses of bupivacaine in caudal anesthesia for neonatal circumcision

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**Background and Goal of Study:** We compared the analgesia quality of low volume, high concentration bupivacaine to the conventional volume and concentrations of the drug in neonates undergoing circumcision with sole caudal anesthesia.

**Materials and Methods:** 50 neonates, undergoing circumcision were randomly assigned to low volume high concentration (group LVHC, n=25) and control groups (group C, n=25). Both groups received a caudal injection: Group LVHC 0.5 ml.kg<sup>-1</sup> bupivacaine 0.375% (1.875 mg.kg<sup>-1</sup>) and group C 1 ml.kg<sup>-1</sup> bupivacaine 0.25% (2.5 mg.kg<sup>-1</sup>). Hemodynamic parameters, block onsets and analgesia periods were compared among the groups. Pain scores were evaluated hourly for 3 hours postoperatively with NIPS (neonatal infant pain score). Statistical analyses were performed with Student's t-test. Mann-Whitney U-tests and X<sup>2</sup> were used for nominal and/or categorical variables.

**Results and Discussion:** Demographic, hemodynamic data, block onset time (group LVHC and C values were 4.9 ± 1 vs 5.2 ± 2 mins, respectively; p=0.53) was similar and postoperative median NIPS (a median value of 0 at all measurement times) were identical among the groups (p=0.7, p=0.9, p=1). None of the neonates required additional analgesic for the first 24 hours following the surgery; therefore postoperative analgesic requirement was similar among the groups (p>0.1). Caudal epidural anesthesia without accompanying general anesthesia was recommended for neonates to reduce the risk of postoperative complications. The quality and level of the caudal block is dependent on the dose, volume and concentration of the local anesthetic drug. A block level limited to sacral dermatomes is enough during circumcision procedure and transient motor block is not a major concern in neonates. Therefore, we used high local anesthetic concentrations (0.375%) along with a

reduced volume providing a decreased local anesthetic dose (1.875 mg kg<sup>-1</sup>).  
**Conclusion(s):** LVHC caudal bupivacaine provided a similar perioperative analgesia quality, time and safety profile compared to conventional bupivacaine doses in awake neonates undergoing circumcision. Low volume, high concentration bupivacaine may be used to reduce the risk of local anesthetic toxicity in outpatient neonates.

### 8AP5-5

#### TAP block: with or without ultrasound guidance for every patient?

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**Background and Goal of Study:** The transversus abdominal plane (TAP) block is performed blindly through the triangle of Petit or under ultrasound guidance. The triangle is variable in term of size, shape and location behind the midaxillary line (1). During the blind technique, depending on the description, the tip of the needle is considered to be located in the TAP after the feeling of one or two successive "pops" (2,3). In this prospective observational study, we confirmed the position of the tip of the needle after the performance of the blind technique at the level of the midaxillary line with an ultrasound examination and test the hypothesis of relations between misplacements of the needle and characteristics of the patients.

**Materials and Methods:** During a period of six months, patients scheduled for surgery involving incision of the abdominal wall were included in the study. The needle is inserted 2 cm above the iliac crest on the midaxillary line and advanced until the feeling of two successive pops. Then, the tip of the needle and a 2 ml test dose of L-bupivacaine 0.375 mg/mL are visualized under ultrasound examination. If necessary, the needle is repositioned under ultrasound guidance before injection of the TAP with 20 mL of L-bupivacaine 0.375 mg/mL. Statistical comparisons (mean±SD) are performed using paired Student *t*-test, Wilcoxon Two sample Test, Fisher's exact test ( $P < 0.05$  significant).

**Results and Discussion:** 75 patients were enrolled in the study and 139 TAP blocks were performed. The needle is located in the TAP in 53.2% of the blocks. Others locations are the plane between internal and external oblique muscles, the internal oblique muscle, the transverse muscle, the pre-peritoneal and the intra-peritoneal position in respectively 1.4%, 25.1%, 6.5%, 0.7% and 6.5% of the cases. 6.6% of the locations could not be confirmed. There are no risk factors of misplacement of the needle related to the age, weight, BMI, sexe and type of surgery ( $p > 0.05$ ).

**Conclusion(s):** In order to inject local anaesthetics inside the TAP and avoid intraperitoneal organ puncture and intramuscular injection, the block should be performed under ultrasound guidance, whatever the characteristics of the patients are.

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### 8AP5-6

#### Transversus abdominis plane block in cadaveric renal transplantation: a randomized trial

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**Background:** Post-operative modes of analgesia in patients with end stage renal failure undergoing renal transplantation are limited. Considerations relate to the patients pre-morbid condition, impaired renal excretory function, uremic bleeding diathesis and the desire to avoid hypotension that may compromise the return of graft function. The transversus abdominis plane (TAP) block is associated with reduced opioid requirements and pain scores for procedures involving the lower abdominal wall [1]. This study assessed TAP block efficacy (landmark technique) in patients following cadaveric renal transplantation.

**Methods:** Following local ethics committee approval and written informed consent, this prospective study randomized 65 adult renal transplant recipients to receive a standardized general anesthetic technique supplemented with levobupivacaine 0.375% 20ml TAP block (TAP group) or sham block with 20ml 0.9% saline (control group). Both groups received intravenous acetaminophen 1g, morphine 0.1 mg kg<sup>-1</sup> and ondansetron 4mg intraoperatively, and patient controlled morphine analgesia with regular acetaminophen in the postoperative period. Patient assessment occurred in the post anesthetic care unit and at 2, 4, 6, 12, and 24 hours. The primary outcome was total morphine consumption in the first 24 hours postoperatively. Secondary outcomes included pain scores, nausea and/or vomiting, sedation and respiratory depression.

Continuous variables were analyzed using the Wilcoxon Mann-Whitney test. Multiple regression analysis was used to calculate morphine requirements and logistic regression was used for analysis of binary endpoints.

**Results:** 32 patients were randomized to the TAP group and 33 to the control group. Morphine requirements did not differ between the 2 groups, 31.6 + 5.6 mg in the TAP group and 32.6 + 5.5 mg in the control group, [ 95% CI (-8.96 to 7.09,  $p=0.817$ ). Pain scores also did not differ significantly at any time point following surgery. Nausea and vomiting rates were increased in the TAP group 53% and 22% respectively compared with 24% and 6% in the control group. No patient exhibited excessive sedation or respiratory depression.

**Conclusion:** The addition of a TAP block using the landmark technique to the analgesia regimen for cadaveric renal transplantation did not confer any additional benefit on opioid requirements or pain scores in the first 24 hours postoperatively.

#### References:

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### 8AP5-7

#### Anatomical investigations for appropriate needle positioning in thoracic paravertebral block in children

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**Background and Goal of Study:** Thoracic paravertebral blockade (TPVB) can be effective in many clinical settings, but many clinicians are so anxious about adverse effects, especially in children that they hesitate to do. Moreover, in reality, there had been nearly no anatomical guidelines on thoracic paravertebral block in children. We aim to estimate the appropriate depth and width for safe needle positioning in children.

**Material and Methods:** We measured the depth from skin to paravertebral space (PVS) and the width from spinous process (SP) to PVS and lateral tip of transverse process (LTTP) at all available sections in 373 pediatric patients examined by chest computed tomography (CT). We analyzed the correlation between age, sex, weight, height, body mass index (BMI) and each measured values.

**Results:** All 4019 sections of 373 children from 12 month to 9 years old were evaluated. Age, weight and height had statistical significances in correlations for each measured values, but sex or BMI had little correlations. The widths from SP to needle entry point(A) are  $13.56 + 0.33 \times \text{age}(\text{yr}) + 0.06 \times \text{weight}(\text{kg}) + 0.46 \times \text{sex}(\text{female}=0, \text{male}=1)$ , and the depths from skin to PVS(D) are  $17.49 - 0.35 \times \text{age}(\text{yr}) + 0.54 \times \text{weight}(\text{kg})$ .

**Conclusion(s):** We propose clinically useful estimates to avoid side effects such as pneumothorax and to get a successful thoracic paravertebral blockade.

### 8AP5-8

#### Ultrasound imaging of musculocutaneous nerve in infants, preschoolers and children

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**Background and Goal of Study:** Localizing the musculocutaneous nerve for neural blockade is crucial to achieve complete anaesthesia of the forearm. However, in children the musculocutaneous nerve is unable to be blocked in up to 40-50%, and it is usually considered as undetectable with ultrasonography. The aim of this imaging study was to investigate whether musculocutaneous nerve is visualized in childhood with the use of ultrasound guidance and to assess the percentage of its localization according to the age.

**Materials and Methods:** After ethical approval and parental written consent, 42 children hospitalized in the paediatric clinic were included in this prospective imaging study. Children were placed in the supine position with the involved arm abducted at 90° and the elbow flexed at 90°. For this study, a portable ultrasound machine was used (GE, LOGIQ Book XP) with a linear probe (8L-RS). The probe was placed at the axillary region, perpendicularly to the axillary artery. The musculocutaneous nerve was searched near the axillary artery and its course was followed both proximally (near the artery) and distally (into the coracobrachialis muscle). The children were divided into three groups according to their age: < 12 months (Group 1, n=14), 13 months-6 years (Group 2, n=14) and 6.5 years -12 years (Group 3, n=14). The power analysis from the initial 10 patients revealed that 12 patients were needed in each group to achieve a 95% confidence interval of  $\pm 7.5\%$ . Descriptive statistics were analysed with SPSS v.15.0.

**Results and Discussion:** The demographic data and the localization rates are shown in the table below. During the study it was found that placing our hand beneath the shoulder to bring the axillary structures more superficially enabled better visualization of the musculocutaneous nerve in infants younger than 8 months.

	Age	Weight (kg)	Height (cm)	BMI	Proximal localization	Distal localization
Infants	5.3 ± 4.0 (months)	6.4 ± 2.0	0.63 ± 0.08	16.0 ± 2.5	93%	93%
Toddlers and Preschoolers	4.1 ± 1.8 (years)	17.7 ± 5.8	1.03 ± 0.17	16.6 ± 3.1	93%	93%
School aged	8.9 ± 1.8 (years)	37.1 ± 14.4	1.37 ± 0.12	19.3 ± 5.2	100%	93%

[Table]

**Conclusion(s):** Musculocutaneous nerve is detectable in childhood with the use of ultrasonography. In infants, slight elevation of the axillary fossa by placing our hand beneath the ipsilateral shoulder of the infant increases imaging success.

### 8AP6-1

#### Single shot femoral nerve block offers superior postoperative mobilisation at an equal analgesia level after total knee arthroplasty compared to continuous nerve block using a catheter

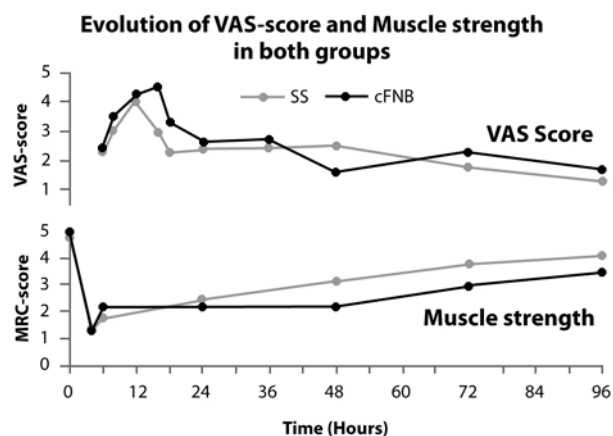
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**Background and Goal of Study:** Femoral nerve blockade is an effective method for pain reduction after total knee arthroplasty(TKA) and can be performed by continuous femoral nerve block using a catheter(cFNB) or a single shot block(SS). There are currently no studies comparing the effects on analgesia and mobility of cFNB versus SS using bupivacaine after TKA. The aim of the study is to compare the effects of cFNB versus SS on pain scores, postoperative mobilisation and hospital stay.

**Materials and Methods:** After local IRB approval and written informed consent. 46 patients scheduled for TKA under spinal anesthesia were randomized to the CFB or SS group. 23 patients in the cFNB group were treated with an initial bolus of 20ml bupivacaine 0.25%. 23 patients in the SS group got a single bolus of 30ml bupivacaine 0.5%. Subsequently, all patients received spinal anesthesia with 3ml bupivacaine 0.5% and the same TKA procedure was performed. At PACU arrival, cFNB was started at 6 ml/h until 6AM at post-operative day 2 in the cFNB group. All patients were equally treated with acetaminophen, naproxen and morphine according to protocol. Pain score using the VAS, quadriceps muscle strength, range of motion (ROM) and mobility (MILAS score) were evaluated at fixed time points. Statistical analysis comprised independent T-test, Chi-square or Fisher's exact test ( $p < 0.05$ ).

**Results and Discussion:** There were no statistically significant differences in patient characteristics, escape medication, VAS score at any time, hospital stay and global patient satisfaction.

Differences in quadriceps muscle strength ( $p=0.004$ ), ROM ( $p=0.01$ ) and MILAS ( $p=0.01$ ) score were significantly better in the SS group at day 2 or non-significant.



[Figure]

**Conclusion(s):** Single shot offers similar pain scores and patient satisfaction and significantly better mobility compared to continuous block. Based on these findings and the known advantages on safety and procedural comfort, single shot seems to be the therapy of choice.

### 8AP6-3

#### Successful treatment of highly potential local anesthetic systemic toxicity by "staged prevention strategy" with intravenous lipid emulsion

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**Background:** Lipid rescue has proven to be an effective approach to dealing with local anesthetic systemic toxicity in cases of refractory resuscitation. In previous case reports, lipid rescue was used only after the appearance of systemic toxicity. This paper reports a successful manipulation in management of potential cardiovascular toxicity by lipovenous and tourniquet deflation.

**Case report:** There was a case of intravenous regional anesthesia involving the mistaken injection of 0.5% 40 ml bupivacaine instead of lidocaine. In a "staged prevention strategy" including lipid rescue and tourniquet manipulation, the procedure remained uneventful through all stages. This included an initial 110 ml (1.5m.kg<sup>-1</sup>) bolus of intralipid and continuous infusion of low dose intralipid for the following two hours. The staged deflated cuff was manipulated by 250mmHg during transport, and staged deflation (200 mmHg for 20 minutes, 180 mmHg for 30 minutes, 150 mmHg for 30 minutes, and 100 mmHg for 30 minutes).

**Discussion:** According to the "lipid sink" theory, we initially intended to apply lipid emulsion therapy in the anesthetized arm prior to deflation of the tourniquet because the lipid emulsion could potentially reduce the concentration of local anesthetic. In addition, this approach should be the best way to decrease the concentration of local anesthetics and minimize the chance of LAST, disregarding the complications associated with the tourniquet and peripheral volume of distribution. It appears that preventative treatment using intralipid offers a safe and effective approach in cases of early detection and those with a high possibility of systemic toxicity.

#### References:

- Weinberg GL, VadeBoncouer T, Ramaraju GA et al. Pretreatment or resuscitation with a lipid infusion shifts the dose-response to bupivacaine-induced asystole in rats. *Anesthesiology* 1998; 88: 1071-1075.
- Corman SL, Skledar SJ. Use of lipid emulsion to reverse local anesthetic-induced toxicity. *Ann Pharmacother* 2007; 41: 1873-1877.

**Learning points:** Early application of "Lipid Rescue" in nearly dangerous local anesthetic systemic toxicity provides a safety strategy.

### 8AP6-4

#### Femoral nerve block after total knee arthroplasty: comparison of single dose versus continuous infusion. Analgesia and functional recovery

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**Background and Goal of Study:** Femoral nerve block is considered the gold standard in postoperative pain management in total knee replacement, advising continuous block versus single injection. However, few studies evaluated the impact of these modalities in patients requiring rapid functional recovery. We evaluated the effects of femoral nerve block, continuous or single bolus, on analgesia and early rehabilitation after primary knee arthroplasty.

**Materials and Methods:** Were included in the study 164 patients ASA I-III, 22% men and 88% women, 70 ± 9 years, 78 ± 13 kg and 159 ± 9 cm, scheduled for primary knee prosthetic surgery. The study was approved by the ethics committee of the Hospital. Patients were randomized into 2 groups: Group 0 (G0, n = 81) was assigned to the single dose femoral nerve block and group 1 (G1, n = 83) who underwent continuous blockade. In both cases was given a bolus of 20 mL of ropivacaine 0.75% and G1 was continued with continuous infusion of ropivacaine 0.2% administered by elastomeric pump (infusion rate: 7 ml/h). We assessed the quality of analgesia using VAS and morphine consumption at 12, 24 and 48 hours postoperatively; and the joint range of motion and functionality tests (Tinetti: gait and balance values; and Daniels: muscle strength) at 24 and 48 hours.

**Results and Discussion:** Groups were comparable for anthropometric data. At 24 hours postoperatively there were no differences in any parameters studied. After 48 h morphine consumption was significantly greater in the G0 (6 ± 8 vs 3 ± 4 bolus,  $p = 0.01$ ). Joint range of motion was lower in G0 (88 ± 9 vs.



92 ± 6 grade,  $p = 0.01$ ). However, the assessment of gait in the Tinetti test was significantly better in the G0 (7.2 ± 2.3 vs 6.2 ± 2.6,  $p = 0.02$ ).

**Conclusion(s):** The femoral nerve block, single or continuous, is effective in pain management postoperative knee prosthetic surgery. Continued blockage slightly reduces the need for morphine and quietly improved knee flexion at 48 hours after surgery; However, the fall risk increase due to a moderate worsening in ambulation.

## 8AP6-5

### Continuous preperitoneal infusion of ropivacaine in major abdominal surgical interventions - should we worry about toxicity?

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**Background and Goal of Study:** Effective postoperative pain control is important from patient perspective. Blockade of parietal nociceptive afferents by continuous infusion of a local anesthetic proved to be beneficial in a multimodal approach to postoperative pain management after major surgery. It has been shown that wound infiltration could result in increased ropivacaine concentration (RC) with impaired liver function (1). This prospective observational study evaluated the safety of analgesia with subfacial local R infusion in patients scheduled for partial hepatectomy (H) or duodenopancreatectomy (DP) according to liver function.

**Materials and Methods:** After approval from our local IRB and written informed consent, a multiholed catheter (Painfusor, Baxter) was inserted peritonally at the end of surgery. A bolus

of 10 mL R was administered at the end of surgery followed by continuous infusion (20 mg/h) planned to last 72h after surgery. Total plasmatic RC was determined by HPLC-UV before infiltration and 4,8,16,28,40,52,68,76,88 and 100 hours thereafter. The peak RC (C<sub>max</sub>) and time to peak (T<sub>max</sub>) were estimated by visual analysis of the time concentration curve. Terminal half life (T<sub>1/2</sub>) was calculated by linear regression using the terminal slope. An indocyanine green plasma disappearance rate (ICG-PDR: Pulsion Medical AG, Germany) was performed in triplicate. Data were compared using a Mann-Whitney or Fisher exact test when required,  $p < 0.05$  being considered as significant.

#### Results and Discussion:

	Hepatectomy(n=22)	Duodenopancreatectomy (n=14)	p
Age(years)	66(41,86)	65(36,82)	0.52
R infusion time(hours)	58(28-72)	63(45-75)	0.36
C <sub>max</sub> (ng/ml)	2745(1035-5022)	2982(920-4065)	0.9
T <sub>max</sub> (hours)	52(27-72)	49(15-67)	0.9
T <sub>1/2</sub> (hours)	19.1(9.8-99)	19.2(7.9-99)	0.8
Highest ICG-PRD%	27.3(15.6-52.5)	31.9(19.6-56.7)	0.45

[Table 1]

Values are expressed in median (minimum, maximum). Six patients showed a C<sub>max</sub> > 4000 ng/mL, 2 in the H and 4 in the DP group ( $P=0.18$ ). No sign of clinical toxicity was observed. No relation was found either with the ICG clearance, nor the length of R infusion, nor the type of surgery.

**Conclusion(s):** RC after wound infiltration may reach high levels after partial hepatectomy as after duodenopancreatectomy. As we could not find any factor predicting RC, careful monitoring is mandatory in all patients undergoing major abdominal surgery to avoid R intoxication.

#### References:

- Chan SK et al. *Anaesthesia* 2010;65:1180-6

## 8AP6-6

### Dose finding of hyperbaric prilocaine 2% for minor perianal surgery in an ambulatory setting

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**Background:** Low-dose spinal anesthesia with hyperbaric substances seems to be superior to general anesthesia for colorectal procedures in multiple aspects [1]. In 2010, with prilocaine 2% the third hyperbaric substance was introduced to the German market. The aim of this trial was to determine the optimal dose of this substance in patients undergoing minor perianal surgery in an ambulatory setting.

**Methods:** All patients (male / female, ASA-status I-III, age: 18-80 years) undergoing perianal surgery were eligible for this prospective, single-centre,

randomised, controlled clinical trial. Exclusion criteria were general contraindications to spinal anesthesia and allergies against NSAID. 120 patients were enrolled to the study and randomised 1:1:1 to receive 10, 20 or 30mg of hyperbaric prilocaine 2% intrathecally.

We measured the expansion of sensoric and motoric block and the times until voiding and discharge.

**Results:** 116 / 120 patients (58 male/58 female) were ready for analyze. In 2/114 the analgesia was inefficient. We found a positive correlation of the applied dose and the expansion of the block ( $p < 0.0001$ , Tab.1), while a significant motoric block occurred only at a dose of 30mg ( $p = 0.0044$ , Tab.2). 10mg led to a significant reduction of time to void compared to higher dosages ( $p < 0.005$ , Fig.2). Patients with 10mg were significantly earlier ready to leave the day-surgery centre ( $p < 0.007$ , Tab.3).

**Conclusion:** Hyperbaric prilocaine 2% is suitable in doses of 10, 20 and 30mg for spinal anesthesia in colorectal surgery. Due to the sufficient analgesia, the missing motor block and the shorter recovery times 10mg of hyperbaric prilocaine 2% is recommended for ambulatory colorectal surgery.

Injected Volume (mg)	10	20	30
Number of anaesthetized dermatoms (median and range)	3 (1-6)	4 (2-6)	5 (3-7)

[Tab.1: Sensoric block]

	0	1	2	3
10mg	91,9%	8,1%		
20mg	80,5%	17,1%	2,4%	
30mg	52,6%	31,6%	10,5%	5,3%

[Tab.2: Bromage Score depending on dose]

	Time to void		Time to discharge	
	min	SD (min)	min	SD (min)
10mg	172,9	31,1	197,9	38,7
20mg	192,2	36,8	219,1	46,2
30mg	212	32,5	230,4	32,1

[Tab.3: Time to void + discharge depending on dose]

#### References:

- Schmittner MD; Randomized clinical trial of perianal surgery performed under spinal saddle block versus total intravenous anaesthesia.; *Br J Surg.* 2010 Jan;97(1):12-20.

## 8AP6-7

### Tramadol as an adjunct to local anaesthetics in brachial plexus block: a meta-analysis

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**Background:** Postoperative pain after upper limb procedures is difficult to manage and brachial plexus blocks have time-limited effects. A variety of adjuncts to local anaesthetics (LA) have been utilized in an effort to prolong such analgesia. In addition to central and peripheral analgesic effects, tramadol has been shown to have LAs properties.<sup>1</sup> Randomized controlled trials have studied adding tramadol to LAs in brachial plexus blockade. A meta-analysis of these studies was undertaken.

**Method:** Studies were identified by a search of MEDLINE and EMBASE and reviewing published abstracts from ESA, ESRA, ASA and ASRA meetings. We used the MeSH terms: brachial plexus, interscalene, supraclavicular, axillary nerve block AND tramadol.

Fifteen studies were identified using various LAs. Six were excluded due to poor methodology or inadequate outcome data leaving nine studies of 386 patients available for inclusion. The tramadol dose varied between 50 and 100 mg. The Jadad scale was used to assess the quality of manuscripts and varied between 1 and 5. Revman statistical software® utilized inverse variance and a random effect model to calculate mean difference (MD) with 95% confidence intervals for continuous variables.

The primary outcome was duration of sensory block. Secondary outcomes were: time to onset of maximum sensory block; time to motor recovery; time to first analgesia; time to visual analogue score (VAS) greater than 3; and VAS score at first analgesic request.

**Results:** Addition of tramadol to LAs increased the duration of sensory block by a mean of 65.5 min and the time to first analgesia by 137.5 min. Motor block was significantly prolonged by 46 min. VAS scores were not significantly decreased.

	Number of studies/ Patients	Mean difference (95%CI):tramadol	p value
Duration of sensory block (min)	6/279	65.5 (20.2 - 110.8)	0.005
Onset of maximum sensory block (min)	3/154	-4.1 (-11.6 - 3.4)	0.28
Time to motor recovery (min)	6/279	46.0 (24.0-68.1)	0.0001
Time to first analgesia (min)	5/192	137.5 (3.1 - 272.0)	0.04
Time to VAS >3	3/157	196.5 (-121.7 - 514.8)	0.23
VAS score at first analgesia	3/133	-0.3 (-0.9 - 0.3)	0.31

[Effect of adding tramadol to brachial plexus block]

**Discussion:** Tramadol significantly increases the duration of brachial plexus block and time to first analgesia at the expense of prolonged motor block. Due to high heterogeneity, these results should be interpreted with caution.

#### References:

1. Robaux S, Blunt C, Viel E, et al. Tramadol added to 1.5% mepivacaine for axillary brachial plexus block improves postoperative analgesia dose-dependently. *Anesth Analg* 2004;**98**:1172-7

## 8AP6-8

### The comparison of two different doses of morphine added to spinal bupivacaine for inguinal herniorrhaphy

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**Background and Goal of Study:** Inguinal herniorrhaphy is commonly performed as an outpatient procedure. In this setting regional anaesthesia provides various advantages when compared with general anaesthesia. Intrathecal morphine (ITM) provides good postoperative analgesia, however its side effects limit its use.

The aim of this study was to compare the effects of two different doses of ITM on postoperative block regression times, postoperative analgesia and the severity of side effects.

**Material and Methods:** After Institutional Ethical Comity approval, 46 ASA I-II patients were enrolled in this randomized double-blinded study. After routine monitoring and premedication, spinal anaesthesia was performed with 0.1 mg (Group I, n:20) or 0.4 mg (Group II, n:26) ITM in addition to low-dose (7.5 mg) heavy bupivacaine.

The onset and regression of sensory and motor block were followed-up. Postoperative side effects (nausea, vomiting, pruritus, dizziness), first mobilization and voiding times and first analgesic requirement were also recorded. Statistical analyses were performed using SPSS 15.0 and  $p < 0.05$  was considered as statistically significant. The numeric data were analyzed by the t-test and presented as mean  $\pm$  SD. Categorical data were analyzed with chi-square test and expressed as number of patients and percentage.

**Results and Discussion:** Demographic data were similar. No differences were found in the onset and regression times of sensory and motor blocks.

Parameters	Group I (n:20)	Group II (n:26)	p values
Sensory onset time (T10)	9.37 $\pm$ 4	9 $\pm$ 4.4	0.63
Onset of motor block (Bromage $\geq$ 2)	9 $\pm$ 3.8	6.9 $\pm$ 3.8	0.16
Regression of sensory block	192 $\pm$ 77	182 $\pm$ 79	0.91
Return of the Bromage score to 0	165 $\pm$ 67	157 $\pm$ 59	0.70

[Sensory and motor block follow-up]

Also, there were no differences related to postoperative pain, first analgesic requirements, and first mobilization and first voiding times. The only difference between two groups was the vomiting incidence. In Group II 26.1% (n=6) of the patients had vomiting during the first postoperative 24 hours compared to 0% in group I (p:0.022).

**Conclusion:** Spinal anaesthesia with a dose of 0.1 mg of ITM combined with low dose heavy bupivacaine for inguinal herniorrhaphy provides comparable postoperative analgesia with a dose of 0.4 mg of ITM.

However, 0.1 mg of ITM induces significantly less vomiting than 0.4 mg of ITM. The dose of 0.1 mg ITM offers adequate anaesthesia and analgesia with lower side effects.

## 8AP6-9

### Local anesthetics mixture improves the speed of surgical blockade for foot surgery: ropivacaine 0.75% vs ropivacaine 0.75% + mepivacaine 1.5%

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**Background and Goal of Study:** The sciatic nerve block by the subgluteal approach is recommended for foot surgery. Nevertheless, the time to obtain a sensitive blockade is often long. The currently used Ropivacaine 0.75% has particular pharmacological properties with respectively long delay and duration of sensitive blockade. The aim of our study was to determine the interest of an equivolume local anesthetics mixture with Ropivacaine 0.75% and Mepivacaine 1.5% for improving the level of care in the field of foot surgery.

**Materials and Methods:** After IRB agreement, 30 patients with ASA status 1 or 2, receiving foot surgery were randomised in 2 groups. When the sciatic block was realized, each patient received either 30ml Ropivacaine 0.75% (ROPI Group) nor 30ml Ropivacaine 0.75% + Mepivacaine 1.5% (ROPI-MEPI Group) in a double-blinded manner.

We observed respectively the time to obtain a surgical status, the duration of sensory and motor blockade, the morphine consumption and the side effects. Results are expressed as means  $\pm$  SEM with  $p < 0.05$ .

**Results and Discussion:** Results are shown in the table below.

Parameters	Ropi group	Ropi-Mepi group	p value
Age (years)	55 $\pm$ 4	63 $\pm$ 3	0.15
Onset of sensitive block (min)	24.2 $\pm$ 4.0	13.2 $\pm$ 2.2	0.04
Duration of sensitive block (h)	13h22 $\pm$ 0h19	12h18 $\pm$ 0h34	0.49
Side effects	2 general anesthesia, 1 onset time > 40', 2 sedation	2 general anesthesia, 1 onset time > 40'	ns
morphine consumption (mg)	19.2 $\pm$ 4.5	8.9 $\pm$ 2.7	0.06
Morphine side effects	3 nausea	1 nausea, 1 sleepiness	ns

[Results in the Ropi-Mepi and Ropi groups]

**Conclusion(s):** Ropivacaine 0.75% + Mepivacaine 1.5% allows a faster surgical status than Ropivacaine 0.75% alone et the postoperative morphine consumption is reduced. Quality of regional anaesthesia and rate of complications are similar in the two groups.

The obtained saving of time can be a factor of improvement of both flow and efficiency of the operating programs. The reduced consumption of morphine could improve the taking care quality by a reduction of side effects.

## 8AP6-10

### Evaluation of the effect of clonidine on different volumes of lidocaine 1.5% (20 and 40 ml) in brachial plexus block for upper limb orthopaedic procedures: randomized and controlled study

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**Background and Goal of Study:** Clonidine is an alpha 2 adrenergic receptor agonist. It has properties associated to local anesthetics adjuvants that have been described increased length of anaesthesia and analgesia in peripheral blocks and neuroeixo. The objective of this study was to compare the features of axillary plexus block, carried out with the addition of clonidine, performed with volumes of 20 (300 mg) and 40 (600 mg) ml of lidocaine 1.5%

**Materials and Methods:** 60 patients scheduled for upper limb surgery under axillary block. They were randomly distributed in 4 groups of 15: LC40-lidocaine 1.5% 40ml, clonidine 150  $\mu$ g; L40-lidocaine 1.5% 40 ml, 1 ml 0.9 % saline; LC20-lidocaine 1.5% 20 ml, clonidine 150  $\mu$ g; L20-lidocaine 1.5% 20 ml, 1 ml 0.9 saline. In all groups was added adrenaline 1: 200000. The final injection of anaesthetic in brachial plexus was determined as time zero (T0). The block duration was defined as the time between T0 and total regression of anaesthesia in 4 territories: radial nerve, musculocutaneous, median and ulnar, with assessments carried out in 1, 2, 3 and 4 hours after the surgery. Similarly, measures were made for analgesia and post-operative pain intensity. The statistical analysis used ANOVA tests, Kruskal-Wallis test, multiple comparisons of Dunn and two-way ANOVA. The determining criterion of significance adopted was  $P < 0,005$ .

**Results and Discussion:** The duration, in minutes, of sensory, motor block, analgesia and ENV (Verbal Numerical pain Scale) average  $\pm$  standard deviation evaluated between groups, LC40, L40, LC20 and L20 was: Sensitive-338.2  $\pm$  77.7; 316.6  $\pm$  57.7; 332.3  $\pm$  58.5 and 286.8  $\pm$  72.7 (p0 .17); Motor-308.9  $\pm$  82.0; 292.6  $\pm$  66.7; 328.3  $\pm$  61.4 and 260.5  $\pm$  79.0 (p0 .067); Analgesia-301.3  $\pm$  84.9; 268.6  $\pm$  64.5; 341.6  $\pm$  76.0 and 236.5  $\pm$  62.6 (p0 .0008); ENV pain-3.87  $\pm$  2.8; 5.8  $\pm$  2.46; 3.73  $\pm$  3.31 and 5.27  $\pm$  2.15 (p0 .089), respectively.

**Discussion -** the use of clonidine associated to lidocaina significantly in-

creased the duration of analgesia, as well as decreased postoperative pain in both groups it was used. There is also significant effect of clonidine on duration of sensory and motor blocks. There is no significant effect of volume on clinical variables and treatment, regardless of clonidine.

**Conclusion(s):** Clonidine produced better effects than enhancing volume of local anesthetic in brachial plexus block.

**References:**

1. Anesth Analg, 2007;104:532-7; Anesthesiology, 2009 ;111:406-15; Br J Anaesth, 2005;94:112-6.

## Pharmacology

### 9AP1-1

#### Influence of bupivacaine on inflammation markers

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**Background and Goal of Study:** Surgical operations have significant influence on homeostasis during the perioperative period. Surgical trauma leads to development of a stress response, caused by activation of the neuroendocrine and immune system. Excess production of cytokines increases the risk of organ dysfunction, morbidity and mortality. The use of local anesthetics for regional blockades can decrease systemic inflammation, and, consequently, decreases the number of complications during the postoperative period. The Goal: to study the influence of bupivacaine on inflammation markers during the operation abdominoplasty.

**Materials and Methods:** After approval by the local ethics committee, 49 patients were prospectively arranged on 2 groups depending on the type of anesthesia: the control group (n=27) was operated on using total intravenous anesthesia (propofol and phentanyl) with miorelaksation and artificial ventilation. The experimental group (n=22) was operated on using epidural anesthesia with bupivacaine (mean dose 100 mg). All patients were comparable according to sex, age, concomitant pathology and ASA degree (I-II). The mean duration of the surgery was 114  $\pm$  11 min. The serum levels of IL-1 $\alpha$ , TNF $\alpha$  and IL-10 before surgery (stage 1), after 24 hours (stage 2) and 5 days after surgery (stage 3) were studied.

**Results and Discussion:** Analysis has revealed reliable decreases of the IL-1 $\alpha$  level after 24 hours (13,3  $\pm$  1,3 vs 17,6  $\pm$  1,1 p $\mu$ g/ml (p=0,005)) and after 5 days (12,9  $\pm$  1,9 vs 17,1  $\pm$  2,2 p $\mu$ g/ml (p=0,019)) post-surgery under the epidural anesthesia. In the experimental group the level of TNF $\alpha$  unreliably decreases after 1 day post-surgery (3,1  $\pm$  1,1 vs 3,6  $\pm$  0,5 p $\mu$ g/ml (p=0,365)) with subsequent increases on day 5 (4,7  $\pm$  1,2 vs 3,6  $\pm$  0,9 p $\mu$ g/ml (p=0,098)). Analysis has not revealed reliable changes of the level IL-10 from the baseline during all stages in patients of both groups.

**Conclusion(s):** Epidural anesthesia with bupivacaine reliably decreases the level of systemic proinflammatory IL-1 $\alpha$ .

### 9AP1-2

#### Effects of Shenmai pre-treatment on bupivacaine cardiotoxicity in rats

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**Background and Goal of Study:** We evaluated the effects of Shenmai (a kind of traditional Chinese medicine) pre-treatment on the cardiotoxicity induced by an infusion of bupivacaine and the success rate of resuscitation in anaesthetized rats.

**Materials and Methods:** Sixteen adult, female Sprague-Dawley rats were randomly divided into two groups: group 1 pre-treated with normal saline (10ml·kg<sup>-1</sup> intraperitoneal every day for three days), and group 2 pre-treated with Shenmai (10ml·kg<sup>-1</sup> intraperitoneal every day for three days). At the 3rd day, one hour after the intraperitoneal pretreatment injection, the rats were anesthetized with thiopental sodium and ketamine intraperitoneally. An overdose of bupivacaine of 0.75% 6 mg/100g was injected intraperitoneally in both groups.

**Results and Discussion:** The heart rate and blood pressure in group 2 after bupivacaine injection decreased a little, showed no significant difference compared with baseline. The systolic pressure, mean arterial pressure and

diastolic pressure in group 1 were significant decreased in 3.9  $\pm$  1.0 min after bupivacaine injection and then all fell to zero quickly. After bupivacaine injection, prolonged PR interval and increased QRS complex happened in both groups. The mean QRS alteration time was 3.95  $\pm$  1.03 min in group 1 while 4.3  $\pm$  1.3 min in group 2, which appeared significant difference. The time to sinoatrial block was 5.7  $\pm$  2.1 min in group 1 and 1.02  $\pm$  1.83 min in group 2, which also showed significant difference. There were no further changes on EEG in the following time in group 2, and all the rats in group 2 were all alive in 30min after bupivacaine injection. The mean time to asystole in group 1 was 8.75  $\pm$  3.5 min, and none was alive in 30min after bupivacaine injection.

**Conclusion(s):** Pre-treated with traditional Chinese medicine of Shenmai may decrease the cardiotoxicity induced by bupivacaine in rats, and may enhance the survival rate.

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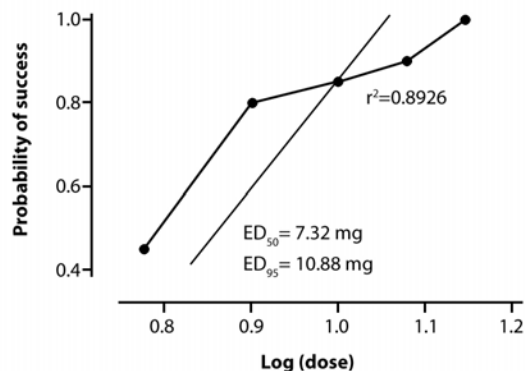
### 9AP1-3

#### ED<sub>50</sub> and ED<sub>95</sub> of isobaric levobupivacaine with fentanyl for transurethral resections under combined spinal epidural anaesthesia

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**Background and Goal of Study:** The use of levobupivacaine as pure S(-) enantiomer of bupivacaine is progressively increased due to its lower cardiotoxicity and neurotoxicity and shorter motor block duration. Opioids are commonly coadministered with lower doses of local anesthetics to decrease the adverse effects of local anesthetics by achieving the same motor and sensory block. This study aimed to determine minimum effective dose, ED<sub>50</sub> and ED<sub>95</sub> of intrathecal isobaric levobupivacaine by addition of fentanyl for patients undergoing transurethral resections.



[Dose-response relationship by regression model]

**Materials and Methods:** After hospital ethics committee approval and getting written informed consent from patients, 100 patients with ASA I-III aged 18-85 were included in the study. Patients received intrathecal isobaric levobupivacaine in doses of 6, 8, 10, 12 or 14 mg in equal volumes with an added 25 mcg intrathecal fentanyl. Sensory levels (pinprick) were evaluated at 1, 3,

5 and every 5 min until a T10 level was achieved. Sensory and motor block, hemodynamic parameters, pain scores, adverse effects, and analgesic requirements of the patients were recorded.

Statistical analysis was performed by SPSS (Statistical Package for Social Sciences) for windows 17.0 program, Graph Pad Prism 5.0 program. ED<sub>50</sub> and ED<sub>95</sub> were determined with use of a linear regression model.

**Results and Discussion:** ED<sub>50</sub> and ED<sub>95</sub> of isobaric levobupivacaine coadministered with 25 mcg fentanyl were 7.32 mg and 10.88 mg, respectively.

There were no significant differences among groups with respect to demographical characteristics, hemodynamic parameters, adverse effects. Speed of onset of maximum motor and sensory block correlated inversely with dose ( $P < 0.05$ ).

**Conclusion(s):** The ED<sub>50</sub> of intrathecal levobupivacaine (7.32 mg) under the conditions of this study is considerably lower than the doses proposed for routine use of levobupivacaine (15 mg). When intrathecal fentanyl is added to levobupivacaine, lower doses of levobupivacaine can be used.

## 9AP1-4

### Influence of the form of lidocaine administered to trachea on its pharmacokinetics

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**Background and Goal of Study:** Endotracheal drug administration is considerable for cardiopulmonary resuscitation. Though the administration results in lower plasma concentration (Cp) of the drug than intravenous administration, changing the form of the drug may increase the concentration. We investigated the influence of the form of lidocaine administered to trachea on its pharmacokinetics.

**Materials and Methods:** After the institutional review board approval, a prospective single-blinded randomized controlled trial was performed. Twenty patients underwent elective prostatectomy or mastectomy were recruited. Ten minutes after induction of total intravenous anaesthesia, 4% lidocaine 2 mg/kg was given to trachea randomly using either mucosal atomization device (MAD spray magic®, Fuji Medical, Tokyo, Japan: typical particle diameter is 30-100 µm: A group) or a spray tube (endotracheal spray tube®, Hakko, Tokyo, Japan: this 160-mm-long tube has 80 number of 1 mm holes over the entire surface at the end of 25 mm of the tube: S group) over 2 s. Ventilation was resumed 30 s after the lidocaine administration. Arterial samples were taken at 0, 1, 3, 5, 7, 10, 15, 20, 30, 45, 60, and every 60 min after the lidocaine administration.

Pharmacokinetic modelling was applied using NONMEM VII®. The maximum Cp, the duration from the time zero to the time when the lidocaine Cp reached maximum, and the mean absorption time of lidocaine calculated on the final model were compared between the groups using unpaired t test. The duration of the lidocaine Cp higher than 1.4 or 6.0 µg/ml (therapeutic or toxic level, respectively) was calculated. Data was shown as mean ± SD.  $P < .05$  was regarded as significant.

**Results and Discussion:** The final model had two compartments with a transit compartment. The transit rate constants were 0.0918 vs 0.0485 /min for A vs S groups. V<sub>1</sub>, V<sub>2</sub>, CL<sub>1</sub>, and Cl<sub>2</sub> were 12.8 L, 164 L, 0.877 L/min, and 3.14 L/min. Using atomizer resulted in higher maximum Cp (1.72 ± 0.45 vs 1.00 ± 0.32 µg/ml;  $P < .001$ ), shorter mean absorption time (11.3 ± 3.3 vs 21.2 ± 6.1 min;  $P < .001$ ), and similar duration to maximum Cp (7.2 ± 4.1 vs 7.2 ± 1.3 min;  $P = .995$ ). The Cp reached therapeutic level in six (for 9.2, 10.1, 11.2, 10.4, 14.6, or 15.5 min) or two patients (for 0.3 or 8.0 min) but not toxic level in all. Atomizing lidocaine changed the pharmacokinetic profile.

**Conclusion:** Atomizing lidocaine shortened the mean absorption time of lidocaine administered to trachea.

## 9AP1-5

### Intravenous lipid emulsion has little effect on plasma bupivacaine concentration in humans

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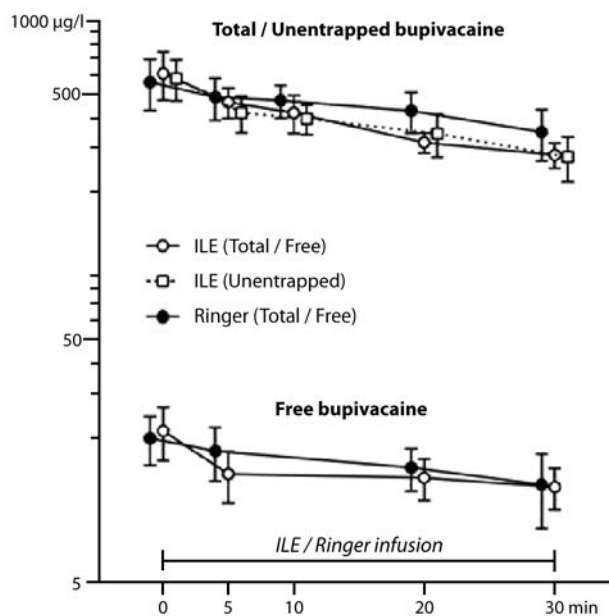
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**Background and Goal of Study:** Intravenous lipid emulsion (ILE) has been recommended for the treatment of severe local anaesthetic intoxication and is thought to entrap lipid soluble drugs by functioning as a "lipid sink" <sup>1</sup>, but its effect on bupivacaine pharmacokinetics in humans is unknown. We measured the effect of ILE on the total, untrapped (non-lipidbound), and free (non-proteinbound) plasma concentrations of intravenously infused bupivacaine.

**Materials and Methods:** Eight healthy male volunteers were infused bupivacaine (0.5 mg/kg) intravenously in 20 min, followed by either ILE or Ringer infusion (1.5 ml/kg in 1 min, followed by 0.25 ml/kg/min) for 30 min in randomized double-blind crossover fashion. Total, untrapped and free bupivacaine concentrations were determined in repeated blood samples.

**Results and Discussion:** At 20 and 30 minutes of infusion the total plasma bupivacaine concentration was lower during ILE than during Ringer infusion ( $p < 0.02$ ). No significant differences in untrapped or free bupivacaine concentrations were found ( $p > 0.05$ ). ILE reduced the context-sensitive half-life of total plasma bupivacaine from 45 (95% CI 32-76) min to 25 (95% CI 20-33) min ( $p = 0.01$ ).

We observed no significant adverse effects of ILE.



[Plasma bupivacaine]

Since the context-sensitive half-life of bupivacaine after intravenous administration depends primarily on tissue distribution, the shortening caused by ILE seems to reflect an increased distribution rate.

The lack of difference in untrapped and total bupivacaine concentrations implies that there was no "lipid sink" effect on the disposition of the non-toxic bupivacaine dose used.

**Conclusion(s):** ILE slightly increases the rate of bupivacaine tissue distribution. No "lipid sink" effect on bupivacaine disposition occurred. ILE was well tolerated.

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## 9AP1-7

### Dimethylsulfoxide potentiates the nerve conduction blocking effect of lidocaine without augmentation of the intracellular lidocaine concentration in the giant axon of crayfish in vitro

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**Background and Goal of Study:** The purpose of this study was to investigate how dimethylsulfoxide (DMSO) potentiates the blocking action of lidocaine.

**Materials and Methods:** A giant axon removed from a crayfish was used to investigate nerve conduction and intracellular lidocaine concentration. The maximum values of the differential waveform (dV/dt max) calculated from evoked action potentials were used for evaluating an inhibition of nerve conduction. The inhibition of the dV/dt max in low-frequency stimulation (tonic block) and high-frequency stimulation (phasic block) after perfusion of 1 mM lidocaine with or without 0.2 vol % DMSO, in which the concentration of DMSO alone had no anesthetic effect, was measured to evaluate the potentiating action of DMSO. The intracellular lidocaine concentration was measured through applying the potential reaction of the lidocaine-sensitive glass microelectrode during 30 minutes of perfusion of 1 mM lidocaine alone or in combination with DMSO.

**Results and Discussion:** A significant nerve conduction block was observed in more than 1 vol % of DMSO alone in a dose-related manner. The  $dV/dt$  max in the tonic block was significantly decreased when 0.2 vol % DMSO was added to the lidocaine solution ( $P = 0.004$ ). In the phasic block, there was no significant potentiating action of DMSO. There were no significant differences in the intracellular lidocaine concentrations with or without DMSO.

**Conclusion(s):** The potentiating effects of DMSO were observed only in the condition of low-frequency stimulation and were not related to the intracellular lidocaine concentration in the giant axon of crayfish in vitro.

## 9AP1-8

### Determination of the ED 90 of hyperbaric prilocaïne for intrathecal anaesthesia in day case knee arthroscopy

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**Background and Goal of Study:** The hyperbaric prilocaïne (HP) for spinal anaesthesia provides rapid sensory and motor block going with fast recovery and low incidence of neurological complications. Consequently this local anaesthetic is increasingly used in spinal anaesthesia for knee arthroscopy in day case surgery (1, 2). Despite this evolution there are no data regarding the ED 90 of HP in this indication. The aim of this prospective study is to define the ED 90 of HP in patients undergoing elective knee arthroscopy.

**Materials and Methods:** Patients are selected regarding their age (18-70 years), height (160-185 cm), ASA (I-II) and BMI (20-30) status. First, ED 50 of intrathecal HP is calculated based on the up-and-down method.

In brief, if surgery is feasible with a dose of X mg, the next patient is administered a dose of X-5 mg. On the contrary, if the surgery is not feasible (VAS > 2 during incision) the subsequent dose will be X+5mg. Sequences are analysed by probit analysis, based on the logistic regression method, using SAS software (SAS 9.1.3. for Windows; SAS Institute Inc., Cary, NC, USA) to obtain the probability of 50 % (ED50) and 90% (ED90) and the associated 95% confidence limits (95% CI). Second, during a period of 6 months an observational study is performed with this calculated dosage (ED 90). Sensory and motor onset times, sensory levels, duration of the block, and non-invasive arterial blood pressure are recorded. These results are expressed as mean  $\pm$  SD.

**Results:** Calculated ED50 is 29.09 mg (24.55-32.99), extrapolated ED90 is 38,11 mg (33.43-66.26). During the observational study intrathecal injection of 40 mg HP allowed surgery in 31 patients out of 33 after 15.5  $\pm$  4.7 minutes (min). Complete sensory block at level T12 is obtained before 10 min in 88% of these cases. Bromage IV is obtained in 71 % of the patients after 20 min. Duration of the block is 199  $\pm$  45 min. Maximal sensory block level was T6 whereas blood pressure did not exhibit any variation ( $\pm 20\%$ ).

**Conclusion:** This study determines the dosage of 40 mg of intrathecal HP as able to achieve an adequate anaesthesia for day case knee arthroscopy in term of timing, comfort and safety.

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## 9AP1-9

### Lidocaine inhibits LPS-induced endothelial adhesion molecules expression and monocyte-endothelial cell interaction

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**Background and Goal of Study:** The mechanism of the anti-inflammatory effects of lidocaine on regulation of monocyte-endothelial cell adhesion and monocyte transmigration has not been fully clarified.

We investigated the effect of lidocaine on lipopolysaccharide (LPS)-induced adhesion molecule expression intercellular adhesion molecule-1 (ICAM-1), vascular cell adhesion molecule-1 (VCAM-1) and E-selectin (CD62E) in human endothelial cells. The effect of lidocaine on monocyte adhesion and migration across endothelial monolayer was also investigated.

**Materials and Methods:** Human umbilical vein endothelial cells (HUVEC) isolated from human umbilical cord and a human monocytic leukemia cell line (THP-1) obtained from ATCC (TIB-202) were used. HUVEC cells were pretreated in the absence or presence of lidocaine (500, 5 and 0.05  $\mu$ g/ml) and then treated with LPS (1  $\mu$ g/mL). ICAM-1, VCAM-1 and CD62E expression were analyzed by western blot. The effect of lidocaine on monocyte-endothelial cell adhesion was measured using Vybrant Cell Adhesion Assay Kit. Transendothelial migration experiments were assayed by using 6.5-mm transwell filters. The number of cells transmigrated to the bottom compartment was quantified by counting migrated cells in six randomly selected fields per well.

**Results and Discussion:** Lidocaine (500, 5 and 0.05  $\mu$ g/ml) inhibited LPS-induced expression of ICAM-1 ( $P < 0.001$ ,  $P < 0.001$ , and  $P = 0.01$ , respectively), VCAM-1 ( $P = 0.006$ ,  $P = 0.03$ , and  $P = 0.5$ , respectively), and CD62E ( $P = 0.006$ ,  $P = 0.02$ , and  $P = 0.9$ , respectively) in HUVECs. Treatment of HUVEC with lidocaine reduced the number of adherent and transmigrated monocytes THP-1 and this effect was dose and time dependent.

**Conclusion(s):** Our results suggest that the anti-inflammatory activity of lidocaine may partly originate from the inhibition of a broad extent of endothelial adhesion molecule expression which may subsequently result in a decrease of monocytes recruitment.

## 9AP1-10

### Comparison of in vitro and in vivo release of lidocaine from biodegradable pellets

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**Background and Goal of Study:** Local anesthetics are most often used for pain relief by epidural analgesia or nerve block. A biodegradable, biocompatible, controlled release system for the delivery of local anesthetics is ideal to obtain prolonged, reversible nerve blockade. In previous research, our lab had developed a solvent-free, hot compressed biodegradable lidocaine pellets. This study compared the pharmacokinetic effects of this lidocaine pellets in vivo with those in vitro. The final goal was to develop solvent-free single-shot local anesthetics for pain control.

**Materials and Methods:** Lidocaine and PLGA powder were mixed with 1:5 ratio. The powder mixture was then compressed and sintered at 75°C to form a pellet with a height of 2.2mm and a diameter of 5mm. An elution method was employed to characterize in-vitro release rate of lidocaine over a 14-day period at 37°C. The determination of lidocaine release in vivo was to implant the pellet beside the sciatic nerve of the rat, and then use the microdialysis technique to obtain local tissue drug concentrations. Both of in-vitro and in-vivo drug release profiles were measured by HPLC. The changes in the surface of pellets after elution or implantation were detected by SEM.

**Results and Discussion:** The HPLC analysis shows that the drug concentrations in vivo were much lower than those in vitro. The result may be caused by the systemic uptake. SEM photos show that small channels were exhibited on their surfaces on Day 1 & 2 after elution or implantation. Then the pellets became viscous on Day 8 in vivo and Day 10 in vitro, which mean the degradation was faster in vivo than in vitro.

**Conclusion(s):** The solvent-free, hot compressed biodegradable lidocaine pellets could provide sustained drug release at least 14 days. However, the drug release rate was much faster in vivo than in vitro. Further studies being conducted are to adjust the drug concentration and release rate in vivo to determine the pharmacodynamic effects.

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## 9AP2-1

### The pharmacokinetics of IV midazolam in obese [morbidly] adolescents

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**Background and Goal of Study:** The presentation of obese pediatric patients has increased within the anaesthesia and surgical arena. Pediatric obesity has been correlated with a multitude of co morbid states including the metabolic syndrome (hypertension, diabetes, and fatty liver).

Despite an increased number of obese children undergoing anaesthesia, there is a paucity of dosing guidelines for this population.

Midazolam (MDZ) is a benzodiazepine frequently used in pediatric anaesthesia. Although there are numerous studies investigating the pharmacokinetics and pharmacodynamics of oral and intravenous MDZ in children with normal weights, there are none in obese adolescents. Our objective was to determine the pharmacokinetics of MDZ, its metabolites (1-OH-midazolam, 4-OH-midazolam) and glucuronide conjugates (1-OH-midazolam glucuronide and 4-OH-midazolam glucuronide) in obese adolescents.

**Materials and Methods:** This is a single center (IRB approved) pilot study in which patients from all ethnic groups were included. Each patient was assigned an ASA physical status of I, II and III prior to out-/inpatient surgery. Weight was defined using BMI percentiles and included the categories of overweight, obese and morbidly obese. Intravenous MDZ was dosed (2 and 3 mg) as an anxiolytic drug. PK blood samples were drawn at 0 (pre-dose), 5, 15, 30 minutes and 1, 2, 4, 6 hours post-dose. Parent MDZ and metabolite determination in plasma was performed by a validated LC/MS-MS assay with an LLOQ of 0.5 ng/mL for all analytes. Population pharmacokinetic models for MDZ were explored using NONMEM v 7.2. and a comparison was performed to evaluate clearance using lean controls.

**Results and Discussion:** Drug concentrations (parent and metabolite) were measurable in all patients. A three compartment population PK model with an allometric expression on clearance best fit the data. A proportional error model yielded 31% CV residual error and the final model was well predicted. The midazolam population clearance in obese children was  $CL_{MDZ}$  (L/h) =  $25.3 \cdot (WT/70)^{0.75}$ . Based on the individual children in this study, this yielded individual clearances between 19.5 and 89.5 L/h (0.253 to 0.687 L/h/kg).

**Conclusion(s):** Historical experience with IV midazolam, indicates a clearance of 4.7 - 19.7 mL/min/kg in children over 12 months. This compares well with our results (4.2 - 11.5 mL/min/kg) suggesting that there is no significant impact of obesity on the clearance of the parent midazolam.

## 9AP2-2

### Preemptive analgesic effect of systemically administered midazolam: experimental study in rats

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**Background and Goal of Study:** Preemptive analgesia suggests that the application of analgesic in prior to proceeding of noxious stimuli prevent the sensibility of the central nervous system which provokes the pain. The aim of this study was to investigate preemptive analgesic effects of intraperitoneally administered midazolam in different doses and midazolam with morphine and diclofenac, in rat model.

**Material and Methods:** After Institutional Ethics Committee approval, 240 male, Sprague Dawley rats, weighing 250-300 gr, were included in the study. The rats are divided in five groups. In group I, midazolam group, midazolam is applied in 0.1, 1, 5 and 10 mg/kg ip; group II diclofenac in doses 10 mg/kg ip; group III, morphine 10 mg/kg ip, and in group IV and V, morphine and diclofenac was added to midazolam. Saline was used as control. The hot plate test, model of acute pain and formalin test, model of inflammatory pain were performed 10 minute after the drug administration. Paw withdrawal in response to thermal stimulation and or paw flinching and shaking in response to sc hind paw formalin injection were measured. Behaviour side effects and motor disturbances were also examined.

**Results and Discussion:** In hot plate test and formalin test, midazolam produced significant preemptive analgesic effects with the 50% effective dose ( $ED_{50}$ ) of 2.82 mg/kg ( $CI_{95\%} = -1.85-5.1$  mg) and 1.6 mg/kg ( $CI_{95\%} = -0.81-4.04$  mg) in phase I and 1.1 mg/kg ( $CI_{95\%} = 0.67-5.03$  mg) in phase II. Antinociceptive effects of midazolam enhanced with morphine, in hot plate test and formalin test.  $ED_{50}$  of midazolam with morphine was 0.91 mg/kg ( $CI_{95\%} = -0.51-3.7$  mg) in hot plate test and 0.8 mg/kg ( $CI_{95\%} = -0.66-3.07$  mg) in phase I and 0.5 mg/kg ( $CI_{95\%} = 0.13-4.53$  mg) in phase II, in formalin test. Midazolam with diclofenac also expressed increased antinociceptive effects, in both tests, The  $ED_{50}$  of midazolam (with diclofenac) 1.0 mg/kg ( $CI_{95\%} = -1.37-5.01$  mg) in hot plate test and 0.9 mg/kg ( $CI_{95\%} = -0.87-4.09$  mg) in phase I and 0.7 mg/kg ( $CI_{95\%} = 0.48-6.63$  mg) in phase II, in formalin test.

**Conclusion (s):** Systemically administered midazolam had preemptive analgesic effects on acute thermal, and acute inflammatory induced nociception in rats. The antinociceptive potency of midazolam enhanced with morphine and diclofenac.

## 9AP2-3

### Preoperative anxiety levels among pre-medicated and non pre-medicated patients undergoing elective surgery

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**Background and Goal of Study:** Patients should not suffer needless anxiety before surgery. Increased anxiety may adversely affect physiological parameters, both before and during anaesthesia. It may also increase post-operative complications.

The goal of this study is to determine the level of anxiety that exist in patients undergoing elective surgical procedure. We also studied the effects of pre-medication on anxiety levels of patients.

**Materials and Methods:** After obtaining Ethical Board clearance, 140 consented patients between the age of 18 to 55 years, undergoing elective surgery, were given the Hospital Anxiety and Depression (HAD) scale questionnaire one day prior to surgery. Patients with GCS (Global Coma Scale) of less than 14, pregnant and severely ill patients were excluded from this study. In this randomized, double-blinded clinical trial, these patients were divided into either pre-medicated or non pre-medicated (placebo) groups. Oral Midazolam was used as pre-medication, and was given 1 hour prior to surgery. The HAD scale questionnaire was used again in all patients 15 minutes prior to induction of anaesthesia. The Data was collected and analyzed with SPSS Version 12.0.

**Results and Discussion:** Anxiety levels were higher in females, ASA (American Society of Anaesthesiologist) Class II patients, and in patients undergoing gynaecological surgery. The patients who had been given Midazolam had a pre-medicated HAD scale score of  $8.3 \pm 2.3$  (mean  $\pm$  SD) and post-medicated score of  $3.3 \pm 1.8$ . The placebo group had a pre-medicated score of  $8.9 \pm 2.3$  and post-medicated score of  $10.24 \pm 2.9$ . The Midazolam group had a significant reduction in pre-operative anxiety levels ( $p < 0.05$ ).

**Conclusion:** Pre-operative anxiety is a significant problem for the anaesthesiologist. Pre-medication with midazolam 1 hour prior to surgery significantly reduced the anxiety levels for patients undergoing elective surgery.

## 9AP2-4

### Co-administration of JM-1232(-) synergistically enhanced the hypnotic activity of propofol and the combination shortened the recovery from anesthesia in ddY mice

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**Background and Goal of Study:** JM-1232(-) (JM) is a newly developed isoin-doline derivative, which induces hypnosis through the benzodiazepine (BZD) site (1, 2), and JM showed the short duration of action and no accumulation effects. Propofol is a popular intravenous anesthetic in clinical settings and synergistic hypnotic interaction with BZD is well known. Thus, we studied the detail of interaction between JM and propofol using ddY mice.

**Methods and Methods:** Male adult mice were given either JM or propofol intravenously to determine the hypnotic dose (Table). Achievement of hypnosis was defined as a loss of the righting reflex (LRR). Other mice were administered JM and propofol, simultaneously. When the animal lost the righting reflex, the duration of LRR was determined. The 50% effective dose ( $ED_{50}$ ) was calculated, and after the confirming of  $ED_{50}$  of JM and propofol, we administered twofold dose of the drugs and compared the hypnotic durations among the combinations using ANOVA.

**Results and Discussion:** The hypnotic dose was  $3.70 \pm 0.18$  mg  $kg^{-1}$  ( $ED_{50} \pm SEM$ ) for JM and  $9.38 \pm 0.93$  mg  $kg^{-1}$  for propofol. Co-administration of 0.5, 1 and 2 mg  $kg^{-1}$  JM reduced the hypnotic dose of propofol to  $1.52 \pm 0.29$ ,  $0.79 \pm 0.34$  and  $0.0033 \pm 0.046$  mg  $kg^{-1}$ , respectively. The LRR duration after administration of twofold  $ED_{50}$  of JM and propofol was  $181 \pm 157$  and  $187 \pm 15$  sec, respectively (Mean  $\pm$  SD.), whereas, the combinations of JM and propofol never prolonged the duration of LRR over 60 sec throughout the study (Fig.).

Table 1. The percent ratios of responders in each treatment.

	Dose of JM-1232 (mg $kg^{-1}$ )								
	3	3.5	4	4.5	5				
JM-1232(-) alone	0	33	83	83	100				
	Dose of propofol (mg $kg^{-1}$ )								
	0.625	1.25	2.5	3.75	5	7.5	10	12.5	15
Propofol alone				0	17	67	67	100	
Combination of Propofol and JM-1232(-)									
JM-1232(-) 0.05 mg $kg^{-1}$	0	33	83	100					
JM-1232(-) 0.1 mg $kg^{-1}$	50	80	100						
JM-1232(-) 0.2 mg $kg^{-1}$	83	100	100	100					

The ratios of responders to total number of animals (n = 6) are expressed as the percentage (%).

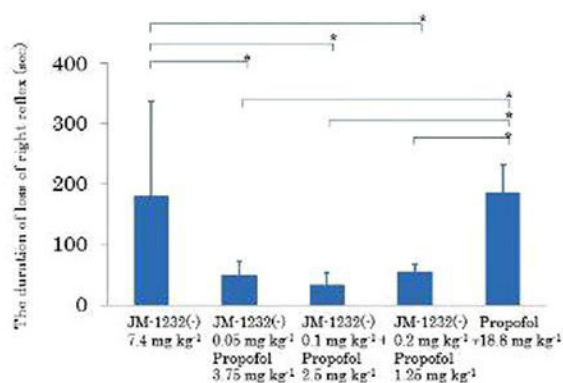


Figure 1. The duration of loss of righting reflex (mean  $\pm$  SD). All animals (n=6) of each group lost of the reflex and the dose of propofol was more than two times of 50% effective dose in each combination. \*:  $P < 0.05$  among groups.

[Figure]

**Conclusions:** The interaction between JM and propofol for achieving hypnosis was synergistic (3). Small and supplemental administration of JM significantly reduced the hypnotic dose of propofol and the combination shortened the time for recovery (4).

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## 9AP2-5

### The effect of bleeding and fluid replacement choice in propofol and propofol free-metabolites concentrations in pigs: a comparison between Lactated Ringer's and Hydroxyethylstarch 130/0.4

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**Background and Goal of Study:** Propofol free-metabolites (2,6-diisopropyl-1,4-quinol and 2,6-diisopropyl-1,4-quinone) may be associated with some potential toxic effects. In this study the effect of two common medical situations, bleeding and fluid replacement with crystalloids and colloids, on the quantity of propofol and propofol metabolites was studied.

**Materials and Methods:** Ten healthy Large White male pigs with  $27.3 \pm 3.5$  kg were submitted to propofol and remifentanyl constant infusion rates of  $15 \text{ mg kg}^{-1} \text{ h}^{-1}$ , and  $0.3 \mu\text{g kg}^{-1} \text{ h}^{-1}$ , respectively. One hour after the beginning of the propofol infusion, 25 ml  $\text{kg}^{-1}$  of blood were passively removed from the femoral artery during 20 minutes. After an extra 20 minutes waiting period, the volume was replaced by Lactated Ringer's 25 ml  $\text{kg}^{-1}$  ( $G_{LR}$ ; n=5) or Hydroxyethylstarch 130/0.4 20 ml  $\text{kg}^{-1}$  ( $G_{HES}$ ; n=5). Blood samples were taken before and after bleeding and, before and one hour after the beginning of volume replacement. Propofol and its free metabolites concentrations were determined by gas chromatography-mass spectrometry. Two-Way repeated measures ANOVA was used to compare data. Data are mean  $\pm$  sd.

**Results and Discussion:** There was a significant increase in propofol plasma concentrations during bleeding (from  $4.6 \pm 1.2$  to  $5.9 \pm 1.3 \mu\text{g/ml}$  in  $G_{LR}$  and from  $4.6 \pm 0.4$  to  $5.6 \pm 0.9$  in  $G_{HES}$ ;  $p < 0.01$ ) as well as in free propofol metabolites (from  $0.09 \pm 0.05$  to  $0.1 \pm 0.05$  in  $G_{LR}$  and from  $0.06 \pm 0.04$  to  $0.09 \pm 0.04$  in  $G_{HES}$ ;  $p < 0.01$ ). One hour after the beginning of the volume replacement the propofol plasma concentration was significantly higher in the lactated ringer's group ( $5.2 \pm 1.2$  in the  $G_{LR}$  compared to  $3.4 \pm 0.3$  in the  $G_{HES}$ ;  $p = 0.02$ ) but no significant differences were found in the metabolites concentration ( $0.14 \pm 0.06$  in the  $G_{LR}$  compared to  $0.09 \pm 0.05$  in  $G_{HES}$ ;  $p = 0.3$ ). However,  $G_{LR}$  tended to have also higher metabolites concentrations than the  $G_{HES}$ .

**Conclusion(s):** The lower concentrations of propofol in  $G_{HES}$  could be related to better hepatic perfusion resulting in higher metabolic rate. However, the fact that the  $G_{LR}$  metabolites tended to be higher suggests that differences caused by the fluids in the rate of metabolization of propofol are not likely to be the reason for the differences observed in the plasma concentrations. Further research is required to find the reason for lower propofol concentrations in  $G_{HES}$ .

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## 9AP2-6

### Natural recovery from neuromuscular blockade by a continuous infusion of rocuronium under sevoflurane and propofol anaesthesia

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**Background:** Although residual neuromuscular blockade impairs pulmonary function, the natural recovery after a continuous infusion of rocuronium (ROC) has not been examined in detail. This study aimed to compare natural recovery characteristics of ROC under either sevoflurane or propofol anaesthesia.

**Methods:** After obtaining informed consent and approval from our institutional Ethics Committee, patients of ASA physical status I or II undergoing laparoscopic abdominal and urological surgery for at least 3 hours, were randomly allocated to two groups according to an anaesthetic agent used (sevoflurane [Group S] and propofol [Group P]). General anaesthesia was induced with propofol 1-1.5 mg/kg IV in Group S and propofol 4  $\mu\text{g/ml}$  using target-controlled infusion technique in Group P along with remifentanyl 0.3  $\mu\text{g/kg/min}$ . All patients received 0.8 mg/kg IV of ROC to facilitate tracheal intubation. Sevoflurane and propofol were titrated to maintain Bispectral Index value between 40 and 55. Neuromuscular blockade was assessed with train-of-four (TOF) at abductor pollicis longus. After T1 recovered more than 5%, ROC was infused at the rate of 7  $\mu\text{g/kg/min}$ . Ulnar nerve was stimulated every 2 minutes and the infusion rate of ROC was changed by an up-down method (1  $\mu\text{g/kg/min}$ ) to archive T1 3-10%. At the end of peritoneal suturing, ROC infusion was discontinued and the recovery times (from the end of infusion to T1 25% and T4 recovery) were noted. When more than 50 minutes was needed to recover TOF ratio TOFR 0.9, sugammadex (SUG) was given. Parametric data was analyzed by unpaired t-test.  $P < 0.05$  was considered statistical significant.

**Results:** The recovery times to the T1 25% (Group S [n=5]:  $18.75 \pm 2.07$  min, Group P [n=5]:  $20.63 \pm 2.93$  min ( $p = 0.64$ )) and to the T4 (Group S [n=5]:  $36.50 \pm 10.74$  min, Group P [n=5]:  $14.40 \pm 10.61$  min ( $p = 0.075$ )) were similar. T4 reappeared earlier than T1 25% recovery in three patients in Group P. All patients received SUG.

**Discussion:** Previous study suggested that the recovery time of T1 to 25% of ROC after 0.6 mg/kg IV bolus was approximately 13 min under propofol anaesthesia (1). From our results, prolongation of the recovery time to T1 25% after the continuous infusion is an important issue in the clinical situation.

**Conclusion:** The natural neuromuscular recovery from the continuous infusion of ROC prolonged beyond the expectation based on the evidence about its bolus injection.

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## 9AP2-7

### Effect of local warming versus local cooling on injection pain after propofol administration during anaesthesia induction

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**Background and Goal of Study:** Propofol is a frequently used intravenous anaesthetic for the induction and maintenance of anaesthesia.

However pain during propofol injection remains a common problem. Various drugs and techniques have been proposed in order to alleviate propofol induced pain. Local warming or warming of propofol has been reported to be effective in reducing the pain but local cooling has not been studied yet.

In this study we aimed to investigate the effect of local warming and cooling on pain induced by propofol.

**Materials and Methods:** One hundred and twenty patients undergoing elective surgery were included in this randomized, prospective, single-blinded study. Patients aged between 18-65 years and were ASA I-III physical status. Patients were divided into 3 equal groups. In Group 1; warming at + 40°C, in Group 2; cooling at + 4°C was applied for 2 min prior to propofol administration at the site of venous access. In Group 3 (Control); no intervention was applied. In each patient, propofol was injected over a period of 1 min at a dose of 2.5 mg/kg. Hemodynamic parameters were recorded before and 1, 2, 3 min after propofol injection.

Patients were asked about any discomfort at the 15<sup>th</sup> seconds of injection and graded by the patient on a 5-point Verbal Rating Scale (VRS) (0= no pain, 1= mild pain, 2= moderate pain, 3= severe pain, 4= severe pain accompanied by facial grimacing and arm withdrawal). Statistics were performed by using Student's t, Pearson Chi-square, One-Way ANOVA, Kruskal Wallis tests where appropriate.

**Results and Discussion:** Demographic and clinical data were comparable between groups. The distribution of pain scores were found to be different among three groups (Table 1). In Group 1, pain scores were significantly lower than Group 2 and Group 3 ( $p < 0.001$ ). There was no difference between Group 2 and Group 3 ( $p = 0.344$ ).

Pain score	Groups		
	Group 1	Group 2	Group 3
0	21 (52,5%)	9(22,5%)	7(17,5%)
1	11(27,5%)	6(15%)	6(15%)
2	7(17,5%)	16(40%)	14(35%)
3	1(2,5%)	7(17,5%)	7(17,5%)
4	0(0%)	2(5%)	6(15%)

[Table 1]

**Conclusion(s):** In accordance with the findings in the previous reports; application of local warming prior to propofol administration effectively alleviated the pain induced by propofol whereas local cooling had no impact.

## 9AP2-8

### Lipid emulsion of propofol and a fat emulsion for parenteral nutrition strongly enhanced platelet activation induced by extracellular proteins, misfolded by structural modification with the granulocyte defense waponn HOCl

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**Background and Goal of Study:** Misfolding of extracellular proteins, induced by environmental factors such as mechanical stress, glycation, oxidative stress, ischemia, proteolysis and electrophilic stress leads to activation of platelets, endothelium and monocytes. Lipid rafts, ganglioside- and cholesterol enriched membrane microdomains, directly promote aggregate formation of misfolded protein. As the general anaesthetic propofol is formulated in a lipid emulsion containing 10% soybean oil, 2.25% glycerol, and 1.2% egg lecithin and fat emulsions are used for parenteral nutrition in intensive care patients we studied the effect of such formulations on the activation of platelets by HOCl modified proteins.

**Materials and Methods:** Platelet function was analyzed using flow cytometry, adhesion assays, aggregation, procoagulant activity, flow chamber thrombosis assays and confocal laser scanning microscopy.

**Results and Discussion:** We observed a strong enhancement of platelet activation induced by differed HOCl modified proteins such as albumin and fibrinogen in all used assays with lipid formulated propofol at clinically relevant concentrations. Pure propofol without lipids had no effect. In addition Lipofundin MCT 20% showed the same enhancing effects as lipid formulated propofol. It is likely, that the fat emulsions induced stronger platelet activation by enhancing the aggregate formation of the misfolded albumin, leading to enhanced crosslinking of platelet receptors and hence stronger activation/ or by direct interaction with the platelet membrane.

**Conclusion(s):** Infusion of propofol or any other lipid-based drug or parenteral nutrition might have an influence on prothrombotic tendency under inflammatory conditions. To study the clinical relevance of these in vitro data in intensive care patients might be promising.

## 9AP2-9

### Effect of paracetamol on the reduction of propofol injection pain

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**Background and Goal of Study:** Propofol remains the most common drug for induction of general anaesthesia, although it causes considerable pain on injection. None of the commonly used methods completely attenuate this discomfort. We aimed to investigate the effect of intravenous paracetamol pretreatment on the propofol injection pain.

**Materials and Methods:** A prospective randomized double-blind study was conducted on 180 patients, ASA I or II status, scheduled to undergo elective surgery. They were randomly assigned to one of the three groups of 60 each. Groups I, II, III were pretreated with 40 mg of lidocaine in saline, 100 mg of paracetamol and 10ml of saline, respectively. All patients had a 18-gauge catheter inserted into a superficial radial vein. After 2 min of venous occlusion, one-fourth of the total propofol dose was injected into the vein over a period

of 20 seconds. A blinded researcher assessed the patient's pain level using a four point verbal rating scale.

**Results and Discussion:** The three groups were comparable in respect to patient's characteristics. The incidence of pain on injection of propofol in placebo, i.v. paracetamol and lidocaine groups was 85%, 36%, 21% respectively ( $p < 0.05$ ).

**Conclusion(s):** Pretreatment using intravenous paracetamol was found to be effective in reducing propofol injection-induced pain.

## 9AP2-10

### Recovery from serotonin syndrome after the use of propofol

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A 24-year-old male patient presented to A&E following an RTA with a 15cm facial laceration. there was no history of memory loss, vomiting or loss of consciousness. Past medical history was thoroughly reviewed and was insignificant. Physical and neurological examination and investigations were normal. The patient was admitted under the plastic surgery team for facial laceration repair under GA. He took Pethidine 100mg IM for pain relief in A&E before going to theatre. IV induction with Medazolam 3mg, Fentanyl 100mcg and Propofol 150mg. LMA size 4 was used. Maintenance of GA with Sevoflurane. He also took Morphine 3mg IV.

The procedure was uneventful. In Recovery room he was fully conscious, free of pain with stable vital signs. Suddenly, 30 min later he started to complain of headache and shortness of breath. He became more drowsy and started to lose consciousness. The neurosurgical team reviewed him, CT brain was done immediately and was normal. ABG's and blood tests were normal. The patient developed a tremor, his consciousness continued to deteriorate, his BP started to rise with a HR > 110bpm, and temp was 37.7C per axilla. He became spastic and was transferred to ICU. He became unresponsive in ICU with GCS 3/15.

After giving him Propofol 150mg IV to facilitate the intubation, and before giving him any other drug, amazingly, he started regaining his consciousness, breathing normally and talking appropriately. After interviewing the patient for a second time, he admitted to being on Fluoxetine 20mg/day for treatment of depression. His stay in ICU for 24h was uneventful and his bloods were normal. Afterwards, he was discharged home. The diagnosis of serotonin syndrome due to drug interaction (SSRI with Pethidine and Fentanyl) was made. The coincidental administration of Propofol was postulated to have resolved the patient's toxicity.

Serotonin syndrome is associated with increased serotonergic activity in CNS. It is seen with therapeutic medication use, inadvertent interactions between drugs, and intentional self-poisoning 1. Serotonin syndrome is characterized by the triad of neuromuscular excitation, autonomic stimulation and changed mental state 2. We found only two reported cases for the use of Propofol in the treatment of serotonin syndrome, one of them in combination with Rocuronium. 3 4

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## 9AP3-1

### Multiparameter flow cytometry analysis of opioid-mediated alteration of human immune signaling pathways

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**Background and Goal of Study:** Opioids are the most common drugs used for the treatment of acute and chronic pain. In addition to their well-described analgesic functions, there is increasing evidence for the role of opioids in modulating the immune system. Since the discovery of opioid receptors on immune cells, studies in isolated immune cells and animal models have provided insight into the intracellular signaling mechanisms that underlie opioid-mediated immune effects. However, in humans the mechanisms by which opioids modulate the immune system remain largely unknown. In this study, we used single-cell, multi-parameter fluorescence flow cytometry (Phospho-flow), and train of flight mass-spectrometry flow cytometry (CytoF), to characterize the intracellular mechanisms of morphine on immune cells, in human whole blood.

**Materials and Methods:** Phospho-flow and CyToF take advantage of multi-channel flow cytometry and phospho-specific antibodies to combine tradi-



tional surface staining of immune cells and intracellular staining of phosphoproteins. While Phospho-flow is based on fluorescent markers, CyToF is based on the detection of rare heavy metal conjugate using mass spectroscopy, which allows the simultaneous detection of a much greater number of signals than fluorescence-based flow cytometry.

Human whole-blood samples were incubated with morphine (10mcM) for short (15min) and long (2h) periods of time. They were subsequently subjected to in vitro stimulation using an array of representative stimuli of innate and adaptive immunity. Samples were then acquired by multiparameter flow cytometry analyzed using the Cytobank software. All experiments were done in duplicate and repeated three times independently for statistical analysis, using standard methods.

**Results and Discussion:** We found that short- and long-term exposure of human whole blood to morphine significantly altered cell type-specific immune signaling pathways. In particular, the IL-6-induced Ras-MAPK and JAK-STAT signaling pathways were significantly inhibited by morphine in monocytes, but not in lymphocytes. These results are consistent with a direct effect of opioids on immune cells and support the notion of a crosstalk between the opioid receptor signaling and immune signaling networks.

**Conclusion:** Morphine significantly inhibited the Ras-MAPK and JAK-STAT response to IL-6 stimulation of human whole blood in monocytes.

### 9AP3-2

#### The influence of age and gender on remifentanyl EC<sub>50</sub> for preventing microemulsion propofol injection pain

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**Background and Goal of Study:** Propofol injection pain is an unpleasant experience of patients and its prevalence can influence on the age and gender. The pretreatment of remifentanyl have been reported to reduce the propofol injection pain. In this study, we determined the half maximal effective concentration (EC<sub>50</sub>) of remifentanyl for preventing the microemulsion propofol injection pain in male, female, old and young group.

**Materials and Methods:** After institutional review board approval, a total of 120 patients was assigned into 4 groups depending on their age and gender; group M (adult male > 20 yr), group F (adult female > 20 yr), group O (age > 65 yr), and group Y (age 20 - 65 yr). Anesthesia was induced with a propofol and remifentanyl by target-controlled infusion (TCI). Effect-site target concentration (EC) of propofol was 4 ug/ml. EC of remifentanyl for the first patient started at 4.0 ng/ml. EC of remifentanyl for each subsequent patient was determined by the response of the previous patient by the Dixon's up-and-down method with an interval of 0.2 ng/ml. After remifentanyl reached target concentration, propofol was administered, and the pain response was observed.

**Results and Discussion:** The remifentanyl EC<sub>50</sub> was 3.8 ± 0.2, 2.7 ± 0.2, 3.2 ± 0.2, and 3.5 ± 0.1 ng/ml in the group M, F, O and Y group, respectively, by Dixon's up-and-down method. From probit analysis, the remifentanyl EC<sub>50</sub> was 3.7 (95% confidence interval(CI), 3.0 - 4.3), 2.7 (95% CI, 1.8 - 2.9), 3.1 (95% CI, 2.8 - 3.4), 3.5 (95% CI, 3.4 - 3.7) ng/ml in the group M, F, O and Y group, respectively.

**Conclusion(s):** The remifentanyl EC<sub>50</sub> for preventing propofol injection pain was lowest in the adult female, highest in the adult male, and higher in the adult group than the old group.

### 9AP3-3

#### Effects of three peptidase inhibitors on anti-nociceptive action of dynorphin (1-13) and dynorphin (1-17) by intrathecal administration in rats

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The main groups of endogenous opioid peptides are enkephalins, dynorphins and beta-endorphin. Opioid peptides are derived from three different precursor peptides: pro-opiomelanocortin, proenkephalin, and prodynorphin. Prodynorphin produces endogenous opioid peptides such as dynorphin (1-13) [Dyn(1-13)], dynorphin (1-17) [Dyn(1-17)], dynorphin B, alpha- and beta-endorphin, and several larger molecules

Previous *in vitro* studies showed a hydrolysis of endogenous opioid peptides by cerebral membrane preparation. Three distinct enzymes, amastatin (an aminopeptidase inhibitor)-sensitive amino peptidase, captopril (a dipeptidyl carboxypeptidase inhibitor)-sensitive peptidyl dipeptidase A, and phosphoramidon (an endopeptidase-24.11 inhibitor) -sensitive endopeptidase-24.11 („enkephalinase“, enkephalinase A; EC 3.4.24.11)[PIs] play critical roles in the

inactivation of exogenously added opioid peptides in isolated preparations.

In the present study, effects of the PIs on the anti-nociception induced by intrathecal[ i.t.] administration of Dyn(1-13)( Tyr-Gly-Gly-Phe-Leu-Arg-Arg-Ile-Arg-Pro-Lys-Leu-Lys) and Dyn(1-17)(Tyr-Gly-Gly-Phe-Leu-Arg-Arg-Ile-Arg-Pro-Lys-Leu-Lys-Trp-Asp-Asn-Gln) were examined. All the present animal experiments were performed in strict accordance with the Guidelines forTokai University. The anti-nociception 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)] x100. The AUC (area under the curve) value for the anti-nociception of an opioid on each rat was calculated for some experiments.

AUC value of 1 nmol Dyn (1-13) and Dyn (1-17) without PIs is 1329 and 2645, respectively, indicating short peptide is more sensitive to PIs .

The AUC of 1 nmol of Dyn (1-13) and Dyn (1-17) with PIs was approximately six and three times than without PIs., respectively. There data demonstrated that the inhibitory effects of Dyn (1-13) and Dyn (1-17) were significantly increased by co-administration of PIs.

The data obtained in the present investigation together with those obtained in previous studies showed that in the presence of the three PIs the anti-nociceptive potency of opioid peptide may depends on their length.

### 9AP3-4

#### Sufentanil pharmacokinetics during coronary artery bypass surgery: the impact of changes in protein binding during cardiopulmonary bypass

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**Background and Goal of Study:** Although it is known that pharmacokinetics of sufentanil are changed during cardiopulmonary bypass (CPB)<sup>1</sup>, there exist no data about its free fraction in this phase. We studied the pharmacokinetics of sufentanil during coronary artery bypass surgery with special regard to protein binding.

**Materials and Methods:** After IRB approval and written informed consent, 13 male patients (53-71 y) undergoing coronary artery bypass surgery received anaesthesia with propofol and target controlled infusion (TCI) of sufentanil, using the Gepts model<sup>2</sup>, targeting plasma concentrations of 0.4 (n=6) or 0.8 ng/ml (n=7). Arterial blood samples were taken before, during and after CPB. Total and unbound sufentanil concentrations were measured by Ultra-HPLC with tandem mass spectrometry. Pharmacokinetics were determined by population analysis.

**Results and Discussion:** Anaesthesia lasted 221 ± 57 min (mean ± SD) with sufentanil doses of 0.56 ± 0.05 and 1.03 ± 0.06 µg/kg/h for targets of 0.4 and 0.8 ng/ml, resp. The main findings are shown in the table. The total sufentanil concentrations were consistently higher than targeted ( $C_{total}/C_{target} > 1$ ), particularly in the pre-CPB phase, and decreased subsequently, whereas the unbound sufentanil concentrations remained fairly constant. Free fraction of sufentanil increased significantly during CPB. Pharmacokinetics were best described by a two-compartment model. The elimination clearance CL was significantly higher during and after CPB. The volumes of distribution V<sub>1</sub> and V<sub>2</sub> increased slightly during CPB. Clearance could be modeled as a function of hepatic blood flow and free fraction ("well-stirred model") assuming an increase of hepatic blood flow during CPB. V<sub>1</sub> and V<sub>2</sub> could be modeled as a function of free fraction. There were no effects of body weight and age.

	C <sub>total</sub> / C <sub>target</sub>	Free fraction	CL (L/min)	V <sub>1</sub> (L)	V <sub>2</sub> (L)
pre CPB	2.45 ± 0.90	8.6 ± 3.3 %	0.60 ± 0.20	9.0 ± 0.5	48.6 ± 8.5
CPB	1.36 ± 0.47 *	13.2 ± 4.7 % *	1.33 ± 0.43 *	9.8 ± 0.7 *	58.8 ± 7.4 *
post CPB	1.35 ± 0.41 *	11.8 ± 4.8 % *	1.04 ± 0.34 *	9.6 ± 0.7 *	58.0 ± 8.6 *

[Mean ± SD. \*:p < 0.05 vs. pre CPB, Tukey test]

**Conclusion(s):** TCI with the Gepts model led to a distinct sufentanil concentration overshoot in the pre-CPB phase. Significant changes of sufentanil pharmacokinetics during CPB could be attributed to changes in protein binding and hepatic blood flow.

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### 9AP3-5

#### Investigation of plasma fentanyl concentrations in patients undergoing mastectomy comparing with simulation

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**Background and Goal of Study:** We administer fentanyl in general anesthesia predicting concentration with a commercial simulator. However, the precision of simulator was not fully understood in clinical settings. We investigated plasma fentanyl concentration in patients undergoing mastectomy.

**Materials and Methods:** Following Research Ethics Board approval and informed consent, women of American Society of Anesthesiologists' class I or II undergoing mastectomy were enrolled. Anesthesia throughout surgery was maintained with sevoflurane and fentanyl after propofol and rocuronium bolus infusion. Anesthesia was titrated subsequently to a bispectral index around 50. A maintenance infusion was administered with 8ml/kg/h of acetate Ringer's solution from anesthesia start to finish of obtaining blood samples. In addition, infusion for blood loss was administered with twice the volume of hydroxyethyl starch 70/0.5. Fentanyl bolus infusion was administered by the attendant anesthesiologist. A blood sample was drawn every 30 minutes during anesthesia. We used Tivatrainer and AnestAssist as a commercial simulator.

**Results and Discussion:** We measured plasma fentanyl concentrations of 111 samples from seventeen patients who underwent mastectomy. The two simulators, Tivatrainer and AnestAssist, were almost equal in the predicted fentanyl concentration. The plasma fentanyl concentration was significantly correlated with the simulated fentanyl concentration ( $r=0.838$ ,  $P<0.01$ ). However, the difference between plasma and simulated fentanyl concentration was  $0.32\pm 0.6$  [-2.7, 2.3]. In addition, 41.1% of all samples had a difference of more than  $\pm 0.5$  ng/ml. A Bland-Altman plot demonstrated a large variation in the difference between these two values. The mean difference was 0.3 ng/ml (95% CI 0.26-0.50) and the width of the 95% limits of agreement was 1.2 ng/ml. The proportional bias was shown.

**Conclusion(s):** The predicted data by two simulators was significantly correlated with the plasma fentanyl concentration. However, the difference might have importance in clinical settings that we could not ignore. We might pay attention to the difference in using the simulator in clinical settings.

**Acknowledgements:** We thank Dr. Matsushita, Dr. Inoue and Dr. Oka, Department of Analytical Chemistry, Kinjo Gakuin University, for the cooperation of measuring plasma fentanyl concentrations.

### 9AP3-6

#### Genetic polymorphisms of hepatic organic anion-transporting polypeptide (OATP) 1B1 transporters: no influence on the disposition of fentanyl and midazolam

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**Background and Goal of Study:** Fentanyl (FENT) and midazolam (MDZ) are routinely administered to patients in anaesthesiology. Plasma levels of both CYP3A4 substrate drugs show a high interindividual variability which might in part be explained by genetic polymorphisms of drug transporters. Hepatic OATP1B1 influx transporters mediate the uptake of a variety of drugs (e.g. statins, bosentan) into hepatocytes. Several genetic variants (single nucleotide polymorphisms) of OATP1B1 are known to affect its transport activity and thereby the disposition of drugs. The aim of this study was to investigate the influence of OATP1B1 polymorphisms on the pharmacokinetics (PK) of FENT and MDZ.

**Materials and Methods:** This study was approved by the Institutional Review Board of Heidelberg University Hospital. Informed consent was obtained before any study measures were carried out. Only individuals homozygous for the genetic wild type of OATP1B1 (c.388A and c.521T) or for a variant with altered transport activity (c.388G and c.521C) were included in the study. 16 healthy volunteers (22-49 yrs) received MDZ (3 mg p.o.) + FENT (5  $\mu$ g / kg i.v.), or MDZ + FENT in combination with the known OATP inhibitor rifampicin (RIF, 600 mg p.o.) in a randomized crossover design. Naloxone was used (0.4 mg i.v.) to mitigate the side effects of FENT. Blood was sampled over 24 hours and analyzed by LC-MS/MS. The PK of MDZ was determined by a limited sampling strategy. Non-compartmental models were used for pharmacokinetic calculations.

**Results and Discussion:** The area under the concentration-time curve (AUC) of FENT was  $16.3 \pm 8.7$  h\*nmol/L (mean  $\pm$  SD) in OATP1B1 wild type individuals (WT) vs.  $12.8 \pm 1.3$  h\*nmol/L in individuals with altered OATP1B1 activity

(GC polymorphism) (n.s.). Under RIF, FENT AUC was  $18.4 \pm 7.3$  h\*nmol/L in WT vs. in GC  $16.3 \pm 5.2$  h\*nmol/L (n.s.). FENT clearance was  $1345 \pm 562$  mL/min in WT vs.  $1484 \pm 287$  mL/min in GC (n.s.). Under RIF, FENT clearance was  $1061 \pm 275$  mL/min in WT vs. in GC  $1295 \pm 558$  mL/min (n.s.). MDZ AUC<sub>2,4h</sub> in WT was  $6.0 \pm 2.8$  h\*ng/mL, and  $8.7 \pm 5.2$  h\*ng/mL in GC (n.s.). Under RIF, MDZ AUC<sub>2,4h</sub> in WT was  $11.0 \pm 4.5$  h\*ng/mL, and in GC  $9.8 \pm 5.7$  h\*ng/mL (n.s.). Partial metabolic clearance of MDZ was  $1065 \pm 390$  mL/min in WT vs.  $849 \pm 451$  mL/min in GC (n.s.), and under RIF  $646 \pm 459$  mL/min in WT vs.  $745 \pm 394$  mL/min in GC (n.s.).

**Conclusion:** Genetic polymorphisms of OATP1B1 do not alter the disposition of intravenously administered fentanyl and oral midazolam.

### 9AP3-7

#### Incidence of fentanyl-induced coughing and effect of injection velocity

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**Background and Goal of Study:** Fentanyl is commonly used as a pre-induction adjunct, but can sometimes elicit cough. The existing literature about the incidence of fentanyl-induced cough (FIC) is extremely diverse and the results of clinical trials are conflicting. The purpose of our study is to investigate the effect of different injection velocity to the intravenous pre-induction dose (2  $\mu$ g/kg) of fentanyl on the incidence and severity of FIC in Turkish population.

**Materials and Methods:** Following local ethical approval and written informed consent, 210 ASA I-III, 18-75 year old patients undergoing general anesthesia for elective surgery were enrolled into this randomized placebo controlled study. The exclusion criteria included, a history of bronchial asthma or chronic obstructive lung disease, respiratory tract infection, smoking, and angiotensin converting enzyme inhibitor use. No premedication was used before surgery. Patients received either 2  $\mu$ g/kg fentanyl injected over 2 sec, 20 sec or same volume saline placebo (NaCl %0.9) injected over 2 sec as group I, II, III respectively. After completion of injections, the onset time and intensity of coughing was observed by a blinded observer for 2 minutes. Severity of coughing was graded based on the number of coughs: mild (1-2), moderate (3-5), severe ( $\geq 5$ ). Statistical analyses were performed with Chi square and independent sample t tests.  $p < 0,05$  was regarded as statistically significant.

**Results and Discussion:** The mean onset time of coughing was  $21 \pm 7,71$  seconds after injection. Incidences of cough of patients were 11.4%, 8.6%, 0% as group I, II, III respectively.

**Conclusion(s):** According to our study, the incidence of cough in study participants after 2  $\mu$ g/kg intravenous fentanyl was in average 10% and take place in the middle of between European and Far East-Asiatic population and most of them were mild in severity.

### 9AP3-8

#### Conjunctival administration of remifentanyl in rabbits

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**Background and Goal of Study:** Delivering analgesics via conjunctival application could provide a rapid and convenient pain relief in disaster medicine. We attempted to determine whether conjunctival administration of remifentanyl could produce significant effect without side effects.

**Materials and Methods:** After ethic committee approval, 10 rabbits were administered conjunctivally remifentanyl 25  $\mu$ g/kg. Measured parameters were SpO<sub>2</sub>, blood pressure (BP) and heart rate (HR) before administration and in 1 minute intervals and immobilisation time (loss of righting reflex).

The measurements were performed for 20 minutes and naloxone 0.2 mg i.m. was then administered to antagonise residual psychomotor effects of remifentanyl. Conjunctival irritation was measured in 1, 10 and 20 min. after administration of remifentanyl according to modified technical standard EN ISO 10993-10. ANOVAs test was used for statistical analysis of hemodynamic parameters.

**Results and Discussion:** Immobilisation time in nine animals was  $159.8 \pm 60.6$  s, loss of righting reflex was absent in 1 animal. There were no changes in cardiorespiratory parameters (initial, 10 and 20 minutes after administration HR  $239.2 \pm 27.5$ ,  $229.7 \pm 58.4$  and  $274.4 \pm 39.9$ , systolic BP  $120.1 \pm 25.2$  mm Hg,  $112.1 \pm 15.3$  and  $125.9 \pm 16.1$  mm Hg and SpO<sub>2</sub>  $99.0 \pm 0.9$ ,  $98.7 \pm 1.1$  and  $98.9 \pm 0.7$ ). These results are in contrast to conjunctival administration of sufentanil 5  $\mu$ g/kg that caused significant decrease of SpO<sub>2</sub> and HR<sup>1)</sup>. We can speculate that the reason for stability of cardiorespiratory parameters was due to the stimulation of NMDA receptors caused by remifentanyl. There were no signs of conjunctival irritation in any animal.

**Conclusions:** Conjunctival remifentanyl 25µg/kg in rabbits produced rapid onset of without changes in cardiorespiratory parameters.

The study was supported by scientific grants IGA NT 11284 and VG20102015014

**Reference:**

1. Malek J et al. Conjunctival administration of sufentanil in rabbits. *Eur J Pain Suppl* 5 (2011), 212

## 9AP3-9

### Nasal administration of remifentanyl in rabbits

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**Background and Goal of Study:** Delivering analgesics via nasal administration could provide a rapid and convenient pain relief in breakthrough pain or in disaster medicine. We attempted to determine whether nasal administration of remifentanyl could produce significant effect without side effects.

**Materials and Methods:** After ethic committee approval, 10 rabbits were administered nasally remifentanyl 200 µg/kg. Measured parameters were SpO<sub>2</sub> and heart rate (HR) before administration and in 1 minute intervals and immobilisation time (loss of righting reflex). The measurements were performed for 20 minutes and naloxone 0.4 mg i.m. was then administered to antagonise residual psychomotor effects of remifentanyl. ANOVAs test was used for statistical analysis of hemodynamic parameters.

**Results and Discussion:** Immobilisation time in 6 animals was 185.0±66.9 s, loss of righting reflex was absent in 4 animals. There were no changes in cardiorespiratory parameters (initial, 10 and 20 minutes after administration HR 239.9±15.9, 240.5±50.6 and 251.1±16.5 and SpO<sub>2</sub> 98.6±1.3, 98.1±1.4 and 99.1±1.1. These results are in contrast to nasal administration of sufentanil 1.5 µg/kg in children that caused significant decrease of SpO<sub>2</sub><sup>1)</sup>. We can speculate that the reason for stability of cardiorespiratory parameters was due to the stimulation of NMDA receptors caused by remifentanyl. Further tests must be done to assess the role of intranasal remifentanyl in humans.

**Conclusions:** Nasal remifentanyl 200 µg/kg in rabbits produced rapid onset of effect without changes in cardiorespiratory parameters. The results of our study may increase the variety of drugs and methods of their administration to induce anxiolysis, sedation and analgesia and safety of patients.

The study was supported by scientific grants VG20102015014 and IGA NT 11284

**Reference:**

1. Abrams R et al. Safety and effectiveness of intranasal administration of sedative medications (ketamine, midazolam, or sufentanil) for urgent brief pediatric dental procedures. *Anesth Prog* 1993;40:63-66

## 9AP4-1

### Early postoperative gastric emptying in patients undergoing laparoscopic cholecystectomy: sugammadex vs. neostigmine/atropine neuromuscular blockade reversal agents

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**Background and Aim:** Neostigmine/atropine is commonly used to antagonise residual neuromuscular block. Both drugs have an dose-response impact on gastric motility, neostigmine increase and atropine delay gastric emptying. Such a relationship between these drugs leads to unpredictable effects on gastric emptying in perioperative period. Sugammadex is a new reversal agent, pharmacologically unrelated to acetylcholine receptors, and therefore can be assumed that there is no impact on gastric emptying. The aim of this study was to evaluate the effect of sugammadex and neostigmine/atropine on gastric emptying in patients undergoing laparoscopic cholecystectomy (LP) in early postoperative period.

**Material and Methods:** In the prospective, randomized, clinical study 42 adult patients undergoing LP were analyzed. The patients were divided in two groups: sugammadex group S (21 pts.: age 50±16 yr.; male 6) and neostigmine/atropine group NA (21pts.: age 51±12 yr.; male 6), respectively. In all patients after the induction of anesthesia a gastric tube is positioned in the stomach. Before awakening 1 g of paracetamol dissolved in 200 mL of water was administered into the stomach. Thereafter, the gastric tube was rinsed with 20 mL of water and removed. For reversal of neuromuscular blockade patients in group S received 2 mg/kg of sugammadex while patients from group NA received 0.04 mg/kg of neostigmine with 0.015 mg/kg of atropine. Venous blood samples were obtained immediately after the arrival of patients in the recovery room (T0) and then after 15 (T15), 30 (T30), 60 (T60), 90 (T90), 120 (T120) and 150 (T150) minute. Paracetamol absorption test was used to

evaluate gastric emptying and paracetamol absorption was assessed from the plasma paracetamol concentration (PPC).

**Results:** The values of PPC immediately after the arrival of patients in the recovery room (T0) were significantly higher between the group S 1.2±0.9 vs. group NA 0.4±0.4 (p < 0.01). Values of the PPC at 15, 30, 60, 120 and 150 min. were higher but not significantly in group S vs. group NA: T15, 2.1±1.5 vs. 1.5±1.4; T30, 3.7±3.8 vs. 2.9±2.2; T60, 4.2±2.8 vs. 3.5±2.7; T120, 5.0±3.4 vs. 4.6±3.6; T150, 5.9±3.4 vs. 4.9±3.2. Values of the PPC at 90 min were minimally higher in group NA: T90, 4.6±3.4 vs. 4.7±3.4 (p=NS).

**Conclusion:** Although the study results show a tendency of faster gastric emptying in sugammadex group, this difference is not significant in most, possibly due to study small sample size.

## 9AP4-2

### Efficacy of sugammadex in reversal profound rocuronium-induced blockade in patients with end-stage renal disease submitted to renal transplantation

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**Background and Goal of Study:** Sugammadex antagonizes rocuronium-induced neuromuscular blockade (NMB) by encapsulating the molecules of this agent in plasma and originating a complex which is mainly excreted by kidneys. The aim of this study was to evaluate the efficacy and safety of sugammadex in the reversal of profound NMB induced by rocuronium in patients with end-stage renal failure and compare it to patients with normal renal function.

**Materials and Methods:** Twenty consecutive patients with end-stage renal disease (CLcr < 20 ml/min), under haemodialysis for at least 3 months, scheduled for kidney transplantation from cadaver donors and twenty control patients (CLcr > 90 ml/min) were included in both Hospitals. Anesthesia was induced and maintained with Propofol (TCI) and Remifentanyl. Rocuronium 0.6 mg/kg was given after induction followed by continuous infusion 0.4-0.6 mg/kg/h to maintain a profound level of NMB (PTC < 3 responses) until the end of the procedure as measured by acceleromyography (AMG). Sugammadex 4 mg/kg was administered once the skin suture was finished. Primary efficacy variable was time from start sugammadex administration to recovery TOF ratio up to 0.9. NMB monitoring continued at the recovery room for 2 hours, along with other clinical signs. Data were analyzed and equivalence established for time to TOF>0.9, if the 95% CI for the differences between groups was within the range of -60 to + 60 s. Data are expressed as mean (SD [Min-Max]).

**Results and Discussion:** Nineteen patients in the renal group (RG) and twenty in the control group (CG) completed the study between October and November 2011. There were no significant differences in terms of age, weight, gender, surgical time and onset time. CLcr was 9.7(4.2[4.1-19.5]) mL/min in RG and 126(34[75-188]) mL/min in CG.

Mean time from sugammadex administration to recovery of T4/T1 >0.9 was 315 (90[33-668]) seconds and 165 (79[63-382]) seconds respectively (p=0,042) with estimated mean (95%CI) differences of 157seconds, thus not meeting the predefined equivalence interval. Neither drug-related adverse events nor clinical or monitoring evidence of recurrence of NMB was observed in any group.

**Conclusion:** Sugammadex 4 mg/kg allows complete, adequate and rapid recovery from deep NMB without adverse events in end-stage renal disease patients.

**References:**

1. Staals et al. *Br J Anaesth* 2008;101(4):492-7. Staals et al. *Br J Anaesth* 2010;104(1):31-9. Snoeck et al. *Euroanaesthesia* 2011; Abstract 9AP2-7.

## 9AP4-3

### Sugammadex dosage based on ideal body weight for profound rocuronium-induced neuromuscular blockade reversal in morbidly obese patients

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**Background and Goal of Study:** In bariatric surgery, a profound neuromuscular blockade (NMB) is required until the end. Rocuronium (R) is used since sugammadex (S) allows recovery of profound NMB. If adjustment of R dosage based on ideal body weight (IBW) is established (1), there are few data concerning the S dosage in morbidly obese patients (MOP) (2). The aim of our study was to determine if a profound R-induced NMB could be reversed by S dosage based on IBW in MOP.

**Material and Methods:** This observational study focused on patients with BMI  $\geq 40$  kg/m<sup>2</sup>, undergoing bariatric surgery. Neuromuscular transmission monitoring at the adductor pollicis was performed using TOF-WatchS. Anaesthesia was induced with remifentanyl, propofol and rocuronium. Anaesthesia was maintained with desflurane (MAC = 1), remifentanyl TCI and R. At the end of surgery, normothermic patients with profound NMB (Train of Four (TOF) = 0 response, and Post-Tetanic Count (PTC) < 5 responses) received either 1 mg/kg S or 2 mg/kg S based on real body weight (RBW), instead of 4 mg/kg (3). Time to complete reversal (TOF ratio > 0.9) was noted. If complete reversal was not achieved within 10 min after S administration or if recurarization occurred (normal TOF ratio decrease less than 0.8), a second dose of S was administered at the same dosage. Neuromuscular transmission monitoring was followed for 15 min after complete reversal.

**Results and Discussion:** Twelve women and 4 men were studied, median age 51 years, median BMI (extreme values) 46 kg/m<sup>2</sup> (39.8-60). Eleven patients received 1 mg/kg and 5 received 2 mg/kg S based on RBW, which corresponded to 2.3 mg/kg (1.6-2.7) and 3.6 mg/kg (3.2-4.9) in IBW basis, respectively. Median time to complete reversal was 6 min (2-10) for 15 patients. TOF ratios were maintained above 0.9 within 15 min. 1 patient presented partial reversal: the TOF ratio did not exceed 0.6 10 min after S administration. This woman (BMI 60 kg/m<sup>2</sup>) received S 1 mg/kg RBW (2.7 mg/kg IBW). TOF ratio reached 0.9, 3.5 min after a second S administration (1 mg/kg RBW).

**Conclusion:** In MOP with profound R-induced NMB, S dosage adjustment on IBW seems to be effective to achieve complete reversal within less than 10 min. TOF ratio monitoring remains mandatory in order to identify incomplete reversal or recurarization. These results must be confirmed in a larger randomized double-blind study.

#### References:

1. Anesth Analg 2004; 99:1086-9
2. Anaesthesia 2011; 66:721-5
3. Anesth Analg 2007; 104 :555-62

## 9AP4-4

### Sugammadex does not influence thyroid hormones in the patients undergoing thyroidectomy in propofol anesthesia

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**Background and Aim:** Sugammadex is a selective relaxant binding agent, but may also bind steroid hormones. Carrier molecules for steroid and thyroid hormones named corticosteroid-binding globulin (CBG) and thyroxine-binding globulin (TBG) are closely related. A crystal structure of steroid binding site in CBG resembles the thyroid binding site in TBG, and is known as hormone binding pocket. The thyroxine is held in the TBG pocket by a series of hydrophobic interactions, as observed with sugammadex and steroidal molecules.

No clinical or preclinical studies were carried out addressing interaction between sugammadex and thyroid hormones. We compared the levels of thyroid hormones in patients receiving neostigmine or sugammadex reversal after thyroidectomy.

**Methods:** After obtaining IRB approval and informed consent 24 euthyroid patients undergoing general anesthesia for thyroidectomy were enrolled in a prospective randomized study. Propofol and fentanyl were used for induction and maintenance of anesthesia, and rocuronium 0.6 mg/kg was given for tracheal intubation. Neuromuscular relaxation was maintained with rocuronium 0.1 mg/kg at 0-1 twitches on TOF. At the end of the surgery patients received either neostigmine 50 µg/kg (N group) or sugammadex 2 mg/kg (S group). Thyroid hormones (FT3, FT4 and TSH) were measured before surgery, 1 hour after reversal and 24 hours after the surgery.

A statistical analysis was performed using Friedman's test, Schaich-Hamerle post-hoc test to evaluate within-group differences over time. Mann-Whitney test was used for two independent group comparisons.  $P < 0.05$  was considered significant.

**Results:** There were no differences regarding patient characteristics and preoperative FT4, FT3 and TSH levels between groups. A significant increase of FT4 levels compared to baseline was observed 1 hour after anesthesia (from 13.3 to 17.5 in N and from 12.6 to 16.2 pmol/L in S-group,  $P < 0.05$ ) and returned to baseline after 24 hours in both groups. FT3 decreased in both groups postoperatively (from 5.2 to 3.5 in N and from 4.9 to 3.3 pmol/L in S-group), with no intergroup differences ( $p > 0.05$ ). The mean TSH after 24 hours was not different between groups (1.32 in N vs. 1.27 pmol/L in S group,  $p = 0.49$ ).

However, it was in the hypothyroid range (TSH > 5 mU/L) in two patients in N and in none in S group.

**Conclusion:** Sugammadex treatment did not change levels of thyroid hormones and may be safely used in the patients undergoing total thyroidectomy.

## 9AP4-5

### Sugammadex after spontaneous neuromuscular recovery to a train-of-four ratio of 0.9 does not further improve muscle function or postoperative quality of recovery score

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**Background and Goal of Study:** Postoperative residual curarisation increases post-operative morbidity. Therefore, neuromuscular monitoring is recommended to a Train-of-four-Ratio (TOF) of  $\geq 0.9$  before extubation. However, due to the margin of safety of neuromuscular transmission, at a TOF of 0.9, approximately 75% acetylcholine receptors are still blocked. In the presented study, we investigated if this remaining subclinical neuromuscular block compromises objective muscle function and subjective well-being of patients.

**Materials and Methods:** After ethic committee approval, 300 patients were tested in pre- and postoperative fine motor function (Purdue Pegboard Test), gross motor function (Hand Dynamometry) and subjective well-being (Quality of Recovery Score 40, QRS 40). All patients received general anesthesia with fentanyl, propofol, remifentanyl, rocuronium and sevoflurane. Continuous electromyographic measurement of neuromuscular function allowed managing anesthesia and neuromuscular block in a way that patients were extubated exactly at a TOF of 0.9 and were able to complete the first postoperative testing within the following 15 min. According to randomisation, patients then received an injection of saline or sugammadex (1 mg/kg). After further 10 min testing was repeated. Data analysis was performed with ANOVA ( $p < 0.05$ ).

**Results and Discussion:** Preoperatively, patients could place  $15 \pm 3$  pegs within 30 s. Postoperatively, the fine motor function was significantly reduced ( $6 \pm 4$  pegs), however improved again 10 min after the study medication ( $10 \pm 4$ ). There was no difference between the groups with a mean difference of less than 1 peg ( $1 \pm 1$ ). Gross motor function changed in the same fashion (pre-OP:  $382 \text{ N} \pm 124 \text{ N}$ , post-OP:  $282 \text{ N} \pm 128 \text{ N}$ , after study medication  $334 \text{ N} \pm 133 \text{ N}$ ), with a non significant mean difference of  $9 \text{ N} \pm 14 \text{ N}$ ,  $3 \text{ N} \pm 15 \text{ N}$  and  $4 \text{ N} \pm 15 \text{ N}$ . There were no differences in the QRS40 score between groups at any time.

**Conclusions:** Fine and gross motor function is reduced after general anesthesia. This is independent of treatment with muscle relaxants and also if TOF has recovered to 0.9. Reversing neuromuscular block over a TOF of 0.9 does not improve muscle function or well-being of patients. Consequently, a TOF of 0.9 safely indicates sufficient neuromuscular recovery. A subclinical postoperative block of acetylcholine receptors does not lead to subjective or objective impairment of patients.

## 9AP4-6

### A successful experience with sugammadex administered to a patient with paraneoplastic dermatomyositis

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**Background:** Dermatomyositis (DM) is an idiopathic inflammatory myopathy involving weakness of proximal muscles.<sup>1</sup> Clinical reports showed a relationship of DM with cancer. Due to its low incidence only few reports exist on the anesthesiologic management of neuromuscular blockade in patients with DM considered for surgery. We present a case in which we used rocuronium and sugammadex in the anaesthetic management of a patient with DM undergoing a right lower lobectomy.

**Case report:** Our patient was a 76-year-old male (weight 65 kg) scheduled for elective right lower lobectomy who had been diagnosed with DM two months before surgery. Before anaesthesia induction the patient was placed in the left lateral position and the epidural space was located at the T 7-8 level. After preoxygenation anaesthesia was induced with fentanyl, propofol and rocuronium 0.6 mg kg<sup>-1</sup>. Neuromuscular function was monitored and recorded (TOF Watch S monitor). Two minutes after the first rocuronium dose, the TOF ratio was 0.25 and a left sided tracheal double lumen tube was inserted, the patient was ventilated with a 40% mixture of oxygen and air, anaesthesia was maintained with propofol and an epidural infusion of 0.2% ropivacaine and fentanyl. Ninety minutes after the first rocuronium dose, the TOF ratio was 1 and a second dose, 0.2 mg kg<sup>-1</sup>, was administered. Sixty minutes later, the surgery was completed, the TOF ratio was 0.3 and the patient received sugammadex 2 mg kg<sup>-1</sup>. At this point we stopped the propofol infusion and ventilated the patient with 100% oxygen. Four minutes after the administration of sugammadex, the TOF ratio was 1 and eight minutes later the patient opened his eyes on call. His spontaneous breathing was sufficient and he was extubated.

**Discussion:** Concerning the anaesthetic management of patient suffering from DM, there is little information on the appropriate use of muscle relaxants. In our case, we decided to use rocuronium because we had its specific antagonist although in the literature there are no studies discussing the use of rocuronium in combination with sugammadex in patients with DM.

**References:**

1- Röckelein S, Gebert M, Baar H, Endsberger G. Neuromuscular blockade with atracurium in dermatomyositis. *Anaesthesist* 1995;44:442-4.

**Learning points:** Sugammadex, in combination with objective neuromuscular monitoring, can be used to reverse rocuronium-induced neuromuscular blockade in patients with DM considered for surgical therapy.

## 9AP4-7

### Double blinded dose-finding study for reversal of shallow residual neuromuscular block with sugammadex

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**Background and Goal of Study:** Residual neuromuscular block (NMB) is a common complication with approximately 40% of patients exhibiting a train-of-four (TOF) ratio < 0.9. Sugammadex effectively and rapidly reverses a deep to moderate rocuronium-induced NMB [1]. However, the required dose of sugammadex for smaller degrees of residual block is not fully investigated. Schaller et al [2], suggested a dose of 0.25 mg/kg to reverse a shallow residual rocuronium-induced NMB at a TOF ratio of 0.5.

**Materials and Methods:** In this single center, randomized, parallel group, double blinded study, 75 patients undergoing elective surgery and given informed consent were randomly assigned to receive sugammadex 0.5 mg/kg, 1.0 mg/kg or 2 mg/kg at the reappearance of T4 and a TOF ratio < 0.7. The independent hospital ethical committee approved the study. Supramaximal (50 mA) square-wave TOF stimulation was delivered to the ulnar nerve via surface electrodes at 15-second intervals. After surgery, when TOF responses ranged T3-T4 (TOF ratios < 0.7), sugammadex was given for reversal of the block. The time to reach a recovery with a TOF ratio > 0.9 was measured. In the PACU, we recorded clinical signs of residual paralysis upon arrival and recovery scores based on the 6-point scale described by Steward.

**Results and Discussion:** All patients from the three groups were reversed to TOF ratio > 0.9. The group receiving 0.5 mg/kg had a significant large individual variability and a significant longer duration of recovery. Ten outliers with a decurarisation time of more than 240 seconds were observed in this group. The group receiving 2 mg/kg had the shortest reversal time. There were no statistical differences in time for extubation and eye opening. Clinical muscle function test and evaluation of consciousness revealed no difference between groups at any time during the postoperative period in the recovery room.

**Conclusion(s):** All patients were totally reversed. At 0.5 mg/kg the duration and variability in time of the reversal was significant different.

**References:**

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## 9AP4-8

### Rocuronium and sugammadex administration in patients undergoing orthotopic liver transplantation

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**Background and Goal of Study:** Rocuronium and neostigmine pharmacodynamics and pharmacokinetics may be altered by organ disease<sup>1,2</sup>. Sugammadex-rocuronium complex has never been studied in end stage liver disease patients.

The aim of the study was to evaluate the recovery time after sugammadex administration when rocuronium bromide was used as muscle relaxant in patients undergoing orthotopic liver transplantation (OLTx).

**Materials and Methods:** 13 consecutive patients undergoing OLTx were enrolled. General anesthesia was induced with propofol (1.5 mg/kg) and alfentanil (15 mcg/kg). To facilitate tracheal intubation rocuronium bromide (0.6 mg/kg) was used. Minute ventilation was continuously adjusted to obtain a carbon dioxide end tidal of 35-40 mmHg. After induction, anesthesia was maintained with sevoflurane (Et 1.5% - 2%), remifentanil (range 0.05 - 0.35 mcg/kg/min) and rocuronium continuous infusion (range 0.3 - 0.6 mg/kg/h to maintain T<sub>1</sub>< 10%). Patients were monitored with ECG, SpO<sub>2</sub>, invasive blood pressure, PiCCO and Swan-Ganz catheter, body temperature, BIS and acceleromyography for neuromuscular function (TOF watch Sx, Organon, Dublin-Ireland). At the

third T<sub>2</sub> reappearance, at the end of the surgery, sugammadex 2 mg/kg was administered. To evaluate liver function indocyanine green plasma disappearance rate (ICG-PDR) was registered at the end of the surgery.

**Results and Discussion:** Rocuronium onset time (T<sub>1,100</sub>→T<sub>1,0</sub>) was 325±198 and first rocuronium dosage (T<sub>1,100</sub>→T<sub>1,10</sub>) lasted 43±21 min. Mean recovery time (from the third T<sub>2</sub> reappearance to TR>0.9) was 8.8±5.1. ICG-PDR was 18±6.9 %/min. No correlation was found between recovery time and ICG-PDR.

Our results show that recovery time after sugammadex administration is longer in patients undergoing OLTx than in healthy patients, and a high variability in its behavior is present.

**Conclusion(s):** More data are needed to understand what happens to this complex in patients with end stage liver disease after OLTx.

**References:**

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## 9AP4-9

### Reversal with sugammadex hasten recovery of tracheal reflexes and extubation compared with neostigmine in patients undergoing thyroidectomy

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**Background:** Sugammadex is a selective relaxant binding agent providing faster recovery of four (TOF). However, time between reversal and extubation, and maximal minute volume (MV) achieved before extubation were not compared after sugammadex and neostigmine reversal until now .

**Materials and Methods:** After obtaining IRB approval and informed consent 36 patients undergoing thyroidectomy were enrolled in a prospective randomized study. Propofol and fentanyl were used for induction and maintenance of general anaesthesia. After TOF monitoring was applied rocuronium 0.6 mg/kg was given for tracheal intubation. Neuromuscular blockade was maintained with rocuronium 0.1 mg/kg at 0-1 twitches on TOF

At the end of the surgery at the reappearance of 2 twitches on TOF-Watch SX propofol infusion was stopped. Patients were randomized to receive either sugammadex 2 mg/kg (SUG group, N=17, mean age 53.8 years, BMI 29.6) or neostigmine 50 µg/kg (NEO group, N=19, mean age 54.7 years, BMI 28.9). A recovery of TOF to 90% of baseline, recovery of cough reflexes enabling safe extubation and spontaneous minute volume at the time of extubation was recorded. Statistical analysis was done using Mann-Whitney and Fisher exact test. Time-to-event data were statistically compared using the log-rank test. A multivariate Cox regression was performed to evaluate the independent significance of prognostic factors.

**Results and Discussion:** There were no differences regarding patient characteristics and drug consumption between groups. In the multivariate Cox regression, increasing age was independent significant predictor for the delayed recovery of TOF 90% or greater (HR=0.97, 95% CI 0.94-0.99, P=0.045). Recovery of TOF 90% was significantly faster (2.5 min, vs. 8.5 min, P=0.045) in SUG. Recovery of cough reflexes occurred earlier in SUG than in NEO group (4.2±2.3 vs. 6.9±3.0 min; P=0.005).

Only six patients in NEO group had TOF ≥90% at extubation vs. 13 in SUG (P< 0.005). Maximal MV at extubation was higher in the SUG group, but difference was not statistically significant (6.1±2.9 vs. 5.6±1.9; P= 0.66). Three patients in the SUG group and 13 in NEO group needed oxygenation ≥10 minutes (p< 0.05).

**Conclusion:** The recovery of cough reflexes was faster and respiration more efficient in patients receiving sugammadex. A safe extubation was determined by age, TOF recovery and by effects of other anaesthetics.

**References:**

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## 9AP5-1

### Sevoflurane minimises reperfusion injury after cold ischemia in ex vivo perfused rat liver

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**Background and Goal of Study:** Ischemia-reperfusion injury of the liver is a major clinical problem after liver transplantation. Sevoflurane proved able to protect the liver during warm ischemia (1).

The aim of this study was to determine the role of sevoflurane on hepatic injury after cold ischemia in *ex vivo* perfused rat livers.

**Materials and Methods:** After University Animal Care Committee approval, fasted female Wistar rats were anaesthetised, the portal vein cannulated, the liver removed and perfused at a flow rate of 5 ml/min ( $\pm$  12 cm H<sub>2</sub>O) in a closed *ex vivo* system with HBSS supplemented with glucose, insulin, HEPES and O<sub>2</sub>. The experiment consisted of three phases: perfusion for 15 min at 4°C, cold ischemia (4°C) for 24 hours, and reperfusion during 60 min at 37°C. Animals were randomly divided into three groups (n = 5): control and sevoflurane groups in which the gas was added to perfusate from the start of the experiment and at reperfusion at two vaporizer concentrations, i.e. 2.5 and 8 %. Lactate, potassium, ALT, AST, and LDH were analysed in perfusate samples at different time-points. Mean  $\pm$  SD. ANOVA test.

**Results and Discussion:** Sevoflurane added to medium at 2.5 and 8 % minimises lactate, potassium and enzymes release at the time of reperfusion when compared to control group. (Table 1)

	Control	2.5% sevoflurane	8% sevoflurane
Lactate (mg/dl)	3.0 $\pm$ 1.0	1.7 $\pm$ 0.6*	3.2 $\pm$ 2.0
Potassium (mEq/l)	8.0 $\pm$ 0.6	6.9 $\pm$ 0.3*	7.1 $\pm$ 0.1*
AST (mU/ml)	983 $\pm$ 331	426 $\pm$ 314*	384 $\pm$ 173*
ALT (mU/ml)	641 $\pm$ 217	339 $\pm$ 306*	240 $\pm$ 135*
LDH (mU/ml)	6600 $\pm$ 3060	1281 $\pm$ 1654*	829 $\pm$ 1344*

[\* p < 0.05 vs control group]

Previous experiments have shown that sevoflurane decreases enzymes release, oxygen consumption, malondialdehyde and cytokines production, and improves tissue blood flow, recovery of ATP and presents antioxidative properties after liver warm ischemia (1-3).

Our results during cold ischemia might be of interest in clinical setting. The administration of sevoflurane in the donor (preconditioning) and the recipient patients might protect against reperfusion injury in liver transplantation, as previously mentioned in human after warm ischemia (3).

**Conclusion(s):** Sevoflurane presents a beneficial effect at reperfusion in *ex vivo* rat liver after cold ischemia.

#### References:

- Bedirli et al. *Anesth Analg* 2008;106:830-7; 2. Song et al. *Anesth Analg* 2010;111:1036-41; 3. Beck-Schimmer et al. *Ann Surg* 2008;248:909-18.

## 9AP5-2

### Pharmacokinetics of glutamate-oxaloacetate transaminase and glutamate-pyruvate transaminase and their blood glutamate-lowering activity in naïve rats

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**Background and Goal of Study:** Intravenous administration of glutamate-oxaloacetate transaminase (GOT) and glutamate-pyruvate transaminase (GPT) enzymes can be used to lower the glutamate concentrations in the blood circulation and to improve the neurological outcome following traumatic brain injury and stroke.

The objective of this study was to analyze the pharmacokinetics and to determine the glutamate-lowering effects of GOT and GPT enzymes in naïve rats.

**Materials and Methods:** Forty six male rats were randomly assigned into one of 5 treatment groups: saline (control), human GOT at dose 0.03 and 0.06 mg/kg and porcine GPT at dose 0.6 and 1.2 mg/kg. Blood samples were collected at baseline, 5min, and 2, 4, 8, 12, and 24 hours after the drug injection. Blood was analyzed for GOT, GPT and glutamate concentrations.

**Results and Discussion:** The pharmacokinetics of both GOT and GPT followed a one-compartment model, and both enzymes exhibited substantial glutamate-lowering effects following intravenous administration. Analysis of the pharmacokinetic data indicated that both enzymes were distributed predominantly in the plasma (central circulation) and did not permeate to the peripheral organs and tissues. A several-hour delay was present between the time course of the enzyme concentrations and the glutamate-lowering effects, leading to a clock-wise hysteresis on concentration-effect curves, apparently due to the time that is required to affect the pool of serum glutamate.

**Conclusions:** We conclude that the interaction between the enzymes (GOT and GPT) and the glutamate takes place in the central circulation. Thus, the glutamate-lowering effects of GOT and GPT apparently lead to a redistribution of the excess glutamate from the brain's extracellular fluid into the blood and reduce secondary brain injury due to glutamate neurotoxicity. The outcomes of this study will be taken into account for the purpose of de-

tailed clinical investigation of the pharmacokinetic and pharmacodynamic properties of the GOT and GPT enzymes and for design of effective neuroprotective strategies in patients with traumatic brain diseases and stroke.

## 9AP5-3

### Progesterone increases the activity of glutamate transporter type 3 expressed in *Xenopus* oocytes

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**Background and Goal of Study:** Progesterone is an important sex hormone for pregnancy and also has neuroprotective and antiepileptic effects as a neurosteroid hormone. It is well known that minimum alveolar concentration (MAC) of inhalation anesthetics is reduced during pregnancy. Glutamate transporters are important for preventing neurotoxicity and for anesthetic action in the central nervous system. The authors investigated the effects of progesterone on the activity of glutamate transporter type 3 (EAAT3).

**Materials and Methods:** EAAT3 was expressed in *Xenopus* oocytes by injecting its mRNA. Oocytes were incubated with diluted progesterone for 72 hours. Two-electrode voltage clamping was used to measure membrane currents before, during, and after applying L-glutamate (30  $\mu$ M). Responses were quantified by integrating the current traces and reported in microCoulombs ( $\mu$ C). Results are presented as mean  $\pm$  S.E.M.

**Results and Discussion:** Progesterone concentration from 1 to 100 nM significantly increased the responses in a dose-dependent manner. Kinetic study showed that V<sub>max</sub> was increased compared with control group (2.7  $\pm$  0.2  $\mu$ C for control group vs. 3.6  $\pm$  0.2  $\mu$ C for progesterone group; n=13-16; p < 0.05), but K<sub>m</sub> was not changed (46.7  $\pm$  10.2 nM for control group vs. 55.9  $\pm$  10.5 nM for progesterone group; n=13-16; p > 0.05). Phorbol-12-myristate-13-acetate, a protein kinase C (PKC) activator did not change progesterone-induced EAAT3 activity. Staurosporine, a protein kinase C inhibitor and wortmannin, phosphatidylinositol 3-kinase (PI3K) inhibitor abolished the progesterone-induced increases of EAAT3 activity.

**Conclusion(s):** Our results suggest that progesterone increases the EAAT3 activity and that PKC and PI3K may mediate this effect. This effects of progesterone may explain its neuroprotective and anesthesia-related properties.

#### References:

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## 9AP5-4

### Do helium and xenon exert their organ protective effects by augmenting caveolin 1 or 3 localization to caveolae?

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**Background:** Caveolins are structural scaffolding proteins that permit organization of signalling molecules in caveolae, membrane-bound vesicular organelles enriched in lipids. Caveolin-3 (Cav-3) is a heart specific isoform that is modulated by ischaemic preconditioning and anaesthetic-induced preconditioning, and is obligatory for cardiac protection. We hypothesized that the cardioprotective noble gases Helium (He) and Xenon (Xe) also influence the enrichment of Cav-3 and possibly Cav-1 to caveolae *in vivo*.

**Methods:** Anaesthetized rats underwent 25 minutes of myocardial ischaemia and 2 hours of reperfusion. Rats were left untreated (Con) or underwent different preconditioning (PC) protocols: in Helium late PC (HeLPC), rats inhaled Helium for 3  $\times$  5 min one day before the experiment, the He Postconditioning (HePost) group inhaled 70% He for 15 min at the onset of reperfusion. The XePC rats inhaled 70% Xe for 3  $\times$  5 min before ischaemia. Hearts were processed for sucrose density gradient centrifugation to purify caveolae. Cav-3 and 1 expression were determined by immunoblotting. Measurements of membrane fluidity and rigidity were determined by electron paramagnetic resonance (EPR) spectrometry.

**Results:** HeLPC and HePost increased Cav-3 localization from 0.2  $\pm$  0.1 in Con to 0.4  $\pm$  0.1 and 0.4  $\pm$  0.2 (arbitrary units), respectively, in buoyant caveolar fractions indicative of increased caveolae formation. Moreover, EPR spectrometry showed that helium preconditioning influences fluidity and rigidity of the cardiac myocyte membrane. XePC had no effect on Cav-3 localization. We found no effect of He or Xe on Cav-1 localization.

**Conclusion:** The mechanism underlying the cardioprotective effects of Helium might involve Cav-3 localization to caveolae.

**References:**

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**9AP5-5****Effects of sevoflurane exposure on muscarinic acetylcholine receptor gene expression, protein amount and cellular localization**

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**Background and Goal of Study:** Alterations in cholinergic neurotransmission might lead to changes in cognitive processing<sup>1</sup>. Exposure to volatile anaesthetics may affect acetylcholine-induced ERK phosphorylation and can induce alterations in both gene expression and cellular protein synthesis<sup>2</sup>. Therefore, perturbation in cholinergic signaling could be of relevance to the problem of postoperative delirium and cognitive dysfunction. We hypothesized that alterations in muscarinic acetylcholine receptor gene expression; receptor protein content or receptor localisation would explain the attenuation of acetylcholine-induced intracellular signalling following exposure to the volatile anaesthetic sevoflurane.

**Materials and Methods:** Phosphorylation of ERK was initiated by acetylcholine stimulation of cultured cholinergic PC12 cell line cells that either had or had not been exposed to 5% sevoflurane for 120 minutes. Quantitative PCR and western blotting was used to investigate alterations in muscarinic acetylcholine receptor mRNA expression and receptor protein amount following sevoflurane exposure. A biotinylation assay was performed to investigate changes in cellular surface localization of muscarinic acetylcholine receptors.

**Results and Discussion:** A marked attenuation of the acetylcholine-induced phosphorylation of ERK was observed in cell cultures exposed to 5% sevoflurane for 120 minutes ( $37 \pm 15\%$  of the control response;  $p=0.024$ ). Although quantification of receptor mRNA ( $M_1$ ,  $M_2$ ,  $M_3$ ,  $M_4$ ,  $M_5$ ,  $\bar{M}_7$ ) showed a significant increase in  $M_1$  mRNA ( $p=0.0003$ ), this did not translate into significant changes in  $M_1$  receptor protein amount ( $M_1$ ,  $p=0.717$  and  $M_1$ ,  $p=0.279$ ). Neither did determination of the localisation of muscarinic receptor acetylcholine receptors indicate any differences induced by sevoflurane.

**Conclusion(s):** We have demonstrated that sevoflurane exposure significantly attenuates the acetylcholine-induced ERK phosphorylation. However, this is not likely explained by alterations in muscarinic acetylcholine receptor gene expression, receptor protein content or receptor localisation. Hence, the underlying mechanisms are to be sought elsewhere along relevant signalling pathways.

**References:**

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2. Alkire MT, Guzowski JF; *Anesthesiology*, 2008 Nov; 109(5): 768-770

**9AP5-6****Glutamate release from rat cerebral cortex nerve terminals is attenuated by lidocaine and bupivacaine through suppression of PKA and PKC activity**

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**Background and Goal of Study:** Local anesthetics, classified as sodium channel blockers, have been used for regional anesthesia and the treatment of cardiac arrhythmias. Recent studies have also demonstrated that low dose systemic local anesthetic infusion has neuroprotective properties. Considering the fact that excessive glutamatergic synaptic transmission can cause neuronal excitotoxicity, we investigated whether local anesthetics could influence glutamate release from truncated nerve terminals (synaptosomes).

**Materials and Methods:** Isolated nerve terminals (synaptosomes) purified from Sprague-Dawley rat cerebral cortex were used to examine the effect of lidocaine and bupivacaine on glutamate release evoked by 4-aminopyridine (4-AP). The effects of lidocaine and bupivacaine on the synaptosomal membrane potential and  $Ca^{2+}$  influx were also examined by  $DiSC_3(5)$  and Fura-2, respectively. Finally, Western blot analysis was used to investigate the downstream signaling pathway.

**Results and Discussion:** Results showed that both lidocaine and bupivacaine exhibited a dose-dependent inhibition of 4-AP-evoked release of glutamate.

In addition, this inhibition was prevented by chelating the intrasynaptosomal  $Ca^{2+}$  ions and by the vesicular transporter inhibitor, but was insensitive to the glutamate transporter inhibitor. Moreover, both lidocaine and bupivacaine decreased depolarization-induced increase in intrasynaptosomal  $Ca^{2+}$  without changing the synaptosomal excitability. The reduction of evoked glutamate release was abolished by the N- and P/Q-type  $Ca^{2+}$  channel blocker, but insensitive to the ryanodine receptor blocker or the mitochondrial  $Na^+/Ca^{2+}$  exchanger blocker. Furthermore, the inhibitory effect of lidocaine or bupivacaine on evoked glutamate release was prevented by the protein kinase A (PKA), and protein kinase C (PKC) inhibitors.

**Conclusion(s):** Our results suggest that local anesthetics inhibit glutamate release from rat cortical synaptosomes through the suppression of presynaptic voltage-dependent  $Ca^{2+}$  entry and PKA and PKC signaling cascade and further delineate the possible neuroprotective mechanism of local anesthetics.

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**9AP5-7****Molecular and cellular effects of propofol on hypoxia-induced cell damage in intestinal cells grown in-vitro: involvement of hydrogen peroxide and catalase**

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**Background:** Ischemia/reperfusion (I/R) injury is relevant during transplantation, vascular surgery, stroke, myocardial infarction and cardiac arrest. In the intestine I/R causes dysfunction of the intestinal barrier, translocation of bacteria and can lead to multiorgan failure. Several anesthetics have been shown to reduce I/R injury<sup>1,2,3</sup>, although the cellular and molecular mechanisms are widely unknown. Aim of the study was to investigate the effects of clinical relevant concentrations of propofol on hypoxia-induced cell-damage employing the intestinal epithelial cell line CaCo-2.

**Materials:** Using a two-enzyme system, hypoxic conditions ( $pO_2 < 5$  mmHg) were induced in the cultures for 1h<sup>4,5</sup>. Propofol (30  $\mu$ M and 100  $\mu$ M) was added during hypoxia and the effects were compared to the respective normoxic controls. Cellular and molecular actions were evaluated by brightfield microscopy, fluorometric quantifications of reactive oxygen species (ROS), hydrogen peroxide-measurements and Western blotting.

**Results:** Hypoxic conditions resulted in morphologically visible signs of cell damage such as cell-rounding and detachment from the growth surface. Moreover, concentrations of ROS significantly increased 2h after hypoxia (hypoxia:  $1.99 \pm 0.11$  au vs. normoxia = 1;  $P < 0.05$ ). Hydrogen peroxide assays revealed an increase of hydrogen peroxide 48h after hypoxia (hypoxia:  $7.12 \pm 1.15$   $\mu$ M vs normoxia:  $2.46 \pm 0.26$   $\mu$ M;  $P < 0.05$ ). Addition of propofol (100  $\mu$ M) under hypoxic conditions decreased hydrogen peroxide levels compared to hypoxia alone (hypoxia + propofol 100  $\mu$ M:  $4.01 \pm 0.43$   $\mu$ M vs hypoxia:  $7.12 \pm 1.15$   $\mu$ M;  $P < 0.05$ ). Western blotting experiments performed 4h after hypoxia showed significantly increased amounts of catalase (CAT) which catalyzes the decomposition of hydrogen peroxide to water and oxygen (hypoxia:  $1.56 \pm 0.16$  au vs normoxia = 1;  $P < 0.05$ ). Addition of propofol further increased the amount of CAT, although statistically significant levels were not reached (hypoxia + propofol 30  $\mu$ M:  $2.42 \pm 0.57$  au; hypoxia + propofol 100  $\mu$ M:  $2.51 \pm 0.43$  au).

**Conclusion:** Propofol reduces the hypoxia-induced increase of hydrogen peroxide levels in intestinal cell cultures possibly via augmenting the concentrations of CAT.

**References:**

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2 Clarkson, *Life Sci* 2007  
3 Vasileiou et al. *Eur J Pharmacol* 2009  
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5 Zitta et al. *Eur J Pharmacol* 2010

**9AP5-8****Propofol protects human neuronal cells from hypoxia/reoxygenation induced damage: implications of reactive oxygen species and hydrogen peroxide**

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**Background:** Propofol, a widely used intravenous anesthetic agent, has been shown to protect neuronal cells from hypoxia/reoxygenation (H/R) injury<sup>1</sup>. However the underlying mechanisms of these neuroprotective effects are still unclear and may potentially be related to reactive oxygen species (ROS)

which are produced during H/R induced injury. Aim of the study was to investigate the molecular and cellular effects of propofol on hypoxia-induced cell-damage employing the neuronal cell line IMR-32.

**Materials and Methods:** Propofol (30 $\mu$ M) was applied to human IMR-32 cells 30min before and for 2h during hypoxia. Hypoxic conditions were induced for 2h using an enzymatic model <sup>2</sup>. Cellular effects were assessed by lactate dehydrogenase (LDH) measurements, brightfield microscopy, hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) quantifications, fluorescent ROS assays (H<sub>2</sub>DCFDA assay), RT-PCR and Western blotting.

**Results and Discussion:** Hypoxia increased the release of LDH (hypoxia: 0.51 $\pm$ 0.03 a.u., normoxia: 0.30 $\pm$ 0.02 a.u.; P< 0.05) and expression of caspase-3 (hypoxia: 0.23 $\pm$ 0.05 a.u., normoxia: 0.15 $\pm$ 0.02 a.u.; P>0.05).

Addition of propofol significantly reduced the hypoxia-induced LDH release (hypoxia + propofol: 0.37 $\pm$ 0.06 a.u.; P< 0.05 vs hypoxia), caspase-3 expression (hypoxia + propofol: 0.04 $\pm$ 0.03 a.u.; P< 0.05 vs hypoxia) and diminished morphological signs of cell damage in the cultures. ROS were increased under hypoxic conditions and significantly reduced by the addition of propofol (hypoxia: 267.70 $\pm$ 14.46 a.u., normoxia: 206.60 $\pm$ 13.99 a.u.; P< 0.01; hypoxia + propofol: 234.00 $\pm$ 16.69 a.u.; P< 0.05 vs hypoxia).

Addition of propofol under hypoxic conditions also decreased H<sub>2</sub>O<sub>2</sub> levels (hypoxia: 18.08 $\pm$ 2.18  $\mu$ M, hypoxia + propofol: 13.22 $\pm$ 0.74  $\mu$ M; P< 0.05). Western blotting experiments showed increased amounts of catalase (CAT) under hypoxic conditions (hypoxia: 1.29 $\pm$ 0.02 a.u., normoxia: 0.92 $\pm$ 0.02 a.u.; P< 0.001). Addition of propofol decreased the amount of CAT (hypoxia + propofol: 1.04 $\pm$ 0.02 a.u.; P< 0.01 vs hypoxia).

**Conclusion:** We suggest that propofol can protect IMR-32 cells from H/R injury and that the associated mechanisms may at least partly be due to the antioxidant capability of the anesthetic.

#### References:

- 1 De La Cruz et al., *Brain Res.*, 1998.
- 2 Zitta et al., *Eur. J. Pharmacol.*, 2010.

## 9AP5-9

### On the influence of xenon anesthesia and nitrous oxide on immune status on patients with cancer of the breast

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**Background and Goal of Study:** Surgery, anesthetic procedures and other associated techniques all alter the patient's immune response. The repercussions on the patient are important, given that alterations suppose increased risk of postoperative infection and increased recurrence of neoplastic disease.

**Materials and Methods:** 59 women with the cancer of breast (T<sub>1-4</sub>, N<sub>1-2</sub>, M<sub>0</sub>) in the age of 29 to 90 years were investigated, 70 % from them have received chemotherapy before operation. All of them have been executed by radical mastectomy. Depending on a kind of anesthesia, all patients have been divided in two representative groups: investigated 28 patients who have received anesthesia by xenon and the control 31 patients - by nitrous oxide. Research of the immune status included studying subpopulation structure lymphocytes peripheral blood, functional activity neutrophils, the maintenance of the basic classes of immunoglobulins. Research was carried out before operation and for 7 day after operation.

**Results and Discussion:** After operation in group of the control over studying subpopulation lymphocytes marked the tendency to depression T- cells (CD4<sup>+</sup>, CD8<sup>+</sup>, CD4<sup>+</sup>/CD8<sup>+</sup>), T- cells (CD22<sup>+</sup>), B- cells (CD22<sup>+</sup>) and significant smaller CD56<sup>+</sup> killer lymphocytes (p < 0,05).

Specific the part of immunity reacted increase of percent of the basic classes of immunoglobulins. The estimation phagocytes potential neutrophils has revealed statistically significant decrease in functional activity in the NST-test (p < 0,05). In control group structure subpopulation T- and B- lymphocytes remained within the limits of reference values.

At an estimation of a specific part of immunity authentic increase IgG in comparison with reference values (p < 0,05) is revealed. Phagocytes potential neutrophils in NST-test exceeded values before operation.

**Conclusion(s):** The xenon anesthesia does not suppress cellular and humoral immunity, and also increase functional activity phagocytes and functional activity in the NST-test.

## 9AP5-10

### Homocysteine levels in the early postoperative period after renal transplantation with or without nitrous oxide

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**Background and Goal of Study:** Nitrous oxide (N<sub>2</sub>O) anesthesia increases postoperative plasma homocysteine (Hcy) levels<sup>1</sup>. Increased Hcy concentrations are shown to be associated with increased postoperative cardiovascular events and mortality in different surgery populations. The increase in Hcy levels after N<sub>2</sub>O anesthesia may be particularly important in renal transplant patients as Hcy levels are nearly 3-fold increased compared to normal population. The aim of our study was to assess the effects of N<sub>2</sub>O on the early postoperative Hcy levels in renal transplantation.

**Materials and Methods:** After ethics committee approval and obtaining written informed consent, 60 patients presenting for scheduled live-donor renal transplantation were randomized to receive general anesthesia with (flowmeter set at 2lt/min N<sub>2</sub>O and 1lt/min oxygen) or without N<sub>2</sub>O (flowmeter set at 2lt/min air and 1lt/min oxygen). All other anesthetic procedures were same between groups. Blood samples were collected for the measurement of Hcy, folat and creatinin at induction (T1), at the time when anesthetic gases are stopped (T2) and at the postoperative 24th hour (T3).

**Results and Discussion:** When compared to the basal measurements 24<sup>th</sup> hour Hcy levels were significantly decreased both in with-N<sub>2</sub>O group (T1:22.34 $\pm$ 16.32 vs. T3:11.76 $\pm$ 9.92;p< 0.001) and in without-N<sub>2</sub>O group (T1:20.91 $\pm$ 15.37 vs. T3:7.95 $\pm$ 5.74;p< 0.001). **Hcy levels in with-N<sub>2</sub>O group at T3 was significantly higher than without-N<sub>2</sub>O group (p= 0.02).** Creatinin levels in with-N<sub>2</sub>O group and without-N<sub>2</sub>O at T2 (p=0.037 and p=0.014, respectively) and at T3 (p< 0.001 in both groups) were significantly lowered when compared with baseline levels. But there was no significant difference between with-N<sub>2</sub>O or without-N<sub>2</sub>O groups for creatinin levels. Folat levels were only significantly decreased from baseline at T3 (10.47 $\pm$ 5.76 vs. 8.59 $\pm$ 7.00;p=0.006) in the with-N<sub>2</sub>O group. There was no significant difference in folat levels. In our literature search there is no study that show the dramatic decrease in Hcy levels after renal transplantation in the early period.

**Conclusion(s):** We found that renal transplantation surgery decreases Hcy in the early postoperative period and nitrous oxide hinders the decrease. Nitrous oxide should be avoided in renal transplantation.

#### References:

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## 9AP6-1

### Influence of BMI and gender on effective doses of rocuronium for tracheal intubation

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**Background and Goal of Study:** Though effective doses of rocuronium may be influenced by patient characteristics like BMI, gender, and age, no quantitative analysis has been made. It is useful both medically and economically to determine the minimum intubation dose of rocuronium because there are many reports of sugammadex-induced anaphylaxis. Our purpose was to investigate how effective doses of rocuronium for tracheal intubation are influenced by patient characteristics.

**Materials and Methods:** 140 adult patients, ASA grade I - II, scheduled for elective surgery under general anesthesia were included in this study. They were randomly divided into 7 groups by the dose of rocuronium administered before tracheal intubation (0.5,0.55,0.6,0.65,0.7,0.75,0.8mg/kg). Anesthesia was induced with fentanyl 2mcg/kg, propofol 2mg/kg, and rocuronium. Patients were intubated 3 minutes after rocuronium was injected. Intubation condition was assessed using the following factors: (1)ease of laryngoscopy, (2)position and movement of vocal cords, and (3)reaction to intubation. If these factors were full marks, we defined the intubation condition as excellent. These factors were referred from guidelines for good clinical research practice (GCRP) in pharmacodynamic studies of neuromuscular blocking agents. Statistical analysis was performed using R2.13.1. A stepwise logistic regression was used to determine significant factors. The dependent variable was whether the intubation condition is excellent or not. The predictor variables were BMI, gender, age, and rocuronium's dose.

**Results and Discussion:** Significant predictor variables were (A)gender: male 1, female 0 (B)rocuronium's dose mg/kg (C)BMI kg/m<sup>2</sup>. The following equation calculates the probability of excellent intubation condition. p=1/(1+exp(12.733+1.910 $\times$ A-11.072 $\times$ B-0.310 $\times$ C))



This equation means that the dose of rocuronium should be decreased by 0.028mg/kg as BMI increases by 1kg/m<sup>2</sup>. As for gender, the dose of rocuronium for a female patient should be 0.17mg/kg lower than that for a male patient who has the same BMI. By using this equation, we made a web application that calculates effective doses of rocuronium based on body weight, height, and gender.

#### Conclusion(s):

1. BMI and gender influence effective doses of rocuronium for tracheal intubation.
2. We determined the equation that calculates the probability of excellent intubation condition by patient's BMI, gender, and rocuronium's dose.
3. We developed a web application by using this equation.

## 9AP6-2

### Storage temperature does not affect atracurium efficacy

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**Background:** Atracurium is an intermediate-acting, non-depolarizing, muscle relaxant. Two elimination pathways have been individualized: plasma esterase metabolism and intrinsic Hofmann elimination which is increased by an alkaline environment and increased temperature. The manufacturer recommends storing this product at a temperature between +2 to +8°C. Despite atracurium stability and efficacy may be affected by storage at room temperature, a reasonable quantity of vials available in the operating room can be more convenient than storage in the fridge. The aim of this observational study was to compare the delay of muscle relaxation of atracurium when stored between +2 and +8°C and at operating room temperature (+15°C to +20°C).

**Materials and Methods:** Consecutive ASA class I or II patients undergoing general surgery were included in 2 groups (n=100 per group): in the COLD group, atracurium was stored at +2 to +8°C, while in the ROOM group, atracurium was stored at +15 to +20°C for 6 to 15 days before use. General anesthesia was induced with propofol, sufentanil and atracurium (0.5 mg/kg, actual body weight) before intubation. Neuromuscular transmission monitoring used train of four (TOF) stimulation applied over the facial nerve (30mA) and clinical assessment of the contraction of the corrugator supercilii muscle. TOF was applied 3 and 6 min after atracurium administration while anesthesia was maintained with isoflurane and sufentanil. Vocal cords opening and Cormack's grade were recorded. Results are reported as mean±SD and percentages(n). Quantitative variables were compared with t-test and categorical variables with the Chi-2 test.

**Results:** Patients aged of 52±18 years, with body mass index of 31.5±8.3kg/m<sup>2</sup>, ASA I (n=60) and II (n=140) were included. Three min after atracurium administration, 43% patients had no TOF response in the COLD vs 52% in the ROOM group (p=NS), and 42% patients had 4 responses in COLD vs 33% in the ROOM group (p=NS). Six min after the injection of atracurium, 74% patients has no TOF response in COLD vs 76% in ROOM group (p=NS), 9% patients has 4 responses in COLD vs. 16% in ROOM group (p=NS). Complete vocal cords opening was observed in 80% patients in COLD vs 85% in ROOM group (p=NS). Cormack's grade 1,2,3 or 4 was 82%,10%,6% and 2% in COLD vs 87%,12%,1%, and 0% in ROOM group (p=NS).

**Conclusion:** Atracurium exposure to room temperature for 1 or 2 weeks does not cause enough degradation to be clinically significant.

## 9AP6-3

### The effect of low dose ketamine and priming of cisatracurium on the intubating condition and onset time of cisatracurium

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**Background and Goal of Study:** Both ketamine and priming may hasten the onset time of neuromuscular blocking agents. We investigate the effect of low dose ketamine and cisatracurium priming on the intubating condition and onset time of cisatracurium.

**Materials and Methods:** After institutional review board approval, 120 consecutive patients (ASA I and II) undergoing general anesthesia were randomly assigned to one of 4 groups. All patients were injected one of normal saline (group C), cisatracurium 0.01 mg/kg (group P), ketamine 0.5 mg/kg (group K) and combination of cisatracurium 0.01 mg/kg and ketamine 0.5 mg/kg (group PK) diluted into a 5 ml solution, followed 3 minutes later by cisatracurium 0.15mg/kg in group C and K, and 0.14 mg/kg cisatracurium in priming group. Onset time was recorded the acceleromyographic responses using single twitch and intubating conditions were evaluated by rating the ease of laryngoscopy, the position of the vocal cords and the response to tracheal intubation at 60 seconds after cisatracurium administration.

**Results and Discussion:** There was most significant hasten in Group PK than others on the lag time, onset time and supramaximal suppression of single twitch (P < 0.008). There was also significantly more hastened in Group P and K compared with Group C (P < 0.008), but there was no differences between group P and K. The mean (minimum-maximum) of onset time was 111.5 (107.8 - 117.6), 91.0 (84.7 - 98.1), 85.0 (8.2 - 89.7), 59.0 (57.4 - 63.4) seconds in Group C, P, K and PK, respectively. The lag time was 49.0 (42 - 68), 34.0 (20.0 - 55), 28.0 (20.0 - 55.0), 24.0 (16.0 - 2.0) seconds in Group C, P, K and PK, respectively. In intubating conditions, 'excellent' was most significantly higher in Group PK than others (P < 0.008) and significantly higher in Group P and K compared with Group C (P < 0.008). However, there were no differences between group P and K (3.3%, 36.7%, 26.7% and 70% in Group C, P, K and PK, respectively).

**Conclusion(s):** The combination of the low dose ketamine and cisatracurium priming hastened the onset time and improved the intubating conditions as much effective as succinylcholine.

## 9AP6-5

### Sugammadex reversal of rocuronium-induced neuromuscular block in interventional bronchoscopy procedures: a comparison with neostigmine

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**Background and Goal of Study:** Prompt recovery of laryngeal reflexes and spontaneous respiration at the end of the interventional bronchoscopy procedures prevent adverse respiratory events.

This prospective randomized study compared the efficacy of sugammadex for reversal of rocuronium-induced profound neuromuscular block with that of neostigmine. The safety of sugammadex and neostigmine was also evaluated.

**Materials and Methods:** Adult patients ASA class IV scheduled for procedures in interventional bronchoscopy were randomized to sugammadex group 2mg/kg or neostigmine 70µg/kg group for the reversal of block induced with rocuronium 0.6mg/kg. Anesthesia was induced with midazolam, propofol and sufentanil and maintained with increments of propofol. Neuromuscular function was monitored with acceleromyograph (TOF-Watch®SX). Adequate muscle relaxation was obtained with bolus doses of rocuronium 0.15µg/kg upon reappearance of second twitch in TOF Sugammadex or neostigmine was administered at the reappearance of 1-2 posttetanic counts. The primary efficacy parameter was time to recovery of TOF ratio to 0.9. We measured the time from the beginning of anesthesia to the time of patient discharge to the PACU and blood gas analysis at the time of discharge.

**Results and Discussion:** 31 patients were randomized, 16 of whom received sugammadex and 15 received neostigmine. After sugammadex, median recovery time of TOF to 0.9 was 1.1min vs. 10.13 min with neostigmine (P < 0.001). Median time from beginning of anesthesia to patient discharge to the PACU was in sugammadex group 49.2min vs. 68.13min in neostigmine group (P < 0.001). Median PaCO<sub>2</sub> value at the time of discharge was 46.19mmHg in sugammadex group vs. 57.20mmHg in neostigmine group (P < 0.001). There were no adverse effects from either sugammadex or neostigmine.

**Conclusion(s):** Sugammadex provided significantly faster recovery time from rocuronium-induced profound neuromuscular block in comparison with neostigmine and shorter duration from the beginning of anesthesia to patient discharge to PACU with lower values of PaCO<sub>2</sub>.

#### References:

1. Jones RK, Caldwell JE, Sorin Ch.B, Brull J, Soto RG. Reversal of profound rocuronium-induced blockade with sugammadex: A randomized comparison with neostigmine. *Anesthesiology* 2008;109:816-24
2. Lee C, Jahr JS, Candiotti KA, Warriner B, Zornow MH, Naguib M. Reversal of profound neuromuscular block by sugammadex administered three minutes after rocuronium. *Anesthesiology* 2009;110:1020-5

## 9AP6-6

### Effects of magnesium sulfate on the pharmacodynamics of rocuronium in geriatric and oncologic patients

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**Background and Goal:** Numerous studies show a potential role of magnesium in reducing anesthetic requirements, postoperative pain and sympathetic response to surgical trauma. These effects would be of great benefit to geriatric oncologic patients. However, its use is limited because magnesium potentiates non-depolarizing neuromuscular blocking agents and there are no

studies of this interaction in this group of patients.

This prospective, randomized, double blind study had the objective of showing the effect of magnesium sulfate on the duration of neuromuscular block produced by rocuronium in this set of patients.

**Materials and Methods:** Forty-two patients, with 60 or more years of age, candidates to head and neck surgery, were randomly allocated to the magnesium group, which received 30 mg.kg<sup>-1</sup> of MgSO<sub>4</sub> in 10 minutes and thereafter, continuous infusion at a rate of 1 g.h<sup>-1</sup>, or to the control group, which received the same volume of saline. Study drugs were given intravenously 10 min before induction of anaesthesia with propofol, fentanyl and rocuronium 0.6 mg.kg<sup>-1</sup>. Anaesthesia was maintained with a target-controlled propofol infusion. Neuromuscular transmission was measured using train-of-four (TOF)-Watch SX acceleromyography.

**Results and Discussion:** Onset time (to 95% depression of T1) was on average 144 [SD=58] s with MgSO<sub>4</sub> and 187 [90] s with saline (P < 0.05). The total recovery time (TOF0.9) was on average 113 [36] min with MgSO<sub>4</sub> and 101 [39] min with saline (P > 0.05). Other results are showed in table 1.

	Magnesium		Control		p
	Median	SD	Median	SD	
Onset time (T1 5%) (s)	144	58	187	90	0.03
Clinical duration (T1 25%) (min)	69	23	59	28	0.15
Recovery index (T1 75-25%) (min)	19	11	17	6	0.44
Total recovery time (TOF0.9) (min)	113	36	101	39	0.3
Recovery time (TOF0.9-T1 25%) (min)	44	22	42	18	0.58

[Table 1]

Onset and recovery time of rocuronium are prolonged in the geriatric oncologic patients. Magnesium sulphate, in the doses given in this study, reduces onset time of rocuronium by 23%, and prolongs recovery time by 12 minutes, a result not statistically significant, and of little clinical relevance.

**Conclusion:** The results showed that magnesium reduces onset of action of rocuronium and prolongs neuromuscular block in oncologic geriatric patients. It is a small increase, of little clinical relevance, in face of potential benefits for its use in this population.

## 9AP6-7

### Rocuronium and sugammadex for electroconvulsive therapy

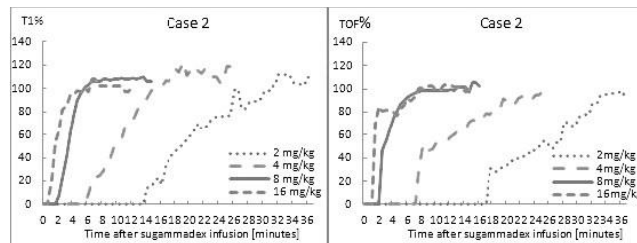
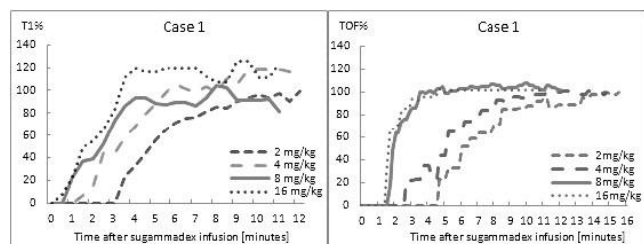
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**Background:** Because of rapid acting feature, succinylcholine has been a standardized neuromuscular blocker for the electroconvulsive therapy (ECT). However succinylcholine has harmful side effects. The purpose of this study was to establish the safe anesthetic procedure for ECT with the combination of rocuronium and sugammadex.

**Methods:** This was a cross-over design, non-randomized and open-labeled clinical study that had been approved by the institutional review board. Anaesthesia was induced with 2 mg/kg of propofol.

After measuring the control value of electromyography TOF and T1 at ulnar nerve region, 1 mg/kg of rocuronium was administered. When T1 totally disappeared, ECT current was loaded. Once convulsion went away, 2, 4, 8 or 16 mg/kg of sugammadex was given. TOF and T1 value were measured every 20 seconds until they returned to the control level. The time interval between the first spontaneous breath (tidal volume > 8ml/kg) and an administration of sugammadex was recorded.

**Results:** Two patients were completed the series of 4 different sugammadex doses. TOF and T1 recovery are shown in the figure for each sugammadex doses.



[Recovery course of T1 and TOF]

The time interval for the first spontaneous breath from the administration of 2, 4, 8 and 16 mg/kg sugammadex were, respectively, 130, 60, 40 and 45 sec for case 1, and 160, 80, 40 and 30 sec for case 2. No apparent side effects nor recurarization were found for both of the cases.

**Discussion:** Although we completed only two cases, recovery time was sufficiently short with 8 or 16 mg/kg sugammadex. The time course of recovery varied between the patients. Two or 4 mg/kg of sugammadex administration, TOF and T1 was not fully been recovered even when the first spontaneous breath.

Therefore, spontaneous breathing was not an indication of muscular blockade recovery, and the muscular relaxation monitoring was mandatory.

**Conclusion:** Combination of rocuronium and sugammadex could be useful for ECT. However further study requires for more safe protocol.

## 9AP6-9

### The RECITE study: a prospective, blinded, multi-site study of the incidence and severity of residual neuromuscular blockade in Canada

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**Background and Goal of Study:** Residual neuromuscular blockade (rNMB) is an established risk factor for critical respiratory events and increased morbidity (1).

Currently, little is known about the occurrence of rNMB in Canada. To investigate the incidence and severity of rNMB, we are performing the RECITE study (REsidual Curarization and its Incidence at Tracheal Extubation).

**Materials and Methods:** This ongoing prospective, blinded, observational study is being conducted at 8 hospitals across Canada. Three hundred adult patients of ASA class 1-3 scheduled to undergo elective laparoscopic or open abdominal surgery are currently being recruited. Neuromuscular function is assessed using acceleromyography with the TOF-Watch® SX. The attending anesthesiologist and nurses are blinded to the TOF ratio results. Utilization of subjective peripheral neuromuscular monitoring, doses of non-depolarizing neuromuscular blocking drugs, administration of reversal of NMB and decision to extubate are at the discretion of the attending anesthesiologist and are performed according to local practices.

The primary and secondary objectives are to determine the incidence of rNMB (defined as TOF ratio below 0.9) just before tracheal extubation and at arrival in the post-anesthesia care unit (PACU), respectively.

**Results and Discussion:** A total of 190 subjects recruited between June 2011 and December 2011 were included in this interim analysis. Among subjects with available and evaluable TOF ratio (n = 133), the median age was 45 years and the mean body mass index was 29.

A total of 124 subjects (93%) were monitored for neuromuscular function using a subjective peripheral neuromuscular stimulator. Rocuronium was used in 98% of the cases and 76% of subjects received neostigmine as a neuromuscular reversal agent. The incidences of rNMB at tracheal extubation and arrival in PACU were 56% and 45%, respectively. Additionally, 30% and 14% of subjects had a TOF ratio < 0.7 at time of tracheal extubation and PACU arrival, respectively.

**Conclusion(s):** Interim results show that a significant percentage of patients are experiencing rNMB immediately before tracheal extubation and at arrival in the PACU.

These data suggest that despite the use of subjective peripheral neuromuscular monitoring and/or the usage of conventional AchE neuromuscular reversal agents, additional resources to prevent rNMB may be warranted.

#### References:

1- Murphy et al., Anesth Analg 2008 Jul;107(1):130-7.

## 9AP6-10

### Pretreatment with nafamostat mesilate, a kallikrein inhibitor, to prevent withdrawal response associated with rocuronium

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**Background and Goal of Study:** Following the anesthetic induction with thiopental or propofol, the injection pain of rocuronium has been reported to occur in 22-84% of adults.

Little is known about the mechanisms by which rocuronium triggers injection pain. According to Borgeat et al., however, following an intravenous injection of rocuronium, due to the release of alogenic substances associated with kallikrein-kinin system as bradykinin, the polymodal nociceptor present in the vascular wall is stimulated and this may lead to the occurrence of pain.

Nafamostat mesilate is a synthetic kallikrein inhibitor, and it can be used in patients with acute pancreatitis or disseminated intravascular coagulation. This randomized, double-blind, placebo-controlled study was conducted to examine the preventive effect of nafamostat mesilate, a kallikrein inhibitor, on withdrawal response associated with injection of rocuronium.

**Materials and Methods:** Ninety ASA physical status I or II patients, aged 18-65 years, were randomly received either a 1.5 ml solution containing 1.5 mg nafamostat mesilate diluted in 5% glucose solution or 1.5 ml 5% glucose solution. Induction of anesthesia was performed using thiopental 5 mg/kg. After confirming loss of consciousness, a tourniquet was applied to the mid forearm sufficient to block venous flow. The test solution was then administered. One minute after the administration of the test solution, the tourniquet was removed and 0.6 mg/kg rocuronium was administered immediately. The patient's response to the injection of rocuronium was graded on a four-point scale in a double-blind manner. Prior to the administration of nafamostat and 5 and 10 minutes following it, activated coagulation time and plasma potassium concentration were measured.

**Results:** The incidence of withdrawal was 68.9% in control group and 24.4% in nafamostat group ( $P < 0.001$ ). The number of patients who showed generalized movement (response 4) with rocuronium injection was significantly lower: 1 (2.2%) for the nafamostat group patients and 15 (33.3%) for the control group ( $P < 0.001$ ). At 5 and 10 minutes following the administration of nafamostat, the measured concentrations of potassium and ACT showed no significant differences compared to baseline value.

**Conclusion:** The pre-treatment with nafamostat mesilate 1.5 mg significantly prevented withdrawal response associated with injection of rocuronium.

## 9AP7-1

### Comparison of stress reaction during anaesthesia with propofol (TIVA) vs. sevoflurane (VIMA) for rectal cancer surgery

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**Background and Goal of Study:** Every kind of injury and break of tissue barriers is connected with stress reaction. The stress response for surgery is characterized by neurohumoral, immunological and metabolic changes. The goal of study was the estimation of stress reaction by comparison of various hemodynamic and hormonal parameters during TIVA or VIMA anaesthesia for low rectal anterior resection.

**Materials and Methods:** After Ethics Committee approval and written informed consent 61 patients (ASA I-II) scheduled for rectal resection were randomized to receive TIVA ( $n=31$ ) or VIMA ( $n=30$ ). Anaesthesia in TIVA group was induced and maintained with propofol according to Roberts outline (10-8-6 mg·kg<sup>-1</sup>·h<sup>-1</sup>). Increasing doses sevoflurane (0,6-1,2-2,4-,4,8Vol%) for induction and maintenance (MAC 0,8) anaesthesia were applied in VIMA group. Analgesia was received with continuous infusion of fentanyl (1,2-5 µg·kg<sup>-1</sup>·h<sup>-1</sup>) and muscle relaxation with atracurium (0,3 - 0,5 mg·kg<sup>-1</sup>·h<sup>-1</sup> according to neuromuscular stimulation). All patients were ventilated Air/O<sub>2</sub> 1:1 at 2 L·min<sup>-1</sup> FGF Standard monitoring with BIS was applied. Hormones: norepinephrine, epinephrine levels and hemodynamic parameters: heart rate, systolic artery pressure, mean artery pressure, diastolic artery pressure and BIS value were recorded at defined time points.

- 1) before surgery,
- 2) during visceral exploration,
- 3) after tumor resection,
- 4) 30min after extubation,
- 5) next morning after surgery.

Data was analyzed with Student t-test, U Mann-Whitney test or ANOVA, reported as mean SD± and statistical significance  $p < 0,05$

**Results and Discussion:** There were no significant differences between groups in hemodynamic parameters. At the moment of visceral exploration in VIMA group increased BIS values were noticed ( $p < 0,05$ ) and an increased adrenaline level was observed ( $p < 0,05$ ). Norepinephrine levels were comparable between groups however twofold increase was noticed with all patients 30 minutes and next morning after surgery referring to pre and intraoperative levels.

#### Conclusion(s):

- 1) The neuroendocrine stress response in sevoflurane induced and maintenance anaesthesia is equivalent to propofol total intravenous anaesthesia. Volatile anaesthesia with 0,8 MAC sevoflurane requires to augment dosage of sevoflurane at the moment of visceral examination only, according to higher adrenaline level and BIS value at that moment.
- 2) Both types of anaesthesia provide hemodynamic stabilization.

## 9AP7-2

### Sevoflurane vs propofol for one-stage reconstructive surgery of the internal carotid and lower-extremity arteries

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**Background and Goal of Study:** The lesions of the brachiocephal arteries occur in 30-67% of patients with atherosclerotic occlusion of the abdominal aorta and lower-extremity arteries. The aim of the study is the anesthesia optimization in one-stage reconstructive surgery of the internal carotid and lower-extremity arteries.

**Materials and Methods:** Comparative assessment of the efficiency of inhalative and non-inhalative methods of anesthesia was performed in this prospective clinical study. The patients were randomized to two groups: 1<sup>st</sup> group - 19 patients who underwent surgery under inhalative anesthesia with Sevoflurane (Sevorane), 2<sup>nd</sup> group - 17 patients who underwent surgery under total intravenous anesthesia (TIVA) based on Propofol. According to the study protocol, both groups had the same depth of anesthesia (BIS 40-50). Monitoring: ECG, HR, SpO<sub>2</sub>, Invasive BP & CVP, Temperature; Fi & Et of O<sub>2</sub>, CO<sub>2</sub> and Sevoflurane; BIS; Transthoracic Echocardiography, Transcranial Dopplerography, Laser Doppler Flowmetry (LDF).

**Results and Discussion:** With the identical depth of anesthesia and volume loading in both groups, the middle cerebral artery mean blood flow velocity during carotid crossclamping was 20% lower in the patients of the Propofol group ( $P < 0.05$ ) as compared to the Sevoflurane group. All patients of the 2<sup>nd</sup> group needed inotrope support (dopamine 3-6 mg/kg x min) unlike those who received inhalative anesthesia. In the postoperative period, statistically significant increase of the left ventricle size was revealed in the patients of the Propofol group: end-diastolic volume increased by 7.2% ( $P < 0.05$ ). The patients in the Sevoflurane group demonstrated positive electrocardiographic dynamics: ejection fraction increased by 8% ( $P < 0.05$ ), left ventricle end diastolic volume reduced by 9% ( $P < 0.05$ ). Assessment of the microcirculation has shown that in the 1<sup>st</sup> group parameters of LDF at the 10<sup>th</sup> minute of anesthesia were 14% higher than the initial blood flow measurements, and 26% ( $P < 0,01$ ) higher than in the 2<sup>nd</sup> group. The number of postoperative complications in the Propofol group was significantly higher than in the 1<sup>st</sup> group: unstable hemodynamics requiring vasopressor therapy (23.5% vs 0%), heart rhythm disorders (11.8% vs 0%).

**Conclusion:** The results provide strong evidence in favor of inhalative sevoflurane-based anesthesia as compared to propofol-based TIVA for one-stage reconstructive surgery of the internal carotid and lower-extremity arteries.

## 9AP7-3

### Target-controlled infusion of propofol and remifentanyl in spontaneous ventilation for endourological surgery

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**Background and Goal of Study:** Endourological surgery includes a large number of procedures frequently in elderly population. General anesthesia with target-controlled infusion (TCI) of propofol and remifentanyl maintaining spontaneous breathing may optimize intraoperative conditions and recovery avoiding neuroaxial anesthesia.

**Materials and Methods:** Prospective study in 234 patients over 18 years undergoing endourological surgery, fulfilling inclusion and exclusion criteria. Patients received a TCI of remifentanyl and propofol adjusted to a target concentration that provided general anesthesia maintaining spontaneous ventilation. Postoperative analgesia was ensured with paracetamol or AINEs. Assessed

variables were: intraoperative haemodynamics, oxygen saturation, sedation score, mean drugs concentration targets, total drugs dose administered, procedure duration and time in the postanesthesia care unit. Airway obstruction, apnea, airway intervention, postoperative nausea and vomiting (PONV) and pain (visual analog scale, VAS) were also recorded.

We evaluated patient comfort and operators' difficulty score regarding surgical conditions. Results are expressed by means usual descriptive statistics and analyzed with appropriate tests.

**Results and Discussion:** Patients were 66[55;75] years, 71.8% males, ASA 1-19.2%, 2-51.7%, 3-25.6%, 4-3.4%. Type of surgery was transurethral bladder tumor resection(38.9%), ureterorenoscopy(38.9%), urethral procedure(8.1%), bladder or prostatic biopsias(7.7%), transurethral prostatic resection(2.6%) or other(3.8%). Ramsay score was 6(96%) or 5(4%).

Median drug target was 2 mcg/ml for propofol (total dose 269.5mg) and 1.7 ng/ml for remifentanyl (total dose 175.2 mcg). Guedel tube need occurred in 72.2%, apnea in 16% and momentary ventilation in 9.3% with no relationship with drug targets. No patient required orotracheal intubation. Duration of surgery was 39[31,62] min and time in postanesthesia care unit 30[15,70] min. This time did not depend on the surgery, ASA or VAS. Patient comfort was good(100%) and operators' difficulty score was none-86.8%, slight-7.2% or moderate-6%. Pain was present in 46.6%(4.7% VAS>3) not depending on the surgery, analgesia or remifentanyl dose. PONV occurred in 4.9%.

**Conclusion:** TCI of remifentanyl and propofol maintaining spontaneous breathing can be used as a safe efficacious anesthesia for endourological surgery with a rapid recovery. However, further studies comparing different techniques would be needed.

## 9AP7-4

### Possible effects of free metabolites of propofol in clinical responses during anaesthesia

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**Background and Goal of Study:** Propofol is a widespread anaesthetic agent used for many procedures in both human and veterinary medicine. One of propofol metabolic pathways consists on its transformation in 4-hydroxypropofol (2,6-diisopropyl-1,4-quinol), either in humans and animals.

This free metabolite is suspected to have one-third of the hypnotic activity of propofol [1]. In the present study, the relationship between propofol and its non-conjugated metabolites (2,6-diisopropyl-1,4-quinol and 2,6-diisopropyl-1,4-quinone) with clinical and electroencephalographic variables was analysed.

**Materials and Methods:** Three consecutive propofol infusion rates (70, 100 and 130 mg.kg<sup>-1</sup>.h<sup>-1</sup>), each maintained during 30 minutes in a random order, were used to anaesthetize six New Zealand White rabbits. In the awake animals, at 20, 25 and 30 minutes after the beginning of each infusion rate and in recovered animals, the clinical responses (namely, Mean Arterial Blood Pressure - MABP), the stages of anaesthetic depth (DoA) [2] and the Index of Consciousness (IoC) were recorded and arterial blood samples were withdrawn. Propofol and propofol non-conjugated metabolites were quantified by Gas Chromatography/ Ion Trap-Mass Spectrometry (GC/IT-MS) assay and their correlation with these clinical responses was analysed.

**Results and Discussion:** Clinical and electroencephalographic responses showed a better correlation with propofol non-conjugated metabolites ( $r_{\text{MABP}} = -0.786$ ;  $r_{\text{DoA}} = 0.851$ ;  $r_{\text{IoC}} = -0.475$  for P values <0.05) than with propofol itself ( $r_{\text{MABP}} = -0.651$ ;  $r_{\text{DoA}} = 0.603$ ;  $r_{\text{IoC}} =$  not significant for P values <0.05).

**Conclusion(s):** These results suggest that propofol non-conjugated metabolites may have hypnotic and haemodynamic depressant effects and/or amplify the propofol effects during anaesthesia.

#### References:

1. Simons, R.J., et al., Species differences in blood profiles, metabolism and excretion of 14C-propofol after intravenous dosing to rat, dog and rabbit. *Xenobiotica*, 1991. 21(10): p. 1243-56.
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## 9AP7-5

### Preoperative intravenous flurbiprofen axetil can reduce the EC50 of fentanyl during propofol anaesthesia

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**Background and Goal of Study:** No previous study has suggested that NSAIDs can decrease the plasma fentanyl concentration required to immobilize 50% of patients during a skin incision (EC50) under target-controlled infusion (TCI) of propofol. We tested this hypothesis using one of NSAIDs, flurbiprofen axetil.

**Materials and Methods:** Sixty two unpremedicated, (ASA physical status I-II) patients scheduled to undergo gynecologic laparoscopy were randomly assigned to receive a placebo (control group,  $n = 31$ ) or 1 mg/kg intravenous flurbiprofen axetil (F group,  $n = 31$ ) preoperatively. General anaesthesia was induced by the combination of fentanyl and propofol. The patients received both fentanyl and propofol to a predetermined TCI (effect-site) and intubated after 1 mg/kg succinylcholine IV.

After sufficient time for equilibration, EC50 was accessed by lack of response to skin incision and measured by withdrawing the blood sample twice, two min before and after skin incision. The up-down method was used to determine the immobilize target concentration at 50% response. Statistic analysis was Student t-test.

**Results and Discussion:** Ten and eleven independent crossover pairs were collected in control and F groups, representing 42 of 62 enrolled patients. There was no patients' characteristic except height but statistically significant differences in fentanyl EC50 were noted between control and flurbiprofen group;  $1.69 \pm 1.16$  and  $0.98 \pm 0.75$  ng/ml ( $p = 0.020$ ) before incision;  $1.81 \pm 1.27$  and  $0.90 \pm 0.67$  ng/ml ( $p = 0.026$ ) after incision. Figure 1 indicates all measured fentanyl concentrations and mean  $\pm$  SD of EC50. However, there was no difference in the Bispectral index (BIS), haemodynamics between the two groups. This is the first clinical study to prove the decrease of fentanyl EC50 by NSAIDs under propofol anaesthesia.

**Conclusions:** Flurbiprofen axetil decreased the EC50 of fentanyl by 42~50% significantly during propofol anaesthesia without changing BIS and haemodynamics.

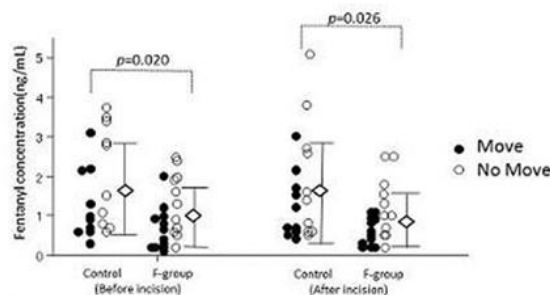


Figure 1.

[Figure 1: Fentanyl EC50 between the groups]

## 9AP7-6

### Can preoperative flurbiprofen axetil reduce the total dose of fentanyl and sevoflurane for breast-conserving surgery?

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**Background and Goal of Study:** We suggested that flurbiprofen axetil decreased the plasma fentanyl concentration required to immobilize 50% of patients during a skin incision under propofol anaesthesia. Next step we have to investigate is to prove the interaction of opioids and NSAIDs in the clinical anaesthesia setting. We hypothesized that preoperative administration of flurbiprofen could decrease the total dose of fentanyl and sevoflurane.

**Materials and Methods:** After getting the IRB and written informed consent, 40 unpremedicated, (ASA I-II) patients scheduled to undergo breast-conserving surgery were randomly assigned to receive a placebo; Intralipid™ 0.1 ml/kg (control group,  $n = 23$ ) or 1 mg/kg flurbiprofen axetil (F group,  $n = 17$ ) preoperatively. General anaesthesia was induced by fentanyl 1 µg/kg and propofol 2 mg/kg. The patients were inserted with laryngeal mask airway (LMA) without neuromuscular drug and maintained 40% oxygen with sevoflurane 2~3% keeping spontaneous breathing. During surgery, we administered fentanyl 25~50 µg or controlled sevoflurane to keep respiratory rate (RR) 5~15/

min, minute volume (MV) 2–6l/min. After surgery, we compared total dose of fentanyl, sevoflurane, max inspiratory sevoflurane concentration (>10min), min RR, SpO<sub>2</sub>, and max ETCO<sub>2</sub> by t-test.

**Results and Discussion:** There was no patients' characteristic but statistically significant differences in max inspiratory sevoflurane concentration ( $p=0.0004$ ). We could not find out any significance on the other parameters indicated at the table (Mean±SD). This is the clinical study to prove the interaction of fentanyl and flurbiprofen under sevoflurane anesthesia with LMA. However, the hypothesis was denied.

	Control	F group	p-value
N	23	17	
Operation time (min)	117±29	129±53	0.37
Total fentanyl dose (µg)	227±70	198±53	0.17
Fentanyl dose/kg (µg/kg)	4.2±1.3	3.9±1.2	0.49
Max sevoflurane concentration (%)	2.9±0.2	2.6±0.2	0.0004
Total dose of sevoflurane (ml)	52.1±3.0	53.1±3.7	0.83
Min RR	6.0±2.2	6.9±2.4	0.27
Max ETCO <sub>2</sub> (mmHg)	53.7±6.9	55.7±7.5	0.39
Min SpO <sub>2</sub> (%)	98.1±1.3	98.0±1.3	0.76

[Table]

**Conclusions:** Flurbiprofen axetil could decrease temporary max inspiratory sevoflurane concentration but not for the total dose of fentanyl and sevoflurane significantly. The clinical value of preoperative flurbiprofen IV to save fentanyl and sevoflurane consumption seems to be low.

## 9AP7-7

### Does propofol intravenous anaesthesia influence exhaled nitric oxide?

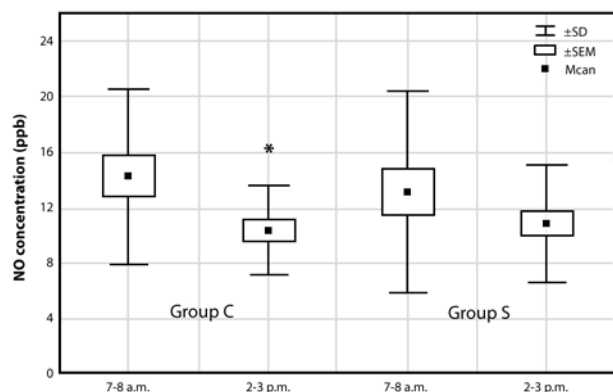
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**Background and Goal of Study:** Propofol has been reported to exert a number of non-anaesthetic effects. The drug has antioxidant, immunomodulatory properties, reduces apoptosis and up-regulates NO production [1]. Some animal studies suggest that propofol by modulating activity of NO synthase has protective effect on damaged lung tissue [2]. The aim of our study was to determine whether total intravenous anaesthesia with propofol changed the exhaled NO concentration in adult patients.

**Materials and Methods:** Patients scheduled for morning gynaecological surgery were studied (group S) whereas healthy non-anaesthetised volunteers (women) served as control (group C). Those with allergy, pulmonary diseases and smokers were excluded. TCI of propofol and remifentanyl was given to obtain serum concentrations of drugs during induction: propofol -10 µg ml<sup>-1</sup>, remifentanyl -9 ng ml<sup>-1</sup>; during maintenance: 3-4 µg ml<sup>-1</sup> and 4-6 ng ml<sup>-1</sup>, respectively. Cisatracurium was used for muscle relaxation. The patients' lungs were ventilated using air/O<sub>2</sub> mixture (FIO<sub>2</sub>=0.33). Exhaled NO (FeNO) was measured twice: at 7-8 a.m. (before anaesthesia) and at 2-3 p.m. (after) the same day by the off-line method according to ATS/ERS recommendations [3] using NO Analyser CLD 88.

**Results and Discussion:** There were no significant differences in demographic characteristics in group S (n=19) and C (n=18). In group S, anaesthesia lasted 87.9±41.7 min. There were no intergroup differences in FeNO values during the 1<sup>st</sup> and 2<sup>nd</sup> measurement. In both groups FeNO values at 2-3 p.m. were lower than at 7-8 a.m. (fig.), however only in group C the differences were significant (\* $p < 0.02$ ).



[Fig 1]

**Conclusion(s):** Total intravenous anaesthesia with propofol tends to decrease FeNO. Further studies are necessary to assess the potential day fluctuations in FeNO in anaesthetised and non-anaesthetised individuals.

#### References:

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3. Am J Respir Crit Care Med 2005; 171: 912-30

## 9AP7-9

### The influence of anesthetic agents on mitochondrial function as determined by high-resolved respirometry of human blood cells

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**Background and Goal of Study:** Anesthetics have been demonstrated to inhibit mitochondrial function in animal models, an effect that could be related to neurological sequelae of prolonged or excessive anesthesia in man. It has been proposed that toxicity of anesthetic agents could be caused by inhibition of the electron transport system. In this study, using high-resolved respirometry of human blood cells, the objective was to evaluate the influence of commonly used anesthetic agents in a wide concentration range on mitochondrial oxygen consumption in platelets.

**Materials and Methods:** Platelets samples were isolated from healthy volunteers and were rapidly analyzed by high-resolution respirometry using an Oroboros-2k Oxygraph. Platelets were exposed to propofol (5-150 microg/ml), sevoflurane (0.4-8 mmol/L) and midazolam (0.1-20 microg/ml). Mitochondria were stimulated with complex-specific substrates and inhibitors. Statistical analysis were performed using one way ANOVA with post hoc Dunnett's test and were compared to a separate control group (n=20). Informed consent was received from all participants and the study was approved by the ethical committee of Tokyo Medical University.

**Results and Discussion:** Within the therapeutic concentration-range of the investigated agents, no apparent inhibition of respiratory capacity was noted. Rather, at therapeutic concentrations, significant increases in mitochondrial respiratory parameters were detected for sevoflurane and propofol. Dose-dependent inhibition of respiration was found in the presence of high doses of propofol (30 microg/ml and above) and sevoflurane (1.6 mmol/L and above). The respiratory inhibition was more prominent for complex I respiration as compared to complex II-supported respiration. For midazolam no significant effects were noted at the concentration range investigated.

**Conclusion:** In freshly isolated and permeabilized human platelets, the commonly used anesthetics sevoflurane and propofol stimulate mitochondrial respiratory capacity at clinically relevant concentrations. At higher concentrations, these agents displayed a dose-dependent inhibition of complex I and II-supported respiration. The increased respiratory capacity induced by sevoflurane and propofol might be beneficial and the inhibition of respiration could be relevant to situations of prolonged or excessive exposure, especially in situations of tissue accumulation of these anesthetics.

## 9AP7-10

### Steinert's disease: an anesthetic dilemma

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**Background:** Steinert's Disease (SD) is a multisystem disorder involving skeletal, smooth and cardiac muscle. SD is a challenge for anesthesiologists due to the risk of myotonic crisis, malignant hyperthermia and the increased sensitivity to anesthetics [1]. This report aims to present a case of appendectomy on a patient with Myotonic Dystrophy (MD) and discuss its implications.

**Case report:** A 60-year old man with SD confirmed by genetic study was admitted into the emergency department with acute appendicitis. The patient had MD with predominant muscular and gastrointestinal involvement, ASA III. Routine preoperative evaluation was normal, except arterial blood gas analysis which showed hypoxemia and normocarbida. He was not premedicated. Standard, temperature, and depth of anesthesia monitoring were applied and blood glucose checked. Anesthesia was induced with a target-controlled infusion (TCI) of remifentanyl and propofol, and intubation was done without neuromuscular blocking drugs. TCI, oxygen and air were used to maintain anesthesia. Warm intravenous fluids and a thermal blanket ensured normothermia. Hemodynamics remained stable throughout the surgery lasting 30 min. Dexamethasone 4mg was administered and analgesia was provided by paracetamol 1g, tramadol 100mg, ketorolac 30mg, and infiltration of the incision site with ropivacaine 0.75%. The patient was extubated once respiratory

efforts were adequate and he was following commands. He was admitted into the post-anesthetic unit for monitoring and transferred to the ward 6h later without intercurrents.

**Discussion:** Anesthetic management in SD is a dilemma. Inhalation agents may be deleterious because the relation between myotonia and malignant hyperthermia is unclear. Etomidate has been shown to cause adrenal suppression. Succinylcholine can trigger a myotonic crisis. Nondepolarizing agents can cause a delay in muscular strength recovery. Because of the marked sensitivity to acetylcholine, neostigmine should not be used in MD. For all these reasons, and despite the controversy around the use of propofol as an induction and maintenance agent in MD, we found a TCI of short-acting agents to be successful in this case.

#### References:

1. M. Bennum, B. Goldstein, Y. Finkelstein et al, *Br J Anaesth* 2000;85:407-9

**Learning points:** Successful anesthetic management of SD includes avoidance of triggers of myotonic crisis, use of short-acting drugs, and close post-operative monitoring for prompt response to any complications.

## 9AP8-1

### Dopamine D<sub>1</sub> receptor-mediated airway smooth muscle relaxation is mediated via a cyclic AMP pathway

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**Background and Goal of Study:** Dopamine receptors are G protein-coupled and comprise two subgroups, "D<sub>1</sub>-like" receptors (D<sub>1</sub> and D<sub>5</sub>) which couple to G<sub>s</sub> protein and "D<sub>2</sub>-like" receptors (D<sub>2</sub>, D<sub>3</sub> and D<sub>4</sub>) which couple to G<sub>i</sub>. In patients with asthma, inhaled dopamine has been reported to induce bronchodilation. Recently, we have demonstrated the expression of the dopamine D<sub>1</sub> and D<sub>2</sub> receptor subtypes on airway smooth muscle. Activation of G<sub>s</sub>-coupled receptors stimulates adenylyl cyclase activity and a consequent increase in cellular cyclic AMP (cAMP) levels.

The increase in intracellular cAMP activates cAMP-dependent protein kinase (PKA), which classically promotes airway smooth muscle relaxation. In addition, large conductance calcium- and voltage-activated potassium (BK<sub>Ca</sub>) channels are also involved in G<sub>s</sub>-coupled receptor-mediated airway relaxation (e.g. β<sub>2</sub>-adrenergic receptor). Although we have demonstrated that the dopamine D<sub>1</sub> receptor agonist stimulated cAMP synthesis and facilitated relaxation of airway smooth muscle, it was unclear whether cAMP synthesis was the only mechanism for dopamine D<sub>1</sub> receptor-mediated airway smooth muscle relaxation. The current study extends the mechanistic understanding of the mechanism by which dopamine D<sub>1</sub>-like receptors modulate airway smooth muscle function.

**Materials and Methods:** To evaluate whether the activation of dopamine D<sub>1</sub> receptor induces airway smooth muscle relaxation, guinea pig tracheal rings suspended under isometric tension in organ baths were treated with cumulatively increasing concentrations of the D<sub>1</sub> agonist A68930 (1-100 μM), following an acetylcholine (EC<sub>50</sub>)-induced contraction in the presence or absence of the PKA inhibitor, Rp-cAMPS (100 μM) or BK<sub>Ca</sub> channel blocker, iberiotoxin (100 nM).

**Results and Discussion:** A68930 dose-dependently relaxed acetylcholine-contracted guinea pig tracheal rings, which was significantly blocked by pretreatment with Rp-cAMPS. In contrast, blockade of the BK<sub>Ca</sub> channel with iberiotoxin did not inhibit dopamine D<sub>1</sub>-like mediated relaxation.

**Conclusion:** Activation of the dopamine D<sub>1</sub> receptor expressed on the airway smooth muscle relaxed airway smooth muscle via cAMP activation of PKA. These findings suggest a novel approach for functional relaxation of airway smooth muscle through the dopamine D<sub>1</sub> receptor.

## 9AP8-2

### Intraoperative administration of glucose attenuates the postoperative insulin resistance

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**Background and Goal of Study:** Hyperglycemia due to decrease in insulin sensitivity is often observed after surgery in spite of normal insulin secretion, and its morbid state is similar to type II diabetes and may worsen the outcome. This postoperative insulin resistance increases according to the magnitude of surgical invasion<sup>1)</sup>.

However, supplementation of carbohydrates before surgery attenuates the postoperative insulin resistance<sup>2)</sup>. This study, therefore, conducted to investigate the effect of intraoperative administration of glucose on the postoperative insulin resistance.

**Materials and Methods:** After getting written informed consent, patients undergoing maxillofacial surgery were randomly assigned to two groups, G group receiving acetated Ringer solution with 1.5% glucose or R group receiving acetated Ringer solution without glucose throughout the surgical procedure. The glucose clamp using the STG-22™ was also performed on the previous day and on the next day of the operation. Insulin was infused intravenously at 1.25mU/kg/min and glucose was simultaneously infused at a variable rate to maintain the blood glucose at 90 mg/dl. In this method, insulin resistance was quantified as the mean glucose infusion rate (M-value) during a steady-state period during the 120 min of the clamps. In addition, plasma glucose, insulin and plasma ketone bodies were measured 5 times during perioperative period.

**Results and Discussion:** Patients in G group (n=11) received 0.15±0.06 g/kg/h of glucose during surgery, while patients in R group (n=11) received no glucose.

But hyperglycemia did not observed in both groups. The mean blood glucose levels were maintained stably less than 150 mg/dL during and after surgery. The plasma concentration of ketone bodies significantly increased after surgery in R group (p=0.0035).

However, it decreased significantly after surgery in G group (p=0.043). The reduction in M-value was significantly lower in G group, 43.3±20.7%, than that in R group, 57.7±9.3% (p=0.041).

**Conclusion(s):** Intraoperative small-dose of glucose administration may suppress ketogenesis and attenuate the postoperative insulin resistance without hyperglycemia.

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2. Ljungqvist O. et al. Glucose infusion instead of preoperative fasting reduces postoperative insulin resistance. *J Am Coll Surg* 1994;178:329-36.

## 9AP8-3

### Membrane interactivities are discriminated between selective and nonselective β1-blockers: characterization of ultra-short-acting highly selective landiolol

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**Objectives:** Apart from the conventional mechanism, we hypothesized that selective and nonselective β1-blockers used for the perioperative treatment might differently interact with biomembranes. We compared the effects of both blockers on lipid membranes, and then characterized newly developed landiolol (Land).

**Methods:** Biomimetic membranes were prepared with 1,2-dipalmitoylphosphatidylcholine (DPPC) or the lipid compositions of cardiomyocyte (Card), lipid raft (Raft) and cardiomyocyte mitochondrial (Mito) membranes.

Selective: esmolol (Esmo) and Land, and nonselective β1-blockers: propranolol (Prop) and alprenolol (Alpr) were reacted with such preparations at 0.5-200 μM. Their membrane interactivities were determined by measuring fluorescence polarization changes (Pol). Their antioxidant effects were assayed by the liposomal membrane system. All results were expressed as mean±SE (n=7) and the statistical tests included a one-way ANOVA.

**Results:** Nonselective β1-blockers, but not selective ones, interacted with DPPC and Card membranes to enhance their fluidity. Prop and Alpr of 20 μM showed Pol of -0.0026±0.0001 and -0.0018±0.0001 (P< 0.01 vs. control for both) in DPPC membranes, and -0.0022±0.0001 (P< 0.01) and -0.0009±0.0001 (P< 0.05) in Card membranes. Land reduced the fluidity of DPPC membranes with Pol of 0.0008±0.0001 (P< 0.05). Since its hydrolysate rigidified the membranes, the effect of Land is due to a morpholine structure. Prop and Alpr fluidized Raft membranes with Pol of -0.0065±0.0001 and -0.0034±0.0001 at 200 μM (P< 0.01 for both), although Esmo and Land were ineffective.

Considering the lipid composition of biomembranes and the β2-receptor localization in lipid rafts, the differentiation between β1-blockade selectivity and nonselectivity is compatible with that between membrane noninteractivity and interactivity. Prop, Alpr, Esmo and Land fluidized Mito membranes at 0.5-40 μM and also inhibited membrane lipid oxidation with the same rank order as that of membrane fluidization. While β1-blockers protect the heart from ischemia/reperfusion injury, the Mito membrane interaction common to them is responsible for this effect not relating to β1-blockade.

**Conclusion:** Selective and nonselective β1-blockers are discriminable by noninteractivity or interactivity with biomembranes which contributes to the β2-blockade through membrane modification. Land is characterized as a selective β1-blocker without membrane interactivity.

### 9AP8-4

#### The effect of incision and amiloride on pH response of muscle afferents

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**Background and Goal of Study:** To understand injured muscle pain is more important for evaluating clinical pathologic pain states and improving their management.

In our previous study using an in vitro plantar flexor digitorum brevis (FDB) muscle-nerve preparation, incision increased on going activity of muscle afferents and enhanced chemosensitivity to lactic acid (pH 5.5 - 6.5). In this study, we investigated the properties of mechanosensitive group III and group IV afferents of incised and unincised muscle, and explored response of the muscle to higher pH 6.5 - 7.6. We also examined the effect of amiloride, a nonspecific acid-sensing ion channel (ASIC) inhibitor.

**Materials and Methods:** A plantar incision was made at the plantar aspect of rat hindpaw through skin, fascia, and underlying FDB muscle. One day after incision, an in vitro muscle-nerve preparation including the tibial nerve and FDB muscle was used for single fiber recording. Mechanosensitive group III and group IV afferents were recorded. Afferent chemosensitivity to lactic acid with varying pH was studied by incubating the FDB muscle with lactic acid pH 6.5, 7.0, control solution and Amiloride (100 micro M, 1 m M), a non-specific ASIC blocker. Mechanosensitivity of afferents was evaluated by applying von Frey filament to the FDB muscle.

**Results and Discussion:** 5.0% of group III and group IV afferents were activated by lactic acid pH 6.5 and 15.0% by pH 7.0. Incision increased the prevalence of on going activity in group III and IV afferents (28.2% vs. 5.0% in control). In the incised afferents, 22.5% of group III and group IV afferents responded to pH 6.5 lactic acid and 19.7% to pH 7.0. Amiloride (100 µM) blocked 3 of 3 acid responsive afferents in the control group. In incision group, 100 µM Amiloride inhibited acid responses of 1 of 8 afferents, enhanced 3 of 8 and did not change 4 of 8. 1 mM amiloride inhibited acid responses of 2 of 7 afferents, whereas amiloride enhanced the responses of 1 of 7 acid insensitive afferents to lactic acid. In the acid-unresponsive afferents, the sensitivity to amiloride increased depending on the concentration of amiloride.

**Conclusion(s):** Our experiments demonstrated that incision increases the responses of muscle afferents to weak acid, pH levels that are found in incised tissue. Both amiloride sensitive and amiloride insensitive responses are present after incision.

### 9AP8-5

#### Comparison of dexmedetomidine and remifentanyl for attenuation of hemodynamic responses to laryngoscopy and tracheal intubation

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**Background and Goal of Study:** This study was designed to compare the effect of dexmedetomidine and remifentanyl used in anesthetic induction on hemodynamic change after direct laryngoscopy and tracheal intubation.

**Materials and Methods:** Ninety ASA class 1 or 2 patients were randomly divided to 3 groups to receive the following in a double-blind manner: normal saline (Group C, n = 30), Dexmedetomidine 1 µg/kg (Group D, n = 30), Remifentanyl 1 µg/kg (Group R, n = 30). Anesthesia was induced with propofol 2 mg/kg and rocuronium 0.6 mg/kg and maintained with 2 vol% sevoflurane and 50% nitrous oxide in oxygen. In group D, Dexmedetomidine 1 µg/kg was infused for 10 minutes before tracheal intubation.

Patients in group R and group C were received remifentanyl 1 µg/kg and normal saline 1 minute before tracheal intubation. The systolic blood pressure, diastolic blood pressure and heart rate were recorded before anesthesia induction (baseline value), at 2 min intervals before intubation, at 1 min intervals for 5 min after intubation.

**Results and Discussion:** The systolic pressure and diastolic pressure 1 min after tracheal intubation were lower significantly in group R ( $P < 0.05$ ). The heart rate 1 min after tracheal intubation were lower significantly in group D and group R than group C ( $P < 0.05$ ).

**Conclusion(s):** Dexmedetomidine and remifentanyl significantly decreased heart rate during anesthetic induction. However in blood pressure, remifentanyl was more effective than dexmedetomidine.

#### References:

1. Maguire AM, et al. *Br J Anaesth* 2001; 86:90-3.
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### 9AP8-6

#### Comparison of effects of subanesthetic dose of ketamine in TIVA anesthesia on perioperative hemodynamic, postoperative recovery, analgesic consumption and cognitive functions

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In the present study, it was aimed to compare effects of subanesthetic dose of ketamine, which was given under TIVA anesthesia, on perioperative hemodynamic, postoperative recovery, analgesic consumption and cognitive functions in patients scheduled for laparoscopic cholecystectomy.

After obtaining approval of local Ethic Committee and written informed consent from patients, 60 patients (age 20-70) with ASA I-III, who scheduled for elective laparoscopic cholecystectomy under general anesthesia, were randomly assigned in one of 2 groups. Mini Mental Test (MMT) was performed in both groups. 0.25 mg/kg ketamine was given to Group 1 (TIVA-ketamine; n=30) 2 minutes before induction. In Group 1 (TIVA-ketamine) and Group 2 (TIVA; n=30), induction was achieved by giving 2 mg/kg propofol and 1 µg/kg fentanyl. Intubation was performed by 0.6 mg/kg rocuronium. In both groups, anesthesia was maintained by 6 mg/kg/hr propofol, 0.15 µg/kg/min remifentanyl and 50% O<sub>2</sub>-50% air mixture. Hemodynamic parameters, time to extubation, eye opening, response to commands and orientation were recorded throughout surgery. On the minutes 5, 10 and 15 after extubation, Ramsey Sedation Score (RSS) and Aldrete Recovery Score (ARS) were recorded. PCA was used for postoperative analgesia. PCA was set to 5 mg/ml Tramadol concentration, 10 mg bolus dose and 12 min. lockout interval. Total analgesic consumption in 24 hour was recorded. MMT test was performed at hour 24 after operation. NCSS, Student t test and chi square tests were used in statistical analysis.

Hemodynamic parameters were similar between Group 1 (TIVA-Ketamine) and Group 2 (TIVA). Total analgesic consumption was significantly lower in patients received ketamine ( $p < 0.01$ ). ADS at minute 5 and 10 were found to be lower in ketamine group ( $p < 0.05$ ). RSS was also longer in group received ketamine ( $p < 0.05$ ). Time to extubation and orientation, and response time to commands were found to be longer ( $p < 0.05$ ). Cognitive functions at postoperative hour 24 were identical to those at baseline. No significant difference was present in MMT and patient satisfaction ( $p > 0.05$ ).

In TIVA anesthesia, subanesthetic doses of ketamine provided an optimum and stable hemodynamic status. Ketamine administration provides better postoperative analgesia; however, a more cautious postoperative follow-up was needed due to sedation and prolonged response time to commands, time to orientation and recovery time.

#### References:

1. Laparoscopic Cholecystectomy; Anesthetic implications. *Anaest. Analg* 1993;76:1120-1133

### 9AP8-7

#### Rat liver mitochondrial complex I impairment after ketamine chronic treatments

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**Background and Goal of Study:** Ketamine sub-anesthetic doses are used for chronic pain management, however hepatotoxicity can be induced in prolonged use<sup>1,2</sup>. It has been suggested that mitochondrial impairment and free radicals production play a key role in this process<sup>3,5</sup>.

The purpose of this study was to investigate the effects of chronic ketamine treatment in rat liver mitochondrial bioenergetics, function and oxidative stress parameters.

**Material and Methods:** Twenty adult Wistar rats were treated SC for 14 consecutive days with a saline solution, 5 or 10 mg/kg of ketamine twice a day. Rats were weighted daily and they were sacrificed 10 days after the end of the treatment period. Oxygen consumption of isolated liver mitochondria was monitored polarographically with a Clark-type oxygen electrode during states 3 and 4 respiration, i.e. in presence and absence of ADP, using glutamate-malate or succinate as substrate; and specific respiratory complex chain enzymes (I-V) were also evaluated. The lipid peroxidation, protein oxidation and antioxidant activity of superoxide dismutase were determined as oxidative stress markers of liver mitochondria.

**Results and Discussion:** Both ketamine treated groups showed a decreased evolution in the body weight gain curve ( $p < 0.05$  vs. saline). Mitochondrial functionality showed decreased state 3 and state 4 respiration when glutamate-malate was used as substrate of complex I in both ketamine groups ( $p < 0.05$  vs. saline). No differences were observed in oxygen consumption when succinate was used. Concerning respiratory complexes the only difference was observed in complex I with decreased activity compared with control.

No significant differences were observed in the mitochondrial lipid peroxidation, protein carbonyls and SOD activity.

**Conclusion:** Both ketamine doses interacted with complex I, but this effect does not reflect any change in promoting redox imbalance of liver mitochondria. Therefore, more research is needed to clarify if this effect can justify the higher sensitivity of some patients in prolonged ketamine use.

**References:**

- 1- Pain Med 2004, 5
- 2- Pain 2011, 152, (9)
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- 4- Br J Anaesth 2009, 102
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**Acknowledgments:** Supported by the Portuguese FCT and co-funded by the COMPETE: -01-0124- FEDER -009497, project grant PTDC/CVT/099022/2008

## 9AP8-9

### Promethazine inhibits NMDA-induced currents: new pharmacological aspects of an old drug

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**Background and Goal of Study:** The phenothiazine derivative promethazine was first introduced into clinical practice as an antiallergic drug owing to its H1-receptor antagonizing properties. Nowadays, promethazine is primarily used as a sedative and/or as an antiemetic. The broad spectrum of clinically relevant effects of promethazine might be mediated by different molecular targets. Since some of these side effects might partly be transmitted via glutamate is the predominant excitatory transmitter in the vertebrate brain which is involved in alertness control, pain processing, and neurotoxicity we tested the hypothesis that promethazine 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.

**Key Results:** Promethazine selectively inhibited NMDA-receptors whereas AMPA- and kainate receptors were hardly affected. Inhibition of NMDA-induced membrane currents occurred in a reversible manner with a half-maximal effect at around 20  $\mu$ M promethazine, independent of the subunit composition. The inhibition occurred in a non-competitive manner as the inhibition did not vary with either the glutamate nor the glycine concentration. Analysis of the underlying mechanism revealed only weak dependency on the use of the receptor or the membrane potential ( $z_d = 0.28$  according to the Woodhull-model). In line with these findings, promethazine did not interact with the  $Mg^{2+}$  binding site.

**Conclusion and Implications:** Promethazine inhibits NMDA-mediated membrane currents in a reversible and concentration-dependent manner. The results presented here provide evidence that the NMDA receptor antagonism may contribute to clinically relevant effects of promethazine like sedation, analgesia or neuroprotection.

## 9AP8-10

### Ketamine can lead to malformation of zebrafish (*Danio rerio*) larvae

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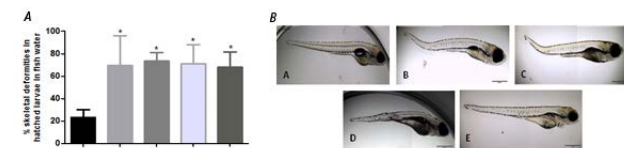
**Background and Goal of Study:** Little is known about ketamine effects in the brain and development and special concerns on effects during early development stages have arisen.

This study aims to evaluate the developmental toxicity and teratogenicity of ketamine in the early phase of zebrafish development.

**Materials and Methods:** Zebrafish eggs were collected and then exposed to ketamine solutions (0.2, 0.4 and 0.8%) from 2-3 hours post-fertilization, in a 20-min period. Embryos or larvae were assessed up to 6 days post-fertilization (dpf) for viability and morphology analysis.

Ethanol at 2% (v/v) was used as a positive control. At selected time points, namely 24, 48, 72 and 144 hpf (hours post-fertilization), embryotoxicity and morphological characteristics of the embryos were evaluated. After hatching, larvae were evaluated for skeletal deformities using a morphological scoring system. Motility recording were analyzed statistically with general linear model. A Tukey's test was used to find which means were significantly different from one another. A significance level of  $P < 0.05$  was used in all statistical analyses.

**Results and Discussion:** After ketamine exposure, zebrafish embryos mortality and most morphological characteristics were similar to those from control group. However, scoring for skeletal deformities showed significant effects on all ketamine exposed groups (Fig. 1A) which included several malformations abnormalities (Fig.1B)



**Fig. 1A** - Mean percentages and standard deviation ( $n = 4$  experiments) of hatched larvae in fish water with skeletal deformities at 144 hpf. \* At  $P < 0.05$  there was a significant effect between tested groups and control group. **Fig. 1B** - Photographs of group representative *D. rerio* larvae at 144 hpf. A) Control; B) 0.2 % ketamine; C) 0.4 % ketamine; D) 0.8 % ketamine; E) Ethanol. Several malformations are detectable upon visualization of embryos exposed to ketamine for 20 min period that include: axis curved or bent in either direction caudal fin malformed or absent; malformed jaw; failure of swim bladder to inflate; yolk sac edema; and short, malformed or absent trunk.

[Fig1AeB]

**Conclusion(s):** These data show that early developmental exposure of zebrafish to ketamine can cause long-term functional and morphological abnormalities of zebrafish larvae.

**Acknowledgements:** Supported by the Portuguese Foundation for Science and Technology (Lisbon, Portugal) and co-funded by the COMPETE: -01-0124- FEDER -009497 through the project grant: PTDC/CVT/099022/2008.

## Paediatric Anaesthesia and Intensive Care

### 10AP1-1

#### Estimating paediatric weight: a new formula

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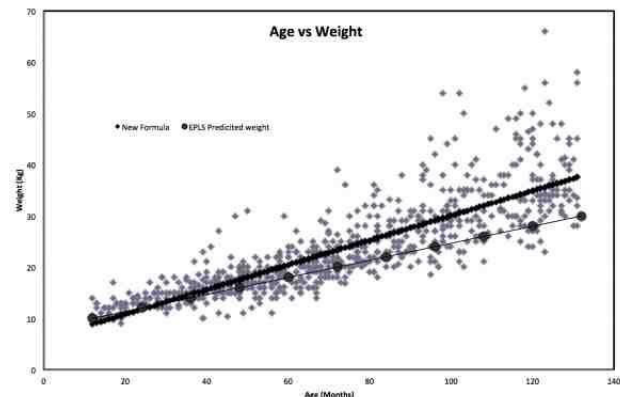
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**Background and Goal of Study:** Weight estimation is of paramount importance in paediatric resuscitation. The formula  $Weight = (Age + 4) \times 2$  was first described in the 1990's, and is the most commonly used formula for this purpose<sup>1</sup>. However, children's weight is increasing, and this formula is now thought to significantly underestimate weight<sup>2</sup>.

The aim of this study was to produce a more accurate formula for weight estimation using data from children in our region.

**Materials and Methods:** We performed a search of our theatre database for patients aged 16 years or under who had attended our preoperative assessment clinic between September 2009 and May 2011. 1252 children were identified and the measured weights were plotted against age. The data was compared against the current EPLS formula<sup>1</sup> and a new formula calculated.

#### Results and Discussion:



[Graph 1: Age vs Weight]



EPLS underestimates weight by a mean of 14.6%. Using our data, (Age in months) / 4 + 6' underestimates weight by a mean of only 5.6%.

**Conclusion(s):** Amongst children in our region, the formula (Age (months) / 4) + 6 provides a better estimation of paediatric weight than the more commonly used EPLS formula'.

**References:**

1. Bingham R. Maconochie I. *European Paediatric Life Support*. 3<sup>rd</sup> edn, Resuscitation Council (UK) 2011.
2. Luscombe MD. "Kids aren't what they used to be": a study of paediatric patient's weights and their relationship to current weight estimation formulae. *Br J Anaesth* 2005;95:578

**Acknowledgements:** Dr. J. Carlisle, Consultant Anaesthetist, South Devon Healthcare NHS Foundation Trust, Devon, UK.

**Conflict of Interest:** None declared

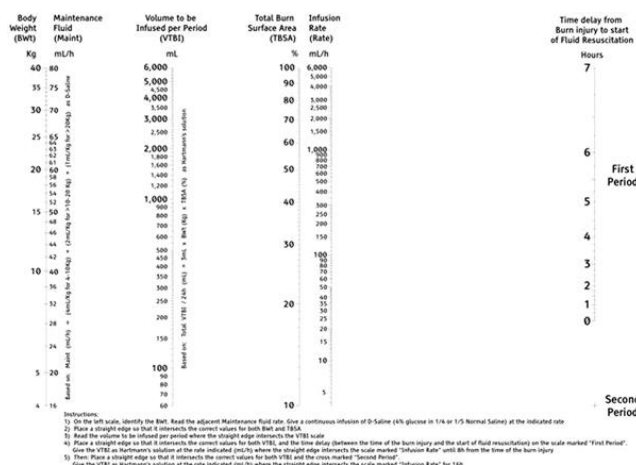
**10AP1-2**

**Validation of a nomogram to aid fluid resuscitation in paediatric burns**

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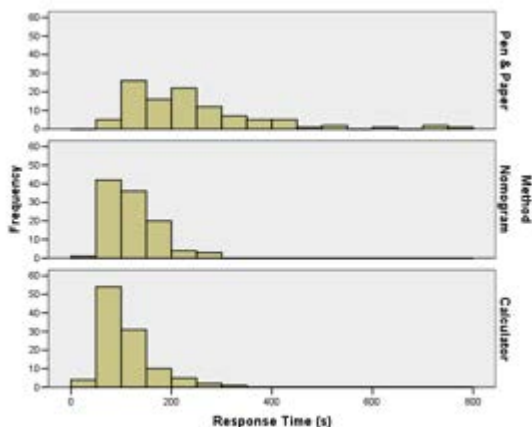
**Background and Goal of Study:** We performed a double blinded randomised study to compare the accuracy and speed of three different techniques (pen & paper, electronic calculator and a novel graphic device: "nomogram") for calculation of resuscitation and maintenance fluid requirements for paediatric patients in the first 24hr of burn injury, based on the Parkland formula.



[The Parkland Formula Nomogram for Paediatric Burns]

**Materials and Methods:** 36 participants performed 318 calculations using a series of computer generated simulated patient data.

**Results and Discussion:** For nomogram, calculator and pen & paper: Magnitude of error [low ( $\geq 25\%$ ), medium ( $\geq 50\%$ ), high ( $\geq 75\%$ ): [5.7%, 4.7%, 3.8%], [12.1%, 12.1%, 7.5%], [28.6%, 21.9%, 16.2%];  $p < 0.01$ . Calculation time: [sec; mean (SD)]: 122(48), 109(52), 240(140);  $p < 0.001$ .



[Histogram of response time]

**Conclusion(s):** The nomogram was more accurate at all levels and was deemed the easiest to use. It is also low cost and robust. Although the electronic calculator was faster than the nomogram it was not statistically significant in a pairwise comparison. We therefore suggest that the Parkland formula nomogram is a suitable method for calculation of resuscitation and maintenance fluid requirements in paediatric burns; particularly for clinicians with limited experience of burns or for those working in difficult environments. It also provides a rapid means of detecting and preventing larger errors that we have shown can occur when an electronic calculator or pen & paper are used as the primary method of calculation.

**10AP1-5**

**The comparison of two different methods of partial inflation of cuff for facile insertion of laryngeal mask airway in paediatric patients**

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**Background and Goal of Study:** The cuff of laryngeal mask airway (LMA) is preferred to be partially inflated before insertion in paediatric patients. However, it is not recommended how much inflation is appropriate. Through the review of previous studies and our clinical experiences, we found that half the maximum volume or the resting volume of cuff could be simply used for partial inflation of cuff before insertion that might reduce the necessity of adjustment of cuff pressure after insertion. This study was conducted to compare two methods of partial inflation of cuff for facile insertion of LMA in paediatric patients.

**Materials and Methods:** 68 children (0-9 years) were randomly allocated to one of two groups. In half the maximum volume group, the cuff of LMA was completely emptied and then the cuff was filled with half the maximum volume according to manufacturer's recommendations. In the resting volume group, the pilot balloon valve was connected to piston-free syringe for keeping the valve open to the atmosphere and allowing the pressure within the cuff of LMA to equalize with atmospheric pressure and then the syringe was disconnected. After insertion of LMA, the intra-cuff pressure of the patients and airway leak pressure were measured. Five corresponding inspiratory and expiratory tidal volumes were recorded for calculating the leakage percentage.

**Results and Discussion:** LMA was inserted in all patients at the first attempt in half the maximum volume group, and was inserted in 33 patients (97%) at the first attempt and in 1 patients (3%) at the second attempt in the resting volume group. The mean intra-cuff pressure of two groups was lower than 60 cmH<sub>2</sub>O of manufacturer's recommendation. The mean intra-cuff pressure in half the maximum volume group was significantly lower than that in the resting volume group. The maximum value of intra-cuff pressure in half the maximum volume group was lower than that of the resting volume group.

	Half the maximum volume(n=34)	The resting volume (n=34)	P
Intra-cuff pressure (cmH <sub>2</sub> O)	50.4 ± 12.1 (30-77)	57.0 ± 13.7 (29-90)	0.038*
Airway leak pressure (cmH <sub>2</sub> O)	22.3 ± 5.5	21.5 ± 5.6	0.573
Leakage percentage (%) at spontaneous ventilation	2.0 ± 2.3	2.5 ± 5.6	0.580
Leakage percentage (%) at mechanical ventilation	5.0 ± 8.5	2.4 ± 6.2	0.167

[Table 1 Intra-cuff pressure and parameters]

**Conclusion(s):** Half the maximum volume or the resting volume of cuff can be simply used for partial inflation of cuff before insertion. Half the maximum volume can provide more tolerable range of intra-cuff pressure than the resting volume.

**10AP1-6**

**Novel devices for calculation of resuscitation fluids in paediatric burns**

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**Background and Goal of Study:** The modified Parkland formula' is the most commonly used protocol for fluid resuscitation of paediatric burns<sup>2</sup>; however calculation is time consuming and error-prone.

We developed two devices to perform these calculations: an electronic device and a circular slide rule ('disc calculator'); and compared performance with

the conventional technique of pen & paper calculations aided by an electronic calculator.

**Methods:** Following a period of instruction, 12 volunteers with no prior experience of the Parkland formula performed 108 calculations using all 3 methods in a double blinded randomised study. Simulated patient data (age, body weight, % burn, delay in presentation, pre-hospital fluids) were randomly generated by software. Participants calculated rates of administration (ml/h) for 1st period, 2nd period and maintenance fluids. All responses and time taken were recorded.

**Results:** Errors were non-normally distributed (K-S test) and therefore categorised by magnitude: response times were normally distributed.

**Conclusion:** Both devices demonstrated fewer and less extreme errors in all calculations, and were faster than conventional methods. The electronic device was most accurate overall; however the disc calculator was low cost and robust. We suggest that both devices are suitable alternatives to conventional methods for calculation of fluid requirements in paediatric burns.

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1. BMJ 2004;329:101-3 2. ANZJSurg 2006;76:35-8

## 10AP1-7

### Anaesthetic time for tonsillectomy in children - do anaesthetic rooms make a difference?

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**Background and Goal of Study:** Undue delays in anaesthesia cause inefficiency in operating list throughput with deleterious effects financially and on waiting lists. We aimed to determine whether use of an anaesthetic room affected anaesthetic time for children under 16 years undergoing tonsillectomy.

**Materials and Methods:** Retrospective review of all paediatric tonsillectomy cases completed between January 2002 and October 2011 at a UK district hospital. We compared the recorded anaesthetic time between those cases done in the day surgery unit (no anaesthetic room) and those done in main theatres (anaesthetic room used).

**Results and Discussion:** 2494 cases were identified and analysed. All children were ASA I or II. When no anaesthetic room was used the mean time was 10 minutes 56 seconds. In main theatres, where an anaesthetic room is used, the mean time was 14m 37s.

	n	Mean age (yrs)	Mean anaesthetic time	Standard deviation
Anaesthetic room	2206	7.3	14m 37s	5m 15s
No anaesthetic room	288	7.7	10m 56s	4m 27s

[Anaesthetic time for tonsillectomy in children]

In our study the anaesthetic time for children undergoing tonsillectomy was not significantly prolonged by use of an anaesthetic room. In a half day session where six tonsillectomies are listed a 3m 41s difference would only equate to 22 minutes lost - not sufficient time to complete a further procedure. It is often perceived (especially by surgeons) that use of an anaesthetic room tends to prolong anaesthetic time and subsequently hinder efficiency of operating sessions. Our findings suggest that this is not the case for children undergoing tonsillectomy. This may be unique to paediatrics where subtle changes in anaesthetic emphasis improve patient throughput indirectly. Successful paediatric anaesthesia requires appropriate preparation in advance of the child entering the anaesthetic room to avoid distress by unduly delaying induction of anaesthesia. Once anaesthesia is induced optimum management then requires slick practical procedures with the minimum of delays. As a consequence of this patients are rapidly ready for surgery, independent of the place of anaesthetic induction.

**Conclusion(s):** Use of an anaesthetic room did not prolong anaesthetic time for tonsillectomy in children. Anaesthetic rooms can be used for tonsillectomy in children under 16 years without hindering theatre efficiency.

## 10AP1-8

### Anaesthetic trainee competence in the management of critically unwell paediatric patients

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**Background and Goal of Study:** Anaesthetic trainees working in District General Hospitals are often expected to manage critically ill children in hospitals with no paediatricians. These trainees have often had limited or no previous paediatric anaesthesia and resuscitation experience. The aim of this survey

was to determine trainee confidence, competence and training in the resuscitation of children.

**Materials and Methods:** Self assessment surveys were sent to trainees in four large district general hospitals within the West of Scotland. It reviewed trainee's previous paediatric anaesthetic and resuscitation training. The frequency and type of paediatric emergencies attended, the level of senior support available and required in each case and the competence and confidence of the trainee's in these situations.

**Results and Discussion:** Forty nine trainees replied to the survey. 60% of trainees had not received any paediatric resuscitation training within the last year and a further 10% had never received any paediatric resus training. Despite often being the most senior doctor on site. Fifty percent of emergencies where primarily airway or breathing problems. Most trainees feel uncomfortable in managing unwell children though felt they had senior support available if required. However at night this was often a consultant at home. Ninety percent of respondents felt they would benefit from further paediatric lecture and scenario based teaching. Simulation teaching has been shown to improve medical education and training by placing doctors out with their own comfort zones in a safe environment. Allowing them to gain confidence and competency in stressful situations without patient safety being compromised.

**Conclusion(s):** This survey indicated a deficiency in trainee confidence in paediatric resuscitation. We propose that the introduction of an induction programme consisting of both lecture based and simulation scenarios would increase trainee competency and confidence in dealing with paediatric emergencies.

**References:**

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2. The role of medical simulation: an overview. Kevin Kunhler. The international Journal of medical robotics and computer assisted surgery. Volume 2 Issue 3. p203-210; Sept. 2006

## 10AP1-9

### Oxygenation index in infants with congenital diaphragmatic hernia after 24 hours of stabilization according to the standardized institutional protocol: a warning of high risk of unfavorable outcome?

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**Background and Goal of Study:** Congenital diaphragmatic hernia (CHD) is associated with high risk of death in first days of life due to lung hypoplasia and pulmonary hypertension, as well as complication due to treatment itself. To date, there are no universally accepted treatment protocols for this anomaly. Oxygenation index (OI) =  $\text{FiO}_2 \cdot 100 \cdot \text{MAP} / \text{PaO}_2$ , where MAP is mean airway pressure, seems to be a useful indicator of the effectiveness of treatment. The aim of this study was to evaluate value of OI, recorded after 24 h of the standardized preoperative stabilization, as a predictor of the outcome.

**Materials and Methods:** Thirty two infants referred to our center from 2007 to 2011 were involved in the retrospective study. Gestational age was 31-40 weeks (median 38 weeks), and birth weight 1300-4220 g (median 3000g); 62% of the neonates had prenatal diagnosis of CDH.

Twenty seven infants were stabilized in the preoperative period according to the standardized institutional protocol involving deep opioid sedation without muscle relaxation, high frequency ventilation (HFV) and NO from admission, and catecholamines as needed. Surgery was performed after cardiopulmonary stabilization was achieved ( $\text{FiO}_2 < 0.5$ , and no crisis of pulmonary hypertension requiring additional treatment during 24 h). Five infants, who obviously belonged to low risk group and never showed any signs or symptoms of pulmonary hypertension, were excluded from the protocol and had conventional ventilation and no NO in the perioperative period.

**Results and Discussion:** Overall mortality to discharge from the hospital was 28% (9/32). All infants who died had  $\text{OI} > 10$  after the initial 24 hours of preoperative stabilization. Five infants never fulfilled the criteria for surgery and died in the preoperative period (1 of them had pneumothorax, and 1 was prematurely born at 31st week of gestation). Four died in the postoperative period (86% survival rate in infants who had surgery). The majority, though not all, of neonates with poor outcome had constantly high OI.

**Conclusion:** OI recorded 24 h after from the beginning of the standardized stabilization seems to be a sensitive predictor of outcome in infants with CHD. Inability to achieve  $\text{OI} < 10$  within 24 hours of standardized invasive treatment involving HFV and NO indicates high risk of unfavorable outcome regardless whether surgical treatment was performed or not.

**References:**

1. CHD EURO Consortium, Neonatology 2010; 98: 354

## 10AP1-10

### Computerized decision-making in nutritional support for neonates: calculating, controlling, balancing

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**Background and Goal of Study:** While defining nutritional support (NS) program in neonate it is necessary to control numerous parameters and rates to minimize severe complications in particular in premature infants. Adjusting the dose of one nutrient leads to changing of the total NS scheme. Computer software may facilitate online monitoring of the main rates and values while developing parenteral (PN) and enteral (EN) nutrition program in neonate.

**Materials and Methods:** While developing robust algorithm mathematical modeling methods were applied to transform all requirements, recommendations, rates and limits into mathematical, logical and algorithmic form. Computer program kernel includes derived formulas, decision-making schemes and resulting algorithm.

**Results and Discussion:** The program provide possibility to define NS scheme in neonate controlling necessary parameters and rates of PN and EN in summary and separately. Adjusting input data (nutrient doses and energy intake according to patient-focused needs) doctor may monitor and quickly assess amino acid, liquid, energy and electrolyte balances of resulting NS scheme and choose the best variant of NS in current clinical conditions. The program allows choosing PN and EN solutions by commercial labels from database and calculates amino acid, lipid and carbohydrate intake provided by each NS component separately. PN infusion parameters are calculated and monitored online: concentration, volume, infusion rate. The program monitors all input and calculated data and alarms if they break fixed limits.

**Conclusion(s):** The program was tested in Kulakov Research Center for Obstetrics, Gynecology and Perinatology (Moscow). Now it is routinely used in department of neonatology and is in process of getting license in Russian Ministry of Healthcare. It is expected to be standard tool in neonatological service of Russia. The program allows saving all neonate data in database, so it may be used in scientific studies concerning neonate nutritional therapy as a tool for data collection for further statistical analysis.

## 10AP1-11

### Paediatric dental anaesthesia survey in Scotland

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**Background and Goal of Study:** Paediatric Dental anaesthesia is a common day case procedure which is carried out in many district general and tertiary paediatric hospitals. This year, „The Association of Paediatric Anaesthetists of Great Britain and Ireland “produced guidelines, in collaboration with the Association of Dental Anaesthetists, and the AAGBI. The aims of these guidelines were to increase patient safety, awareness of potential complications and develop an evidence-based management pathway. We conducted a survey to review current dental anaesthetic practice, prior to release of new guidelines.

**Materials and Methods:** We distributed a questionnaire to all members of Scottish Paediatric Anaesthetic Network via an email link using survey monkey. This allowed us to assess anaesthesia practice Scotland wide. We enquired about availability of local guidelines, pre-assessment, monitoring, admission and discharge criteria and practices of analgesic and anti-emetic prescription.

**Results and Discussion:** Response rate was 57% (37/65 surveys returned). 91.7% of the respondents were involved in day case dental procedures and local guidelines were already in use in over 70% of cases. majority were pre-assessed at dental clinics. 30/37 responded to the monitoring question. SpO<sub>2</sub> and Capnography was used by 100%(30/30), whereas all gas monitoring, ECG and NIBP were monitored by 97%, 93% and 73% of the respondents, respectively. Only 93 % gained venous access. Reasons for not securing IV were -gas inductions, short procedures, no prior complications. Anti-emetics were used by 65.5%, mostly after opioid use. 100% used analgesia intra-operatively, while 65.5% and 93.1% prescribed it pre and post operatively, respectively. 60% were unaware of the new guidelines in development. More than 50% felt that their set-up was sub-optimal reasons due to several reasons such as isolated sites, limited recovery space, large catchment areas and needed improvements in admission and discharge criteria.

**Conclusion(s):** This survey showed wide variation of practice across Scotland and need for an evidence based consensus. Dental anaesthesia often occurs in isolated sites, which hold its own complications. Having guidelines on the key components of patient care will lead to improvements in overall patient outcome. A repeat survey in the near future would allow us to determine the impact of the new guidelines once their effect has been implemented.

## 10AP2-1

### Parent experiences in the anaesthetic room

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**Background and Goal of Study:** Current guidelines<sup>1</sup> state that all patients should be assessed pre-operatively by an anaesthetist. In paediatric anaesthesia, there should be parental involvement with provision for them to accompany their child to the anaesthetic room. Prior to admission, parents should receive written information regarding anaesthesia.<sup>2,3</sup>

**Aim:** To obtain an overview of parental experiences whilst accompanying their child to the anaesthetic room.

**Materials and Methods:** Questionnaires designed to assess parental experiences were distributed to parents of all children who had undergone surgery at Moorfields Eye Hospital, over a one month period.

**Results and Discussion:** 101 questionnaires were returned. 8 were incomplete, and excluded. 93 forms were analysed. All parents felt that the anaesthetic plan had been adequately explained, and were “happy” with the plan. The anaesthetic plan changed in 6/93 cases (6.5%). 64/93 (68.8%) inductions were intravenous, 29/93 (31.2%) were inhalational. The mean value of overall parental experience on a scale from 1-10 was 8.8. 96.8% stated they want to be present at induction, with 58/93 (62.3%) stating that a leaflet sent pre-operatively would have been helpful. 61/93 (65.6%) had undergone an anaesthetic before. 40/61 patients had received intravenous induction previously. 31.1% found this experience better than previous, 63.9% no difference, and 4.9% worse. 51/61 of children received the same mode of induction on both occasions. 48/51 rated the experience better or no difference, with 3/51 rating the experience worse than previously.

**Conclusion:** The overall experience of parents accompanying their child to the anaesthetic room was rated highly. 65% parents felt that a pre-operative leaflet would have been helpful. The NCEPOD report<sup>4</sup> found that only 56% units in the UK complied with RCOA guidance on provision of information about their anaesthesia. This is an area that needs to be addressed in an effort to better inform parents and their children when preparing for their anaesthetic.

#### References:

1. “Guidelines for the Provision of Anaesthetic Services”, The Royal College of Anaesthetists.
2. “Your Anaesthetic Explained” The Royal College of Anaesthetists.
3. “Anaesthesia information for children and young people” The Royal College of Anaesthetists
4. National Confidential Enquiry Into Patient Outcome and Death (NCEPOD) Are we there yet? A review of organisational and clinical aspects of children’s surgery 2011

## 10AP2-2

### The validation of a visual analogue scale for parents as an assessment tool for their child’s anxiety at induction of anaesthesia

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**Background and Goal of Study:** Anxiety at induction is an important issue in paediatric anaesthesia (1, 2). The aims of this study are: 1. to test the validity of a Visual Analogue Scale (VAS) completed by parents to assess their child’s anxiety at induction compared to the “Golden standard”: the modified Yale Preoperative Anxiety Scale (m-YPAS); 2. to assess the agreement between the parental versus the anaesthetist’s assessment of the child’s anxiety at induction; 3. to evaluate the influence of parental state anxiety on their ability to assess the child’s anxiety.

**Materials and Methods:** After IRB approval, a prospective cohort study was carried out as part of an ongoing study. Parental anxiety was measured by Spielberger’s State-Trait Anxiety Inventory (STAI). The child’s anxiety at induction was rated by an independent trained research nurse completing the m-YPAS. The parent and anaesthetist simultaneously assessed the child’s anxiety at induction using respectively VAS<sub>parent</sub> and VAS<sub>anaesthetist</sub>. Correlation analyses were performed.

**Results and Discussion:** The cohort included 206 parents (81.6% female) with median age of 34 (IQR 30-39). Spearman rank correlation revealed strong correlations as between the m-YPAS nurse rating and VAS<sub>parent</sub> (n = 206, r = .67; P < 0.001) and as between the m-YPAS nurse rating and VAS<sub>anaesthetist</sub> (n = 205, r = .75; P < .001). Comparison of correlation coefficients between m-YPAS and VAS<sub>parent</sub> versus m-YPAS and VAS<sub>anaesthetist</sub> showed no significant difference (Z = -1.64; P = .1). A cut-off value of ≥ 46 on the state subscale of STAI was used to dichotomize parents between: 1. anxious (n = 46); 2. not

or slightly anxious parents (n = 160). Comparison of correlation coefficients between the m-YPAS and VAS-scores of non anxious parents (r = .65; P < .001) versus m-YPAS and anxious parents (r = .77; P < .001) did not reveal significant differences (Z = 1.42; P = .15).

**Conclusion(s):** VAS is a valid tool for parents to assess their child's anxiety at induction. There were no differences in VAS-scores of attending anaesthetists and parents. Parental state anxiety did not influence parental ability to assess the child's anxiety at induction.

#### References:

- 1 Watson AT, Visram A. Paediatr Anaesth 2003; 13: 188-204.
- 2 MacLaren JE, Thompson C, Weinberg M, et al. Anesth Analg 2009; 108: 1777-1782

## 10AP2-3

### Continuous epidural anaesthesia with 0.2% ropivacaine and sufentanil for postoperative pain relief following major surgery in infants: how effective? How safe?

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**Background and Goal of Study:** As shown in our previous study (1), sufentanil administered with ropivacaine for postoperative pain relief reaches analgesic concentrations in plasma by the end of surgery, and cumulates during the postoperative period. Sufentanil concentration increases even further when epidural infusion with ropivacaine is stopped, reaching and exceeding 0.1 ng ml<sup>-1</sup>, which was shown to produce respiratory depression (2).

The aim of this study was to evaluate postoperative analgesia and respiratory complications of epidural infusion of sufentanil with ropivacaine.

**Materials and Methods:** With consent of local Ethics Committee and informed parental consent, 20 infants, 11.6 ± 9.9 mo, 8.6 ± 3.8 kg were enrolled in prospective study. Epidural catheter was placed under general anaesthesia (N2O/O2/ desflurane/ remifentanyl), in the lumbar epidural space. Initial bolus dose of 0.2% ropivacaine, 0.5 ml kg<sup>-1</sup>, sufentanil, 0.2 µg kg<sup>-1</sup> was given and intraoperative infusion of 0.2% ropivacaine, 0.15 ml kg<sup>-1</sup> h<sup>-1</sup> with sufentanil 0.112 µg kg<sup>-1</sup> h<sup>-1</sup> was started. Sufentanil dose was reduced to 0.037 µg kg<sup>-1</sup> h<sup>-1</sup> for postoperative infusion. Paracetamol, 80 mg kg<sup>-1</sup> day<sup>-1</sup> was given IV. Analgesia and sedation was evaluated every 2 h by the PACU nurses using the COMFORT scale (3). Respiratory rate (RR) was recorded every 2 hours. Oxygen mask was used at the discretion of attending nurse to maintain O2 sat > 90%.

**Results and Discussion:** Most children showed some agitation at admission to PACU, but most of them responded to „tender, loving care“ which suggests that discomfort was produced by other factors than pain. Analgesia was rated excellent to good in 18/20 infants. Two infants required additional pain medication. RR < 20/min. was recorded in 7 infants (3.2% of all recordings were < 20/min. ). No other respiratory complications were noted.

**Conclusion:** Excellent-to-good analgesia provided by continuous epidural infusion of ropivacaine and sufentanil depends in part on local action of the ropivacaine and opioid and by systemic action of the latter. Sufentanil reaches concentrations which actually decrease respiratory rate, therefore monitoring for potentially life-threatening respiratory depression is mandatory.

#### References:

1. Woloszczuk-Gebicka B. et al. Euroanaesthesia 2011,
2. Benlabeled, Anesthesiology 1992; 3. Ambuel B. et al. J Pediatr Psych 1992;17: 95.

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## 10AP2-4

### Acute intraoperative shunt failure in a child with myelomeningocele: case report

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**Background:** Spine deformity in patients with myelomeningocele (MM) has a high rate of complications. Most patients with MM have a ventriculoperitoneal shunt (VPS) with the potential for malfunction either during or in the immediate postoperative period.

**Case report:** A 15 year old boy with a thoracic level MM who presented to our institution with a severe scoliosis measuring 120 degrees. He had a VPS shunt placed at birth and not required any shunt revisions. Preoperative neurosurgical evaluation revealed no evidence of shunt malfunction. He was scheduled for a T2 to Pelvis spine fusion in a planned staged surgical approach. During Stage 1 he was positioned prone on gel pads and his abdomen allowed to hang freely, although given his severe deformity this required multiple adjustments. While exposing the spine it was noted that he had an unexplained

rise in his mean arterial pressure with associated bradycardia. An emergent VPS tap was performed and revealed an ICP greater than 20 (normal less than 10). The procedure was aborted and he awoke from surgery without any neurological deficit. He returned to the operating room two weeks later for continuation of Stage 1 of his procedure. After he was positioned prone, with the abdomen to be free, a 23 gauge butterfly needle was placed into his VPS reservoir and transduced to a pressure monitor. His opening pressure was 5 and remained less than 15 for the entirety of the procedure. He was subsequently placed in halo gravity traction. After 8 weeks he returned to the operating room for stage 2 posterior spine fusion completion. Again, a VPS monitor was utilized and intermittently drained to maintain the ICP under 15. This required draining 50 ml of CSF. The patient awoke from surgery without any new neurological deficits.

**Discussion:** This case highlights the potential occurrence of acute shunt malfunction as manifested by increased intracranial pressure resulting in bradycardia and hypertension during surgery. The spine surgeon and anesthesiologist should have a high suspicion for this complication and continuous ICP monitoring should be considered. Intraoperative positioning should allow the abdomen to be free and permit access to the shunt for tapping.

#### References:

1. Geiger F, et al (1999). Complications of scoliosis surgery in children with myelomeningocele. Eur Spine J 8(1):22-26.

**Learning points:** Patients with VPS and MM will not experience high ICP during spine surgery. If this occur, consider continuous ICP monitoring.

## 10AP2-5

### Slight caudo-lateral traction of the ipsilateral arm can relieve the head rotation-induced overlap between internal jugular vein and common carotid artery in infants

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**Background and Goal of Study:** Central venous catheterization is frequently performed in pediatric patients undergoing major surgery and the internal jugular vein (IJV) is generally preferred for catheterization compared to the subclavian vein. In spite of the previous studies where have suggested that head rotation increased the overlapping of the IJV to the carotid artery (CA),<sup>1,2</sup> IJV catheterization without head rotation is extremely difficult in infants.<sup>1</sup> Considering head rotation caused the movement of the cephalic part of the IJV to the contralateral side from the puncture site, we thought that the counter traction of the caudal part of the IJV using the caudo-lateral traction of the ipsilateral arm might relieve the overlapping. The aim of the study is to evaluate the effect of the caudo-lateral traction of the ipsilateral arm on the overlap of the IJV to CA in infants.

**Materials and Methods:** Twenty-five infants (95 ± 105 days old) scheduled for elective surgery were included. The patients were positioned in the 10° Trendelenburg position with a shoulder roll under general anaesthesia. Using 2-dimensional ultrasound, CA overlap and IJV safety portion were measured in the right-sided neck before and after the arm traction at 0°, 40°, and 80° of head rotation, respectively. The same measurements were performed in the left.

**Results and Discussion:** The caudo-lateral traction of the ipsilateral arm decrease the overlap of the IJV to the CA and increased IJV safety portion in both right and left sides (Table 1).

**Conclusion(s):** The slight caudo-lateral traction of the ipsilateral arm relieves the magnitude of the overlap of the IJV to the CA and increases the safe portion of the IJV. Our simple maneuver might be helpful for IJV catheterization in infants.

Table 1. Changes in the carotid artery and the internal jugular vein before and after arm traction

	Head rotation	Right		Left	
		Before	After	Before	After
CA overlap (%)	0°	16.8 (17.9)	7.8 (11.7)*	35.6 (30.6)	25.6 (30.0)*
	40°	26.3 (25.4)	17.3 (21.5)*	58.4 (32.3)	32.6 (33.2)*
	80°	39.5 (33.3)	22.9 (22.1)*	61.8 (46.5)	45.8 (41.8)*
IJV safety portion (%)	0°	91.0 (9.6)	96.0 (6.1)*	82.0 (16.1)	87.7 (14.3)*
	40°	85.9 (14.3)	91.3 (11.1)*	76.7 (16.3)	84.0 (15.3)*
	80°	79.9 (16.2)	88.3 (10.9)*	69.1 (21.4)	77.8 (17.5)*

[Table 1]

Data were expressed as mean (SD)

\*P < 0.05 compared to before arm traction

#### References:

1. Hong JY et al. J Crit Care 2010; 25:360.e9-360.e13
2. Gwak MJ, et al. Anaesthesia 2010; 65:272-6

## 10AP2-6

### Sub-Tenon block combined with sevoflurane general anaesthesia reduces incidence of postoperative nausea and vomiting in paediatric strabismus surgery

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**Background and Goal of Study:** Paediatric patients undergoing strabismus surgery represent one of the highest operative risk groups for postoperative nausea and vomiting (PONV). Although its exact cause(s) is poorly understood, post-surgical pain, opioid use for analgesia, and/or foreign body eye sensation might result in this paediatric PONV. Sub-Tenon block, one of regional anaesthetic techniques, has been gradually accepted for ophthalmic anaesthesia. However, the impact of sub-Tenon anaesthesia on paediatric PONV remains to be determined in strabismus surgery. In a randomized controlled trial, we assessed our hypothesis that sub-Tenon block would decrease frequency of PONV in paediatric strabismus surgery.

**Materials and Methods:** After obtaining approval from the IRB, we enrolled 59 paediatric patients aged less than 10 years old, who were scheduled for primary bilateral strabismus surgery. Children with chromosomal and genetic abnormalities were excluded. Under sevoflurane general anaesthesia, patients were randomly assigned to receive either sub-Tenon block with 0.04 - 0.1 ml/kg of 2% lidocaine and 0.75% ropivacaine mixture (50:50) before commencement of surgery as intervention group or 2 - 4 µg/kg of intravenous fentanyl before surgery as standard-control group. The primary endpoint was the incidence of PONV during the first 24 hrs. The secondary endpoint was postoperative pain score (FLACC score) for the first 24 hrs. Statistical analyses were performed using Mann Whitney U, Chi square test, and 2-way analysis of variance as appropriate. Differences were assessed with two-sided tests, with an alpha level of 0.05.

**Results and Discussion:** The PONV rates were 10% in the patient group who received block (3/29) and 37% in the fentanyl group (11/30) ( $P=0.017$ ). The overall rate of PONV was 23% (14/59). Patient's age, body weight, or anaesthetic duration did not differ significantly between the two groups ( $6 \pm 2$  yr versus  $6 \pm 2$  yr,  $P=0.8$ ;  $22 \pm 6$  kg versus  $20 \pm 6$  kg,  $P=0.3$ ;  $59 \pm 10$  min versus  $65 \pm 14$  min,  $P=0.06$ , mean  $\pm$  S.D., respectively). The block group had a lower postoperative pain score for the first 24 hours ( $P < 0.001$ ). Neither block-related complications nor morbid events were found in all patients during and after surgery.

**Conclusions:** Among strabismus surgery children, combined sub-Tenon block and sevoflurane anaesthesia might reduce the incidence of PONV at least in part because of its effective perioperative analgesia.

## 10AP2-7

### What is the factor of the leakage during pediatric continuous epidural anesthesia?

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**Background:** Epidural infusions provide good postoperative analgesia in children and have few hemodynamic complications. One of the most common reasons for premature discontinuation of epidural infusions is leakage at the catheter site, which generally presents as exudation on the dressings. We designed a prospective observational study to identify risk factors leading to leakage.

**Material and Methods:** The study enrolled 50 children younger than 6 years undergoing elective surgery. Epidural catheters were inserted immediately after inducing anesthesia, but before the start of surgery. All epidural catheters were used for postoperative care and attached in a similar way. After injecting 0.7-1.0 ml/kg 0.2% ropivacaine, we inserted a 22G single-hole epidural catheter using a 19G Tuohy needle. A continuous epidural infusion was run at 0.2 ml/kg/h with a syringe pump; no bolus infusion from the catheter was used. We prospectively investigated the patient characteristics, catheter insertion procedure, and postoperative course. The patients were divided into group A, which developed catheter leakage, and group B, which did not. Differences between the two groups were compared using the  $\chi^2$  test or  $t$ -test. Multiple logistic regression analysis was used to identify independent risk factors.

**Results:** The mean age of the children was 2.9 (range 0.5-5.9) years and their mean weight was 12.3 (6.1-20.9) kg. The catheters were inserted in the thoracic ( $n = 30$ ), lumbar ( $n = 15$ ), or sacral ( $n = 5$ ) region. The mean duration of the epidural infusion was 1.5 (1-6) days. The frequency of leakage was 20% (10/50). The contusion count and bleeding during catheter insertion were significantly higher in group A than in group B, whereas no significant difference in age, gender, weight, height, region, depth of insertion, or duration of

epidural infusion was found between the two groups. The multivariate logistic regression analysis found no independent predictors of leakage.

**Discussion and conclusions:** It is important to prevent leakage during continuous epidural anesthesia from the perspective of infection, analgesic effect, and management of narcotics. We could identify no risk factor predicting leakage. Therefore, we must consider not only patient factors, but also how to control the epidural catheters.

## 10AP2-8

### Efficacy of tramadol with local anaesthetic for caudal analgesia in paediatric surgery: a meta-analysis

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**Background:** Caudal block is a common local anaesthetic (LA) technique in paediatric anaesthesia. Duration of analgesia after single shot caudal bupivacaine ranges from 4-8 h.<sup>1</sup> The addition of opioids can prolong the duration of analgesia but their use is limited by side-effects. Tramadol is an opioid that has no respiratory depressant effect and has been shown to prolong duration of analgesia in randomised controlled trials (RCTs). A meta-analysis was performed to explore the effects of the addition of tramadol to caudal bupivacaine.

**Methods:** RCTs on Medline, EMBASE and Google Scholar were sought using the keywords: caudal, tramadol. Bibliographies of relevant reviews and RCTs were searched. Published abstracts from 2000-10 were reviewed. Manuscripts were rated for quality using the Jadad scale.<sup>2</sup> RevMan statistical software utilised inverse variance and random effect to calculate weighted mean difference (WMD) for continuous variables and odds ratio using the Mantel-Haenszel test with 95% confidence intervals for dichotomous variables. Primary outcome was duration of analgesia; secondary outcomes were nausea and vomiting (PONV), respiratory rate and urinary retention.

**Results:** 16 RCTs were identified of which 12 (634 patients) published between 1997 and 2010 met the inclusion criteria. The quality of the manuscripts ranged between 3-5 on the Jadad scale. Duration of analgesia in the tramadol plus LA group was prolonged by 4 h compared to LA alone. PONV was higher in the tramadol group but there was no significant effect on respiratory rate or urinary retention.

Outcomes	Number of Studies/ Participants	WMD / OR, (95% CI)	P Value
Duration of Analgesia (h)	8/437	3.99 (2.01, 5.97)	<0.0001
Incidence of Nausea and Vomiting	11/579	2.23 (1.24, 4.00)	0.007
Resp Rate/min	3/195	0.9 (-1.03, 2.83)	0.36
Incidence of Urinary Retention	3/130	0.93 (0.45, 1.95)	0.85

[Table 1: Summary of Outcome Measures]

**Discussion:** This meta-analysis suggests that caudal tramadol prolongs duration of analgesia by 4 h. However, due to the high heterogeneity between studies, the results should be treated with caution. More RCTs are needed in this respect.

#### References:

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## 10AP2-9

### Comparison of ultrasound-guided supraclavicular and infraclavicular approach for central venous catheterization in children

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**Background and Goal of Study:** The subclavian vein (SCV) is often the preferred site for central venous access. Ultrasound-guided SCV catheterizations with supraclavicular (SC) or infraclavicular (IC) approach have been proved to be useful in children.

**Materials and Methods:** In this prospective, randomized study, we studied 68 children. The patients were divided into two groups, SC group ( $n=36$ ) and IC groups ( $n=32$ ). Each SCV catheterization was performed under ultrasound-guidance. We compared the success rate, number of attempts, time to catheterization, and complication.

**Results and Discussion:** The time to SCV catheterization was longer in the IC group than the SC group ( $6.54 \pm 3.93$  vs  $3.25 \pm 1.28$  min,  $P < 0.01$ ). The success rate was not significantly different between among the two groups. The rate of successful SCV catheterization at the first attempt was higher in the SC group than the IC group (83.3% vs 46.9%,  $P < 0.05$ ). The incidence of wrong placement of guide wire with IC approach was higher than that with SC approach (6 vs 0,  $P < 0.05$ ). There was no pneumothorax or arterial puncture in both groups.

**Conclusion(s):** Despite similar success rate, the SC approach for SCV catheterization has more clinical benefit than IC approach.

## 10AP2-10

### Acupuncture reduces pain during injection of local anaesthetic in paediatric dentistry - a randomized crossover trial

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**Background and Goal of Study:** Despite a plethora of therapeutic approaches, the injection of local anaesthetics itself remains one of the most painful and dreadful procedures among children. Stimulation of acupoint LI4 is associated with analgesic effects in dentistry (1). The aim was to investigate whether stimulation of LI4, added to standard therapy (ST), reduces pain and distress during injection of local anaesthetic (LA) in comparison with ST alone.

**Materials and Methods:** Children, scheduled for dental treatment in local anaesthesia on 2 separate days were enrolled in this trial, approved by the local ethics commission. On one day each child received bilateral acupuncture of LI4 point, using indwelling fixed "New Pyonex" needles (0.2 x 1.5 mm; Seirin, Japan). The parents of the children were asked to stimulate the needles by massage. Standardized injection of LA was performed 5 min following acupuncture. The needles were withdrawn at the end of dental treatment. On the other day of treatment children received LA injection without acupuncture. The order of treatment days (acupuncture first or vice versa) was randomised. Primary endpoint was the pain intensity during LA injection reported by children on Visual Rating Scale from 0=no pain to 10=maximal pain imaginable (VRS-11). Secondary endpoints were parent- and dentist-assessed pain intensity (measured on Numeric Rating Scale 1-10), patients' heart rate before and during dental treatment and satisfaction with received therapy (measured on Numerical Rating Scale 1-5.) Side effects of LI4 stimulation were also recorded.

**Results and Discussion:** The data of 49 children (22 females; age  $10 \pm 4$  yrs; mean  $\pm$  SD), who completed both visits, were analysed. Children reported less pain with than without acupuncture:  $2.2 \pm 2.5$  vs.  $3.9 \pm 2.7$ ; mean  $\pm$  SD,  $p < 0.001$ . Heart rate decreased after LI4 stimulation compared to ST alone throughout the dental treatment ( $p < 0.05$ ). LI4 stimulation was safe and raised better satisfaction with the treatment among children and parents, than ST alone ( $p < 0.05$ ). Other secondary endpoints were comparable between both sessions.

**Conclusion(s):** Stimulation of acupoint LI4 reduces pain and autonomous stress during injection of local anaesthetics in paediatric dentistry.

#### References:

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## 10AP2-11

### Supraclavicular ultrasound guided subclavian vein cannulation in infants under 5 kg

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**Background:** Central venous cannulation is at some point difficult in small children and is associated with many complications especially at multiple attempts cases. Various techniques exist to achieve successful cannulation. Ultrasound (US) guided techniques are reported to be safe and reduce rate of complication for internal jugular vein (IJV) cannulation.

We describe US-guided supraclavicular approach to another central vein - subclavian vein (SCV). Supraclavicular approach to subclavian vein with anatomical landmarks was described by Yoffa, but physician are hesitant to use this technique, because safety.

**Materials and Methods:** The principle of US navigated technique is to find SCV at the supraclavicular level and to obtain a longitudinal view of SCV and to allow a access to the vein in-plane view (absolute control of the needle). The ultrasound probe (2.5 cm 6-13 MHz) was placed above the clavicle to visualize IJV and tilted showing subclavian artery and subclavian vein in lon-

gitudinal view. This view permitted an in-plane puncture of the vein avoiding arterial or plural hit.

**Results and Discussion:** 78 infant and newborns under 5 kg (1.2 kg - 5 kg) and 83 subclavian vein cannulation were enrolled in this observational study during period of 11 month (january 2011 - november 2011). All cannulations were performed by single anesthesiologist trained for ultrasound in central line cannulation with established eye-hand coordination (5 years experience with peripheral blocks under US).

For all cases were subclavian vein easily and quickly visualized, one cases had extremely narrow SCV. US window for cannulation were always established for free in-plane placement of the needle. The overall success rate for puncture was 100% and for cannulation 98%. In case with extremely narrow vein (because oedema and stricture) SCV was punctured but it was impossible to pass catheter in. Success rate of puncture at first attempt was 97%, at second attempt 100%. Second attempt was necessary in two cases because needle visualization and angle of the needle movement was not considered as correct. No complication was reported.

**Conclusion(s):** Supraclavicular US-guided approach to subclavian vein cannulation is safe and effective possibility for central vein cannulation in small infant. More studies needed to establish learning curve for pure paediatric intensivist without experience with US navigation.

## 10AP3-1

### Comparison between milrinone and milrinone with sildenafil in children with ventricular septal defect and pulmonary arterial hypertension

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**Background and Goal of Study:** Pulmonary hypertension (PHT) has a great impact during the perioperative period for its potential to cause right ventricular failure, cardiogenic shock and death. There are just a few citations in the international literature regarding the intraoperative management of PHT. The objective of this study was to compare the effects of milrinone alone and milrinone with sildenafil in the perioperative period of children with ventricular septal defect (VSD) and PHT.

**Materials and Methods:** Prospective study in which 79 children with VSD and PHT were randomized to receive milrinone alone (n=38) or milrinone and sildenafil (n=41) at the end of the circulatory bypass period. Pulmonary arterial pressure, systemic arterial pressure, use of vasoactive drugs, time to extubation, total time of hospitalization, time in the intensive care unit, and time in the ward were all evaluated.

**Results and Discussion:** Both groups were similar in demographics. The group that received milrinone and sildenafil presented lower values of pulmonary arterial pressure ( $p < 0.001$ ) and time to extubation ( $p = 0.012$ ). There was a strong correlation of sildenafil use and lower incidence of pulmonary hypertension crisis ( $p < 0.001$ ), but no difference was detected when we evaluated the use of vasopressors ( $p = 0.650$ ).

The results show that the treatment of PHT with milrinone and sildenafil in children under correction of VSD achieves lower values of pulmonary arterial pressure, lower incidence of pulmonary hypertension crisis and lower time to extubation.

**Conclusion(s):** Sildenafil leads to pulmonary vasodilatation without systemic hypotension and its use with milrinone was shown to be effective in the perioperative period of children submitted to correction of VSD.

#### References:

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## 10AP3-2

### Peculiarities anesthesiological management in patients with complete atrioventricular septal defect

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**Background and Goal of Study:** This study was designed to research of correlation dependence between the basic clinical characteristics which impact on the results of operative treatment of infants with complete atrioventricular septal defect (CAVSD).

**Materials and Methods:** 22 infants with CAVSD underwent surgical intervention. Mean age of patients was  $10.07 \pm 2.9$  month (range from 3 month to 2,9

year) and mean weight was  $6.69 \pm 0.72$  kg (range from 3 to 12 kg). Anaesthetological management consisted of sevoflurane, rocuronium bromide, fentanyl. All operations were performed under cardiopulmonary bypass (CPB) and moderate hypothermia ( $+28 - +29^\circ\text{C}$ ). Bretschneider's cardioplegic solution was used for myocardial protection. CPB and aortic cross-clamping time, sevoflurane concentration, utilization of inotropic agents, duration of postoperative mechanical ventilation (MV), troponin T (TnT) level were assessed and statistically analyzed.

**Results and Discussion:** Correlative analysis of all perioperative factors showed that there was statistically significant correlation dependence between CPB time, aortic cross-clamping time and duration of postoperative MV ( $r=0.49602$ , ( $p < 0.05$ )) and ( $r=0.25835$ , ( $p < 0.05$ )) respectively.

However duration of cross-clamping of aorta and duration of postoperative MV had a weak correlation. It was statistically significant positive correlation between length of ischemia and used of epinephrine ( $r=0.6733$ ,  $p=0.0117$ ). At the same time there was no correlation between used of dopamine and duration of cross-clamping of aorta (time of cross-clamping of aorta/dopamine:  $r=-0.1860$ ,  $p=0.6591$ ). When the correlation between sevoflurane concentration in the breathing mixture (v%) and TnT (ng/ml) level in the early postoperative period was analyzed it was no correlation between these indicators after 6 hours as well as after 24 hours after ending surgery ( $r=0.0212$ ,  $p=0.9253$ ;  $r=0.0313$ ,  $p=0.8901$  respectively).

**Conclusion(s):** We conclude that CPB time is the main risk factor for prolonged postoperative mechanical ventilation after repair of CAVSD. Duration of cross-clamping of aorta is not the risk factor for prolonged postoperative mechanical ventilation.

The use of sevoflurane can provide myocardial protection regardless of its concentration in the breathing mixture.

### 10AP3-3

#### Do antihistamines decrease the incidence of postoperative vomiting in children?

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**Background:** Children undergoing ophthalmologic and otorhinolaryngologic surgeries are at high risk for development of postoperative vomiting (POV). Our goal was to evaluate the prophylactic effect of classical psychotherapeutic antihistamines, namely diphenhydramine and hydroxyzine, on POV in children after highly emetic surgical procedures.

**Methods:** Study subjects were consecutive 645 children (aged 2-12yr) undergoing ophthalmologic ( $n=355$ , eyelid or strabismus surgery) or adenotonsillectomy ( $n=290$ ). These children were prospectively allocated to receive diphenhydramine (1mg/kg), hydroxyzine (1mg/kg), or no antiemetic prophylaxis (control) intravenously after induction of anesthesia.

Anesthesia was induced and maintained with sevoflurane in oxygen-air and a supplementation of fentanyl, but without  $\text{N}_2\text{O}$ . The incidence of vomiting was recorded from the end of surgery to the first postoperative day. Demographic characteristics were compared using one-way ANOVA for mean difference, and, Fisher exact test or chi-square test for percentage difference. An unconditional logistic regression model was used to estimate odds ratios (ORs) and their 95% confidence intervals (CIs) of POV.

**Results:** Demographic characteristics were similar among the three groups. The incidence of POV after ophthalmologic surgery was significantly lower among children receiving diphenhydramine/hydroxydine (1.3%/4.7%) compared to those receiving no antiemetic prophylaxis (16%).

ORs of POV for hydroxyzine and diphenhydramine, compared to no antiemetic prophylaxis, were 0.15 (95% CI: 0.03-0.68) and 0.24 (95% CI: 0.007-0.45), respectively.

In contrast, the incidence of POV within 24hrs after adenotonsillectomy did not significantly differ among the three groups (12% vs. 8.5% vs. 9.0%). ORs of POV after adenotonsillectomy for hydroxyzine and diphenhydramine, compared to no antiemetic prophylaxis, were 0.75 (95% CI: 0.31-1.82) and 0.70 (95% CI: 0.31-1.82), respectively.

Of note, no relevant side effects were observed in the hydroxyzine and diphenhydramine groups.

**Discussion:** Intravenous antihistamines (hydroxydine and diphenhydramine) were effective in preventing POV after ophthalmologic surgery, but not for POV after adenotonsillectomy

This study demonstrates that the type of surgery may influence a prophylactic effect of intravenous antihistamines on POV in children.

### 10AP3-4

#### Body temperature decreases in pediatric patients undergoing magnetic resonance imaging under general anaesthesia

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**Background and Goal of Study:** Recent studies has reported significant increases in body temperature in pediatric patients undergoing magnetic resonance imaging (MRI) under anaesthesia/sedation. We, therefore aimed to evaluate body temperature changes in pediatric patients undergoing MRI scanning under general anaesthesia.

**Materials and Methods:** 30 patients aged between 0-7 and undergoing cranial/orbital MRI scan under general anaesthesia were included to this prospective study. Children were taken to MRI suite while their parents were accompanied to them. Anaesthesia was induced with sevoflurane (8%) via facemask. We used an MRI-compatible anaesthesia machine and an MRI-compatible vital signs monitor. After an i.v. route was established, anaesthesia was maintained with sevoflurane in oxygen 100% via laryngeal mask airway. Scans were performed on a 1.5-Tesla MR system. Tympanic temperature was monitored on right ear just before the patient was positioned in the head coil. At the end of MRI scan, temperature monitoring was performed again. Shapiro-Wilk, unpaired and paired t test and Mann Whitney-U were used for data analysis.

**Results and Discussion:** Mean age of the patients was 19.3 months. Body temperature was found as decreased  $0.4^\circ\text{C}$ , when pre-scan and post-scan temperatures were compared ( $< 0.001$ ). Body temperature was decreased in 21 patients (70.0%), was increased in 8 (26.7%), and showed no change in 1 patient (3.3%) in the study. Increases were not above  $1^\circ\text{C}$  in any patient. When patients whose body temperatures were decreased or showed no change were compared with those whose body temperatures were increased, mean age of patients with increases were detected as lower than the others ( $p=0.008$ ). MRI scanner generates radiofrequency radiation which is absorbed by the patient. This can cause local or systemic warming during scanning. Conversely, cool environment with low humidity required for proper magnet function is a potential cause for a decrease in body temperature. Children are known to be more prone to hypothermia. Anaesthesia/sedation also impairs thermoregulation. So, either warming or cooling may occur in these patients depending of these opposite factors.

**Conclusion(s):** Anaesthesiologists should be aware of that both a rise or a decrease in body temperature can be seen in anaesthetised pediatric MRI patients. Temperature monitoring should be implemented in these cases.

### 10AP3-5

#### Metabolites retrieved in 24 h urine collections after intravenous propofol bolus in neonates

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**Background and Goal of Study:** compared to adults, in neonates propofol mainly undergoes hydroxylation to quinol metabolites with only limited contribution of the glucuronidation pathway (1,2). The aim of this study is to further describe urinary propofol metabolites and its covariates in early life.

**Materials and Methods:** In neonates receiving a single iv propofol bolus, urine was collected during 24 hours. Clinical characteristics were recorded. Urinary propofol metabolites [propofol glucuronide (PG), 1- and 4-quinol glucuronide (QG)] were determined using high-performance liquid chromatography (HPLC) after a dual-step solid phase extraction (SPE) combined with UV and fluorescence detection. Individual propofol metabolites, their contribution to total metabolite elimination and metabolite ratios were determined. The impact of continuous [postmenstrual age (PMA), postnatal age (PNA), weight, propofol dose, creatinaemia] and dichotomous variables [PNA  $\geq 7$ days (yes/no), PNA  $\geq 10$ days (yes/no), hyperbilirubinaemia (yes/no), cardiopathy (yes/no)] on PG/QG ratio and on patients with low ( $\leq 10\%$ ) versus high ( $> 10\%$ ) urinary PG recovery were examined.

**Results and Discussion:** Thirty-five neonates were included. Median total propofol metabolite recovery was 48.74% (range 5.39 - 340.67%) with PG/QG ratio 0.36 (range 0.01 - 5.93). PNA correlated significantly with PG/QG ratio. Patients with low versus high urinary PG fraction also differed significantly in PNA and significance was more pronounced with PNA 10 days ( $\chi^2$  test;  $p=0.007$ ) as cut off point for early neonatal life compared to PNA 7 days ( $\chi^2$  test;  $p=0.015$ ).

**Conclusion(s):** PNA, either continuous or discontinuous, is a significant covariate of neonatal propofol metabolism, with PNA 10 days as an important key moment. This confirms earlier reported propofol clearance covariates (PNA  $<$  or  $>$  10 days)(3).

**References:**

- Allegaert K, et al. *Br J Anaesth* 2008;101:827-31. (2) Sneyd R, et al. *Xenobiotica* 1994;24:1021-8. (3) Allegaert K, et al. *Br J Anaesth* 2007;99:864-70.

**10AP3-6****Thiopental vs. propofol during magnetic resonance imaging in children: something old, something new**

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**Background and Goal of Study:** We analyze two most popular anesthetics used for magnetic resonance imaging (MRI), traditional sodium thiopental and novel propofol. The aim of this study is to determine optimal dose of propofol and thiopental during MRI and to establish safety and efficacy of these drugs.

**Methods:** After ethics committee approval 90 children, aged 6 months-12 years with ASA physical status I-II were included in the study. Patients received: group I; propofol 0.5 mg/kg or group II; thiopental 2.0 mg/kg, for anesthetic induction. After initial dose of the drug the sedation level of the children were measured using the University of Michigan Sedation Scale (UMSS). The UMSS assigns a score of 0-4 based on the clinical assessment of the level of sedation. Scores 3 were accepted as procedural sedation and 4 was accepted as deep sedation. If a UMSS score of 3 was not achieved after initial dose of propofol and thiopental, supplementary boluses of drugs were added. Patients were allowed to breathe spontaneously without an artificial airway throughout the procedure. Oxygen was administered via facemask. Quality of the MRI was evaluated by a radiologist using a three-point scale. Side effects could occur during and after sedation were recorded.

**Results:** Data were obtained from 13 infants and 67 children. The groups were similar in age, gender, ASA physical status class, type of MRI (brain) and duration of intervention.

Median age was 4.1 for group I and 4.5 for group II. The average time from initiation of sedation to full recovery was significantly longer in propofol group (55 minutes vs. 26.9 minutes, respectively;  $P < 0.01$ ). The mean recovery time group I was significantly longer than the corresponding mean for group II (1.7 minutes vs. 13 minutes, respectively;  $P < 0.01$ ). The average overall doses of propofol and thiopental infused were 70  $\mu\text{g}/\text{kg}/\text{min}$  and 3.6 mg/kg, respectively. These differences between the pre-sedation behaviour score, UMSS and quality of MRI were not significant.

Oxygen saturation  $< 93\%$  (1.6%), bradycardia (11%), apnea (0.8%), and transient airway obstruction (1.1%) were the most common complications noted in propofol group.

**Conclusions:** Thiopental provided adequate sedation, faster recovery and lower rate of side effects, like bradycardia and desaturation, in most of the children. We suggest that thiopental should be reconsidered for sedation in radiodiagnostic procedures and is appropriate drug to achieve moderate level of sedation.

**10AP3-7****Intramuscular dexmedetomidine for pediatric electroencephalogram (EEG) sedation**

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**Background and Goal of Study:** Sedation for pediatric electroencephalograms (EEGs) poses the challenge of choosing a sedative which will have limited effect on the validity of the results. Dexmedetomidine has been shown in children to produce conditions which simulate natural sleep. We describe our experience when using it via the intramuscular (IM) route for sedation for diagnostic EEGs.

**Materials and Methods:** Institutional Review Board (IRB) approval was obtained for retrospective review of Quality Assurance (QA) data collected for all consecutive children who received IM dexmedetomidine for EEG from August 2007-September 2009. An initial bolus of undiluted IM dexmedetomidine (1-4 mcg/kg) in the deltoid could be repeated once if needed to achieve a Ramsay Sedation Score (RSS) 4. All EEGs were visually evaluated for sleep spindles, K-complexes, delta waves and fast waves in order to determine the sleep stage achieved.

**Results and Discussion:** One hundred and seven ( $n=107$ ) children (mean 3.5 years) received dexmedetomidine IM. The initial dose of IM dexmedetomidine was a mean of 2.6 mcg/kg (range 1.0 - 4.5 mcg/kg). Two patients (1.9%) required a second dose of dexmedetomidine. The time to achieve sedation, defined as a minimum RSS 4, was 15.5 minutes (range 3.0 - 55.0). EEG studies averaged  $34.2 \pm 22.6$  minutes. The average recovery time, from arrival in recovery room to meeting discharge criteria, was 12.5 minutes (range 0 - 77). The incidence of hypotension, defined as either a 20% deviation from baseline or from established age-adjusted awake normal values, was statistically similar regardless of the reference point used (patient's baseline versus established norms), 17% and 16% respectively. There was no bradycardia (a deviation in heart rate of 20% from baseline), hypertension or evidence of respiratory compromise (oxygen desaturation, apnea). The stages of sleep recorded was: awake ( $n=1$ ), stage 2 ( $n=51$ ), and stage 3 ( $n=55$ ). Excessive beta activity was seen in only one patient. Epileptiform activity was noted in 11 patients. No electrographic seizures were recorded in any patient. All EEGs were successfully completed.

**Conclusion:** Dexmedetomidine can be administered via the IM route to achieve a natural non-rapid eye movement (REM) of sleep in children for sedated EEG studies. Hypotension should be anticipated in up to 17%. No adverse respiratory events or hemodynamic instability necessitating pharmacologic intervention was noted.

**10AP3-9****Intra-operative lactates vs. unmeasured anions as an early indicator of outcome in pediatric cardiac surgery patients**

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**Background and Goal of Study:** This study evaluated whether intra-operative lactate or unmeasured anion (UMA) levels can predict the outcome and which one is superior in pediatric patients undergoing cardiac surgery under cardiopulmonary bypass (CPB).

**Materials and Methods:** We studied 102 patients with congenital heart disease. Arterial blood samples for lactate and UMA levels were obtained after inducing anesthesia (T1), 5 min after weaning from CPB (T2), and after sternal closure (T3). The Stewart method was used to calculate UMA. Major adverse events (MAE) were defined as a condition needing cardiac compression, chest opening due to hemodynamic instability, or extra-corporeal membrane oxygenator support, renal dysfunction with a creatinine level higher than 2 mg/dL, or death. The patients were divided into MAE and non-MAE groups. The Mann-Whitney *U*-test was used to compare the two independent groups. The predictability of MAE was assessed using the area under the receiver operating characteristic (ROC) curve.

**Results and Discussion:** MAE occurred in 8 (7.8%) of the 102 patients. The lactate level at T2 and T3, and its intra-operative changes (changes of lactate level from T1 to T2, T2 to T3, T1 to T3) were significantly higher in the MAE group than the non-MAE group, while there were no significant differences in the UMA levels and their changes between the groups. The change in the lactate level from T2 to T3 was the best predictor of MAE according to the receiver operating characteristic curve (the area under the curve is 0.810).

**Conclusion(s):** Intra-operative lactate values are more closely associated with MAE. Intra-operative lactate is more useful for predicting the outcome of pediatric cardiac patients than UMA.



## Obstetric Anaesthesia

### 11AP1-1

#### Unilateral sixth cranial nerve palsy following Cesarean section as a complication of spinal anaesthesia

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**Background:** Cranial nerve palsy (CNP) is a rare complication following lumbar puncture which is a common procedure most often used for diagnostic and anesthetic purposes. The sixth cranial nerve is the most commonly affected nerve. We report a case of unilateral sixth nerve palsy after unintentional dural puncture that improved immediately after an epidural blood patch (EBP).

**Case report:** A 29-year-old 38 weeks pregnant woman underwent surgery for a c/s while she was under spinal anaesthesia. On the first postoperative day, the patient experienced a severe headache that did not respond to standard NSAID medication and hydration. After 16 hours from the surgery she experienced head, neck, shoulder and orbital region pain.

During the second postoperative day, she experienced nausea that did not respond to antiemetic medication but responded well when the patient was placed on her back. On the third postoperative day she complained of nuchal rigidity, diplopia (double vision) and her examination revealed strabismus on the right eye. She was unable to make a lateral gaze with her right eye and diplopia on the horizontal side and the long vision. An ophthalmology and neurology consults were obtained. Unilateral abducens nerve palsy was diagnosed. A lacunar infarct was diagnosed in cranial computerised tomography. Cranial magnetic resonance imaging was normal.

On the fourth postoperative day an EBP was performed by the anaesthesiologist. The patient remained supine position for one hour and complete relief of the headache was noted two hours after the procedure without any other therapeutic intervention.

Her diplopia resolved completely after 11 days and strabismus after 4 weeks.

#### References:

1. Niedermüller U, Trinka E, Bauer G. Abducens palsy after lumbar puncture. *Clin Neurol Neurosurg.* 2002;104:61-63.
2. Kose KC, Cebesoy O, Karadeniz E, Bilgin S. Abducens palsy as a complication of spinal anaesthesia. *MedGenMed.* 2005;7(4)

**Learning points:** Blood patching may be a reasonable treatment for ocular nerve palsy as it relieved the postdural puncture headache (PDPH) and improvement of the diplopia. Atraumatic needles with side holes such as Sprott, Whitacre or smaller dimension Quincke type needles may be used during spinal anaesthesia to decrease the incidence of PDPH. EBP can be routinely applied if large needles are used, and if multiple needle insertions are made to the subarachnoid region, these may increase the incidence of both PDPH and abducens palsy.

### 11AP1-2

#### Refractory hypotension after pheochromocytoma resection in a puerperant: a case report

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**Background:** Pheochromocytoma during pregnancy is very rare. Anesthetic management for combined cesarean section and tumor resection may present unpredictable challenge to anesthesiologists.

**Case report:** A 22-year old woman with 29 weeks' gestation was admitted for refractory hypertension. The diagnosis of pheochromocytoma was confirmed by elevated 24-hour urinary norepinephrine level. Echocardiography showed a slightly decreased left ventricular ejection fraction of 50%. With 6 weeks' treatment with phenoxybenzamine and labetalol, combined cesarean section and tumor resection was performed.

Anesthesia was induced with propofol, fentanyl and succinylcholine, and maintained with sevoflurane-nitrous oxide-O<sub>2</sub>. Nitroprusside infusion (0.01-1.0 µg·kg<sup>-1</sup>·min<sup>-1</sup>) and bolus nitroglycerin were used to control BP. Remifentanyl infusion was started after delivery for pain control. After tumor removal, patient's BP was maintained by volume expansion and norepinephrine (0.3µg·kg<sup>-1</sup>·min<sup>-1</sup>) infusion.

However, 30 minutes later refractory hypotension and tachycardia recurred, unresponsive to α-agonists. PiCCO indicated that multiple parameters decreased from baseline, including GEDVI(410 Vs 435 ml/m<sup>2</sup>), SVI(23 Vs. 38 ml/m<sup>2</sup>), GEF (24 Vs. 33%) and dPmax (860 Vs. 1010mmHg), despite aggressive volume expansion. Hemodynamic balance restored with inotropic support

and further volume expansion. SVI increased to 39 ml/m<sup>2</sup>, GEF 31%, dPmax 1040 mmHg/s and GEDVI 510 ml/m<sup>2</sup>. GEDVI further increased to 607 ml/m<sup>2</sup> when pneumoperitoneum withdrew and patient's position back to supine from lateral jackknife level.

**Discussion:** This case is notable for the unpredicted hemodynamic collapse after tumor removal, and the reason for which may be multifactorial. Corresponding management through pure clinical experience may lead to fluid overload, which may consequently cause acute pulmonary edema in puerperant. Therefore invasive hemodynamic monitoring is essential to guide the treatment. Furthermore, we suspect that pneumoperitoneum along with lateral jackknife position may decrease the effective circulating blood volume, which may persist until pneumoperitoneum ceased and position changed.

**Learning points:** 1. Unpredicted hemodynamic collapse may occur after pheochromocytoma resection in a puerperant, and the reason for which may be multifactorial. 2. Invasive hemodynamic monitoring is essential to guide the treatment in this situation.

### 11AP1-3

#### Epidural anaesthesia for vaginal delivery in a woman with arthrogyposis multiplex congenita. A case report

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**Background:** Arthrogyposis multiplex congenita (AMC) is a rare disease, usually diagnosed at birth and with high mortality during childhood. In addition, AMC patients usually can not get pregnant. For these reasons, there are only 6 reported deliveries in AMC patients, 5 of them with caesarean section, and just one vaginal delivery.

**Case report:** A 34 years-old patient, usually treated for her AMC in our hospital, came to the emergency room with a ruptured amniotic sac on the 34th week of pregnancy. After reviewing all the cases reported in the literature, and due to a very low predicted weight of the new-born, anaesthesia, paediatrics and the obstetric team jointly decided to try a vaginal delivery.

Therefore, an epidural puncture was performed after publication consult and reviewing the patients clinical history.

The insertion of an epidural catheter was done with an 18G Tuohy needle, using the saline loss of resistance technique. Although our patient was overweight, the epidural puncture was easy. After an epidural test dose, we started a Levobupivacaine 0.125% + Fentanyl 2.5mcg/mL infusion. We were able to reach a proper analgesia.

After 2 hours, the second stage of labour was shortened with Thierry's spatulas. A live boy weighing 2300 g was born, with an Apgar score of 9-10 (1-5 min). There was no incident other than a vaginal grade 2 tear in childbirth.

**Discussion:** We share our experience with a rare case report of vaginal delivery under epidural analgesia in an AMC patient. Our patient had, in common with previous reports, the fact that the new-borns were expected to have a low-weight, and we think it is key to allow a vaginal delivery in AMC patients. Focusing on analgesia, AMC patients usually have a very distorted lumbar spine, but the epidural insertion was easy and her overweight was the only difficulty to locate the interspinous gap.

**Conclusion:** Vaginal delivery in AMC patients, although very rare, is possible. Epidural analgesia is safe and feasible. A multidisciplinary approach including obstetric, anaesthetic and paediatric co-ordinated teams is surely the main point in the management of these complex patients.

### 11AP1-4

#### Anaesthesia for Caesarean section in a patient with complex regional pain syndrome, spinal cord stimulator and severe symphysis pubic dysfunction

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**Background:** Complex regional pain syndrome (CRPS) is a poorly understood condition, usually presenting with pain, hyperalgesia, trophic changes and vasomotor disturbances.

We describe the management of a woman suffering from severe CRPS who presented for elective Caesarean Section (CS).

**Case report:** A 33 year old primigravida (BMI 30) with CRPS, an implanted (insertion level T3/T4) spinal cord stimulator (SCS) and severe symphysis pubic dysfunction (SPD) presented for an elective CS at 36 weeks of gestation.

Her co-morbidities included asthma, multiple allergies, celiac disease and hypothyroidism. The CRPS was affecting her right arm and left leg and the combination with severe SPD had rendered her wheelchair confined. After a multidisciplinary meeting including anaesthetists, obstetricians, chronic pain team and pharmacist, a management plan was put into place. This included regional anaesthesia for the CS, local anaesthetic (LA) infiltration to skin prior to incision and the use of local anaesthetic gel for the urinary catheter insertion. All these were done in order to minimize the chances of CRPS spread. We used the affected CRPS arm (after EMLA cream) for cannulation (patient's request) - contrary to the chronic pain team advice and current recommendations. A combined spinal epidural (CSE) anaesthetic was performed (2.5 ml of 0.5% heavy bupivacaine and 300 mcg diamorphine) and the epidural catheter was left in place for 24 hrs for postoperative analgesia. The CS was uneventful and she had excellent postoperative pain relief. She was discharged six days postop with no deterioration or spread of the CRPS.

**Discussion:** The number of pregnant women with SCSs is likely to increase in the future. A traumatic vaginal delivery or CS can cause deterioration of CRPS and spread to previously unaffected areas. Literature review shows only several case reports of CRPS and SCS in pregnancy.

However there are significant differences in presentation and management between those and our case. Our case was unusual in that patient was wheelchair bound with CRPS/CPD, we performed CSE with subsequent epidural diamorphine and we used local anaesthetic prior to catheterization and surgical incision.

#### References:

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**Learning points:** Multidisciplinary team work is essential in looking after patients with CRPS. A combination of different anaesthetic techniques could prevent its spread or deterioration.

## 11AP1-5

### Prolonged hypotension following subarachnoid block (SAB) in the setting of an oral $\beta$ -adrenergic antagonist

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**Background:** While hypotension is commonly seen following SAB, there have been no case reports of prolonged hypotension following SAB unresponsive to either fluid resuscitation or  $\alpha$ - or  $\beta$ -adrenergic agonists in an obstetric population taking  $\beta$ -blockers.

**Case report:** A 33-year old, Caucasian, 167cm in height; 67kg para(1+0), presented at 39 weeks gestation for elective LSCS. Her past medical history was significant for Wolf-Parkinson-White syndrome, treated with cardioablation. She also had paroxysmal atrial fibrillation treated with metoprolol 75mg once daily as required.

However she had not taken the medication during her pregnancy except on the morning of her surgery on her own account, due to anxiety. In theatre, her first blood pressure (BP) was 137/84 mmHg and heart rate (HR) of 113bpm. SAB was performed in a seated position using aseptic technique at the L3-L4 interspace using 25G Whitacre needle. Two ml of 0.5% Heavy Bupivacaine (10 mg) with 20 mcg of fentanyl and 100 mcg of morphine HCL were injected into the SA space. She was then placed in a supine position with left uterine displacement. Subsequently her BP became unrecordable with HR of 130bpm. She was fluid resuscitated and had total 5mg of phenylephrine and 60mg of ephedrine. Oxygen (10L/min) via facemask was given and her Glasgow Coma score remained 15/15. The first BP of 87/47 was obtained 13minutes following SAB.

The fetus was delivered 19minutes after the SAB. The baby was resuscitated, intubated and transferred to Neonatal Intensive Care Unit and was subsequently extubated that evening without evidence of neurological sequelae.

**Discussion:** Metoprolol is a  $\beta$ -antagonist that has been used for the treatment of arrhythmia during pregnancy. Currently there are no case reports or studies identifying the adverse effect of metoprolol or any  $\beta$ -blocker drugs following SAB in the obstetric population. Vukelic et al demonstrated that the use of beta-adrenergic blocker prior to SAB in orthopaedic surgeries was associated with serious adverse effects<sup>1</sup>.

#### Reference:

1-J Vukelić et al. Adverse effects of  $\beta$ -blockers during spinal anaesthesia with 0.5% bupivacaine, Crit Care. 2010; 14(Suppl 1): P480.

**Learning points:** We advise that intermittent use of  $\beta$ -blocker during pregnancy should be sought and should be withheld on the morning of surgery due to its potential detrimental effects on the mother and fetus.

## 11AP1-8

### Cerebral venous thrombosis after accidental dural puncture and blood patch

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**Background:** Cerebral venous thrombosis (CVT) is a rare and potentially fatal occurrence during pregnancy and puerperium.

**Case report:** A 38 year-old healthy woman (G1 P0) in her 41st week of pregnancy starting labour. An epidural anaesthesia is performed with a Touhy needle (18G), producing a CSF leak. After a second puncture without incident, the woman gives birth. She suffers from post-dural puncture headache (PDPH) that does not respond to medical treatment, so that a blood patch is required, to which she responds favourably. She consults on the sixth day for seizures that leave her with hemifacial and right hand paresthesia. CT and MRI reveal a subacute parietal cortical vein thrombosis on the left side with a small haemorrhage. A heparin and anticonvulsant treatment is administered and the patient is discharged asymptomatic. A hemostasis test is conducted; its result being negative, the possibility of congenital or acquired thrombophilia is ruled out.

**Discussion:** CVT is a rare cause of stroke affecting 5 people per million annually, mostly young individuals and women of childbearing age. Pregnancy and puerperium are two significant risk factors. Its symptoms and clinical evolution are highly variable, the most frequent being headache and seizures<sup>1</sup>. The PDPH can in many cases further complicate the diagnosis. It can be caused by many factors, such as the pathophysiologies associated with Virchow's triad. As protrombotic disorders were ruled out, the puerperium and the CSF pressure decrease due to dural puncture both appear as risk factors that may contribute to the development of thrombosis.

CVT is diagnosed through imaging, usually by performing venographic studies with CT or MRI.

#### References:

1. Saposnik G, Barinagarrementeria F, Brown RD Jr, Bushnell CD, Cucchiara B, Cushman M, deVeber G, Ferro JM, Tsai FY Diagnosis and management of cerebral venous thrombosis: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2011 Apr;42(4):1159-71.

**Learning points:** In this case, we emphasize postpartum as the main risk factor for CVT. However, there is an additional factor: the dural puncture, which with or without PDPH can lead to serious complications. We recommend a rigorous clinical monitoring and follow-up of the patient after dural puncture to diagnose and treat such complications as early as possible.

## 11AP1-9

### A survey of obstetric patients who refuse regional anaesthesia, causes of refusal and the role of the anaesthesiologist

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**Background and Goal of Study:** Regional anesthesia(RA) for cesarean section is a global trend due to lower morbidity and mortality. However, there are still obstetric patients who refuse it. This study was carried out to investigate the reasons for refusing RA in order to gain some insights into the attitudes and concerns of patients and if there is the possibility of changing their opinion and choosing a safer type of anaesthesia

**Materials and Methods:** After institutional approval, one hundred obstetric patients who had refused regional anaesthesia from different nations , who had received general anaesthesia for Cesarean Section(CS) in the past and were scheduled for elective CS were interviewed just before entering the operating room. They were asked to give one or two reasons for refusing regional anaesthesia. After that, the anaesthetist in charge tried to convince them for the benefits of RA versus GA by explaining the risks and underlying the safety of the baby. After the CS pts were asked why they changed their mind and what type of anaesthesia they would prefer for a future CS

**Results and Discussion:** 94 of the 100 pts were convinced to receive RA. 94 pts received combined spinal -epidural anaesthesia and 6 received general anaesthesia. The pts received epidural analgesia for 48 hours.

52% of the fears of all respondents were about paralysis and neurologic disorders , 42% about peri-operative pain, 38% about seeing the surgery and hearing the surgical procedure, 33% were worried of backache and 15% were afraid of the needle. None of the patients were aware of the risk of aspiration or the risks of general anaesthesia. Finally, 93.6% of the women who received regional anaesthesia would choose neuraxial anaesthesia for a future caesarean section.

The most important reason for changing their minds was the safety of the baby 88.2%

**Conclusion(s):** Patients' fears and conceptions about regional anaesthesia are distorted due to the lack of information regarding regional anaesthesia and the risks of general anaesthesia.

Anesthesiologists should be aware of the patients' concerns and must be capable and willing to discuss with them the relevant problems and suggest with evidence-based data the safest way to receive anesthesia.

**References:**

1. N. M. Gajraj, *Anaesthesia* 50, 8, 740-741, August 1995
2. Anaesthesia preference, neuraxial vs general, and outcome after caesarean section 2010, Vol. 30, No. 8, Pages 818-821A. Fassoulaki

## 11AP1-10

### Factors of patient dissatisfaction after spinal anesthesia for Cesarean section

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**Background and Goal of Study:** The spinal anesthesia is a common practice when performing the caesarean section. Multiple factors can affect the success, the side effects, and patient satisfaction with this procedure. The aim of this study is to discover factors affecting dissatisfaction of spinal anesthesia after cesarean section.

**Materials and Methods:** This is a prospective study including patients who underwent spinal anesthesia for cesarean section. Intraoperative and postoperative data on the day after surgery were collected. The patients were also asked about their general satisfaction with spinal anesthesia, and causes of dissatisfaction with the procedure.

Data are expressed as number (%). Associations of categorical variables with patient dissatisfaction and refusal were assessed using chi square tests. A univariate odds ratio (OR) and a 95% confidence interval were used as estimates of the risk of categorical variables. Significant ( $P < 0.05$ ) variables were then entered into multivariate logistic regression models to calculate the adjusted OR. A two-sided P value of  $< 0.05$  was used for statistical significance.

**Results and Discussion:** These are preliminary results. Six patients among 195 cases were excluded from the study because of spinal anesthesia failure. The dissatisfaction rate of spinal anesthesia was 16.4%; its risk factors were summarized in Table 1:

	Incidence	Univariate p value	Multivariate OR (95% CI)	p value
Puncture attempts (>2)	7.9%	0.8		
Paresthesia at the puncture site	34.9%	0.375		
Intraoperative hypotension	48.1%	0.02	0.05 (0.005-0.576)	0.02
IONV	21.1%	0.93		
PONV	23%	0.023	0.9 (0.1-2.1)	0.8
Postoperative backache	10%	0.05	0.6 (0.01-2)	0.09
PDPH	34.3%	0.039	0.8 (0.01- 2.5)	0.8

[Table 1 : Factors for Patient Dissatisfaction after]

OR: odd ratio; CI: confidence interval; IONV: Intraoperative nausea and vomiting; PONV: postoperative nausea and vomiting, PDPH: postural puncture headache.

**Conclusion(s):** Although spinal anesthesia was conducted safely during the study and revealed a high rate of patient satisfaction (83.6%), side effects may lead to patient dissatisfaction. Therefore, attending anesthesiologists must pay attention to patients under spinal anesthesia and mainly prevent intraoperative hypotension which can cause patient dissatisfaction.

## 11AP2-1

### A case of impossible venous access in an emergency Cesarean section

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**Background:** Rapid venous access of good caliber is of utmost importance before any emergency surgery. A cesarean section in extreme emergency poses this challenge even harder. Venous cannulation is the condition sine qua non. One can imagine then the frustration of not being able to start a venous line in such a situation.

**Case report:** We present a 25 year old primiparous patient, 37 weeks pregnant who is admitted with serious vaginal bleeding, Fetal Heart Rate of 60 and

Echographic evidence of massive placental abruption. She was immediately rushed to the operation theater where she was draped and covered for surgery with the surgeons getting ready as quickly as possible.

Meanwhile myself - a Senior Consultant in Anesthesiology and the nurse with more than 15 years of experience are trying to start a venous line. Unfortunately this proves to be impossible. The veins on both arms are practically missing, so are the external jugular veins. The legs are covered and the clock is ticking while a vein of any caliber is desperately searched for. In the position of the anesthesiologist I decided that a Central Catheter would take at least 7- 10 min in the minimum. Echographic guidance was available at the moment but would have added even more time to the procedure.

In a growingly desperate situation I decided to turn to inhalational induction as the quickest option for the delivery of the baby. In this theater at that moment I only had Isoflurane. Induction was less than perfect with coughing and salivation, but otherways rapid. I had estimated the young woman not to be challenging for intubation, which proved to be correct. Delivery was rapid and I was quickly busy inserting an internal jugular line.

In the mean time I counted on tracheal drug application if need there was. The child was resuscitated and was alive. He later developed severe neurological deficit. The rest of the cesarean was uneventful. The mother explained later that she had been a serious venous drug abuser years earlier. Unfortunately this had left no scars. Only the veins were missing.

**Discussion:** Inhalation induction is considered highly risky in obstetric patients particularly with Isoflurane and very few cases are reported. Unfortunately at the time I felt I had little choice left. Despite the rapid intubation the gamble didn't exactly pay off.

**Learning points:** Increasing the chances of the baby sometimes endangers his mother. A choice that is always always hard.

## 11AP2-2

### Anaesthetic considerations for pregnancy in Alagille syndrome: a case report

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**Background:** Pregnancy in patients with Alagille syndrome (AS) is rare. This disease has varying severity which involves various organ systems. We describe a case of successful peripartum management of a woman with AS.

**Case report:** A 31 year old female with a history of two previous vaginal births was admitted at 37 weeks of gestation in labour. She was diagnosed with AS at the age of 15. She presented with signs and symptoms of chronic liver disease, moderate aortic and pulmonary stenosis, episodes of dizzy spells, and posterior embryotoxin in eyes, Bell's palsy, nevus comidonicus, poor exercise tolerance, and non-functioning left kidney.

An emergency caesarean section (Grade 1) was required due to pathological CTG. After preoxygenation, a rapid sequence induction of anaesthesia was done with Thiopentone sodium (5 mg/kg) and Suxamethonium (2 mg/kg) and a Portex size 7 endotracheal tube was placed. Anaesthesia was maintained with O<sub>2</sub>/ N<sub>2</sub>O (50%) with Sevoflurane and morphine 0.1mg/kg was given. Postoperatively patient stayed in the high dependency unit and made an uneventful recovery.

**Discussion:** Alagille syndrome is characterised by hepatic, cardiac, ophthalmic, skeletal, renal and craniofacial anomalies with a prevalence of 1 in 100,000 live births. More than 50% of the affected patients will have hepatic signs of involvement. Cardiac anomalies may vary innocent murmur, or more severe lesions such as pulmonary stenosis, pulmonary atresia, ASD, VSD, and tetralogy of Fallot.

Vertebrae (butterfly vertebrae is most common) are involved in more than 50% of patients. Various facial defects include prominent forehead, deep set eyes, pointed chin, saddle or straight nose with potential difficult airway. Rarely renal failure, pancreatic insufficiency and developmental delay are seen.

There are issues which directly affects peripartum management such as cirrhotic liver with clotting abnormalities, risk of rupture of oesophageal varices due to pregnancy induced cardiovascular changes, and intra abdominal pressure. During normal delivery, minimal expulsive efforts, use of suction or forceps are recommended.

**References:**

1. Alagille D, Estrada A. Syndromic paucity of interlobular bile ducts (Alagille syndrome or arteriohepatic dysplasia) *J Pediatr* 1987; 110:195-200

**Learning points:** With the advanced medical treatments, we will see more pregnant women with AS. An awareness of possible organ involvement and multidisciplinary approach is required in patients with AS.

## 11AP2-3

**Radiographically prove clinical presentation of subdural catheter placement during labor analgesia: a case report**

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**Background:** Delayed, extensive sensory block, grossly asymmetric block, sparing of sacral dermatomes and varying degrees of motor block are features of subdural block. We present a case of a subdural catheter confirmed by magnetic resonance imaging (MRI) and computerized axial tomography (CT scan) from a catheter that had previously provided a relatively normal block with dilute ropivacaine and sufentanyl.

**Case report:** A pregnant woman thirty five weeks gestation, aged twenty eight with Psoriasis present in the hospital with premature rupture of membranes. Labor was induced and she received an epidural for labor analgesia, placed on a single pass at the L3-L4 interspace, with a 18 gauge Tuohy needle, loss of resistance method with saline was used for identifying the space while she was in left lateral position. Needle entry was bevel cephalad, with no rotation. The catheter was threaded to 4 cm beyond the Tuohy; aspiration test for cerebrospinal fluid and blood were negative. There were no complications. Using ropivacaine 0,2% 10 ml mg and sufentanyl 5 µg, we initiated the epidural analgesia for labor. Bolus was administered-as-requested. Sensory level was similar on both sides and the patient remained comfortable. After 14 h, caesarean delivery was recommended for failure to progress and non-reassuring cardiotocography. In the operating room, the catheter position was unchanged at the skin, with negative aspiration. Ropivacaine 0,75% and sufentanyl 10 µg was administered in divided doses. After 20 minutes and a total of 18 ml, the patient complained of decreased strength of the proximal upper limbs, a strange sensation in the throat and refers pain in distribution. Rapid sequence induction was made and caesarean delivery was complete. The patient was extubated uneventful at the end of surgery. After patient consent, a MRI and CT scan revealed subdural location of the catheter: „the catheter enters the right at L1-L2 probably through the subdural space, passes to the left and holding down the hole conjugation and the upper part of the lateral recess by L2-L3“.

**Discussion:** A catheter provided a normal labor analgesia with dilute local anaesthetic, but dosing for caesarean delivery resulted in a presentation compatible with subdural cannulation as later proven by imaging. The trend toward using smaller concentrations of local anaesthetics for labour analgesia may obscure dangerous catheter malposition and lead to life-threatening block.

## 11AP2-4

**The spina bifida occulta challenge for anaesthesia during labor**

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**Introduction:** Spina bifida occulta is a congenital spinal column defect (prevalence from 5 to 40%) usually located at L5-S1 level. It is frequently diagnosed by chance, on radiologic tests performed for other reasons. The epidural approach is the anaesthesia technique of choice for labor. This anaesthesia technique may be challenging in spina bifida occulta patients, because of changes in sacrolumbar anatomy, dural puncture risk and unpredictable anaesthetic distribution.

**Case report:** We report the case of a 39 year-old woman with history of previous cesarean performed under general anaesthesia and subsequent diagnosis of spinal column dysmorphogenesis at lumbosacral region with spina bifida occulta, involving L4-L5 and L5-S1 levels. An epidural approach was used for anaesthesia management during labor. With the patient in sitting position, the puncture in L1-L2 epidural level was performed using the "loss of resistance to saline" technique with a Tuohy 18 G needle. The epidural space was finally located 5 cm deep from the skin and an epidural catheter introduced 9 cm. An intradural or intravascular location was previously ruled out by injection of 3 mL of a 0,25% bupivacaine solution. An initial dose of 6 mL of bupivacaine 0,25% + fentanyl 50 µg was administered through the catheter 5 minutes after the puncture, followed by a perfusion of bupivacaine 0,0625% + fentanyl 2 µg/mL at 12 mL/h, initiated 15 minutes later. The patient was stable for the whole procedure, without neurological complications. Vaginal delivery occurred six hours later, without complications. There were no differences in spreading, dose requirements and duration of the anaesthesia compared to the regular epidural technique. No complications were reported during the 24 hours post-delivery and long-term.

**Conclusion:** Spina bifida occulta represents a challenge for epidural anaesthesia technique, poorly reported in literature. Nevertheless, known benefits

of epidural anaesthesia for labor make the adaptation of this technique in this challenging situation preferable to general anaesthesia. As shown, epidural anaesthesia may be still feasible in patients with spina bifida occulta.

**References:**

1. Acta Anaesthesiol Scand. 2007 Aug;51(7):955-6.
2. Rev Esp Anestesiol Reanim. 2004 Aug-Sep;51(7):404-5.
3. Anaesthesia. 1988 Oct;43(10):867-9.

## 11AP2-5

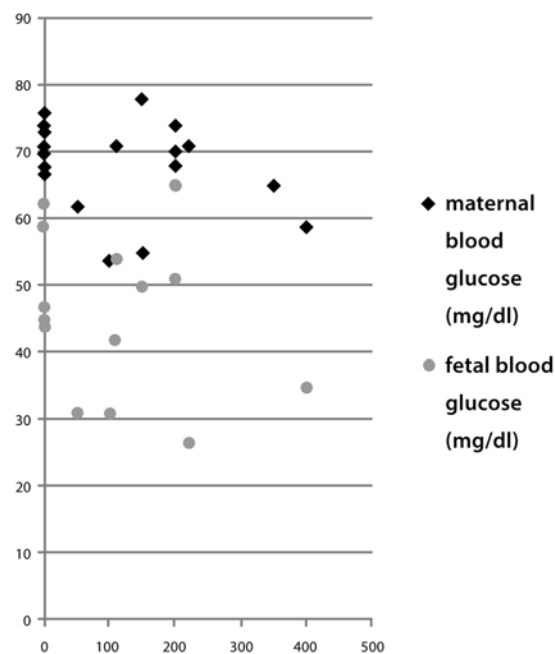
**Maternal and fetal blood glucose levels do not correlate with the amount of 2.5 % carbohydrogenated oral rehydration solution taken prior to selective Caesarean section**

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**Background and Goal of Study:** Preoperative fasting guidelines have been revised lately. According to the Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology, adults and children should be encouraged to drink clear fluids up to 2 hours before elective surgery (including caesarean section(CS)) . Our institution follows it with modification that the only allowed fluid is 2.5 % carbohydrogenated oral rehydration solution (ORS) at the moment. As previous studies showed neonatal hypoglycemia due either to maternal starvation for too long or to excessive sugar infusion to mother, optimal amount of sugar given to mothers prior to elective CS is of interest. We investigated the effects of 2.5 % carbohydrogenated ORS on maternal and fetal blood glucose levels.

**Materials and Methods:** All the monotonous pregnant women without diabetes, indicated for elective CS scheduled as the first case of the day at our institution for four months from August till November 2011, were included in this study. 19 cases were eligible. The following data were examined or investigated through the charts: demographic data, the amount of ORS, maternal and fetal (umbilical artery) blood glucose level, types and amount of the infusions, and the necessity of vasopressors.

**Results and Discussion:** 19 maternal and fetal blood glucose levels are scattered on the graph.



[ Maternal and fetal blood glucose ]

They do not correlate with the amount of 2.5 % carbohydrogenated ORS taken prior to elective CS. Maternal body glucose and fetal one correlate positively. None required any treatment for profound hypoglycemia. The new institutional regulation on fasting the mother before elective CS has not posed any problems so far. This study is underpowered to refer to the optimal amount of 2.5 % carbohydrogenated ORS given to mothers prior to elective CS.

**Conclusion(s):** Maternal and fetal blood glucose levels do not correlate with the amount of 2.5 % carbohydrogenated ORS taken prior to selective CS.

## 11AP2-7

### Caesarea in ICU, in pregnant women in the third quarter, with respiratory distress influenza A

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**Background:** Pandemic Influenza A H1N1, has drawn attention to the risk of swine flu in pregnant women, especially those who are between the second and third quarters, there is also an increased risk of stillbirth or spontaneous abortion in women infected with the virus A. (1).

**Case report:** This is a 25 year old woman, pregnant for 37 weeks, as a history of interest. She went to the emergency room because of a deterioration of her symptoms, with minimal effort dyspnea and high fever up to 39 °C. On arrival at the ICU, respiratory failure occurred, requiring intubation and mechanical ventilation performed with an EVITA 4 ventilator, using a BIPAP mode with protective ventilation and with high FIO<sub>2</sub> to maintain saturation 93-94%, being peak and plateau pressures after first 24 hours above 35-40 cm H<sub>2</sub>O, with respiratory rates 22-28.

Despite maintaining adequate sedation and relaxation of the patient arterial blood gases showed hypoxemia and PaO<sub>2</sub> / FIO<sub>2</sub> < 200. The chest radiograph showed bilateral pulmonary infiltrates.

Empiric antibiotic therapy was prescribed with meropenem, azithromycin and oseltamivir. Atypical pneumonia serology and nasal and pharyngeal swabs (RT-PCR for influenza A) were positive(2)

Because of the poor outcome of respiratory distress and the risk of stillbirth or spontaneous abortion, an emergency caesarean section was decided in the ICU instead of surgery room due to the severe respiratory instability of the patient.

**Discussion:** Pregnant women not only seem to be more susceptible to influenza A. They also have an especially increased risk of severe complications from influenza, and as such, there should be more important. The risk is probably increased by the physiological changes of pregnancy at immunological, cardiovascular, respiratory systems etc .... Clinically suspected, treatment with oseltamivir should be administered as soon as symptoms appear.

#### References:

1. Lancet jul2009(DOI:10.1016/S0140-6736(09)61304-0);
2. declaracion FAO/OMS/OIE about flu A, may 2009.
3. arch Gynecol Obstet (2011)284:1133-1135

**Learning points:** Infection with influenza virus A (H1N1) can lead to severe respiratory infection and ARDS. The clinic is indistinguishable from any respiratory infection and a pandemic situation is necessary to be applied (3)

## 11AP2-8

### Endocarditis in pregnancy: a case report

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**Background:** Infective endocarditis in pregnancy has been shown to be unusual. It usually has a subacute course, with higher incidence in the third trimester of pregnancy.

**Case report:** A 38-years-old woman at 32 weeks of gestational age at her second pregnancy developed a *Streptococcus mitis* infective endocarditis. Symptoms on admission to a district hospital were dyspnea, fever and chest pain. The chest X-ray and a first echocardiogram were negative. She was discharged with amoxicillin clavulanate. Five days later the patient was referred to our institution with neurological facial deficits, the cerebral MRI showing two small ischemic lesions in the right carotid territory. A second echocardiogram showed small vegetation on the aortic valve; blood culture was positive for *Streptococcus mitis*.

An emergency cesarean section at 33 gestational week was performed for a symptomatic episode of atrial arrhythmia. The patient was then referred to cardio-surgical ward for an aortic valve replacement five days later. The post-operative period was complicated by a complete heart block which required the implantation of a definitive pacemaker. At 6-months follow-up the patient and the newborn were in good clinical conditions.

**Discussion:** In a pregnant woman with fever of unknown origin and heart murmur, differential diagnosis of endocarditis should be considered (1). Whenever possible, trans-esophageal echocardiographic evaluation should be performed because transthoracic echocardiography might not always demonstrate vegetations (3). Active endocarditis is a serious, life-threatening condition, and surgical treatment is usually delayed until the infection has been eliminated to avoid the risk of re-infection. Emergency surgical treat-

ment must be performed if shock, severe heart failure or persistent embolic events are present (3).

#### References:

1. Regitz-Zagrosek V. Cardiovascular Diseases in Pregnancy. Deut Arzt Int 2011; 108(16): 267-73.
2. Vizzardi E. Infectious endocarditis during pregnancy, problems in the decision-making process: a case report. Cases Journal 2009; 2:6537.
3. Vincelj J. Infective endocarditis of aortic valve during pregnancy: a case report. Int J Cardiol 2008;126.

**Learning points:** Pregnant women without history of heart disease often underestimate cardiac symptoms. The decision if to keep the fetus or to terminate the pregnancy, and mode of delivery, should be given by an interdisciplinary team in order to minimize maternal and fetal mortality.

## 11AP2-9

### Anesthesia for Cesarean section in a parturient with a large intracranial mass

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**Background:** To illustrate the anesthetic management of a term parturient with a large brain tumour scheduled for Cesarean section.

**Case report:** 21 year old woman, height 1.60 m, weight 64 kg, in the 35th week of her first pregnancy. She complained of a headache that persisted for 3 months. Five weeks before hospital admission she developed left hemiparesis and diplopia.

Magnetic resonance imaging demonstrated a 5-cm axial mass compatible with a glioblastoma, arising from the left temporal lobe associated with shift of the midline structures and compression of the brainstem. Regarding timing of delivery required discussion between the neurosurgeon, obstetrician and anaesthetist based on assessment of fetal maturity. She remained stable neurologically until elective Cesarean section. Immediately prior to induction of general anesthesia. Remifentanyl, thiopentone sodium and succinylcholine were administered in a rapid sequence fashion following voluntary hyperventilation to an endtidal CO<sub>2</sub> of 28 mmHg. Anesthesia was maintained with sevoflurane in oxygen/air and an infusion of remifentanyl. The baby was delivered without any operative complication. Postoperative pain control was achieved using a multi-modal approach which included intravenous acetaminophen and morphine. The patient was then transferred to the neurosurgery center to perform a craniotomy.

**Discussion:** Management of obstetric patients with brain tumours is complex, requiring knowledge of the physiological effects of pregnancy on tumour size and labour on intracranial pressure. Both of these may influence the choice of labour analgesia or anaesthesia for caesarean section. General anesthesia combined with multi-modal balanced analgesia should be the predefined anesthetic management goals and it is associated with a favourable outcome.

## 11AP3-1

### Preoperative factors associated with excessive blood loss during Cesarean section in patients with placenta previa

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**Background and Goal of Study:** Advanced maternal age is associated with high incidence of placenta previa. Cesarean section in women with placenta previa can lead to excessive intraoperative blood loss. The purpose of this retrospective study is to identify the preoperative factors that promote excessive blood loss during Cesarean section in patients with placenta previa.

**Materials and Methods:** We reviewed the medical records of 102 singleton pregnant women with placenta previa who underwent Cesarean section between January 2003 and October 2011. Maternal age, maternal history, anterior placental location, type of placenta previa and anesthetic technique were reviewed, and their association with amount of blood loss was analyzed. Multiple logistic regression analysis was used to control for confounding factors.

**Results and Discussion:** Univariate analysis showed that anterior placental location (p=0.03), history of previous Cesarean section, and previous myomectomy and uterine myoma (p= 0.003), but not maternal age (rs=0.02, p=0.19), type of placenta previa (p=0.29) and anesthetic technique (p=0.42), were associated with amount of blood loss. Multiple logistic regression analysis identified anterior placental location (OR, 2.9; 95%CI, 0.9-9.5), history of previous Cesarean section, and previous myomectomy and uterine myoma (OR, 3.5; 95% CI, 1.0-11.7) were independent and significant factors associated with excessive intraoperative blood loss (> 2000 ml), but not maternal age (>35 years) (OR, 0.8; 95%CI, 0.2-2.5), type of placenta previa (OR, 0.5;

95%CI, 0.1-1.6) and anesthetic technique (OR, 1.6; 95%CI, 0.5-5.3). These findings indicate that the type of placenta previa is not associated with excessive blood loss at least during Cesarean section. We consider that intraoperative blood loss increases when the placenta or myoma is located beneath the incision site.

**Conclusion(s):** Anterior placental location, history of previous Cesarean section, and previous myomectomy and uterine myoma are preoperative risk factors for excessive blood loss during Cesarean section in patients with placenta previa. Anesthetic management should be tailored in women with these preoperative risk factors.

### 11AP3-2

#### Postoperative analgesia for Caesarean section: epidural versus intrathecal morphine

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**Background and Goal of Study:** Neuraxial anaesthesia for caesarean section allows injection of epidural or intrathecal opioids, namely morphine, which provides long lasting postoperative analgesia. We compare these two administration routes prospectively in two groups of 20 pregnant women undergoing elective caesarean section.

**Materials and Methods:** Spinal anaesthesia with bupivacaine 7.5 mg and sufentanil 2.5 ug was performed. For postoperative analgesia patients received epidural morphine (2 mg initially followed by 2 mg 12 hours after) or intrathecal morphine (150 ug). The pain scores were evaluated using the numeric pain scale at 2, 12 and 24 hours postoperatively. The maximum pain score during the first 24 hours was likewise evaluated. Potential side effects and global satisfaction with the technique were also recorded.

**Results and Discussion:** The average pain score 2 hours postoperatively was higher in the epidural group ( $p=0.001$ ). The average pain score 12 hours postoperatively was somewhat higher in the epidural group but not statistically significant. In the intrathecal group, the average pain score was higher at 24 hours postoperatively ( $p=0.017$ ). The mean perceived maximal pain score during the first 24 postoperative hours was 4.1 in the epidural group and 4.95 in the intrathecal group. In both groups the incidence of nausea / vomiting was 20%. Pruritus was described more often in the intrathecal group: 75% versus 40% in the epidural group. In both groups, more than 95% of the patients described their overall satisfaction with the technique as "very good" or "good".

**Conclusion(s):** Despite the differences between the two groups in the quality and duration of analgesia and the higher incidence of pruritus in the intrathecal group, the overall satisfaction with the analgesic technique was similar.

### 11AP3-3

#### Influence of administration of 1% glucose solution on neonatal blood glucose concentration in Cesarean section

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**Background and Goal of Study:** Perioperative administration of adequate glucose, e.g., Ringer's solution with 1% glucose, prevents hypercatabolism and reduces ketone body production [1]. However, excessive glucose administration until delivery of fetus might cause newborn hypoglycemia in caesarean section. In this retrospective study, we investigated whether the administration of 1% glucose solution in caesarean section influenced neonatal blood glucose concentration.

**Material and Methods:** We enrolled consecutive patients between 37 and 41 weeks of gestation who underwent caesarean section under combined epidural and spinal anesthesia between July 2009 and July 2011. Patients with multiple pregnancies were excluded. We divided the patients into 2 groups: those receiving 1% glucose solution (group A) and those receiving a solution without glucose (group B) until delivery. We recorded umbilical cord blood glucose and electrolyte ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ , and  $\text{Mg}^{2+}$ ) concentrations on delivery, neonatal blood glucose level 3 h after delivery, and 1- and 5-min Apgar scores.  $P < 0.05$  was considered significant.

**Results and Discussion:** We enrolled 46 patients (23 in each group). Gestation week, age, body mass index, time from drug injection into the subarachnoid space to delivery of fetus, and total amount of infusion until delivery were not significantly different between the 2 groups. The dose of glucose administered until delivery of fetus in group A was  $3.6 \pm 1.7 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$  (mean  $\pm$  SD) and that in group B was  $0 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$ . Umbilical cord blood glucose concentration on delivery of fetus in group A was significantly higher than that in group B ( $101 \pm 19 \text{ mg/dl}$  vs  $66 \pm 10 \text{ mg/dl}$ ;  $P < 0.0001$ ). Neonatal blood

glucose level 3 h after delivery was not significantly different between the 2 groups ( $90 \pm 15 \text{ mg/dl}$  vs  $90 \pm 21 \text{ mg/dl}$ ;  $P = 0.96$ ). The 1- and 5-min Apgar scores were similar between the 2 groups ( $7.9 \pm 0.8$  vs  $8.0 \pm 0.8$ ;  $P = 0.59$  and  $8.8 \pm 0.5$  vs  $8.7 \pm 0.7$ ;  $P = 0.64$ , respectively). Umbilical cord blood electrolyte concentration was not significantly different.

**Conclusion:** Administration of 1% glucose solution in caesarean section maintained umbilical cord blood glucose concentration at optimal level. Further, no neonatal hypoglycemia occurred 3 h after delivery. In caesarean section, administration of 1% glucose solution is optimal for the neonate.

#### References:

1. Yamasaki K, et al: J Anesth. 2010;24:426-31.

### 11AP3-5

#### Neonatal outcome in women with arterial hypertension following Cesarean section under general and spinal anaesthesia

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**Background and Goal of Study:** Spinal anaesthesia (SA) is generally preferred for caesarean section (CS), however, there are conditions when general anaesthesia (GA) is required. The goal of this study was to assess neonatal outcome following GA and SA in women with chronic arterial hypertension (CAHT).

**Materials and Methods:** With local Ethics Committee approval, written informed consent was obtained from 40 ASA II women with CAHT undergoing CS. They were randomized in two groups of 20 for GA with sevoflurane or SA with hyperbaric bupivacaine. The groups were similar in relation to age, ASA risk, CS duration and maternal baseline hemodynamic measurements.

GA was induced with thiopental and maintained with 2% sevoflurane in 50% oxygen. 12.5mg of hyperbaric bupivacaine was used for SA with the block at  $T_{4-5}$ . Apgar scores (AS) were assessed at 1 and 5 min after birth. Umbilical venous blood samples were taken for measurement of blood gases and acid-base status at delivery. Mann-Whitney test was used for statistical analysis of nonparametric parameters.

**Results and Discussion:** Times to delivery (min) in GA group and in SA group were similar ( $6.81 \pm 0.87$  vs  $7.15 \pm 1.05$ ;  $p > 0.05$ ). Women received phenylephrine by syringe pump ( $50 \mu\text{g/h}$ ) for prevention maternal hypotension during SA. Neonates in both groups were similar with regard to birth weight and gestational age. AS at 1 min were lower in GA group than in SA group ( $6.16 \pm 0.23$  vs  $7.00 \pm 0.14$ ;  $p < 0.01$ ) but there was no difference in AS at 5 min between the two groups ( $7.75 \pm 0.16$  vs  $8.0 \pm 0.07$ ;  $p > 0.05$ ). There were no significant differences in umbilical venous pH in GA group and SA group ( $7.292 \pm 0.007$  vs  $7.311 \pm 0.007$ ;  $p > 0.05$ ) and venous BE ( $-3.51 \pm 0.53$  vs  $-3.40 \pm 0.49$ ;  $p > 0.05$ ). Fetal umbilical venous oxygenation in GA group was higher than in SA group:  $\text{pO}_2$  ( $33.96 \pm 1.46$  vs  $23.44 \pm 1.46$ ;  $p < 0.001$ );  $\text{SO}_2$  ( $65.69 \pm 3.64$  vs  $47.89 \pm 3.49$ ;  $p < 0.01$ ) and  $\text{TO}_2$  ( $14.49 \pm 0.63$  vs  $11.02 \pm 0.97$ ;  $p < 0.05$ ). The lactate concentration was lower in GA group than in SA group ( $1.37 \pm 0.05$  vs  $2.18 \pm 0.14$ ;  $p < 0.001$ ). Early neonatal period in all newborns was uneventful.

**Conclusion(s):** Apgar scores at 5 min were similar in GA and SA groups. Neonates in GA group had significantly higher umbilical venous oxygenation and significantly less lactate than those in SA group. Our study showed better utero-placental perfusion in pregnant women with chronic arterial hypertension under GA with sevoflurane than under SA with bupivacaine.

### 11AP3-6

#### Haemodynamic parameters of pregnant women with chronic arterial hypertension during Cesarean section: comparison of general and spinal anaesthesia

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**Background and Goal of Study:** Hypertension in pregnancy is associated with high maternal and neonatal morbidity and mortality. The purpose of this study was to compare the haemodynamic parameters of pregnant women with chronic hypertension undergoing caesarean section under different methods of anaesthesia.

**Materials and Methods:** After local Ethics Committee approval and informed consent, 50 term pregnant women with chronic arterial hypertension were randomized in two groups of 25 patients each: general anaesthesia (GA) with sevoflurane and spinal anaesthesia (SA). Both groups were similar in relation to age, physical status (ASA II), surgery duration time and maternal base-

line haemodynamic measurements. The following maternal haemodynamic parameters were measured by noninvasive bioimpedans technology: heart rate (HR), mean blood pressure (BP), cardiac index (CI), systemic vascular resistance (SVR). Data were recorded before induction (baseline), after induction of anaesthesia (prenatal), after delivery (postnatal) and at the end of operation. Mann - Whitney U test was used for statistical analysis.

**Results and Discussion:** Results are presented in the table below as mean±SD, \*p< 0.05 considered as statistically significant. HR was significantly higher in GA group at all stages of the operation. BP was significantly higher in GA group on prenatal and postnatal stages than in SA group. CI was significantly higher in SA group at the prenatal stage, whereas SVR was significantly higher at the prenatal stage in GA group.

	Group	Baseline	Prenatal	Postnatal	End of operation
HR	SA	90.2±2.4	84.6±4.1*	84.7±3.2*	79.9±2.6*
HR	GA	84.9±2.4	114.6±2.4	98.7±3.6	99.4±2.9
BP	SA	112.9±3.4	108.1±2.9*	104.6±2.5*	103.6±2.8
BP	GA	106.6±2.3	130.2±2.9	95.4±2.7	98.4±2.8
CI	SA	3.4±0.1	3.5±0.1*	3.7±0.2	3.3±0.1
CI	GA	3.3±0.1	3.1±0.1	3.5±0.1	3.4±0.1
SVR	SA	1457.8±82.5	1340.9±62.3*	1240.6±62.3	1341.5±71.4
SVR	GA	1432.7±93.2	1813.3±86.5	1120.2±65.4	1198.9±66.1

[Table 1]

**Conclusion(s):** This study demonstrated better haemodynamic stability if SA is used during caesarean section in pregnant women with chronic arterial hypertension compared to GA with sevoflurane.

### 11AP3-7

#### Airway variables associated with adverse pregnancy outcomes and symptoms of sleep-disordered breathing

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**Background:** Data shows sleep-disordered breathing (SDB) increases in pregnancy and is related to adverse pregnancy outcomes. Simple assessments can identify those at high risk of SDB, yet their usefulness in identifying risk for adverse outcomes in pregnancy is unknown. We examined the associations between hypertensive disorders of pregnancy and non-invasive markers of SDB.

**Methods:** A retrospective review was performed of all admissions to the obstetric suite at an academic, tertiary referral center from September 2005 to December 2010. Demographic variables, diagnosis codes for gestational hypertension and pre-eclampsia, BMI, MMP (Modified Mallampatti) scores, and Neck Circumference (NC) were extracted from medical records. Women were at risk of SDB if they had a MMP III/IV and/or NC≥40cm. Logistic regression models determined which airway variables were independent predictors for the outcomes (gestational hypertension and pre-eclampsia). The C-statistic was used to measure the area under the curve of a receiver operator characteristic curve. This allows determination of the probability that a classifier will rank a randomly chosen disease-positive subject higher than a disease negative subject.

**Results:** 17,083 medical records were identified. Complete airway data was available in 10,973 subjects (64%) of the sample. Women with MMP III/IV were more likely to report snoring than women with MMP I/II (25.8% vs. 16.9%; p< 0.001); similarly those with NC ≥40 cm were more likely to report snoring than those without (46.3% vs. 17.4%; p< 0.001). Women with MMP III/IV, compared to those without, were more likely to have pre-eclampsia (10.3% vs. 5.2%, p< 0.001). Women with NC ≥40cm, compared to those without, were more likely to have gestational hypertension (4.8% vs. 2.1%, p< 0.001) and pre-eclampsia (10.9% vs. 4.4%, p< 0.001). Using the C-statistic, for the total sample (n=10,973), the model for gestational hypertension, including the independently associated variables of obesity, and thick/obese neck was 0.62; for pre-eclampsia, the independent variables were thick/obese neck, MMP score III/IV, and obesity, C statistic of 0.61. In the subgroup of women with neck circumference measures (n=2733), the above models were repeated with minimal change.

**Conclusion:** Non-invasive markers of SDB are associated with hypertensive disorders of pregnancy. Simple non-invasive airway assessments may have clinical utility in the obstetric setting.

### 11AP3-8

#### Ringer's lactate (RL) and balanced Ringer's solution (BR) during elective Caesarean delivery in spinal anaesthesia: effects on neonatal homeostasis

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**Background:** Balanced solutions may be superior to unbalanced infusions during fluid resuscitation. There is some evidence that during Caesarean section ephedrine can pass the placenta and cause metabolic acidosis in the newborn (1). Whether intravenous infusions affect the newborn during and after Caesarean section is unknown. Our aim was to compare the effects of intraoperative RL vs BR on the homeostasis of the newborn.

**Methods:** We performed a prospective randomised controlled clinical trial on 102 patients. After Ethics Committee approval, and informed consent all pregnant women scheduled for elective Caesarean section were recruited. In cases of: fetal distress, severe comorbidities, urgent Caesarean section by any causes, patients were excluded. Patients were randomised into RL (n=49) and the Balanced Ringer's (BR) groups (n=53). Maternal cardio-respiratory parameters (MAP, HR, SpO<sub>2</sub>) were recorded in 5 timepoints: 1-before spinal anaesthesia, 2-after prone positioning, 3-incision, 4-extraction, 5-cutting through the umbilical cord. The type and volume of the given infusion, the required ephedrine dose were also recorded. Umbilical vein (t<sub>0</sub>), and after 1 hour (t<sub>1</sub>) capillary blood gas samples were taken from the neonates. Primary end point of the study was the acid-base balance at t<sub>0</sub> and t<sub>1</sub>.

**Results:** Patients in both groups received similar amount of crystalloid (RL=572±442; BR=617±260 ml), colloid (RL=293±198; BR=364±241 ml) and ephedrine (RL=8.0±4.9; BR=8.0±4.5 mg), and remained haemodynamically stable with no significant difference between the groups. There was a significant increase in the serum lactate levels in both groups after 1 hour: RL: t<sub>0</sub>=1.9 (1.3-2.3), t<sub>1</sub>=2.9 (1.9-3.3) ; BR: t<sub>0</sub>=1.5 (1.2-1.8), t<sub>1</sub>=2.4 (2.0-2.9) mmol/L (p< 0.001), but there was no difference between the groups, and the pH, PaCO<sub>2</sub> was also within the normal range in both groups. There were more newborns with lactate ≥ 3mmol/L at t<sub>1</sub> in the RL (n=20) vs. BR (n=10) but it did not reach statistical significance.

**Conclusion:** These results suggest that both infusions can be safely used during routine Caesarean sections. The finding that there was a significant increase in the newborns' postoperative lactate levels 1 hour after delivery in the whole sample, has not been reported yet, and although it did not cause acid-base imbalance, it requires further studies for explanation.

#### References:

1. Ngan Kee WD et al. *Anesthesiology* 2009; 111: 506-512.

### 11AP3-10

#### No benefit of low-dose bupivacaine (7.5mg) in spinal anaesthesia for Caesarean delivery to prevent hypotension

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**Background and Goal of Study:** Spinal anaesthesia is the preferred anaesthetic technique for elective Caesarean deliveries. Hypotension is the most common side-effect and has both maternal and neonatal consequences. Different strategies have been attempted to prevent spinal-induced hypotension, including the use of low-dose bupivacaine.

**Materials and Methods:** Following Research Ethics Board approval and informed consent eighty six ASA1 women scheduled for elective caesarean section were randomized into two groups A and B receiving respectively 10 and 7.5 mg of hyperbaric bupivacaine both with 25 microg of fentanyl and 100 microg of morphine in spinal anaesthesia. All patients' intravenous fluid and vasopressor administration were standardized. Sensory block level and the incidence of hypotension were evaluated from the time of injection to delivery.

**Results and Discussion:** Peak sensory level was higher and motor block more intense in groupe A. Four patients in group B required and epidural supplementation of 1% lidocaine. The incidence of hypotension was similar in both groups. In group A larger dose of ephedrine was needed (21, 98 mg versus 19, 98; p= 0.042).

**Conclusion(s):** The development of hypotension after spinal block in subjects undergoing cesarean section was not prevented despite low-dose (7.5 mg). It also compromises anaesthetic efficacy.

## 11AP4-1

**Effect of lateral tilt angle on inferior vena compression in singleton pregnant women, as determined by magnetic resonance imaging**

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**Background and Goal of Study:** Although the left-lateral tilt position following spinal anesthesia is often promoted to reduce compression of the inferior vena by the pregnant uterus, the assumption that this position leads to decreased compression of the inferior vena has not been validated.

Here, we examined whether the left-lateral tilt position reduces inferior vena compression by the pregnant uterus using magnetic resonance (MR) imaging.

**Materials and Methods:** MR images of 6 singleton parturients (39 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 and Discussion:** Based on the MR images, the inferior vena cava was totally compressed with the parturient in the supine position and compression was not reduced by any of the left-lateral tilt positions. Rather, when the fetus was in the right occiput anterior position, the fetus was positioned on top of the inferior vena cava when the parturient was in the left-tilt position. Mean arterial pressure and cardiac output were not significantly different among the parturient positions.

**Conclusion(s):** These findings indicate that a left-lateral tilt position of 45° or less did not reduce compression of the inferior vena cava or change mean arterial pressure and cardiac output in singleton pregnant women.

## 11AP4-2

**Effect of twin pregnant uterus on the inferior vena compression in twin pregnant women in the supine and in the left-tilt position**

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**Background and Goal of Study:** When the singleton pregnant women lie supine, the gravid uterus completely occludes the inferior vena cava, which is resolved in the lateral position.

There is, however, no information regarding the effect of pregnant uterus on the inferior vena compression in twin parturient, of which the uterus is larger than that in singleton pregnancy. The present study was designed to investigate the effect of twin pregnant uterus on the inferior vena cava compression in the supine and in the left-tilt position.

**Materials and Methods:** MR images of 4 twin parturients (34 weeks' gestation) were obtained for the observation of inferior vena cava in the supine, and the left-lateral tilt position (15, 30, 45°, each), inserting of a hard V-block, which is made of closed cell polyethylene foam with 1.8 m height, under the whole right side women's body from head to toe. In addition, hemodynamic variables, such as mean arterial pressure and cardiac index, were measured in each position, using a thoracic bioimpedance technique.

**Results and Discussion:** The inferior vena cava was totally compressed in the supine position and this compression was not restored in any left-lateral tilt position, as determined MR images.

As parturient positioned in the left-tilt, fetus in the right mother's uterus mounted on the inferior vena cava in left-tilt position. Although mean arterial pressure failed to reveal the significant difference parturient positions, heart rates in the 15, 30 and 45° tilt position significantly decreased than that in the supine position ( $P < 0.05$ , respectively). In addition, cardiac index in the 15 and 30° tilt position significantly increased than that in the supine position (2.4, 2.5, 2.2 L/min/m<sup>2</sup>;  $P < 0.05$ , respectively).

**Conclusion(s):** These findings indicate that inferior vena cava was compressed by twin pregnant uterus in the supine position, similar to singleton parturient and that the left-lateral tilt position  $< 45^\circ$  did not reduced the compression of inferior vena cava. They also indicate that the left-lateral tilt position may influence on hemodynamic variables.

## 11AP4-3

**Postpartum headache: a common reality**

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**Background and Goal of Study:** Headache is a common symptom in the postpartum period, which can present as a benign primary disorder or as consequence of secondary disorders such as postdural puncture headache (PDPH). The goal of this study was to determine the incidence, etiology and risk factors for headache in the first 48 hours after delivery in a maternity.

**Materials and Methods:** Over a two months period, we interviewed and consulted the clinical registrations of 88 women concerning the first 48 hours after delivery. The variables studied were: age, body mass index (BMI), ASA classification, history of migraine or neck pain, type of anesthesia, complications of anesthetic technique, pregnancy comorbidities, type of birth, duration of intravenous (IV) fluids ( $< 12h$ ,  $> 12h$ ), hemoglobin concentration, length of admission, occurrence of fever or hypertension and the presence of headache. When present the headache was classified as primary or secondary disorder. Puerperal women with known intracranial pathology were excluded from the study.

**Results and Discussion:** The population mean age was 30,5 years and had a mean BMI of 28,6. A total of 90,9% underwent anesthesia: 61,3% epidural, 18,2% spinal+epidural and 3,4% general. The majority had iv fluids for less than 12hours (56,8%). Fever presented in 6,8% and hypertension in 13,6%. The incidence of postpartum headache was 23%: 18,5% primary postpartum headache (PPPH) and 4,5% PDPH. Late discharge occurred in 6,3% and 100% respectively. 56,3% of the women who presented with PPPH had caesarian section and 75% was over 30 years. The only significant risk factor for the development of PPPH was duration of IV fluids longer than 12hours (31,3% vs 68,8%,  $p = 0,028$ ). Of those who presented with PPPH 62,5% underwent epidural, 31,3% spinal+epidural and 6,3% general anesthesia. In the total of cases of PDPH 75% occurred after spinal+epidural and 25% in epidural.

**Conclusions:** Postpartum headache was a common symptom found in our group of study. All women who developed either primary or secondary headache were submitted to anesthesia. Women who were older than 30 years or underwent caesarian section had higher prevalence of PPPH. Late discharge occurred in all cases of PDPH.

Prolonged IV fluids administration was a predisposing factor to the development of PPPH. No other variable confirmed to be of significant interest in the development of postpartum headache.

## 11AP4-4

**Intravenous paracetamol loading dose pharmacokinetics: the effect of gestational age at delivery**

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**Background and Goal of Study:** Pregnancy affects intravenous (iv) paracetamol pharmacokinetics (1), but there are no studies on covariates of iv paracetamol pharmacokinetics within a pregnant population.

**Materials and Methods:** Shortly following caesarean section, women received a loading dose (2 g) of iv paracetamol and 4 (1, 2, 4 and 6 h) plasma samples were collected and analysed with an earlier reported HPLC technique (2). Individual pharmacokinetics were calculated assuming a linear one compartment model with instantaneous input, first order output. Covariates of between subject variability (preterm vs term, maternal disease vs healthy, twin vs singleton) within this cohort were explored (Mann Whitney U).

**Results and Discussion:** Pharmacokinetics were calculated for 34 patients. Median clearance was 20.3 (11.8-62.8) l/h or - when corrected for body surface area - 10.9 (range 7-28.3) l/h.m<sup>2</sup>. No significant effect of twin (n=8) pregnancy or maternal co-morbidity (n=3) was observed, but median clearance after preterm delivery (n=12,  $< 37$  weeks gestational age) was significantly higher (23.2 vs 19.8 l/h and 12.6 vs 10.2 l/h.m<sup>2</sup>, both  $p < 0.05$ ) compared to term (n=22) delivery. Similarly, there was a difference in median distribution volume (0.75 vs 0.69 l/kg,  $p < 0.05$ ), resulting in the absence of differences in median elimination half life (108 vs 119 min).

**Conclusion(s):** Women who underwent a preterm caesarean had a higher paracetamol clearance compared to term cases. Consequently, we suggest to reconsider iv paracetamol dosing, with potential additional value to either use higher doses or shorter time intervals in preterm cases. We encourage caregivers to perform similar within-pregnancy studies for other drugs administered in this population because of absence of pharmacokinetic data.

**References:**

1. Kulo A, et al. Int J Obstet Anesth (in press)
2. Allegaert K, et al. Eur J Clin Pharmacol 2004;60:191-197



### 11AP4-5

#### Does pregnancy affects pharmacokinetics of intravenous ketorolac?

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**Background and Goal of Study:** Intravenous (iv) ketorolac is administered as part of the UZ Leuven multimodal analgesia protocol after cesarean (1), but data on ketorolac pharmacokinetics (PK) at delivery are absent. The goal of this study was to document ketorolac disposition in term women post-cesarean and compare these estimates with observations in non-pregnant healthy adult volunteers as published in literature (2).

**Materials and Methods:** Term pregnant women who underwent a cesarean section and received an intravenous dose of 30 mg ketorolac were included in this open-label PK study. Blood samples were collected at predetermined time points (at 1, 2, 4, 6 and 8 hours after ketorolac administration). Concentrations of ketorolac were determined by high-performance liquid chromatography with UV detection (3). A pooled noncompartmental linear pharmacokinetic model was used. Data on gestational age (GA), body weight (BW) and body surface area (BSA) at delivery were collected.

**Results and Discussion:** 142 plasma ketorolac time-concentration points were collected in 29 women [median (range) GA 38 (37-41) weeks, BW 74 (56.5-106) kg, BSA 1.88 (1.57-2.26)]. Median (range)  $C_{max}$  was 1.40 (0.87-0.42) mg.L<sup>-1</sup>, median  $C_{trough}$  was 0.18 (0.08-2.73) mg.L<sup>-1</sup>. Consequently, median distribution volume was 0.27 L.kg<sup>-1</sup>, clearance was 0.07 L.h<sup>-1</sup> and elimination half life was 2.76 h. When compared to data as published in literature in healthy non-pregnant adults (2), both distribution volume (0.27 vs 0.17-0.25 L.kg<sup>-1</sup>) and clearance (0.07 vs 0.018-0.033 L.h<sup>-1</sup>.kg<sup>-1</sup>) seem to be higher at delivery compared to the non-pregnant setting.

**Conclusion(s):** An iv dose of ketorolac immediately following cesarean section results in relatively lower initial peak concentrations due to a greater distribution volume and even lower ketorolac concentrations afterwards because of higher clearance in pregnancy compared to non-pregnant healthy adults. These pharmacokinetic estimates might be of pharmacodynamic relevance.

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1. Kulo A et al. Int J Obstet Anaesth (in press).
2. Brocks DR & Jamali F Clin Pharmacokinet 1992;23:415-27.
3. Wu AT & Massey IJ. J Chromatogr. 1990 ;14:241-246

### 11AP4-6

#### Investigation whether different solvents in hydroxyethyl starch affect blood composition of the umbilical artery

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**Background and Goal of Study:** Hypotension following spinal anesthesia for cesarean section is common because spinal block cause peripheral vasodilation and venous pooling. To prevent and treat hypotension, volume load of hydroxyethyl starch (HES) is usual. Composition of HES is different among countries, in addition, in our country, there are two products of 6% HES 7000/0.45 which have different solvents: normal saline and Ringer solution including 1% dextrose. The effects of these differences are not fully understood. We investigate whether different solvents in HES affect blood composition of the umbilical artery.

**Materials and Methods:** Following Research Ethics Board approval and informed consent, women of American Society of Anesthesiologists' class I or II undergoing elective cesarean section were enrolled. Patients were randomly divided into two groups: Group S (N=10) received HES with normal saline, Group R (N=14) received HES with Ringer solution including 1% dextrose. Patients were administered 500 ml of each HES before spinal anesthesia. Infusion of each HES was continued at delivery or stable of circulation. Intravenous phenylephrine was given if the systolic blood pressure fell below 100 mmHg. Umbilical arterial blood glucose, lactate and gases were analyzed, and we followed all neonate progress.

**Results and Discussion:** Between two groups, there was no difference in total amount of HES (S:1585±436 ml, R:1514±237 ml). There were no significant differences in pH, pO<sub>2</sub>, pCO<sub>2</sub>, base excess, electrolytes, and lactate in analysis of umbilical arterial blood.

However, only umbilical artery glucose concentrations differed significantly (P< 0.01) between two groups (S:56±9 mg/dl, R:97±14 mg/dl). There were no neonates who suspected hypoglycemia. There were several reports to give glucose-containing intravenous fluid at the parturient was not good. They said neonatal hypoglycemia was occurred because hyperinsulinemia was induced when maternal and fetal hyperglycemia was occurred. However, our

results showed a small amount of glucose may avoid hypoglycemia and may not induce hyperglycemia.

**Conclusion:** In cesarean section under spinal anesthesia, the different solvent of 6% HES affected glucose concentration of umbilical arterial blood. In the case of no-glucose-containing 6% HES, there were some cases in which umbilical arterial concentration of glucose was less than 50 mg/dl, which might cause neonatal hypoglycemia.

### 11AP4-7

#### A survey on the use of combined spinal-epidurals in obstetrics by UK anaesthetic trainees

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**Background and Goal of Study:** Combined spinal-epidurals (CSE) are used in obstetrics for labour analgesia and anaesthesia. Despite the use of evidence-based medicine and competency-based training in anaesthesia in the UK, individual practice can vary. We conducted a survey to observe such variation.

**Materials and Methods:** An electronic survey was designed on the website SurveyMonkey (<http://www.surveymonkey.com>) and sent by email to all 28 Schools of anaesthesia in the UK. Trainees were asked to respond about their use of CSE for labour analgesia and elective caesarean section (CS).

**Results and Discussion:** The survey was completed by 327 trainees (response rate 9.8%) from 22 schools. Two hundred and eleven respondents (65%) perform CSE as shown in Table 1. Reasons for using CSE in CS were; ability to prolong neuraxial block (74%), local policy (67%) and using the epidural as a backup if the spinal fails (62%).

	Yes	No
Perform CSE in labour room	130 (62%)	81 (38%)
Perform CSE for Elective LSCS	61 (29%)	150 (71%)

[Table 1. Preferences of trainees who performed CSE]

Our results show a large variation in practice (Table 2) with some trainees rarely using CSE while others use it in up to 26.2% of elective CS. The clustering of these results suggest that local policy and training has a major impact on trainee practice.

	Labour (%)	CS(%)
Central London	9.2	24.6
East Midlands South School	3.8	19.7
Imperial School	14.6	16.2
Leeds/Bradford School	15.4	19.7
Northern School	11.5	3.3
All other schools	0.8-9.2	1.6-3.3

[Table 2. Regional variation of trainees]

CSE is advantageous in labour analgesia with less motor block, and a higher rate of catheter success compared to conventional epidurals but without increased complications.

For elective CS, CSE can result in a lower risk of conversion to general anaesthesia and allows for a reduced intrathecal dose to be given, resulting in less hypotension and faster motor recovery. Despite this published evidence, many trainees do not use CSE.

**Conclusion:** Published evidence suggests that CSE is better for obstetric analgesia & anaesthesia. Our survey shows that most trainees do not perform CSE routinely and that local policy and teaching has a bigger impact on current practice. This survey is hampered by the low response rate.

### 11AP4-8

#### Obstetric analgesia and anesthesia in the 19<sup>th</sup> century in Greece

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**Background and Goal of Study:** The aim of our study was to record the development of pain management in childbirth in Greece in the 19<sup>th</sup> century.

**Material and Methods:** We searched for Greek medical journals and textbooks of the 19th century. We studied all relevant publications, and all publi-

cations related to development of pain management in childbirth in Greece in the 19<sup>th</sup> century were isolated.

**Results and Discussion:** The medical journals "Asclepius", "New Asclepius", "The Athens Medical Bee", "The Athens Bee", "Hippocrates", "Galen" and textbooks of Pharmacology and Obstetrics were found.

The first reference to the management of the pain of childbirth is found on a manual of Pharmacology in the year 1845, which proposed the use of rubbing extract of the leaves and the root of the Belladonna. The first anesthetic for childbirth was held in Greece in 1847 by Erik Treiber. The obstetrician was Nikolaos Kostis, who in 1849 in his "Manual of Midwifery" suggests warm baths and opium in ointment or enema. The first publication for management of pain of childbirth is found on "Asclepius" in 1859. It involves the topical application of Tannium, or injections of cold water accompany by the use of the Peruvian bark and iron preparations.

We found also other publications considering the use of chloroform (1862, 1869, 1873), sulfuric ether (1862), belladonna (1869), chloral hydrate (1873, 1874), cocaine hydrochloride (1885), camphora (1880) and antipyrine (1889). There are also sources related to the implementation of phlebotomy and the use of leaves and root of belladonna, ethyl ether or bromide ether, potassium bromide and the combination of morphine and chloroform with naphae (1879, 1891).

**Conclusion:** The medical community began to deal with the pain of childbirth after the second half of the 19<sup>th</sup> century. But the lack of infrastructure and the religious beliefs of 19<sup>th</sup> century prevented the establishment of any strategy to relieve women from the pain of childbirth.

## 11AP4-9

### Effects of maternal magnesium sulfate therapy in preeclampsia/eclampsia on clinical outcomes in neonate

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**Background and Goal of Study:** Magnesium sulfate therapy (MST) is method of choice in prophylaxis/treatment of eclamptic seizures in many countries. A lot of high-quality clinical trials and meta-analyses proved its efficacy and safety for mothers. But the effect of maternal MST on fetus and neonate is still controversial. The goal of the study was to test adverse effects of maternal MST on mature fetus and term neonate.

**Materials and Methods:** The trials were searched in PubMed database among English-language articles published in 1990-2010. Analysis includes randomized controlled prospective clinical trials comparing MST with no treatment, placebo or other anticonvulsant. The following neonatal outcomes were chosen as main endpoints of the study: neonatal death, neonatal hypotonia, Apgar score < 7 at 1 and 5 min, intubation at place of delivery, admission to NICU, treatment in NICU > 7 days. Total effect of MST was measured as relative risk of outcome in MST group comparing with control and its 95% confidence interval (95%CI). Meta-analysis of neonatal outcomes was performed under random effect model for 7 endpoints and fixed effect model for 3 endpoints.

**Results and Discussion:** Neonatal mortality in MST group was compared with different control groups. Each of these studies showed no significant difference between 2 groups:

MST/mixed (0.89, 95%CI 0.80 to 0.99), MTS/no treatment-placebo (0.99, 95%CI 0.93 to 1.05), MTS/diazepam (1.09, 95%CI 0.91 to 1.29), MTS/fenitoin (0.75, 95%CI 0.56 to 1.02). Neonatal hypotonia rate is significantly higher in MST group (3.57, 95%CI 2.89 to 4.42), though significant heterogeneity of control group may be valuable confound factor.

There were no evidence for changing incidence of Apgar < 7 at 1 and 5 minute in MTS group comparing with control (0.79, 95%CI 0.70 to 0.89) and (0.80, 95%CI 0.64 to 0.99) correspondingly.

The same results were observed for intubation at place of delivery (1.04, 95%CI 0.90 to 1.29) and admission to NICU (0.96, 95%CI 0.85 to 1.08). The incidence of treatment in NICU > 7 day was significantly lower in MST group than in control (0.54, 95%CI 0.52 to 0.78).

**Conclusion(s):** Maternal MST given as prophylaxis/treatment of eclamptic seizures does not affect neonatal mortality and incidence of neonatal hypotonia, Apgar < 7 at 1 and 5 min, intubation at place of delivery and admission to NICU in population of term newborns. Maternal MST significantly reduces risk of neonate treatment in NICU > 7 days in this population.

## 11AP4-10

### Variability of clinical practice in obstetric epidural analgesia.

#### General vs maternity hospitals

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**Background and Goal of Study:** Clinical practice variability in obstetric anesthesia among anesthesiologists working in general (GH) or maternity (MH) hospitals is not reported in Spain. To analyze variability in indication, or not, for labor epidural analgesia (LEA) in GH or maternity MH. To compare this practice with the best available evidence (BAE) and with the Spanish legislation

**Materials and Methods:** We have conducted a questionnaire survey about indication, or not, for LEA, under 18 clinical assumptions:

- 1/oral communication is not possible,
- 2/communicating through an interpreter,
- 3/under 16 (informed consent from the parent),
- 4/oligophrenia (informed consent from the parent),
- 5/epilepsy,
- 6/neurofibromatosis,
- 7/multiple sclerosis,
- 8/instrumented lumbar spine,
- 9/leukocytosis (15 a 25 x1000/ $\mu$ L),
- 10/thrombocytopenia (>75 x1000/ $\mu$ L),
- 11/fever (38°C),
- 12/Won Willebrand type I,
- 13/Leyden,
- 14/intrapartum coagulation study not available,
- 15/cervical dilation > 8 cm,
- 16/cervical dilation < 4 cm,
- 17/morbid obesity,
- 18/lumbar tattoo with an ink-free area.

The plausible answers were: YES (indicated), NO (not indicated) and NO RESPONSE. In each hospital a coordinator recorded survey results and provided the assisting data for his center. We define MH as hospitals which had >5.000 births/year and anesthesiologists working preferably within the obstetric wing, and GH the ones not meeting one or both of these conditions. We consider according to BAE response YES to the questions 2-18, and NO to 1. Analysis multivariable descriptive: frequency contingency tables, inferencial:  $\chi^2$  test.

**Results and Discussion:** A total of 7 GH (107 anaesthetists) and 6 MH (89 anaesthetists) took part in the study (92% responders). The polled hospitals performed 50.650 deliveries/year (>10% of the total in Spain). Percentage of affirmative:

**Clinical assumption number (MH % /GH %):**

1(32/33); 2(100/96); 3(98/96); 4(81/84); 5(94/82\*); 6(64/46); 7(72/45\*\*); 8(55/54); 9(83/64\*); 10(64/50); 11(77/61\*\*); 12(70/34\*\*); 13(75/24\*\*); 14(40/33); 15(85/55\*); 16(100/97); 17(98/94); 18(99/97)

\*:p < 0,05; \*\*:p < 0,01

**Conclusion(s):** We highlighted an absence of differences under questions 1 to 4, both groups agree with spanish legislation. GH were less likely to indicate LEA (in seven clinical assumption) and disagree with the BAE more than MH. Both groups disagree with BAE in 14.

The publication and distribution of specific guidelines in Spain could be beneficial to parturients.

## 11AP4-11

### Maternal and neonatal complications of severe preeclampsia: preliminary prospective study

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**Background and Goals of Study:** Preeclampsia complicates 2 to 8% of pregnancies. It is a frequent cause of both maternal and perinatal morbidity and mortality, accounting for 10 to 15% of maternal deaths, particularly in severe forms.

The aim of this study is to describe the complications found in patients with severe preeclampsia (SP) in a tertiary hospital, and to determine the associated risk factors.

**Material and Methods:** A prospective observational study was designed to include women admitted to intensive care unit (ICU) with the diagnosis of SP, from January 1st 2010 to February 6th 2011.

After local Ethics Committee approval, the following data were collected: demographics, medical co-morbidities, obstetric history, maternal complications (HELLP syndrome, acute renal failure -ARF-, obstetric hemorrhage with transfusion -OHT-, abruptio placentae, eclampsia and pulmonary edema) and neonatal complications (great prematurity and low birth weight).

The data were analyzed using t-Student for parametric data and Chi-2 for non parametric ones.

**Results:** 99 women were analyzed. 54.5% of patientes were caucasian, and 34.3% amerindian. The most frequent medical co-morbidities were obesity (37.4%), diabetes (21.2%) and asthma (9.1%). Regarding obstetric history, 52.5% of patients were primigravidae, 12.1% had previous history of pre-eclampsia, 12.1% presented twin pregnancies, 12.1% were result of IVF techniques, and 31.3% presented intrauterine growth restriction.

The number of patients with serious complications was 43 (43.4%): 11.1% presented OHT, 16.2% ARF, 8.1% HELLP syndrome, 7.1% abruptio placentae, 9.1% pulmonary edema and 2% eclampsia. 23 neonates suffered great prematurity, and 3 died. 53% of neonates showed low birth weight. The average time spent in ICU was  $36.1 \pm 32.5$  hours. Gestational age at birth was  $35.2 \pm 4.5$  weeks, and SP was diagnosed at  $34.5 \pm 4.7$  weeks.

The diagnosis of SP before 32 weeks of pregnancy is significantly associated with the onset of HELLP syndrome ( $p=0.02$ ). There is a significant association between the incidence of OHT and amerindian race ( $p=0.02$ ). Abruptio placentae is more frequent in primigravidae ( $p=0.005$ ).

**Conclusions:** The predominant maternal complications of SP are ARF, OHT and HELLP syndrome. Regarding neonatal outcomes, we found a high rate of prematurity and low birth weight. Obesity and diabetes were the predominant risk factors for SP.

### 11AP5-1

#### Combined spinal epidural for labor using sufentanil epidurally versus intrathecally: influence on fetal heart rate

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**Background:** Non-reassuring fetal heart rate changes following combined spinal epidural for labour are sometimes attributed to the intrathecal use of opioids.

We retrospectively compared a protocol using sufentanil and ropivacaine intrathecally with a protocol in which only ropivacaine was administered intrathecally and sufentanil was used epidurally.

**Methods:** 520 cardiocotocographic tracings were examined for changes in foetal heart rate and uterine activity following combined spinal epidural analgesia. Charts were consulted for neonatal and labour outcome. In 231 cases the combined spinal epidural consisted of 3 mg ropivacaine together with 2.5  $\mu$ g sufentanil intrathecally. In 289 cases 4 mg ropivacaine was used intrathecally followed by an epidural administration of 7.5  $\mu$ g sufentanil.

**Results:** When sufentanil was used epidurally, fetal heart rate patterns were found to be more prosperous, demonstrated by a higher percentage of normal tracings (74.5% versus 60.4% when sufentanil was used intrathecally;  $p=0.007$ ) and more tracings displaying 3 or more accelerations in fetal heart rate in 45 minutes (93.5% versus 83.9%;  $p=0.003$ ) together with less tracings showing bradycardia (7.5% versus 14.1%;  $p=0.035$ ) and less tachycardia (3.5% versus 11.4%;  $p=0.005$ ). There were no differences in labor and neonatal outcome.

**Conclusions:** Considering the fetal heart tracing it seems favourable to ban sufentanil from the intrathecal compartment. This retrospective study provides arguments to propose 4 mg ropivacaine intrathecally followed by epidural administration of 7.5  $\mu$ g sufentanil as a valuable alternative for combined spinal epidural analgesia in labor.

**Keywords:** combined spinal epidural, sufentanil, foetal heart rate, bradycardia, accelerations

### 11AP5-2

#### The efficacy of cephalad vs caudad oriented epidural catheter direction for labor analgesia: a pilot study

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**Background and Goal of Study:** The larger size of the first sacral nerve root has been reported to be a leading factor of sacral sparing in epidural anesthesia.

Theoretically, the caudal placement of epidural catheter should give more spreading and accumulation of local anesthetic and provides favorable pain relief than cephalad placement. This study was aimed to determine the efficacy of labor analgesia between a cephalad vs caudad epidural catheter

placement direction and use this data to calculate the sample size for the future study.

**Materials and Methods:** This study is a pilot, prospective, descriptive study of 20 parturients undergoing normal delivery with epidural analgesia. All parturients were divided into 2 groups. The epidural catheter was placed either to a cephalad (CEP group,  $n=10$ ) or caudad (CAU group,  $n=10$ ) direction. Pain score was assessed with verbal numerical rating scale (VNRS). Both groups were received 0.125% bupivacaine 10 ml for initial bolus then 5 ml every 10 min until satisfied (VNRS < 3). PCEA was setting as followed; background infusion with 0.0625% bupivacaine and fentanyl 2 mcg/ml rate 3 ml/hr, PCEA dose 3 ml and lockout interval 10 min. The onset of pain relief, initial analgesic bolus volume, total analgesic dose, PCEA requirement, duration of first and second stage, and incidence of adverse events were recorded.

**Results and Discussion:** In CEP group: onset of pain relief was  $19.30 \pm 8.78$  min, initial bolus volume were  $14 \pm 4.59$  ml, total dose of local anesthetic were  $40.77 \pm 8.80$  mg, PCEA dose were  $8.10 \pm 2.55$  times, duration of first stage labor were  $567 \pm 105.57$  min and duration of second stage labor were  $32 \pm 13.09$  min. CAU group: onset of pain relief were  $21.20 \pm 11.97$  min, initial bolus volume were  $14.50 \pm 4.37$  ml, total dose of local anesthetic were  $38.93 \pm 12.83$  mg, PCEA dose were  $7.80 \pm 4.28$  times, duration of first stage labor were  $550 \pm 188.42$  min and duration of second stage labor were  $28.40 \pm 11.48$  min.

**Conclusion(s):** In this pilot study, Caudal placement of epidural catheter for labor analgesia can provided adequate analgesic effect as cephalad direction. In order to detect the different with 80% power at the 5% significant level, total sample size of 64 parturients should be recruited in the next study.

### 11AP5-3

#### Life-threatening and other major complications related to regional analgesia: a retrospective review of 64813 consecutive neuraxial block for labour analgesia

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**Background and Goals of the Study:** The reported incidence of major complications with central neural blocks is under 4 per 10.000 procedures<sup>1,2</sup>. Due to the infrequency at which neurologic injuries occur, it is extremely difficult to obtain incidence data. Our goal was to describe in a wide database our incidence of "life-threatening situations" (LTS) and "major complication" (MC) secondary to labour analgesia under central blocks.

**Materials and Methods:** After local ethics committee approval, the medical database records of all patients who underwent neuraxial analgesia block for labour between April 20<sup>th</sup> 1998 and June 30<sup>th</sup> 2009 were retrospectively reviewed. We describe as LTS: subdural block, complete spinal block, vertebral canal abscess, meningitis, wrong route errors or seizures, fatal cardiovascular collapse and death and as MC of central neuraxial block: Horner's syndrome, accidental dural puncture, unintentional intradural catheter, transient loss of strength.

**Results and Discussion:** Total number of deliveries in the study period was 106253. The total number of neuraxial blocks performed was 64813 (61%) corresponding to 54380 epidural blocks (83.9%), 9790 combined spinal epidural analgesia block, (15.1%), 10 spinal blocks(0.015%) and 4 continuous intradural analgesia (0.006%). No data were available of the neuraxial analgesic technique in 844 patients (1.3%). LTS and MC are reported in table 1. None of the 64813 patients developed fatal cardiovascular collapse, death or meningitis.

**Conclusion:** The incidence of LTS and MC in our tertiary teaching university hospital are not greater than in other publications. LTS and MC are rare events. Institutional incidence of complications must be taken into account for patient consent.

#### References:

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### 11AP5-4

#### Evaluation of Cardiac Index by thoracic impedenziometria during labor with epidural analgesia

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**Background and Goal of Study:** The labor analgesia involves the placement of an epidural catheter to administer local anesthetics and opioids that may cause hypotension and bradycardia. The thoracic bioimpedenziometria (TB)

is a non-invasive method to obtain hemodynamic measurements.

We studied a group of patients undergoing labor analgesia, monitoring hemodynamic parameters with TB

#### Materials and Methods:

37 patients in active labor requiring epidural analgesia were enrolled. Inclusion criteria: age > 18, no pharmacological allergy, no pregnancy-related diseases.

Exclusion criteria: patient's refusal, conditions that interfere with the blood thoracic flow.

Baseline hemodynamic evaluation is performed in periods free of uterine contractions; we monitored heart rate (HR), mean arterial pressure (MAP), stroke index (SI), stroke volume (SV), cardiac index (CI), peripheral vascular resistances indexed (SVRI), pre-ejection period (PEP), Acceleration Index (ACI), thoracic fluid content (TFC) and left ventricular activity index (LCWI).

After administration of fentanyl 100 µg and levobupivacaine 0.0625% (1 ml per 10 cm in height of the patient), we provided for the measurement of all the parameters for 15 minutes

**Results and Discussion:** In the first minutes anesthetic action is not complete and therefore exposure to pain justifies the very uneven pattern of MAP and HR, then significantly reduced.

The CI is reduced in a non-statistically significant and remained in a physiological range. The SVRI shows a reduction that becomes statistically significant eighth minutes after administration of analgesia.

We can therefore assume that the volumes and cardiac inotropism remain unchanged after the administration of analgesics and that the sympathetic lysis interests cardiac chronotropic activity. This hypothesis seems to be confirmed if we examine other parameters such the PEP that does not change.

**Conclusion(s):** Our work is, to our knowledge, the first ever to document the continuous changes in hemodynamic parameters during labor with epidural analgesia.

Those are just preliminary results, however, we can affirm that the protocols implemented at our center have made it a safe and effective practice, with obtaining a great comfort for the mothers and minimizing the occurrence of complications. LCWI, CI and MAP, while staying in a physiological range, have revealed a minimum reduction of the activity of the sympathetic system, so that has never been required to fill volume or use vasoactive drugs.

## 11AP5-5

### CSE for labor analgesia with and without intrathecal fentanyl

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**Background and Goal of Study:** Although the efficacy of CSE for labor pain relief is evident the use of intrathecal fentanyl remains controversial.

The study examined the median times from analgesia start to first top-up dose (TASFD), total amount of epidural ropivocaine (TA), duration of I stage (dIS) and VAS in women who received (FR) or did not receive fentanyl (NF) intrathecally.

**Materials and Methods:** 84 nulliparous patients with a singleton fetus in vertex presentation 22-28 years old in active labor with cervical dilation < 2 cm were enrolled. Baseline characteristics of the patients were similar. Labor analgesia was initiated with a CSE technique at L3-L4 interspace using an intrathecal dose of 2 mg 0.5% bupivocaine alone (43 women) or with fentanyl 25 µg (41 women) randomly.

Thereafter, 10 mL ropivocaine 1mg/mL was given through epidural catheter on demand. The analysis was completed on 78 patients using UPSS 17.0 software pack. 6 women went to cesarean section.

**Results and Discussion:** The study results are presented in Table 1.

	TASFD min	TA mL	dIS min	VAS at 45min
FR (n=41)	102.3 ± 10.31*	16.3 ± 4.16*	124.6 ± 10.82	< 10%
NF (n=43)	72.5 ± 8.27*	32.7 ± 8.52*	142.5 ± 14.62	< 20%

[(M±m)]

Analgesia for first 45 min was better in FR group. TASFD was much longer in FR group and was statistically significant (SS). Labor I stage duration had no SS difference. TA was twice more in NF group and was SS. The incidence of fetal bradycardia in FR group was in 26.4% and was treated with tocolytics. Mild pruritus occurred in 43.5% FR patients and needed no medication.

**Conclusion(s):** The results indicate that CSE with intrathecal fentanyl provides better quality and duration for labor analgesia. At the same time additional studies need be done on best intrathecal fentanyl dose.

#### References:

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## 11AP5-6

### Pain and epidural analgesia at birth - mothers expectations

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**Background and Goal of Study:** Labour and delivery result in severe pain for most women. Attention to comfort and analgesia for women in labour is important for physiological reasons and out of compassion. There is an imbalance between maternal knowledge, maternal expectations and provision of labor pain services. Maternal experience may have an impact on attitudes toward the mode of future deliveries and on cesarean section rates.

**Materials and Methods:** Following institutional approval and after written informed consent, we conducted structured interviews based on a questionnaire with 150 women. All statistics were performed with SPSS software. Data are expressed as means SD or as median with interquartile range (IQR) according to the distribution of the data. A p value less than 0.05 indicated significance.

**Results and Discussion:** The majority of the 150 women were nulliparous (70%); The average previous cesarean section rate among the parous minority (30%) was 72%. Expectation of labor pain was very common. In the absence of an idea of its severity (48%), a majority were ready to tolerate it as a natural phenomenon (56%). For most interviewees, information about epidural labor analgesia was new (60%), although they were prepared to ask for effective pain relief (80%). 66% of subjects considered cesarean section as an option to avoid labor pain, while 72% perceived cesarean section to be safer for the baby than vaginal delivery.

**Conclusion(s):** This study indicates that information on what to expect during labor and delivery, the potential role of epidural labor analgesia, and the impact of cesarean section on neonatal outcome should be the focus of services instituted to improve antenatal and perinatal care. Despite its complex pathophysiology, labor pain can be efficiently managed. Thanks to multidisciplinary care, obstetric analgesia (mainly epidural analgesia) prevents deleterious effects of labor pain on the mother and fetus.

## 11AP5-7

### Perifix® ONE catheter decreased the incidence of intravenous migration during epidural catheterization in labor analgesia

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**Background and Goal of Study:** Intravascular migration of an epidural catheter is a morbid complication of epidural anesthesia, and consequent intravascular administration of a local anesthetic can cause arrhythmia, seizure and cardiovascular collapse. An epidural catheter can migrate more easily by overswelling of blood vessels in the epidural space in pregnant patients than in nonpregnant patients. Perifix® ONE (B Braun Co., Melsungen, Germany), an improved epidural catheter with a soft tapered tip, is expected to reduce the incidence of intravascular migration in the epidural space. In this study, we investigate the incidence of intravenous migration of Perifix® ONE in labor analgesia.

**Materials and Methods:** After approval of the hospital ethics committee and informed consent, eighty parturients requiring labor analgesia were enrolled in this study. Epidural block was performed via the L3/4 intervertebral space in the lateral position. After detection of the epidural space by the loss of resistance technique with 2 ml of physiological saline, Perifix® ONE was inserted 5 cm cephalad. Intravascular migration was determined by an aspiration test using a 5 ml syringe.

Success rate of epidural catheterization, frequency of intravascular migration and outcomes of labor analgesia were compared with those in previous reports retrieved from PubMed and Central Cochrane Controlled Trial Register databases. Statistical analysis was performed by Kruskal-Wallis analysis and Fisher's exact test.

**Results:** All parturients completed the study, and mean distance from the skin to the epidural space was 4.3 cm. Blood aspiration through the epidural catheter was observed in 1 patient (1.3%). Re-epidural catheterization was required in 2 patients because of intravascular migration in 1 patient and insufficient analgesia in 1 patient. Neither intrathecal migration nor severe complications were observed. Patient-controlled epidural analgesia was adequately used during labor, and all of the parturients were satisfied with the labor analgesia using the epidural block. Rate of intravascular migration of an epidural catheter in previous studies (2-9%) was significantly higher than that in the present study (p < 0.01)

**Conclusion:** The use of Perifix® ONE facilitates prevention of intravascular migration of the epidural catheter and increases the success rate of proper epidural catheterization.

## 11AP5-8

### Combined spinal-epidural for labor analgesia

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**Background and Goal of Study:** Combined spinal epidural analgesia (CSE) has become an increasingly popular technique for providing labor analgesia. By using an intrathecal opioid in combination with a small dose of local anesthetic, excellent analgesia is provided with minimal motor block.

At our clinic patients who have received CSE are allowed to ambulate during labor. The onset of analgesia is more rapid with CSE compared to conventional epidural analgesia.

These unique characteristics of CSE make it the ideal labor analgesia technique in some situations.

**Materials and Methods:** We analyzed 68 patients admitted at Clinic for Gynecology and Obstetrics that received combined spinal-epidural for labor analgesia in period of 1 year. The median age was  $29 \pm 2$  (range 20-39), all of the patients were multiparous, in advanced stage of labor and ASA 1. Spinal injection of 20 mgr fentanyl with 2,5 mg bupivacain was administrated and epidural catheter was placed on L2-L3 level. If needed, epidural was activated 1 hour after the spinal injection with continuous infusion of 0,1 % bupivacain and fentanyl 2 mgr/ml 6-10 ml/h. We evaluated blood pressure, quality of analgesia, motor block, pruritus as side effect and obstetric outcome.

**Results and Discussion:** All patients have superior quality of analgesia with rapid onset of analgesia. In 6 patients (8,8%) we registered hypotension no more than 15% and did not require medical treatment. 2 patients (2,9%) had mild motor blockade (Bromage 1) that lasted shortly. 27 patients (39,7%) complained of some form of itching but no one needed medical treatment. 6 patients required cesarean delivery, 2 instrumental deliveries.

**Conclusion(s):** CSE labor analgesia provides excellent labor analgesia with a more rapid onset, less motor block and much bigger incidence of pruritus than conventional epidural analgesia. In selected patients, such as multiparous patients in advanced labor, it is the technique of choice.

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## 11AP5-10

### Effective dose 50 of sugammadex required at term pregnancy to reverse neuromuscular blocked at a train-of-four count of two

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**Background and Goal of Study:** The dose of sugammadex required to reverse the level of neuromuscular blockade at a train-of-four count of two in pregnancy is not known.

We measured the effective dose 50 (ED50) of sugammadex required to reverse this depth of neuromuscular blocked in term pregnancy using the Dixon Massay up-and-down method (1).

**Materials and Methods:** Following informed patient consent we recruited 21 healthy pregnant women at term aged between 20 and 40 years old, scheduled for elective caesarean section.

After 3 min of preoxygenation and anesthesia induction with thiopental, all parturients received a single bolus dose of rocuronium 0.9 mg/kg, followed by maintenance doses (rocuronium 0.15 mg/kg) as needed. Neuromuscular blockade was monitored using kinemyography. After the last dose of rocuronium and at train-of-four count of four, a single bolus dose of sugammadex was administered. The primary efficacy variable was the recovery of T4/T1 ratio of 0.9 in 5 min from the start of sugammadex administration. The dose of sugammadex was given according to the Dixon and Massey up-and-down method (1).

The dose for the first patient in each group was 1 mg/Kg. An ineffective dose was defined as recovery of the T4/T1 ratio < 0.9 in 5 min, directed an increase of 0.1 mg/Kg to the next woman and vice versa. The ED50 was calculated using the method of Dixon and Massey. In all women the prepregnancy weight was used for the calculations

**Results and Discussion:** The ED50 of sugammadex to reverse the level of neuromuscular blockade at a train-of-four count of two was calculated as 0,94 mg/Kg with SD 0.09 mg/Kg, SE 0.03 mg/Kg and Confidence Interval (CI) 95% 1.00-0.88 mg/Kg. There were no adverse effects related to study treatments. In a previous unpublished study(2), the ED50 of sugammadex to reverse the level of neuromuscular blockade at a train-of-four count of four was calculated as 0.69 mg/Kg.

**Conclusion(s):** The ED50 of sugammadex required to reverse the level of neuromuscular block at a train-of-four count of two in term pregnancy is calculated in this study as 0.94 mg/Kg. More investigations are needed for the ED95 and the safe reversal of the neuromuscular blockade

#### References:

1. Dixon WJ, Massey FJ. In: *Introduction to statistical analysis*. 1983:426-41
2. Stamatakis E, Saiti A, Iliopoulou C, Valsamidis, D. Effective dose 50 of sugammadex required at term pregnancy to reverse neuromuscular blocked at a train-of-four count of four. *EJA*. 2011;28:133

## 11AP5-11

### Comparison of two doses of ephedrine infusion in Caesarean section under spinal anesthesia

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**Background and Goal of Study:** Spinal anesthesia for caesarean section is associated with a high incidence of hypotension, which can require the use of vasoconstrictors.

The aim of this study is to compare the effects of two doses of continuous ephedrine infusion (15mg or 30mg) to prevent hypotension occurring after spinal anesthesia for caesarean section.

**Materials and Methods:** After obtaining local ethic committee approval and informed consents, we conducted a prospective, randomized, double blinded study where seventy four pregnant women undergoing elective caesarean section under spinal anesthesia. The patients were randomized to receive either 15mg (group A, n=35) or 30mg (group B, n=39) of continuous perfusion of ephedrine in 30mn started after spinal anesthesia.

A bolus of 6mg of ephedrine was given if an episode of hypotension occurred. The spinal anesthesia and fluid loading protocols were standardized.

Baseline PAS, PAD, MAP, cardiac frequency was recorded then every 2mn before baby extraction and every 5min after baby extraction.

Data were entered and analyzed using SPSS18.0, Student's t-test was used for parametric data; non-parametric data were analysed with a Khi-2 test.

**Results and Discussion:** Seventy four patients were enrolled. Demographic patients characteristics were similar among the two groups.

The incidence of hypotension was similar among the two groups (Group A: 62.8 %; Group B: 61.5; p= 0.225).

Number, duration and depth of hypotension episode were summarized in table1.

	Groupe A n=35	Groupe B n=39	p
Mean number of hypotension episode	1,54±1,55	0,97±1,03	0,06
Duration of hypotension (min)	3,09±3,11	1,95±2,07	0,06
The depth of hypotension episodes	26,63%	22,24%	0,137
Mean added dose of ephedrine	10	4,2	0,002

[Table 1: Number, depth and duration of hypotension]

Incidence of vomiting was lower in group B (12.82 vs 22.85%, p= 0,25).

**Conclusion(s):** 30mg of ephedrine perfusion in caesarean section under spinal anesthesia lead to better hemodynamic stability, less nausea and vomiting.

## Intensive Care Medicine

### 12AP1-1

#### Serum levels of zonulin in patients with sepsis

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**Background and Goal of Study:** Zonulin is an eukaryotic protein structurally similar to *Vibrio cholerae*'s zonula occludens toxin. It plays an important role in the opening of small intestine tight junctions. The loss of gut wall integrity during sepsis has been described in various experimental as well as human studies. Increased levels of zonulin could be demonstrated in diseases associated with increased intestinal inflammation, such as celiac disease and type 1 diabetes; we therefore investigated the role of zonulin as a non-invasive marker of gut wall integrity.

**Materials and Methods:** Serum level of zonulin was measured in 21 patients with sepsis, severe sepsis or septic shock according to ACCP/SCCM criteria. 10 patients who underwent surgery and 17 healthy probands served as control. Serum levels were determined by using commercially available ELISA kit. Data are given as mean  $\pm$  SEM.

**Results and Discussion:** A significant increase of zonulin serum level was found in the sepsis group:  $7.471 \pm 1.446$  ng/ml, as compared to patients in the surgery group:  $3.209 \pm 0.678$  ng/ml ( $p=0.0190$ ), as well as to the healthy group:  $3.470 \pm 0.231$  ng/ml ( $p=0.0106$ ).

**Conclusion(s):** Disruption of the gut wall integrity may be detrimental in sepsis. Our data provide evidence for a defective tight junction regulation in the small intestine during sepsis. Zonulin may be a useful marker for the assessment of sepsis.

### 12AP1-2

#### Paraneoplastic limbic encephalitis in patients with adenocarcinoma of the colon

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**Background:** Paraneoplastic limbic encephalitis (PLE) is a rare disorder characterized by the development of neuropsychiatric symptoms associated with malignancies

**Case report:** A 61-year-old woman was admitted to the hospital because of abdominal pain and altered mental status. On admission, her temperature was 39.4°C, blood pressure was 140/80 mmHg, pulse rate 110 beats/min, and she had extremely high blood glucose level of 44.9 mmol/l.

On physical examination, she was unresponsive to verbal stimuli, the abdomen was distended and had peritoneal signs. After stabilization and correction of the hyperglycemia the patient underwent emergency surgery. Laparotomy revealed marked dilatation with gangrenous changes affecting the colon and stenosing tumor in the sigmoid colon.

After the operation the patient was transferred to the ICU for mechanical ventilation and remained ventilator dependent for 42 days. Most of the time she was febrile and despite various antibiotic treatment fever persist with a peak of 40°C. Neurological examination showed somnolence state and left-sided hemiparesis.

On MRI scanning hyperintensities in both hippocampal areas were seen. An EEG showed sharp-wave activity in temporal lobes Examination of the CSF revealed slightly elevated protein level and laboratory assessments showed an elevated titer of anti-YO antibodies. Forty two days after the onset of illness the patient remained somnolence and ventilator-dependent and was transferred to the Department of Medicine and Geriatrics for ventilator rehabilitation.

**Discussion:** Although, we do not have pathological confirmation of limbic encephalitis in our patient, the diagnosis of paraneoplastic limbic encephalitis was presumed on the basis of MR imaging findings, EEG abnormality elevated of CSF protein, positive anti YO antibodies, combination of neurological symptoms and exclusion of other causes. The most patients usually start to gradually improve neurological status within 2 to 3 weeks of tumor removal but our case show that the recovery of some patient's could be unexpected and patients may remain ventilated for several months in a somnolence state.

#### References:

1. Foster AR et al. Paraneoplastic Limbic Encephalitis. *Psychosomatics* 2009;50:108-13

**Learning points:** This case highlights the importance of considering paraneoplastic syndromes in patients with progressive neurological symptoms in the context of colonic cancer malignancy.

### 12AP1-4

#### Tubular proteinuria during experimental sepsis is associated with changes in hyaluronan and sialic acids expression

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**Background and Goal of Study:** In an experimental model of sepsis in the rat we have recently documented that albuminuria is combined with disruption of the glomerular filtration barrier (GFB)-associated glycocalyx [1]. In the present study, we evaluated whether sepsis causes also "low molecular weight" proteinuria and alterations in the glycocalyx of proximal tubules, which actively participate to the reabsorbing of low molecular weight proteins.

**Materials and Methods:** Polymicrobial sepsis was induced by cecal ligation and puncture (CLP) in rats (n=9); control animals (CTRL, n=9) received laparotomy only. Urine and blood were sampled at 0, 3, 7 hours following CLP or laparotomy in order to determine creatinine clearance and urinary protein loss.

At the same timepoints, kidney specimens were collected to perform evaluation of hyaluronan expression (by immunohistochemistry) and sialic acids content (by lectin histochemistry) in tubules.

**Results and Discussion:** No differences in creatinine clearance was found between control and CLP rats. A significant increase in low-molecular-weight protein loss into urines ("tubular proteinuria") was observed in CLP rats as compared to CTRL group at 3 and 7 hours after surgery. Tubular proteinuria was associated with a decrease of hyaluronan and sialic acids expression on tubular cells, particularly in proximal tubules, as compared to CTRL animals.

**Conclusion(s):** Sepsis, in the early phases, induces an impairment in kidney function not showed by changes in creatinine clearance but documented by tubular proteinuria. This functional alteration is associated with a decrease in hyaluronan and sialic acid content on tubular cells.

#### References:

1. Adembri C, Sgambati E, Vitali L et al. *Crit Care*. 2011;15:R277

### 12AP1-5

#### Mortality rate of ICU patients is influenced by VRE colonization at ICU admission but not by VRE acquired infections during the ICU stay

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**Background and Goal of Study:** To date, the role of Vancomycin-Resistant *Enterococcus* (VRE) colonization on ICU mortality has not been elucidated. The aim of the present study was to determine the role of VRE colonization and the factors associated with the prevalence and the ICU mortality.

**Materials and Methods:** Prospectively, over 22 months in all general ICU patients (n=383) a rectal swab was taken upon admission and thereafter every 7 days. Epidemiologic data were collected from the ICU computerized database and patient chart reviews. Isolation of enterococci was performed by BHI enrichment followed by inoculation onto blood agar plates and identification by Vitek 2 (bioMerieux).

Antibiotic susceptibility testing was performed according to CLSI guidelines. The strains were tested for the presence of *vanA* and *vanB* genes by PCR. Statistics was by one-way ANOVA or chi2, as appropriate.

	Survivors (n=277)	Non-Survivors (n=106)	P
APACHE II at admission	13.4 $\pm$ 7.05	17 $\pm$ 7.5	***
SAPS II at admission	31.7 $\pm$ 12.1	43 $\pm$ 13	***
ICU LOS (days)	12.4 $\pm$ 12.4	21 $\pm$ 19	***
VRE-positive at admission [n(%)]	33 (11.9)	24 (22.6)	**
vanA-positive [n(%)]	28 (10.1)	22 (20.8)	**
vanB-positive [n(%)]	5 (1.8)	2 (1.8)	ns
Respiratory insufficiency at admission [n(%)]	44 (15.9)	37 (34.9)	***
Chronic diseases (n)	0.76 $\pm$ 0.95	1.2 $\pm$ 1.1	***
VRE infection during ICU stay [n(%)]	1 (0.4)	2 (1.8)	ns

[Differences between survivors and non-survivors]

**Results and Discussion:** Overall ICU mortality was 27.7%. Table 1 shows the differences between survivors and non-survivors. Positive VRE colonization, APACHE II and SAPS II scores at ICU admission, number of chronic diseases and ICU-LOS were increased in non-survivors.

**Conclusions:** Positive VRE colonization at ICU admission seems to play an important role on ICU survival. However, VRE-infections during ICU stay did not influence mortality suggesting that VRE-colonization influences mortality via another route.

## 12AP1-6

### Pulmonary vascular permeability in patients with burn sepsis

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**Introduction:** The aim of investigation was to study the correlate between vascular lung water index (ELWI), intrathoracic blood volume index (ITBI), calculate pulmonary vascular permeability index (ELWI/ITBI) and pulmonary damage and organ failure in patients with burns sepsis.

**Methods:** The investigation included 47 injured patients in age from 21 to 60 years with TBSA 25-78%. All patients were prospectively observed for the development of severe sepsis, septic shock. Severe sepsis and septic shock were diagnosed according to the ACCP/SCCM consensus conference criteria. The sepsis-related organs failure was calculated using sequential organ failure assessment (SOFA) scores and pulmonary damage was evaluated by Murray. Parameters of volume status, extravascular lung water and calculate pulmonary vascular permeability index were studied using transpulmonary thermodilution (PICCO plus; Pulsion Medical Systems (Germany)). Correlation analysis was performed using Pearson and Spearman criteria ( $r$ ;  $p$ ). Comparison between groups were performed the Mann-Whitney test. Differences were significant at  $p < 0.05$ . ROC-analysis was used to study specificity and sensibility diagnostic tests.

**Results:** All patients had pulmonary damage (Murray =  $1.6 \pm 0.4$ , PO<sub>2</sub>/F<sub>I</sub>O<sub>2</sub>  $226 \pm 25$ ) and organs failure (SOFA- $7 \pm 1.9$ ). Decrease PO<sub>2</sub>/F<sub>I</sub>O<sub>2</sub> ratio was related to increasing of ELWI up to  $16 \pm 1.7$  ( $r = -0.68$ ;  $p = 0.0006$ ). There was not statistically significant correlation ELWI with ITBI ( $r = 0.20$ ,  $p = 0.38$ ). Increasing ratio ELWI/ITBI to 0,016 was related by increasing Murray to 1 point and SOFA to 2 points. That models had specificity 100% and 92%, sensibility 88% and 90%, AUC 0,97 and 0,95.

**Conclusions:** Pulmonary damage of patients with sepsis was accompanied by ELWI at the background of alteration of intravascular penetration. Results ROC-analysis were demonstrated the high level of specificity and sensibility ratio ELWI/ITBI for prognosis pulmonary damage and organs failure in patients with burn sepsis.

## 12AP1-7

### Chronic nicotine intake ameliorates sepsis-induced multi-organ failure in rats

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**Background and Goal of Study:** Sepsis is a severe systemic inflammation with acute multi-organ failure, which remains the most common cause of death in intensive care units. Nicotine decreases obesity-related inflammation and improves gut function in patients with ulcerative colitis, presumably by inhibiting pro-inflammatory cytokines. In a sepsis model, we aimed to elucidate the protective effects of nicotine on target organs.

**Materials and Methods:** In male Wistar albino rats under ketamine anesthesia, sepsis ( $n = 45$ ) was induced by ligation and puncture of the cecum, while sham control group ( $n = 8$ ) had only laparotomy. Rats received either nicotine (50mg/ml) in tap water or just tap water for 14 days prior to surgery, while in a subgroup of rats, nicotine drink was withdrawn for 5 days before sepsis induction.

In another group, rats were injected once with nicotine (30mg/kg, intraperitoneally) before sepsis, but received only tap water. Rats were decapitated 24 hours after surgery to obtain blood for the determination of cytokine levels and lung, liver, ileum, heart, kidney tissues to determine malondialdehyde (MDA) levels as products of lipid peroxidation, antioxidant glutathione (GSH) levels and myeloperoxidase (MPO) activities as indicators of neutrophil infiltration. Data were analyzed by ANOVA and Tukey multiple comparison tests.

**Results and Discussion:** Sepsis resulted in increased tissue MPO activities and MDA levels, serum IL-6 and IL-1b levels as compared to control group, while GSH levels were decreased in all tissues ( $p < 0.05-0.001$ ). However, in the chronic nicotine intake group, but not in withdrawal or single-dose groups, these elevations were abolished ( $p < 0.05-0.001$ ). Histological analy-

sis revealed that all nicotine treatments ameliorated tissue damages at varying degrees ( $p < 0.05$ ).

The findings suggest that long-term nicotine consumption reduces sepsis-induced organ damage, which appears to involve the inhibition of neutrophil recruitment to the inflamed tissues.

**Conclusion(s):** Long-term nicotine intake reduces sepsis-induced oxidative damage and its withdrawal provokes tissue damage and delays recovery of the tissues.

#### References:

- Steiner AA et al. Nicotine administration and withdrawal affect survival in systemic inflammation models. *J Appl Physiol* 105: 1028-1034, 2008.
- Lucidarme O et al. Nicotine withdrawal and agitation in ventilated critically ill patients. *Crit Care*. 9;14(2):R58, 2010.

## 12AP1-8

### The use of prophylactic antibiotics in acute severe pancreatitis on HDU/ICU: an audit against UK guidelines

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**Background and Goal of Study:** Current evidence with regards to the use of prophylactic antibiotics in acute pancreatitis is conflicting and inconclusive, as to what may represent best practice. No consensus exists on the preferred agent or ideal course of therapy. UK guidelines recognise this lack of definitive evidence but do suggest that if prophylactic antibiotics are used, a maximum of 14 days should be given [1].

We aimed to assess current practice in our HDU/ICU with regards to prophylactic antibiotics in the management of acute pancreatitis.

**Materials and Methods:** A retrospective review of case notes of all patients admitted to HDU/ICU with the diagnosis of acute pancreatitis over a four year period in a District General Hospital.

**Results and Discussion:** Of 51 admissions reviewed:

- all patients had a full septic screen taken - including blood, urine, sputum (if applicable) cultures.
- 8 patients (15.6%) showed evidence of infection with positive cultures. Of these 8 patients, all received a course of intravenous antibiotics.
- 43 patients (84.4%) showed no evidence of infection on cultures.
- of the 43 patients with no evidence of infection: 39 (90.7%) patients received a course of prophylactic antibiotics. Four patients did not receive any prophylactic antibiotics.
- the mean course length of antibiotics overall was 6.13 days: 8.5 days in the group with evidence of infection on culture versus 5.64 days in the group with no evidence.
- a wide variation between antibiotics prescribed existed, irrespective of whether a Microbiologist was consulted or not.

Our data showed a tendency for patients to receive prophylactic antibiotics despite negative cultures. The mean course of antibiotics was well below the maximum duration recommended. There was a lack of consistency however between agents chosen and reasoning behind starting/stopping prophylactic antibiotics in those without evidence of infection.

**Conclusion(s):** As recognised by the UK Working Party, there is a need for further study into this area to determine appropriate use of prophylactic antibiotics [1]. However, in the meantime, the implementation of a local guideline may lead to a more consistent approach, both on antibiotic prescribing, agents chosen and duration of the course of therapy - to improve practice at a local level.

#### References:

- UK Working Party on Acute Pancreatitis. UK Guidelines for the management of acute pancreatitis. *Gut* 2005; 54: 1-9.

**Acknowledgements:** None.

## 12AP1-9

### Effects of albumin infusion on LPS-induced damage of mesenteric microcirculation

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**Background and Goal of Study:** Microcirculatory dysfunction is a central element in the pathophysiology of sepsis and damage of endothelial glycocalyx - the extracellular network of surface-anchored proteoglycans, glycoproteins and plasma constituents such as albumin - may play a key role [1].

For this reason, fluid therapy capable of reestablishing glycocalyx structural integrity would represent a symptomatic, as well as causal, treatment of microcirculatory damage.

In this study we evaluated whether exogenous albumin is able to positively influence sepsis-induced microcirculatory alterations.

**Materials and Methods:** Sprague-Dawley male rats (n=10) received lipopolysaccharides (LPS) from *Escherichia coli* (30 mg/kg in 0,1 ml of NaCl 0,9%) to induce microcirculatory alterations. Controls (Sham, n=5) received normal saline solution only. 20 minutes after LPS injection, NaCl 0,9% (15 ml/kg/h i.v.; LPS+S, n=5) or human albumin 20% (3 ml/Kg/h i.v.; LPS+ALB, n=5) were given to the rats. Functional microcirculatory alterations were studied in the cecal mesentery with intravital microscopy (number of capillaries/optic field, red blood cells flow velocity and fluorescence intensity in the extravascular space).

To detect changes in glycocalyx components, histochemical analysis using MAA lectin, was performed. This technique is able to identify sialic acid, one of the main component of glycocalyx.

**Results and Discussion:** LPS caused a reduction in the number of perfused capillaries and red blood cells velocity. Albumin infusion did not change the number of perfused capillaries, but it increased red cells flow ( $930 \pm 280$  microm/sec vs  $166 \pm 20$  microm/sec Sham vs LPS+S  $p < 0,05$ ;  $166 \pm 20$  microm/sec vs  $890 \pm 300$  microm/sec LPS+S vs LPS+ALB,  $p < 0,05$ ), and stabilized fluorescence intensity in the extravascular space ( $395 \pm 80$  vs  $1300 \pm 110$  Sham vs LPS+S  $p < 0,05$ ;  $1300 \pm 110$  vs  $1270 \pm 115$  LPS+S vs LPS+ALB). Reactivity to MAA lectin was reduced in the LPS+S group, but recovered in the LPS+ALB group.

**Conclusion(s):** LPS induced a functional (decreased flow velocity and increased vascular permeability) deficit on microcirculation and glycocalyx degradation. Fluid replacement therapy with albumin solution 20% was able to improve hemodynamic parameters and microcirculatory perfusion and was associated with the recovery of some glycocalyx components.

#### References:

- Marechal X, Favory R, Joulin O et al. Shock 2008;29:572-6.

## 12AP1-10

### Risk factors for KPC-producing *Klebsiella pneumoniae* faecal colonization of ICU patients

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**Background and Goal of Study:** To study the risk factors for KPC-producing *Klebsiella pneumoniae* faecal colonization (KPC-Kp) during ICU hospitalization and their potential impact on ICU mortality.

**Materials and Methods:** Prospectively, over a period of 2 years rectal samples were taken from each patient at ICU admission and thereafter every 7 days. Rectal swabs were inoculated in chromogenic agar (Oxoid). Antibiotic susceptibility test was performed by Kirby Bauer method according to CLSI. Presence of *bla*<sub>KPC2</sub> gene was confirmed by PCR. Epidemiologic data were collected from the ICU computerized database and patient chart reviews. Statistics was by one-way ANOVA or  $\chi^2$ , as appropriate.

**Results and Discussion:** Data from patients (n=213) hospitalized for > 7 days in the ICU which were negative for KPC-Kp enteric carriage at admission, were included. The majority of patients (n=154, 72.3%) were colonized during ICU stay, while the *bla*<sub>KPC2</sub> gene was found in all KPC-Kp isolates. The variables studied and the results of the univariate analysis are shown in Table 1.

	KPC-Kp positive pts. (n=154)	KPC-Kp negative pts. (n=59)	p
APACHE II at admission	16,7 ± 7,14	14,4 ± 7,1	*
Number of chronic diseases	0,8 ± 1	0,6 ± 0,8	ns
Carbapenem administration [n (%)]	141 (91,6)	41 (69,5)	***
Number of antibiotics administrated	3,5 ± 1,3	2,5 ± 1,2	***
Previous patient at bed colonized [n (%)]	98 (63,6)	7 (11,9)	***
Mean KPC-Kp positive nearby patients per day	0,9 ± 0,5	0,3 ± 0,4	***
Mean KPC-Kp positive patients at ICU per day	4,6 ± 1,9	2,7 ± 1,4	***
ICU LOS (days)	25,2 ± 17,3	13 ± 7	***
Mortality [n (%)]	52 (33,8)	18 (30,5)	ns

[Differences between KPC-Kp-pos. vs KPC-Kp-neg pts]

**Conclusions:** The prior increased antibiotic use and especially the administration of carbapenems as well as the high prevalence of KPC-Kp ICU carriers, played a predominant role in the induction of colonization, while severity of disease at ICU admission and chronic diseases seem to be less important.

Although the two groups had a similar mortality rate, the KPC-Kp carriers had an increased length of stay in the ICU. These results mandate the implementation of surveillance measures and the isolation of KPC-Kp positive patients, but also the reduction of antibiotic consumption during the ICU stay, in order to reduce further contamination of other ICU patients.

## 12AP1-11

### Linezolid-resistant Coagulase Negative Staphylococci (CoNS) in a teaching university hospital in Italy: epidemiological characteristics

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**Background and Goal of Study:** The spread of resistance among Gram-positive bacteria represents a growing challenge for hospitalized patients especially those admitted in ICU. The increase in the MIC of vancomycin and the poor penetration of vancomycin into organs such as lungs have prompted an extended use of linezolid in recent years.

Resistance to linezolid has recently been reported, firstly in clinical isolates of enterococci and then in staphylococci spp also. The knowledge of local bacterial epidemiology represents a main aspect for the correct choice of empirical antibiotic treatment. Aim of the present study was to evaluate the presence and epidemiological characteristics of linezolid resistance in a teaching university hospital in Florence.

**Materials and Methods:** Species identification and antibiotic susceptibilities were determined in blood culture positive for methicillin-resistant Gram-positive strains from November 2010 to November 2011. Methicillin susceptibility was assessed by measuring the MIC of oxacillin by macrobroth dilution method. Vancomycin, linezolid and daptomycin susceptibility was assessed by measuring MIC by macrobroth dilution method with dilutions ranging from 0,5 microg/ml to 128 microg/ml. MIC was calculated as the value at which the zone of inhibition converged on the comb like projection of the strip. Clinical and demographic data of patients with linezolid resistant blood cultures were collected and analyzed.

**Results and Discussion:** Seventeen methicillin-resistant CoNS resistant to linezolid (MIC between 75 microg/ml to 275 microg/ml) were isolated from blood cultures in the 1-year study period. All the strains were susceptible to vancomycin and daptomycin. Linezolid resistant CoNS were isolated from ICU patients only (12 men and 5 women, mean age 65 years, APACHE II score at ICU admission 14).

All the patients had been previously treated with several antibiotics classes (cephalosporins, fluoroquinolones, carbapenems and linezolid). About 70% of patients presented polymicrobial infections.

**Conclusion(s):** Our epidemiological study shows that linezolid-resistant strains are now present in our hospital. At present, it appears to be limited to CoNS microorganisms and to affect only ICU patients with multiple comorbidities and previously exposure to antibiotic therapy. The spread of resistance from CoNS to other strains and other type of patients is likely in the near future.

## 12AP2-1

### Atrial natriuretic peptide for management of acute kidney injury: systematic review

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**Background and Goal of Study:** Atrial natriuretic peptide (ANP) had been used to manage acute kidney injury (AKI) without rigorous clinical evidence. After a systematic review was reported in 2009, some RCTs have been published.

We aimed to review trials systematically including those new RCTs as to effectiveness and risks of ANP in preventing and treating AKI.

**Materials and Methods:** We searched MEDLINE, Japan Medical Abstracts, Clinical Trials.gov and reference lists of retrieved articles available until December 2010. We included RCTs comparing ANP with placebo or standard treatment or no treatment in adult patients at risk or with AKI.

Outcomes were mortality and need for renal replacement therapy (RRT), and they were analyzed separately for low and high dose ANP for preventing and treating AKI. The incidences of hypotension and arrhythmia were also analyzed.

We performed subgroup analyses to evaluate the effects of ANP after cardiovascular surgery (CVS). Dichotomous data were analyzed by Mantel-Haenszel model to calculate relative risks with 95% confidence intervals.



**Results and Discussion:** 24 trials were eligible and included 1321 patients in ANP group and 1148 patients in control group. Five new studies (606 patients) were added to our review; three of them (562 patients) were prevention study using low dose ANP after CVS.

Regardless of dose and purpose of administration, ANP did not show any effectiveness in mortality. Low dose ANP significantly reduced need for RRT (RR 0.38, 95%CI 0.18 - 0.81) for preventing AKI. As for adverse events, incidence of arrhythmia was lower in low dose ANP group for preventing AKI; however incidence of hypotension was not estimable. Subgroup analysis to study the role of ANP in patients undergoing CVS showed that low dose ANP was associated with reduction of RRT. We evaluated this effect separately according the dose of ANP and first showed a finding which previous studies did not reveal; low dose ANP was associated with reduction of RRT need after CVS not only for preventing AKI (RR 0.21, 95%CI 0.05 - 0.82) but also for treating AKI (RR 0.23, 95%CI 0.06 - 0.89).

**Conclusion:** Low dose ANP was associated with reduction of RRT requirement for preventing AKI. Limited to post CVS, low dose ANP might have effectiveness on reduction of RRT need not only for preventing AKI but also treating AKI.

## 12AP2-2

### The effect of the molecular adsorbent recirculating system (MARS) on antibiotic clearance

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**Background and Goal of Study:** Adequate plasma antibiotic concentrations are necessary for effective elimination of invading microorganism in the host, however extracorporeal organ support systems are well known to alter plasma concentrations of antibiotics, requiring dose adjustments to achieve effectual minimal inhibitory concentrations in the patient's blood. We assessed possible removal of widespread used broadspectrum antibiotics like the minimally albumin bound meropenem and moderately albumin bound moxifloxacin by the various components of the MARS circuit.

**Materials and Methods:** A mock MARS circuit was set using 5000ml of bovine heparinized whole blood to simulate an eight hour MARS treatment session. After the loading dose of 400mg of moxifloxacin or 2g of meropenem was added, blood was drawn from the different parts of the MARS circuit at various time points.

Additionally, meropenem concentrations were determined in the plasma of one patient treated with MARS suffering from acute liver failure (ALF) due to a idiosyncratic reaction to immunosuppressive medication. Moxifloxacin concentrations in serum and ultrafiltrate were measured with an UltiMate 3000 fluorescence detector. The concentration of meropenem in plasma and dialysate was determined by HPLC. Coefficients of accuracy and precision for both compounds were < 8%. The experiments were run in triplicates.

**Results and Discussion:** In our single compartment model a significant decrease in the "systemic" concentration of moxifloxacin and meropenem could be detected as early as 15 minutes after commencing of the MARS circuit. Moreover, within 60 minutes the moxifloxacin and meropenem concentration was less than 50 percent of the initial value. The activated charcoal removed the majority of moxifloxacin and meropenem in the albumin circuit.

In our patient, the concentrations in the return line after MARS were continuously lower than in the access line, indicating a removal of meropenem by MARS.

**Conclusion(s):** Our data provide evidence, for antibiotic removal from the patient's blood through MARS treatment, which could lead to inadequately low plasma levels in the respective individual, requiring dose adjustments of the antibiotic.

## 12AP2-3

### Incidence and risk factors of acute kidney injury after thoracic aortic surgery for acute dissection

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**Background and Goal of Study:** Previous studies reported a high incidence of acute kidney injury (AKI) after thoracic aortic surgery in heterogeneous patient cohort, including various aortic pathologies and the use of deep hypothermic cardiac arrest.

Moderate hypothermia with selective cerebral perfusion makes deep hypothermia non-essential but can make end-organ susceptible to ischemia during circulatory arrest. We investigated incidence and risk factors of AKI after graft

replacement of thoracic aorta with and without moderate hypothermic circulatory arrest for acute dissection.

**Materials and Methods:** We reviewed electronic medical records of 98 patients undergoing graft replacement of thoracic aorta for acute dissection between 2008 and 2011 in a university hospital. AKI was defined by RIFLE classification (Risk, Injury, failure, Loss, and End stage), which is based on serum creatinine or GFR.

**Results:** Mean age was  $55 \pm 15$  years; 72% were male. Surgical procedures with 96% of emergency included ascending aorta (67%), aortic arch (41%), descending thoracic aorta (41%), and aortic valve (5%). Moderate hypothermic cardiac arrest was performed in 75%. The incidence of over all AKI was 54%; 11% of all patients required renal replacement therapy. Thirty day-mortality increased with RIFLE class severity of AKI ( $p=0.002$ ). Independent risk factors for AKI were long CPB duration ( $>180$  min) (Odds ratio, 7.50;  $p=0.008$ ) and preoperative serum creatinine level (Odds ratio, 8.43;  $p=0.016$ ).

**Conclusions:** Incidence of AKI after graft replacement of thoracic aorta for acute dissection with or without moderate hypothermic circulatory arrest was 54%. Long CPB duration ( $>180$  min) and preoperative serum creatinine are independent risk factors for AKI, but moderate hypothermic circulatory arrest is not. RIFLE criteria correlate with 30-day mortality.

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## 12AP2-4

### Time on cardiopulmonary bypass and risk of postoperative acute kidney injury

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**Background and Goal of Study:** Extracorporeal cardiopulmonary bypass is one of the predisposing factors to developing acute kidney injury (AKI) following heart surgery. <sup>1</sup> Studies specifically exploring the role of cardiopulmonary bypass (CPB) time and the development of AKI are relatively few. Our specific goal was to investigate the impact of CPB time on the development of AKI at our center.

**Material and Methods:** We obtained IRB approval to retrospectively review adult cardiac surgical cases at our institution from 2006-2010. AKI was defined using the AKIN criteria.<sup>2</sup> Cardiac transplant, "off-pump", congenital heart disease, and patients with circulatory assist devices were excluded from our final cohort.

**Results and Discussion:** We included 375 patients in the final analysis of which, 154 underwent valve procedures, 169 underwent CABG and 52 patients had a combined CABG-valve procedure. In the unadjusted analysis of the two cohorts (AKI vs. No AKI), the AKI cohort were older ( $p < 0.003$ ), had history of Diabetes mellitus ( $p < .004$ ), preexisting kidney disease ( $p < .003$ ), higher transfusion rates ( $p < .004$ ), a higher numeric Euro score. ( $P < 0.001$ ) and longer CPB times ( $p < .0001$ ). Ejection fraction  $< 40$  and gender were not statistically significant between the two cohorts.

Logistic regression model was fitted for AKI that included CPB time (continuous variable) and other independent variables (mentioned above) that had a significant association with AKI. This analysis revealed an OR of 1.17 per 30-minute increase in CPB time. Surgery type specifically CABG+ Valve vs. CABG (OR: 2.93 95%CI: 1.37-6.28;  $P=0.06$ ), Valve only vs. CABG (OR 1.66 95%CI: 0.96-2.88;  $P=0.07$ ), preexisting kidney disease (OR: 2.08 95%CI: 1.26-3.44;  $P=0.004$ ), BMI  $> 40$  (OR: 2.72 95%CI: 1.17-6.34;  $P=0.02$ ), age per 10 year increase (OR: 1.30 95%CI: 1.08-1.55;  $P=0.005$ ) and DM (OR: 1.68 95%CI: 0.98-2.87;  $P=0.059$ ) were other significant risk factors for development of AKI in this model.

**Conclusion:** In this multivariate logistic regression model using time as a continuous variable, increments of 30 minutes of CPB time is associated with an increased risk of developing postoperative AKI.

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## 12AP2-5

### Age as risk factor associated with mortality in critical postoperative patients who need continuous renal replacement therapy

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**Background and Goal of Study:** Some variables such as age, medical and surgical history and others are related with mortality in postoperative critical patients requiring Continuous Renal Replacement Therapy (CRRT). Our objective was to determine the influence on mortality rate in Postanesthetic Critical Care Unit (PACCU) of: age, gender, history of High Blood Pressure (HBP), Diabetes, Chronic Kidney Disease (CKD), emergency surgery and type of CRRT.

**Materials and Methods:** We reviewed the clinical records of patients admitted in PACCU who needed CRRT between August 2006 to August 2011. We included 120 patients and we collected data of age, gender, history of High Blood Pressure (HBP), Diabetes, Chronic Kidney Disease (CKD), unscheduled surgery, type of CRRT and mortality rate during stay in PACCU.

**Results and Discussion:** No differences were found for mortality in gender (HR 0.757, 95% CI 0.431-1.329,  $p=0.3329$ ), history of HBP (HR 1.406, 95% CI 0.803-2.462,  $p=0.2327$ ), Diabetes (HR 1.535, 95% CI 0.811-2.904,  $p=0.1879$ ), CKD (HR 1.775, 95% CI 0.952-3.307,  $p=0.0710$ ), emergency surgery (HR 1.178, 95% CI 0.663-2.092,  $p=0.5771$ ) and type of CRRT ( $p=0.1163$ ). Only age was found as an independent risk factor associated with mortality (HR 1.040, 95% CI 1.013-1.068,  $p=0.0039$ ).

Features	Patients (n=120)
Age-yr, mean(SD)	69.96(12.77)
Male, n(%)	76(63.33)
HBP, n(%)	68(56.67%)
DM, n(%)	26(21.67)
Chronic Kidney Disease (CKD), n(%)	36(30)
Unscheduled Surgery, n(%)	79(65.83)
CVVHF/Other CRRT, n(%)	105(87.5)/15(12.49)
Length of stay in PACCU, mean(SD)	16.20(14.45)
Survival in PACCU, n(%)	68(56.67)

[Table 1.]

CVVHF (Continuous venovenous hemofiltration)

**Conclusion:** Age is an independent risk factor for mortality in critical postoperative patients that require CRRT.

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## 12AP2-6

### Incidence, risk factors and outcome of acute kidney injury in liver transplant recipients from live-liver donors

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**Background and Goal of Study:** The reported incidence of acute kidney injury (AKI) following orthotopic liver transplantation (OLT) was as high as 98% depending on definition criteria. In this study we aimed to investigate the incidence and outcome of AKI in the liver recipients from live liver donors and identify preoperative and intra-operative risk factors for developing AKI within the first 72 hours.

**Materials and Methods:** 5 years retrospective study (Jan 2005-Dec 2009) of 1<sup>st</sup> time OLT recipients from adult live-liver donor at UPMC, Pittsburgh. There were total of 107 patients. Six patients were excluded for being on dialysis and one patient was re-transplanted after 48 hours. Majority of the recipients were Caucasian (94%), received a right hepatic lobe graft (95%) with the support of veno-veno bypass (94%). Aprotinine was used in 3 patients. None of the above mentioned variables were included in the logistic regression model. Inclusion statistical significance was 0.1.

**Results and Discussion:** Incidence of AKI in our population was 21%. Demographic data, the significant dependent variables used for the final model and

1-year graft and patient mean survival are listed in table 1. None of the following factors reached statistical significance: CHILD score, diabetes mellitus, coronary artery disease, preoperative serum creatinine, ammonium level, duration of surgery, cold and warm ischemic time, intra-operative fluid administration, packed red cells, fresh frozen plasma, cryoprecipitate and methylene blue administration.

	AKI (n=21)	non-AKI (79)	p
Age (years)	52.4±11.9	52.8±12.1	0.895
Gender (female)	8 (38.1%)	39 (49.4%)	0.358
Weight (kg)	80.1±17.7	79.4±16.8	0.869
MELD score	14.9±5.9	12.6±4.5	0.052
Pre-transplant lactate	1.34±0.41	1.11±0.38	0.041
Units of platelets administered	1.24±0.89	0.77±1.1	0.076
PRS	6 (28.6%)	6 (7.6%)	0.009
1 year graft survival	61%	88.5%	0.027
1 year patient survival	70.6%	92.3%	0.05

#### [Results]

The final model retained the pre-transplant lactate level (OR of 5.7) and severe PRS (post-reperfusion syndrome - OR of 10). 13 patients with AKI recovered within the 1<sup>st</sup> month. At 90 days post-OLT there were 9 patients who progressed to chronic kidney disease but none required dialysis.

**Conclusion(s):** The presence of severe PRS will increase the risk for post-OLT AKI by 10 times. AKI also negatively impacts one-year graft and patient survival.

## 12AP2-7

### Acute kidney injury after lung transplantation by AKI network definition: risk factors and mortality

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**Background and Goal of Study:** Acute kidney injury (AKI) is a common complication following lung transplantation. Our objective was to evaluate the incidence of AKI and associated morbidity and mortality in lung recipients, and predict risk factors for AKI in the immediate postoperative.

**Materials and Methods:** We analyzed retrospectively 63 patients who underwent lung transplantation between December 2009 and November 2011. We used the AKI Network criteria for AKI. Three patients were excluded for heart-lung transplantation or intraoperative deaths. Patients were classified in four groups to analyze severity of AKI: A (No AKIN), B (AKIN 1), C (AKIN 2), D (AKIN 3). We performed univariate and multivariate analysis to identify variables associated with AKI.

**Results and Discussion:** We studied 60 patients, 39 male (65%) and 21 female (35%) with a mean age of 51.5 ± 13.4, followed-up during ICU stay. Of these patients, 37 (61.7%) developed AKI: 14 patients (23.3%) had AKI 1, 12 patients (20%) had AKI 2, and 11 patients (18.3%) had AKI 3. A total of 9 patients (15%) required renal replacement therapy. During ICU stay, 12 patients (20%) died; 32.4% of patients who developed any AKIN died. No patient in the absence of AKI (Group A), died. In univariate analysis, intraoperative transfusion ( $p=0.007$ ), use of cardiopulmonary bypass (CBP) ( $p=0.096$ ), lung allograft ischemic time ( $p=0.092$ ), intraoperative administration of tranexamic acid ( $p=0.039$ ), ICU stay ( $p=0.002$ ), prolonged mechanical ventilation ( $p=0.024$ ), tracheostomy ( $p=0.006$ ) and procalcitonin serum levels  $>2$  ng/mL in the first postoperative week ( $p=0.006$ ), were different between AKI group and NO AKI group. In multivariate analysis, we investigated independent associations between AKI and significant variables (use of CBP,  $p=0.426$ ; intraoperative transfusion,  $p=0.093$ ; intraoperative administration of tranexamic acid,  $p=0.29$ ; procalcitonin serum levels  $>2$ ng/mL,  $p=0.08$ ), and no significant differences were observed.

**Conclusion(s):** The results suggest a relationship between AKI and increased morbidity and short-term survival after lung transplantation. Despite the limitations of our study, as a small sample or retrospective design, procalcitonin serum levels  $>2$ ng/mL in the immediate postoperative and intraoperative transfusion, could play a predictive role in the onset of AKI. More studies are needed to test this correlation.

## 12AP2-8

### Delayed graft function in renal transplantation: risk factors and impact on prognosis - a single center analysis

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**Background and Goal of Study:** Early graft function is crucial for successful kidney transplantation. Delayed graft function (DGF), defined as the need for dialysis during the first week after renal transplantation is an important adverse clinical outcome.

Our objective is to identify among a group of kidney's recipients the incidence, risk factors and impacts on patient and graft survivals of DGF

**Materials and Methods:** This retrospective single center study analysed 339 patients who underwent renal transplantation between January 2009 and December 2010 in University Hospital of Coimbra. We analysed hemodynamic and non-hemodynamic factors related to donor and recipient and their influence on the occurrence of DGF Follow-up after 1,3 and 6 months.

The hemodynamic factors included: MAP < 70 mmHg, CVP < 12 mmHg, donor's serum creatinine, recipient's serum creatinine after 1, 3 and 6 months.

Non-hemodynamic factors: recipient's age and weight, duration of haemodialysis pre- transplantation, donor demographic and epidemiologic data such as age, gender and cold ischemia time

Statistical analysis was performed with SPSS :Mann-Whitney and Pearson Correlation test, univariate analysis with logistic regression with odds ratio (OD). P < 0.05 was considered to be significant.

**Results and Discussion:** 262 patients (77%) had immediate graft function (IGF), 65 (19%) had DGF and 12 (4%) non-graft function (excluded). Univariate analysis showed a greater occurrence of DGF among recipients of kidneys with less ischemia time (mean:  $19 \pm 4.02$  p=0.036) and from older donor's (mean:  $53.57 \pm 1.41$ , p=0.02)

Upon logistic regression analysis donor MAP < 70 mmHg significantly influenced the rate of DGF (OD: 2.03, 95%CI: 3, 75, p < 0.02).

There was no influence of other factors on the occurrence of DGF postoperatively.

Follow-up revealed that recipients who had DGF presented higher serum creatinine levels after 3 (mean:  $1.86 \pm 0.87$ , p=0.036) and 6 (mean:  $1.85 \pm 0.98$ , p=0.04) months.

**Conclusion(s):** We examined the influence of donor's and recipient's factors on the occurrence of DGF, revealing no correlation except with cold ischemic time, donor's age and MAP < 70mmHg. DFG correlates with higher creatinine levels in long term, disrupting graft function and compromising transplant's outcome.

The occurrence of DGF can be reduced by maintaining an adequate MAP on donor and by diminishing cold ischemic time which can be the surrogate marker of renal graft function in long term.

## 12AP3-1

### The effect of high and conventional frequency peritoneal jet ventilation on hypoxemia in ARDS dogs

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**Background and Goal of Study:** To observe the effect of high and conventional frequency peritoneal jet ventilation to hypoxemia in ARDS dogs.

**Materials and Methods:** Fifteen dogs with a mean ( $\pm$ SD) weight of  $11.1 \pm 1.2$ kg were anesthetized, intubated and rendered surfactant depletion by preheated saline lavage to achieve ARDS and then randomly divided in three groups (N=5, each): control group (no transperitoneal ventilation), conventional frequency group (CFJV group, transperitoneal jet ventilation, 12 bit/min) and high frequency group (HFJV group, transperitoneal jet ventilation, 150 bit/min) in a blinded fashion, and received appropriate treatment in each group.

Arterial and mixed venous blood gas analysis was performed. Electrolyte, HR and MAP was observed in all groups before and 15, 30, 60, 90, 120min after the establishment of model.

**Results and Discussion:** The PaO<sub>2</sub> progressively increased in CFJV group and HFJV group after transperitoneal jet ventilation, and was significantly different with the control group at the same time. The average increase of PaO<sub>2</sub> was higher in HFJV group than CFJV group, but there was no significant difference with them. The electrolyte, HR and MAP had no obvious change in three groups.

**Conclusion(s):** These results of our experiments suggested that high and conventional frequency peritoneal jet ventilation can both markedly improve the oxygenation of ARDS dogs.

## References:

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## 12AP3-2

### The correlation between QT interval prolongation in cirrhotic cardiomyopathy and the severity of the liver disease

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**Background and Goal of Study:** QT interval prolongation predicts severe ventricular arrhythmias. The prolongation of the QT interval has been reported in many conditions as cardiac disease, electrolyte abnormalities or commonly used drugs. Acquired prolongation of the QT interval has been documented in cirrhosis and it might be an important sign helpful to identify patients at risk of cirrhotic cardiomyopathy. The aim of this study was to confirm the prolongation of the QT interval in a group of patients with severe cirrhosis and define its association with the severity of the disease.

**Materials and Methods:** 20 patients with cirrhosis Child Pugh C admitted in ICU in a three-months period were enrolled in a retrospective transversal study. Patients with coronary artery disease, conduction abnormalities, arrhythmias, arterial hypertension, chronic lung disease, intrinsic renal disease were excluded from the study. Liver and renal function tests, plasma electrolytes were determined by standard laboratory techniques. The presence of ascites was documented by ultrasonography. QT interval was read from a 12 lead electrocardiogram recorded at 25 mm/s and was corrected for the heart rate using Bazett's formula. Statistical analysis was performed using Fisher's Exact Test ( Medcalc statistical software).

**Results and Discussion:** Our study suggests a relationship between QTc prolongation and the severity of the cirrhosis as assessed by markers of liver function. Statistically significant correlations were found between QTc and serum albumin, hyponatremia, coagulopathy and serum creatinine. The QTc prolongation was found to be independent of the etiology of the disease or the sex of the patients. This finding confirms previous studies. We couldn't find a correlation in our study between the QTc prolongation and serum bilirubin, ascites, spontaneous bacterial peritonitis or the MELD score.

**Conclusion(s):** QTc interval is frequently prolonged in patients with cirrhosis regardless the etiology of the disease. QTc prolongation correlates well with the severity of the liver disease. This abnormality may have a prognostic significance that needs to be assessed in further studies with a longer follow-up of the patients. The additional risk for severe arrhythmias in patients with QTc prolongation should be evaluated before any pharmaceutical interventions are made.

## 12AP3-3

### Levosimendan in management of critical care patients after orthotopic liver transplantation

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**Background:** Levosimendan (LS), a novel calcium sensitiser, is already implemented in management of heart failure after cardiac surgery<sup>1</sup>. There are reports that LS has been used in a variety of clinical settings, including acute heart failure, low cardiac output state (LCOS), adult respiratory distress syndrome, ischaemic myocardial stunning, and refractory septic shock. No reports have been made of LS use in liver transplant patients.

**Case report:** We present 3 case reports of patients admitted to the ICU after OLT, who encountered cardiac complications, and were eventually treated with LS. We did not limit our use of LS only to those patients with LCOS, but rather we used it as a rescue therapy in those with high dose catecholamine requirements, despite adequate fluid resuscitation. LS loading dose of 12 µg/kg over 15 minutes followed by 0,1 µg/kg/min over 24 hours was administered in all cases. All patients were male, ASA 4, in their 60's, average MELD 27, average SAPS II 62. They all underwent OLT due to alcoholic end stage liver disease (ESLD).

**Discussion:** OLTs were characterised by severe hemodynamic instability, large volume shifts and massive blood transfusions. Vasopressor/ inotropic catecholamine support was initiated intraoperatively to maintain adequate MAP<sup>2</sup>. Hemodynamic instability was aggravated in short post-transplant pe-

riod, necessitating high doses of vasopressors. Hemodynamic parameters were obtained using pulmonary artery catheter (PAC), before and every 3 hours after LS administration. Several hemodynamic parameters (MAP, PCWP, CI and SVRI) significantly improved.

Patients become hemodynamically stable resulting in cessation of vasoactive support, improved LV function and adequate diuresis. Two patients fully recovered; one eventually died due to surgical complication.

#### References:

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**Learning points:** Management of patients after OLT represents a great challenge. This is even more stressed when the post-transplant course is complicated with LCOS. In our patients LS has rapidly improved cardiac function and hemodynamic stability. Therefore it could serve as an ideal inotrope in non-cardiac surgery, even in critical post-transplant patients.

## 12AP3-4

### The influence of different ventilatory setting with positive end-expiratory pressure on stroke volume variation in cardiac surgery patients

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**Background and Goal of Study:** Fluid management after cardiac surgery is very important because it can affect global cardiac function and postoperative morbidity and mortality. For appreciate fluid management, exact evaluation of volume status is necessary and several parameters like stroke volume variation, systemic pressure variation, change of pulse pressure have been used for it. However, many factors with mechanical ventilation might affect these parameters.

The aim of this study is to confirm the effects of different ventilator setting, especially positive end-expiratory pressure (PEEP), on hemodynamic status and volume status.

**Materials and Methods:** All patients were admitted to intensive care unit after surgery, and fully sedated and mechanically ventilated. After maintenance of stable vital sign for 1 hour according to standard institutional protocol, the non-invasive cardiac output monitoring (NICOM) was started. Patients were assigned to responder or non-responder group according to 7% increase of cardiac output through NICOM, compared with baseline by passive leg raising test. The hemodynamic parameters and cardiac output, cardiac index, stroke volume, stroke volume variation (SVV) by NICOM were evaluated with the following setting: conventional ventilation of tidal volume 10 ml.kg<sup>-1</sup> with PEEP 0 (C0), 5 (C5), 10 (C10) cmH<sub>2</sub>O and protective ventilation with tidal volume 6 ml.kg<sup>-1</sup> with PEEP 0 (P0), 5 (P5), 10 (P10) cmH<sub>2</sub>O. 5 minutes time interval was applied between each measured points.

**Results and Discussion:** Thirteen patients were included in this study and responder group was 7 patients. In responder group, SVV were 13.0 ± 4.4% at C0, 15.3 ± 4.2% at C5, 17.1 ± 3.3% at C10, 13.0 ± 5.0% at P0, 14.6 ± 4.0% at P5 and 15.7 ± 3.6% at P10. In non-responder group, SVV were 10.7 ± 3.2%, 11.0 ± 3.2%, 11.3 ± 3.1%, 10.3 ± 2.1%, 11.0 ± 2.1% and 11.0 ± 2.5%, respectively. At C10 and P10, SVV values were significantly different between each group (p = 0.007, p = 0.022). Area under curve with receiver operation curve analysis were 0.655 at C0, 0.786 at C5, 0.940 at C10, 0.702 at P0, 0.786 at P5 and 0.869 at P10. Cut off values between responder group and non-responder group were 12.5%, 13.0%, 13.5%, 11.5%, 13.5% and 14.0%, respectively.

**Conclusion(s):** SVV is affected by amount of tidal volume and level of PEEP in same patient and same volume status. This effect must be regarded when SVV is used to predict volume status of mechanically ventilated patients.

## 12AP3-5

### Postoperative atrial fibrillation and sepsis

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**Background and Goal of Study:** Postoperative atrial fibrillation (POAF) is the most common postoperative arrhythmia, both in cardio-thoracic and general surgery patients. In surgical patients, development of atrial fibrillation (AF) may be associated with septic complications, other than cardiovascular. It has been shown that in 20-30% of patients with postoperative arrhythmias, an underlying sepsis is present and in these patients the cause of death is often non cardiovascular.

The aim of the present study was to assess the clinical correlation between POAF and septic complications in a population of critically ill patients who underwent major general surgery.

**Materials and Methods:** All patients consecutively admitted in a postoperative intensive care unit (ICU) for elective postoperative monitoring over a 6 months period were considered. Patients with permanent AF were excluded. POAF was defined as every episode of new-onset AF, as found on a 5-lead EKG, which occurred in the first 6 days of ICU stay. Patients with POAF were included in POAF group, the others in the control group. Differences in rates of septic complications, length of stay in ICU (ICU-LOS) and 28-day mortality were searched across the two groups. The association between POAF and septic complications was evaluated by logistic regression analysis we evaluated.

**Results and Discussion:** A total of 295 patients were considered, and 18 of them developed POAF (6.1%). Patients in the POAF group showed longer ICU stays (6.7 ± 6.9 vs 2.4 ± 1.4 days, p < 0.0001) and higher 28-day mortality rates (22.2% vs 4.7%, p = 0.0141) when compared to control group. Rate of septic complication differed in the POAF group and in the control group (50.0% vs 24.9%, respectively, p = 0.019). Logistic regression analysis showed an OR of 3.0 for POAF as a risk factor for sepsis (95% CI 1.2-7.9, p = 0.025).

**Conclusions:** Postoperative, critically ill patients with POAF have a worse outcome in terms of complications, ICU-length of stay and mortality. POAF seems to be tightly associated with septic complications, suggesting that the development of this arrhythmia in non cardio-thoracic surgical patients may be related to a septic source (e.g. anastomotic leak) rather than cardiovascular issue. These considerations may suggest that the treatment of POAF, besides a specific anti-arrhythmic therapy, should include a careful evaluation of the patients to identify the possible underlying septic complications.

## 12AP3-6

### Resveratrol improves liver function after hemorrhagic shock in rat

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**Background and Goal of Study:** Resveratrol is a phytoalexine component of red wine and a substance with a large antioxidant capacity. Resveratrol has recently been demonstrated to improve organ function if applied in experimental models of oxidative stress, such as sepsis and shock [1,2]. However, it has not been investigated whether resveratrol may be able to improve intravital liver function after hemorrhage and resuscitation. This study was designed to investigate whether treatment with resveratrol may improve liver function measured by means of plasma disappearance rate of indocyanine green, after hemorrhagic shock in rat.

**Materials and Methods:** After approval of the responsible animal use committee (permission no. 47/2011), male Sprague-Dawley rats were anesthetized and underwent hemorrhagic shock (MAP 35 ± 5 mmHg) for 90 minutes. At the end of shock, animals received either resveratrol (shock/res; 0.2 mg/kg iv), or vehicle (2.5 ml/kg 1% EtOH solution) and were resuscitated with shed blood and acetated Ringer's solution; sham-operated controls were included (each group; n = 6). After 2 hours of reperfusion, animals underwent measurement of plasma disappearance rate of indocyanine green (PDR<sub>ICG</sub> in percent per minute [%/min]), as a sensitive parameter of liver function. Data were evaluated by ANOVA followed by a Student-Newman-Keuls test (mean ± standard deviation).

**Results and Discussion:** Sham-operated animals presented with physiological values for PDR<sub>ICG</sub> (14.96 ± 2.55 %/min). After hemorrhagic shock, PDR<sub>ICG</sub> was significantly attenuated in vehicle treated animals, compared to sham-operated animals (6.20 ± 4.65 %/min; p = 0,018 vs. sham/vehicle). Compared to vehicle treated animals, administration of resveratrol significantly improved PDR<sub>ICG</sub> after hemorrhagic shock (22.41 ± 8.33 %/min; p < 0,001 vs. shock/vehicle). Therapy with resveratrol after hemorrhage and resuscitation resulted in values for PDR<sub>ICG</sub> that are similar to physiological levels; this indicates an extensive protective potential of resveratrol with respect to liver function.

**Conclusion:** This study shows that resveratrol therapy may improve liver function after hemorrhage and resuscitation in rat. Resveratrol may therefore evolve into an interesting experimental substance for the treatment of liver failure after hemorrhagic shock.

#### References:

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## 12AP3-7

### Intravenous S-ketamine does not inhibit alveolar fluid clearance in septic rats with acute lung injury

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**Background and Goal of Study:** S-ketamine is frequently used for analgesation, especially during sepsis. We have previously shown that intratracheally administered S-ketamine inhibits alveolar fluid clearance (AFC)<sup>1</sup>. The present study investigated whether intravenous (i.v.) S-ketamine also inhibits AFC and whether its effect is affected by lipopolysaccharide (LPS)-induced lung injury which might favor the appearance of S-ketamine at the alveolar surface.

**Materials and Methods:** AFC was measured in fluid-instilled lungs of anesthetized rats using a 2% dextran-500 solution containing fluorescein isothiocyanate-labeled dextran as alveolar volume marker. S-ketamine was either administered i.v. over 6 h (loading dose: 20 mg/kg, followed by 20 mg/kg/h) or added to the instillate (75 µg/ml). To induce lung injury, lipopolysaccharide (LPS; 7 mg/kg) was injected i.v. Interleukin (IL)-6 and cytokine-induced neutrophil chemoattractant (CINC)-3 in plasma and bronchoalveolar lavage fluid (BALF) were measured by ELISA. In other experiments isolated rat alveolar type II cells were exposed to S-ketamine (75 µg/ml) for 6 h and/or to the sodium channel blocker amiloride (100 µM), and transepithelial transport indicated by short circuit currents (ISC) was measured in Ussing chambers. Data are Mean±SEM. Level of significance p < 0.05.

**Results:** AFC was 27±2% after 60 min in control rats and was not affected by i.v. S-ketamine. In contrast, LPS decreased AFC to 16±2% (p < 0.01). In rats treated with LPS and i.v. S-ketamine AFC was 19±2% (p < 0.05 vs. control, p=0.28 vs. LPS). LPS caused an increase in plasma IL-6 and CINC-3 after 6 h (each p < 0.05). This increase was accompanied by an increase of IL-6 and CINC-3 in BALF (p < 0.05). Tracheally administered S-ketamine reduced AFC to 18±3% (p < 0.05). In isolated alveolar type II cells 6 h S-ketamine decreased ISC by 36% (p < 0.01), an effect related to a decrease in amiloride-sensitive sodium transport.

**Conclusion:** These findings show that direct exposure of the rat alveolar epithelium to S-ketamine, either by tracheal administration or by administration to isolated alveolar epithelial cells, decreases amiloride-sensitive sodium transport and AFC. In contrast, S-ketamine applied intravenously does not affect AFC, even when the alveolar permeability was increased by LPS. Thus, S-ketamine does not seem to be disadvantageous for patients with pulmonary edema.

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## 12AP3-8

### Refractory ventricular fibrillation after thyroidectomy, parathyroidectomy and panhypopituitarism

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Low Ca and Mg levels are complications, which occur following parathyroidectomy performed after thyroidectomy operation. Empty Sella syndrome is a condition in which enlarged and deformed Sella turcica is partially or completely filled with cerebrospinal fluid either as idiopathic or secondary to elevated intracranial pressure; thereby, that can result in secondary adrenal insufficiency (SAI) or panhypopituitarism (PHP)(1,2). We presented a PHP case, which was controlled by Mg, steroid and thyroid replacement therapy. A 42-year old woman was presented to ER with sore throat, dysphagia, facial and generalized edema. She had thyroidectomy and parathyroidectomy 10 years ago and was receiving only Ca therapy with discontinuation of thyroid hormone replacement 8 months ago. She was admitted to ETN ward with the diagnosis of tonsillitis and pharyngeal abscess.

2<sup>nd</sup> day she was transferred to internal medicine due to onset of acute renal failure (BUN:148;Creatinine:5.6;K:5.1;Ca:5.2).

3<sup>rd</sup> day, anesthesia assessed the patient who had deteriorated and developed hypotension, unconsciousness and respiratory distress (BP:75/43mmHg,sPO2:78;HR: 123); then she was admitted to intensive care unit. Her GCS was 10.

VF occurred three times at 1<sup>st</sup>, 4<sup>th</sup>. and 24<sup>th</sup> h after admission to ICU. Considering refractory fibrillation, Mg was initiated to the patient who respond to defibrillation. VF no longer occurred. Since hypothyroidism (T<sub>3</sub> < 1; T<sub>4</sub> < 0.4; TSH:0.47) was detected in the patient, thyroid replacement was initiated. Methylprednisolone (MP) was initiated to the patient who had hypotension, hyponatremia, hypoglycemia and cafe au lait spots on the lateral side of left leg with the consideration of SAI.

50<sup>th</sup> day patient was transferred to internal medicine.

Since levels of estrogen, progesterone, LH and FSH were found to be low, patient was considered as PHP. Partial empty sella was detected on MRI. She was discharged by prescribing MP, levothyroxine, Ca+ and Mg cachet.

On the control visit, patient was considered to be healthy, mobilized and able to perform daily activities.

Early diagnosis and timely intervention is essential in patients presented with these symptoms and SAI have to be kept in mind.

Via considering the diagnosis of the patients, performing differential laboratory tests will shorten the process of diagnosis and treatment.

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1. Empty sella in children as a key for diagnosis. *BrainDev* 2001;23:422-3  
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## 12AP3-9

### Analysis of genetic factors influencing the outcome of pneumonia induced sepsis

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**Background and Goal of Study:** Sepsis syndrome is a leading cause of death in the critically ill. Nucleotide polymorphisms, taking part in the inflammatory response, may explain the variable survival rates observed during similar infections. We investigated the effect of functionally relevant 4G/5G polymorphism of the *PAI-1* gene and the influence of AH8.1 (ancient haplotype 8.1) carrier state in regard of the severity and mortality of pneumonia induced sepsis.

**Materials and Methods:** 208 Caucasian patients with severe sepsis due to pneumonia, admitted to an ICU were enrolled in the study between June 2004 - June 2007. The *PAI-1* 4G/5G polymorphism was genotyped and the AH8.1 carrier state was determined in 207 patients. Patients stratified according to the occurrence of multiple organ dysfunction syndrome (MODS), septic shock or death were followed up until ICU discharge or death.

**Results and Discussion:** Carriers of the *PAI-1* 4G/4G and 4G/5G genotypes had a 2.74-fold higher risk for MODS (OR 95%CI=1.335-5.604; p=0.006) and a 2.57-fold higher risk for septic shock (OR 95%CI=1.180-5.615; p=0.018) than 5G/5G carriers.

The multivariate logistic regression analysis adjusted for independent predictors (age, nosocomial pneumonia and positive microbiological culture) also supported that carriers of the 4G allele had a higher prevalence of MODS (aOR=2.957; 95%CI=1.306-6.698; p=0.009) and septic shock (aOR=2.603; 95%CI=1.137-5.959; p=0.024). Genotype and allele analyses did not show significant difference regarding mortality. The length of ICU stay of non-survivors was longer (p=0.091), fewer ventilationfree days (p=0.008) and days without septic shock (p=0.095) were observed during the first 28 days in 4G allele carriers.

In patients without chronic obstructive pulmonary disease (COPD), septic shock occurred significantly less frequently (OR=0.3383; 95%CI=0.1141-0.995; p=0.043) in carriers of AH8.1, than in non-carriers. According to the multivariate logistic regression analysis, AH8.1 had an independent protective role against septic shock in all patients (OR=0.315; 95% CI=0.100-0.992; p=0.048), particularly in COPD-free patients (OR=0.117; 95% CI=0.025-0.554; p=0.007).

**Conclusion(s):** In Caucasian patients with severe sepsis due to pneumonia carriers of the 4G allele of *PAI-1* polymorphism have higher risk for MODS and septic shock, and show more fulminant disease progression. AH8.1 may confer protection against the progression of bacterial infection.

## 12AP4-1

### Prognostic value of nutritional and inflammatory markers in severe malnourished patients

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**Background and Goal of Study:** Malnutrition and inflammation parameters are strongly correlated with prospective hospitalization duration and mortality. In this study, we determined NRS-2002 score, serum prealbumin, albumin, CRP and ferritin levels as indicators of prognosis in severe malnourished patients.

**Materials and Methods:** Total of 397 tertiary intensive care unit patients with NRS-2002 score ≥ 3 and total parenteral nutrition supplementation were included in the study.

Patients were divided into two groups based on whether they are discharged from intensive care unit (group 1) or deceased (group 2). Patients were evalu-

ated at hospitalization (initial) and prior to patients' discharge or death (last).

**Results and Discussion:** Mean duration of intensive care unit hospitalizations in group 1 and 2 were  $11.97 \pm 10.57$  and  $13.43 \pm 12.67$  days respectively. NRS-2002 score decreased at last measurement in group 1. Initial and last measurements of CRP levels of group 2 were significantly higher than the CRP levels of group 1. Ferritin level was significantly higher in last measurement of group 2 than that of group 1. Initial and last prealbumin and albumin levels of group 2 were significantly lower than prealbumin level of group 1.

	Group 1 (Discharged group)			Group 2 (Deceased group)		
	Initial	Last	P value	Initial	Last	P value
CRP (mg/dL)	$8.01 \pm 0.52$ (n=269)	$7.61 \pm 0.63$ (n=135)	0.463	$10.87 \pm 0.99$ (n=98)	$14.68 \pm 1.70$ (n=50)	0.02
Ferritin (ng/mL)	$290.13 \pm 62.69$ (n=250)	$253.91 \pm 25.51$ (n=111)	0.008	$472.91 \pm 173.85$ (n=87)	$639.08 \pm 113.24$ (n=35)	< 0.0001
Albumin (g/dL)	$3.11 \pm 0.03$ (n=288)	$2.92 \pm 0.04$ (n=151)	0.0002	$2.74 \pm 0.06$ (n=101)	$2.32 \pm 0.09$ (n=51)	< 0.0001
Prealbumin (mg/dL)	$11.83 \pm 0.45$ (n=179)	$12.18 \pm 0.52$ (n=120)	0.595	$10.01 \pm 0.67$ (n=64)	$8.37 \pm 0.55$ (n=42)	0.166

[Biochemical parameters]

Albumin was found to be the most specific predictor of mortality determination with 91% specificity, 86% sensitivity. Sensitivity of prealbumin was found to be 59% for assessing the malnutrition with a specificity of 70%. Specificity for using CRP as an indicator of mortality was 87% with 93% sensitivity. Ferritin levels were not significant predictors of malnutrition prognosis.

The statistical analysis was performed using Graph Pad Prism (USA). Comparisons between two groups were assessed by means of Mann-Whitney U test and Spearman's correlation analysis for non-parametric variables. Receiver operating characteristic (ROC) curve analysis was used to calculate sensitivity and specificity levels.

**Conclusion(s):** Serum albumin, prealbumin and CRP levels were shown to be associated with mortality prediction.

## 12AP4-2

### Prognostic value of procalcitonin as a predictor of postoperative complications and mortality in lung transplantation

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**Background and Goal of Study:** It remains unclear the role of procalcitonin as an earlier predictor of postoperative complications in lung transplantation. The goal of our study was to determine the prognostic value of procalcitonin during the immediate postoperative period of lung transplant surgery.

**Materials and Methods:** We performed a retrospective study focused on 63 patients who underwent lung transplantation between December 2009 and November 2011. We excluded 6 patients: 3 had missing data, 1 heart-lung transplantation and 2 intraoperative deaths. Procalcitonin serum levels (PCT) were measured on admission in ICU and on postoperative days 1-7. Transplant recipients were divided in three groups: Group 1 involved patients with PCT levels < 2 ng/mL, Group 2 patients with PCT levels 2-5 ng/mL and Group 3 included patients with PCT levels > 5 ng/mL. Lung recipients were followed up during ICU stay. Clinical outcome measured as prolonged mechanical ventilation, reintubation, rejection, surgical reintervention, early renal replacement therapy and mortality was collected.

**Results and Discussion:** 57 patients were included, 38 male (66.6%) and 19 female (33.3%) with mean age of  $51.98 \pm 12.8$ . Of these patients, 42 (73.6%) underwent double lung transplantation, and 15 patients (26.3%) one lung transplantation. A total of 20 patients (35%) had PCT > 5 ng/mL. Prolonged mechanical ventilation (>72 hours), reintubation and tracheostomy were higher in Group 3 ( $p = 0.002$ ,  $p = 0.015$  and  $p = 0.023$  respectively). Group 3 showed higher rates of rejection than Group 1 and 2 (35% vs 3.8 and 18.2%,  $p = 0.023$ ). 30% of patients in Group 3 required renal replacement therapy compared to 7.7% and 9.1% in Group 1 and 2 ( $p = 0.096$ ). Mortality in ICU was higher in Group 3 than in Group 1 or 2 (45% vs 3.8% or 9.1% respectively,  $P = 0.001$ ). We did not find significant correlation between procalcitonin serum levels and colonization of tracheobronchial aspirates which could be associated with an increased risk of infection.

**Conclusion(s):** We suggest that elevated procalcitonin serum levels (>5 ng/mL in our study) on the first postoperative week, could predict significant postoperative morbidity and short-term mortality. Serial monitoring of procalcitonin levels could be an important tool to predict clinical outcome and management. More studies are needed to test this hypothesis.

## 12AP4-3

### The effect of ultra-early enteral nutrition after esophagectomy on the prevention of intestinal mucosa atrophy and management of blood glucose

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**Background and Goal of Study:** Esophagectomy is a highly invasive procedure, and nutritional support is an important factor to reduce perioperative complications. Postoperative enteral nutrition via the jejunostomy tube is widely performed. However, there is no evidence regarding the time of initiation of enteral nutrition in esophagectomy. Hence, we aimed to determine the optimal timing of initiation of enteral nutrition from the perspective of intestinal function and glucose management. We hypothesized that, compared to early enteral nutrition, ultra-early enteral nutrition contributed to the prevention of intestinal mucosa atrophy and management of desirable blood glucose levels. We used a prospective randomized trial to investigate this hypothesis.

**Material and Methods:** We enrolled patients who underwent esophagectomy. The jejunostomy tube was inserted into the jejunum of all patients. The patients were randomly divided into 2 groups. In group E (ultra-early enteral nutrition), enteral nutrition was administered immediately after intensive care unit (ICU) admission for 12 h, at a dose of 30 ml/h (30 kcal/h; 360 kcal/12 h). In group T (early enteral nutrition), parenteral nutrition was administered for the same period at a dose of 54 ml/h (30 kcal/h; 363 kcal/12 h), but enteral nutrition was not given during the first 12 h. After 12 h of ICU admission, both groups received the same parenteral and enteral nutritional therapy. Prealbumin, transferrin, retinol-binding protein (RBP), and diamine oxidase (DAO) levels were measured on preoperative day 1, immediately after ICU admission, and on postoperative days 1, 2, and 7. Blood glucose was maintained around 150 mg/dl by using an artificial pancreas and insulin consumption during the first 12 h was recorded.  $P < 0.05$  was considered statistically significant.

**Results and Discussion:** We enrolled 22 patients (11 in 2 groups). Patient background, anesthesia management, and surgical procedures were similar in the 2 groups. Prealbumin, transferrin, RBP, and DAO levels were also similar. Insulin consumption was significantly lower in group E than in group T ( $30.1 \pm 12.0$  vs  $37.6 \pm 7.8$  U;  $P = 0.04$ ). These data showed that a difference of 12 h did not influence the intestinal mucosa and nutritional conditions.

**Conclusion:** Blood glucose management is easier in ultra-early enteral nutrition than in early enteral nutrition after esophagectomy. The former method might contribute to optimal blood glucose management.

## 12AP4-4

### The intra-abdominal pressure and respiratory function in patients after repair of ventral hernia

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**Goals of Study:** To determine the influence of intra-abdominal pressure (IAP) on respiratory function after ventral hernia repair (VHR) and to compare the different methods of IAP measurement.

**Materials and Methods:** Twenty adult patients after VHR were enrolled into a prospective study and received monitoring of IAP via gastric tube (CiMON, Pulsion Medical Systems, Germany) and urinary catheter (UnoMeter Abdo-Pressure Kit, (UnoMedical, Denmark). The measurements included also arterial blood gases (ABL 550, Radiometer, Denmark) and end-tidal  $\text{CO}_2$  (Et $\text{CO}_2$ , Orion MicroCap, Israel). The study had following stages: after tracheal intubation, after VHR, at the end of surgery, during spontaneous breathing through the endotracheal tube, and at 1 hour after tracheal extubation. Data are presented as median [25<sup>th</sup> - 75<sup>th</sup> percentiles]. Statistical analysis was performed using Wilcoxon signed-rank test. The Spearman correlation coefficient ( $\rho$ ) and Bland-Altman analysis were used for assessing the agreement between two methods of IAP measurement.

**Results and Discussion:** The mean age of patients was 58 [51 - 68] yrs. During VHR, IAP increased by 40% from baseline ( $p < 0.05$ ) that can be explained by the tension of abdominal wall. The maximal rise of IAP was observed during spontaneous breathing through the endotracheal tube (10 [8 - 12] mm Hg vs. 5 [4-7] mm Hg before the surgery;  $p = 0.01$ ). In parallel, the gradient between Pa $\text{CO}_2$  and Et $\text{CO}_2$  ( $\Delta\text{PaCO}_2\text{-EtCO}_2$ ) rose significantly, peaking during spontaneous breathing. Oxygenation index (Pa $\text{O}_2/\text{FiO}_2$ ) decreased to 330 [290-442] mm Hg to the last stage ( $p = 0.02$ ), possibly due to deterioration of pulmonary function caused by increased IAP.

At all study stages, we revealed a significant correlation between two methods of the IAP measurement ( $\rho = 0.67\text{-}0.8$ ,  $p < 0.01$ ). The mean bias be-

tween gastric and urinary methods of IAP monitoring during the study varied from -0.02 mm Hg (SD 4.2 mm Hg) to 0.83 mm Hg (SD 2.7 mm Hg).

**Conclusion:** The surgical repair of ventral hernia is accompanied by 2-folds rise in IAP and parallel increase of  $\Delta\text{PaCO}_2\text{-EtCO}_2$  followed by decline in arterial oxygenation. These changes can be explained by the deterioration of respiratory function after the increase of IAP. The measurements of IAP using gastric tube and urinary catheter demonstrate a good agreement between both methods.

## 12AP4-5

### A new system to predict operative mortality in patients undergoing cardiac surgery: PCSS (Post Cardiac Surgery Scale)

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**Background and Goal of Study:** Nowadays, the most popular systems to evaluate the risk of mortality after a cardiac surgery (EuroSCORE, ACEF) take into account preoperative patient's parameters. As we think intraoperative factors may change the patient's risk profile, shouldn't be parameters recruited on the arrival at the intensive care unit (ICU) better to predict operative mortality in this kind of patients?

The goals of this study were

1) to find a relationship between general parameters of organ function on arrival at the ICU and patient's in hospital (90 days) mortality rate after a cardiac surgery and

2) to develop a new system to predict operative mortality after this kind of surgery.

**Materials and Methods:** We conducted a prospective study. 929 patients who had undergone a cardiac surgery were included.

We used logistic EuroScore and ACEF (using preoperative organ function parameters of patients) and APACHE II (using the 24 hour worst organ function parameters of patients) to predict patient's operative mortality risk. Several parameters recorded on the arrival at the ICU were explored looking for an univariate and multivariate association with in hospital mortality (90 days).

**Results and Discussion:** In-hospital mortality (90 days) was 9%. 6 of the parameters analyzed were considered to be independent factors of mortality. So this six postoperative parameters were included in the mortality risk model and conform our new system to predict in-hospital mortality risk profile (PCSS): Creatinine, mean arterial pressure, heart rate, troponin T, lactate and International Normalized Ratio (INR).

Our new system to predict operative mortality risk after a cardiac surgery was compared with 4 other systems for the same purpose. The best accuracy to predict in-hospital mortality was achieved by PCSS. The area under the ROC curve of the different systems analyzed were 0,890 (PCSS), followed by 0,768 (APACHE II), 0,754 (logistic EuroSCORE), 0,714 (standard EuroSCORE) and 0,699 (ACEF score).

**Conclusion(s):** Our new system to predict operative mortality risk of patients undergoing a cardiac surgery is better than others used for this purpose (APACHE II, logistic EuroSCORE, standard EUROSCORE, and ACEF score)

## 12AP4-6

### The impact on drug mass flow rate of interrupting and resuming carrier fluid flow: an *in vitro* study on a multi-lumen infusion device

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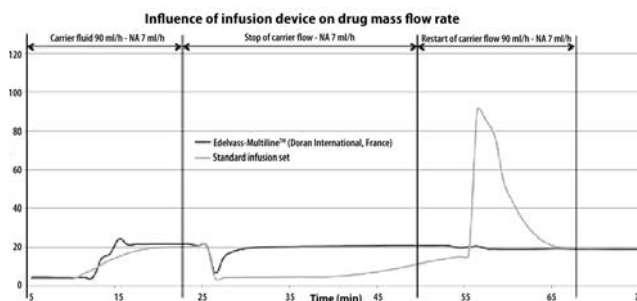
**Background and Goal of Study:** Stopping and resuming carrier fluid flow can lead to hazardous disturbances in drug delivery. The present study was designed to assess *in vitro* whether using a multi-lumen infusion device can prevent these disturbances.

**Material and Methods:** Two infusion devices were studied. The one was standard set with a four stopcocks manifold and 1.5m extension line (dead-volume space  $V=11.6\text{mL}$ ). The other was a nine-lumen infusion device (Edelvaiss-Multiline™, Doran International, France) with eight accesses connected to nine separate lumens in a single tube of 150cm, seven accesses connected to peripheral lumen ( $V=0.9\text{mL}$  for each one) and one for the carrier fluid access connected to two lumens ( $V=2.9\text{mL}$ ).

The protocol was performed with a carrier fluid flow of 90ml/h associated with noradrenaline infused at 7ml/h. During the protocol, the carrier fluid was stopped and resumed at the same rate 30 minutes later. Effluent noradrena-

line concentration was measured continuously using UV spectrophotometry ( $n=5$  trials). Flow change efficiency (FCE) was calculated from the ratio of the area under the experimental mass flow rate curve to the area under the theoretical instantaneous mass flow rate curve for the two devices. The Mann-Whitney U test was used to compare FCE.

**Results and Discussion:** Using standard set, two major phenomena were observed: sudden decrease in drug delivery after stopping carrier flow and sudden temporary increase after resuming it (Figure 1).



[Figure 1]

FCE was significantly different using both infusion sets during the 10-minute period after interrupting carrier fluid flow (standard set vs. nine-lumen infusion set (mean value  $\pm$  SD):  $24.2\% \pm 2.3\%$  vs.  $98.4\% \pm 11.5\%$ ;  $p=0.008$ ) as well as during the 10-minute period after restarting it ( $253.5\% \pm 13.7\%$  vs.  $102.6\% \pm 9.8\%$ ;  $p=0.008$ ).

**Conclusion:** The use of the Edelvaiss-Multiline™ device instead of a standard set considerably attenuates disturbances in drug delivery during stop-and-go carrier fluid flows.

## 12AP4-7

### A retrospective audit against national standards in the use of enteral versus parenteral nutrition in the management of acute severe pancreatitis

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**Background and Goal of Study:** Management of acute severe pancreatitis shows wide variation throughout the UK, including the provision of nutritional support.

Although the evidence is not conclusive to support the use of enteral nutrition in all patients, UK guidelines recommend that the enteral route should be attempted first, particularly nasogastric, if tolerated [1].

Our goal was to assess the management of patients on our HDU/ICU with acute severe pancreatitis in terms of nutritional support against these national guidelines.

**Materials and Methods:** A retrospective review of case notes of all patients with acute pancreatitis admitted to HDU/ICU in a District General Hospital, over a four year period.

**Results and Discussion:** A total of 51 admissions over set period. Of these:

- 36 (70.5%) had a nutritional assessment during admission. 15 did not.
- mean time from diagnosis to nutritional review was 3.8 days.
- of the 36 reviewed, 33 (91.6%) patients required additional nutritional support.
- of those not reviewed, 3 patients required additional support.
- in total 70.5% patients required nutritional support. Of these 36 patients - 20 via TPN (55%); 14 (38.8%) via enteral route (11 NG; 3 NJ); 1 patient died prior to support; 1 patient, support not started.
- no more likely to receive enteral nutrition after a dietician review.
- of the 20 that received TPN, enteral nutrition was not trialled first in any patient.

Our results show lack of adherence to the UK guidelines - most notably the small proportion of patients receiving nutrition via the enteral route. Also, importantly, no patient who ultimately received TPN had enteral nutrition trialled first. In this high risk group of critical care patients, not all patients were reviewed by a dietician.

**Conclusion(s):** Early nutritional support plays an important role in ensuring optimal and quicker recovery in acute pancreatitis [2]. Adequate and timely assessment of nutritional requirements in these patients on HDU/ICU is vital to identify those at risk. As UK guidelines recommended, enteral nutrition should be at least attempted in these patients, with NG feeding proving to be effective in up to 80% of cases [1].

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**Acknowledgements:** None.

**12AP4-8****Glucose variability and preoperative fasting as determinants of post-operative complications after major general surgery**

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**Background and Goal of Study:** Hyperglycemia is common in patients undergoing major surgery and is related to a delay in wound healing and increased risk of post-surgical infections. A prolonged preoperative fasting may be related both to hypoglycemia and insulin-resistance mediated hyperglycemia, ie, glycaemic instability as measured by the glucose variability (GV). The aim of the study was to evaluate the influence of duration of preoperative fasting on glucose variability and rate of complications.

**Materials and Methods:** All patients who underwent major abdominal surgery between 01/06/2011 and 30/06/2011 were considered. Exclusion criteria were diabetes mellitus/abnormal glucose metabolism and intraoperative infusion of glucose solutions. GV was defined as the ratio between standard deviation and mean of glycaemic values collected for each patient from the time of induction up to 48 hours after end of surgery. A correlation between GV and duration of fasting was searched with Pearson's analysis. Differences in GV among complicated patients and controls were searched with Student-t test. Moreover, differences in duration of preoperative fasting between patients with high or low glycaemic instability were searched with Student-t test. A  $p < .05$  was considered as statistically significant for all tests.

**Results and Discussion:** A total of 41 patients were considered for the study. Pearson's analysis showed a positive correlation between duration of preoperative fasting and GV ( $r=0.44$ ). GV was higher in patients with complications than controls ( $22.2\% \pm 7.2$  vs.  $15.4\% \pm 7.4$ , respectively,  $p < .05$ ). In patients with  $GV < 20\%$  (low GV), rate of complications was 53%, while in those with  $GV > 20\%$  (the high GV) the rate was 82%. In both sub-groups, duration of fasting was significantly higher among complicated patients than controls ( $11.3$  hrs  $\pm 2.4$  vs.  $8.6$  hrs  $\pm 0.9$  for the low GV pts. and  $12.3$  hrs  $\pm 3.6$  vs.  $8.5$  hrs  $\pm 0.6$  for the high GV pts.,  $p < .05$ ).

**Conclusion(s):** Glycaemic instability, measured as glucose variability, is proportional to durations of preoperative fasting in patients undergoing major abdominal. High GV is significantly associated with occurrence of postoperative complications.

A long preoperative fasting correlated to the occurrence of postoperative complications, particularly in patients with high glycaemic instability.

**12AP4-9****Liver transplantation for fulminant hepatic failure due to *Amanita phalloides*: mortality in 13 years of anesthesiologic practice. Giving a chance to survival**

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**Background:** Acute hepatic failure (AHF) by *Amanita phalloides* is a rare clinical entity, with devastating results (mortality rate 70 to 90%)<sup>(1)</sup>. This work refers to a case report series of hepatic transplantation after amatoxin intoxication, between 1997 and 2010.

**Case report:** Eight patient series. Anesthetic technique according to protocol of the transplant unit (induction: thiopental, fentanyl, succinylcholine; maintenance: isoflurane (50%)/sevoflurane (50%), fentanyl and vecuronium). Invasive arterial pressure and central venous pressure were monitored. Pulmonary arterial catheterization with Swan-Ganz catheter was made on the adult population. Intracranial pressure was not monitored. Vasopressor support with dopamine (75%) or dopamine plus norepinephrine (25%) was needed. Recovery was assured on hepatic transplantation unit. Post-operative mortality rate was 62.5%.

**Discussion:** Although it's a heterogeneous population in gender and age, all transplanted patients were submitted to identical medical-anesthetic approach and intensive care. The majority of patients were transplanted 6 days after the intoxication; at hospital admission they had oliguric acute renal failure and were compliant with Clichy criteria<sup>(2)</sup>, and at 48h with Kings College criteria<sup>(2)</sup>. Higher degree of pre-operative encephalopathy seems associated with more severe circulatory dysfunction and poorer prognosis. Intracranial

pressure monitoring is controversial<sup>(3)</sup>. The exact timing for transplantation isn't defined and there are no prognostic criteria with absolute value. The poor prognosis of this pathology makes transplantation inevitable as a life-saving therapy<sup>(3)</sup>. Considering that our patients had additional factors of poor prognosis such as ingestion to symptoms time > 8H, protrombinemia < 10% by day 4 and serious dysfunction pre-transplantation, and considering that the average time to obtain a liver after a superurgent appeal was 2 days according to our national transplantation system, it can be assumed that early transplantation is possible and could provide additional benefit in survival. We can improve our practice.

**References:**

1. *Curr Opin Organ Transplant* 2010;15:368-373.
2. *Journal of Hepatology* 2004; 40:192-197.
3. *Hepatology* 2005;41:1179-1197.

**Learning points:** Besides aggressive medical therapy and hemodynamic support, it's imperative to be alert to poor prognosis criteria in order to anticipate the decision of transplantation and give a chance to survival with the minimum morbidity.

**12AP4-10****High prevalence of significant hypophosphatemia in patient undergoing reconstructive surgery for head and neck cancers**

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**Background and Goal of Study:** Excision of tumor with microsurgical free flap reconstruction (FFR) is a leading treatment of head and neck cancers. FFR is a long complex procedure accompanied by significant complications including electrolytes derangements. Phosphorus is an essential element for all living cells.

Although often asymptomatic, hypophosphatemia (HP) may lead to multiple of symptoms including fatal cardiac and respiratory failure. In general hospitals population prevalence of HP ranges between 2.2 and 3.1%. HP found much common of patients after cardiac (34%) and after hepatic surgery (up to 100%). Prevalence of HP after FFR has not been reported. Goal of the study was to determine prevalence of clinically significant (moderate and severe) HP in patients undergoing FFR surgery.

**Materials and Methods:** After obtaining REB approval we prospectively studied 55 consecutive patient undergoing FFR. Exclusion criteria was renal insufficiency with creatinine level > 200  $\mu\text{mol/L}$ .

Anesthetic management was done according to current standards of practice for FFR surgery. Blood samples were collected at the PACU admission, 24, 48 hours thereafter, and on day 14<sup>th</sup> after the surgery. Plasma was separated by a centrifuge within 1 hour after collection and analyzed with Abbott Chemistry C8000 analyzer (Abbott Laboratories, Abbott Park II, USA). The normal range of serum phosphate was 0.81-1.45 mmol/L. HP was defined as mild 0.66-0.81 mmol/L, moderate 0.32-0.65 mmol/L, and severe < 0.31 mmol/L. Data were presented as the mean  $\pm$  SD. Statistical analysis was performed using analysis of variance.

**Results and Discussion:** Fifty one patients (93%) developed HP after FFR with the nadir of  $0.59 \pm 0.14$  mmol/L at 48 hours after surgery ( $p < 0.001$  comparing to levels of plasma phosphate at the PACU admission, 24 h, and on day 14<sup>th</sup> after FFR) (Figure 1). HP was mild moderate and severe in 16%, 72%, and 5% of patients respectively. Phosphate level returned to normal range at day 14<sup>th</sup> after FFR. We found moderate and severe HP in 77% of patients undergoing FFR. This severity of HP should warrant prompt therapy. However it is remains unclear whether HP actually contributes to morbidity or is a marker for severity of perioperative illness.

**Conclusion(s):** Clinically significant HP is common after FFR surgery. The nadir of HP appeared to be delayed to 48 h after the surgery. Ability of treatment of HP to improve outcome after FFR should be addressed in further RCT.

**12AP4-11****High risk factors in locomotor trauma for the appearance of fat embolism syndrome and the role of drug and surgical prophylaxis in reducing the incidence**

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**Goal:** To determine the group of patients with high risk. To highlight the role of drug and surgical prophylaxis in reducing the incidence.

**Material and Methods:** The study included 7763 patients with fractures of the extremities treated QKT - SUQU the period 2007 - September 2011. Patients were randomized into three groups: Gr.1. prophylaxis group with metilpred-



nisolon 2159 pt ; Gr 2. anticoagulant prophylaxis group with 4178 pt ; Gr3. group without prophylaxis 1426 pt>Data were analyzed: incidence of FES at gr.1; gr.2; gr.3. The incidence in patients operated 24 h before trauma and after the first 24h. Incidence by sex, age, and type of fractures, closed or open.

**Results:** The incidence of FES at gr.1 = 0.64%; gr.2 = 1.8%; gr.3 = 6.5%. Changing incidence between gr.1 and gr.2; gr.3 is significant. OR = 2.88 1:58 < OR < 5:33 P = 0.0001475

Changing incidence of FES between Pt' of group operated the first 24 hours compared with gr.of Pt' operated after 24 hours ,is significant. OR = 1.76 1:04 < OR < 2.95 P = 0.0237522

FES incidence is higher in the age group 21-40 years, male, in fractures of the lower extremities, closed.

**Conclusions:** Corticosteroids have a prophylactic effect in reducing the incidence of FES. Early fixation of fractures reduces the incidence of FES. High-risk patients, ages 21 to 40 years old, male, closed fractures, the lower extremities.

## 12AP5-1

### Delirium assessment in postoperative patients: validation of the Portuguese version of the Nursing Delirium Screening Scale in critical care

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**Background:** Postoperative delirium occurs commonly in critical care patients and has been associated with poor hospital outcomes and higher mortality. Assessing delirium with a validated and reliable instrument is recommended for early and effective management. The aim of this study was to validate the Portuguese version of the Nu-DESC for its use in critical care settings.

**Methods:** The Nu-DESC was formally translated and back-translated in accordance with available guidelines. All postoperative patients admitted to a PACU over a 1-month period were enrolled. Each patient was independently assessed for delirium using the Nu-DESC and the Intensive Care Delirium Screening Checklist (ICDSC) within the first 24 hours of admission by both a physician and one of the PACU bedside nurses. The internal consistency of the Nu-DESC was evaluated using Cronbach's alpha. The diagnostic accuracy of the Nu-DESC was determined using sensitivity, specificity and ROC curve analyses with 95% confidence intervals (95%CI). Agreement between nurses' and physicians' ratings was also evaluated using Intraclass Correlation Coefficient (ICC).

**Results:** 78 patients eligible for the scale-rating were enrolled. Delirium was present in 21 patients based on the ICDSC. With ICDSC ratings as the gold standard, the Nu-DESC possessed a sensitivity of 100% (95% CI = [75%,100%]) and a specificity of 86% (95% CI = [76%,93%]). All delirious patients were correctly detected by both physician and nurses for all Nu-DESC ratings. There were no significant differences between area under the curve (AUC) for physician ratings, (AUC=0.985, 95%CI=[0.928,0.999]), and nurses ratings (AUC=0.979, 95% CI=[0.918,0.998]). The Cronbach's alpha of the Nu-DESC was high for both physician's (0.81, 95%CI=[0.73,0.87]) and nurses's ratings (0.79,95%CI=[0.71,0.85]). Proportions of agreement between physician and nurses and the research staff for the Nu-DESC items were all high (>0.96) and kappa ranged from 0.79 to 0.93. ICC between physician and nurses for the total Nu-DESC score was 0.98 with (95% CI = [0.96 to 0.99]). The Nu-DESC took less than 1 minute to complete.

**Conclusions:** The Portuguese version of the Nu-DESC appears to be an accurate and reliable assessment instrument for delirium in critical care settings, whether rated by physicians or nurses. The Nu-DESC could be an interesting alternative to other instruments that take longer to administer in these fast-paced settings.

#### References:

1. Anasth08,43:98-102;2.VHealth05,8:94-104

## 12AP5-2

### Why do patients die on ICU? - an audit of ICU admissions and mortality following the introduction of critical care outreach services

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**Background:** Intensive care units (ICU's) provide intensive observation and treatment for critically ill patients with potentially reversible conditions. Critical care outreach (CCO) services, consisting of ICU nurses and intensive care physicians, aim to identify such patients who may benefit from ICU early in the course of their illness.

We analysed the effect of introducing CCO services in our hospital, to determine the effect on ICU admissions and mortality rates.

**Materials and Methods:** Our study was based at the Lister Hospital, Stevenage, UK - a 480 bed district hospital serving a population of approximately 600,000. Intensive care facilities comprise 6 ICU and 6 HDU beds. We compared admission figures and mortality rates from 2006-07 and 2010-11, representing periods before and after the introduction of CCO. Admissions and mortality data was sourced from the Intensive Care Audit & National Research Centre (ICNARC) database.

**Results:** In the period 2010 - 11 there were 417 separate ICU admissions. Accounting for re-admissions, 396 individual patients were admitted. In comparison, the period 2006-07 saw 320 separate admissions, consisting of 299 patients. During the period 2010-11, there were 121 (31%) deaths on ICU, compared to 111 (37%) in 2006-07. Of patients who died in ICU, the median length of ICU stay was 2 days (IQR 2-6 days) and median APACHE II score was 21 (IQR 18-25). The majority of patients died on ICU due to the initial clinical insult for which they were admitted (81%), rather than a complication of ICU stay (7%) or a co-morbid illness (12%).

**Discussion:** There were a greater number of admissions to our ICU in the period 2010 -11 compared to the period 2006-07 (417 vs. 320). Despite the greater number of admissions, the proportion of patients dying on ICU was smaller (31% vs 37%). There was no change in bed capacity in the intervening years. The main change in service delivery has been the introduction of critical care outreach teams. This service allows early identification of critically ill patients and timely involvement of intensive care physicians. Patients who have suffered an acute deterioration are offered the best opportunity for survival by accessing ICU facilities.

**Conclusion(s):** Our figures suggest that one consequence of the introduction of critical care outreach services has been an increased throughput of patients admitted to ICU with proportionally fewer deaths.

## 12AP5-3

### Sedation with sevoflurane in postoperative cardiac surgery: influence on troponin T and creatinine values

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**Background and Goal of Study:** To investigate the effects on markers of myocardial damage (Troponin T) and renal function (creatinine) of prolonged sevoflurane administration versus sedation with propofol during the postoperative period of cardiac surgery with extracorporeal circulation

**Materials and Methods:** Prospective study with sequential selection of patients undergoing coronary or coronary and valvular surgery. Intraoperative anesthetic maintenance was performed with sevoflurane and remifentanyl, establishing two subsequent groups of sedation with sevoflurane (S) through the Anaconda® device and sedation with propofol (P). The goal of sedation was fixed through bispectral index among 60 and 80. Minimum length of sedation was 120 minutes, with markers of myocardial damage and creatinine being determined at 4, 12, 24 and 48 hours after surgery and prior to hospital discharge.

**Results and Discussion:** We analyzed data from 129 patients, 62 sedated with propofol and 67 with sevoflurane. The analysis of Troponin T (TnT) values showed significant differences at 12 and 48 hours after ICU admission. Mean TnT values at 12 hours in groups P and S were 0.89 µg.L-1 (SD = 0.55) and 0.69 µg.L-1 (SD = 0.40), respectively (p = 0.026). Mean TnT values at 48 hours were 0.60 µg.L-1 (SD = 0.46) and 0.37 µg.L-1 (SD = 0.26), respectively (p = 0.007). Creatinine levels were not significantly different between the two groups during these 48 hours up to discharge. No differences were found in the use of inotropic agents or vasopressors between the two groups. The mean length of stay in ICU was 46.7 hours (SD = 31.42) in group P and 44.1 hours (SD 30.3) in group S, p = 0.625. The mean hospital stay between the end of surgery to discharge was 7.5 days (SD 7.3) in group P and 6.5 days (SD 2.9) in group S, p = 0.117. Mortality at 30 days was nil in both groups.

**Conclusion(s):** Prolonged sedation with sevoflurane in the postoperative of cardiac surgery with extracorporeal circulation is a valid alternative to propofol administration resulting in reduced TnT values at 12 and 48 hours after admission in ICU. Although no increase in side effects relating to kidney damage in patients without preoperative renal disease was seen, the lower TnT values did not result in a decreased length of ICU or hospital stay.

## 12AP5-4

### Incidence and risk factors of delirium in critically ill patients after major abdominal surgery

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**Background and Goal of Study:** During recent decades, success of the surgical treatment is defined not only by the absence of postoperative complications and mortality rates, but also by the quality of life of a patient after surgery. Delirium is a common and deleterious complication in critically ill patients after surgery. The purpose of this study was to determine the incidence, risk factors and outcomes of delirium in critically ill patients after major abdominal surgery.

**Materials and Methods:** All patients (n=80) undergoing major abdominal surgery from January 2010 to January 2011 were investigated prospectively. The diagnosis of delirium was made based on the Diagnosis and Statistical Manual of Mental Disorders. The patients were grouped into two according to the presence (group I) or absence (group II) of delirium. Data on pre-, per- and postoperative factors, and the adverse outcomes were analysed.

**Results and Discussion:** 32 patients (40%) developed delirium. The patients who developed delirium were older (68+/-17 vs 60+/-15 years, p=0.05), had a longer operation time (5+/-1 vs 4+/-2h, p=0.015) and hospital stay (11+/-9 vs 7+/-5 days, p=0.019). The morbidity and mortality rates were not significantly different between the groups (77% vs 46%; 10% vs 1%, respectively). The causative factors in the development of delirium were older age, longer operation time, abnormal serum chemistry values of sodium, potassium, calcium and glucose, hypoalbuminaemia, the presence of the postoperative respiratory distress and infection and blood transfusion (p < 0.05).

**Conclusion(s):** Delirium is associated with adverse outcomes including a longer hospital stay, and increased morbidity and mortality rates. The identification, detection and elimination of these risk factors are recommended.

## 12AP5-5

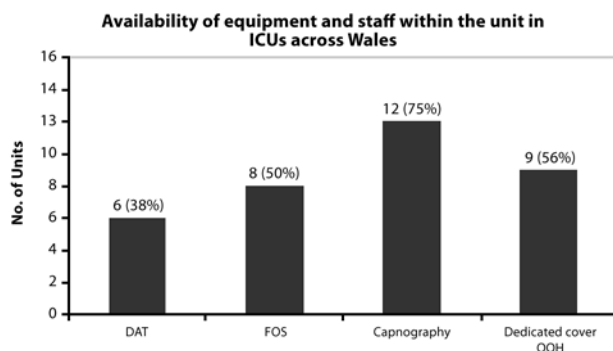
### A survey of Welsh intensive care unit standards based on the Fourth National Audit Project

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**Background and Goal of Study:** The Fourth National Audit Project (NAP4) of the Royal College of Anaesthetists[1] looked at the major complications of airway management in the UK. At least one in four major airway events were in Intensive Care Units (ICU) or the emergency department. These events were more likely to lead to permanent harm or death than those in anaesthesia. Analysis of these cases identified gaps in care that included inadequate provision of equipment and skilled staff to manage these events successfully. We therefore decided to survey all Intensive Care Units in Wales to assess whether they comply with the standards set in the NAP4.

**Materials and Methods:** A telephone survey of the 16 adult ICUs in Wales was conducted during December 2011. We contacted a lead clinician to respond to an anonymous questionnaire. Our goal was to find out about the immediate availability of difficult airway trolleys (DAT), fiberoptic scopes (FOS) and the availability of capnography for all ventilated patients. Additionally, we investigated the provision of staff that covered only ICU out of hours (dedicated cover), time taken for equipment to become available and the grades of staff covering ICU.

**Results and Discussion:** All 16 ICUs responded (100%). The data is presented in the graph.



[Availability of equipment and staff]

The majority of the ICUs in Wales did not have a DAT on the unit. DAT and FOS were alternatively available from theatre, however the time taken to access them varied. Dedicated ICU cover was not available out of hours (OOH) in 44% of units. We noted that this OOH cover was occasionally provided by anaesthetists with less than two years training.

**Conclusion(s):** Significant numbers of ICUs in Wales have not yet taken on board the implications of the NAP4 findings. Our survey will hopefully encourage ICUs to make changes that can potentially improve the safety of airway management.

#### References:

1. Cook TM, Woodall N, Harper J, Benger J. *British Journal of Anaesthesia* 2011; **106**: 632-42.

## 12AP5-6

### Readmissions to a cardiothoracic intensive therapy unit

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**Background:** Readmission to ITU is associated with increased mortality.<sup>1</sup> A paper by Rosenberg<sup>1</sup> showed readmitted cardiac surgery patients did worse but predictors were poorly understood. Litmathe<sup>2</sup> found valve and valve/coronary artery bypass graft (CABG) procedures were readmitted more frequently, usually with respiratory failure. The quoted mortality was 14.4%. Little data exists for thoracic readmissions. A prospective evaluational study was designed to determine causes of readmission to a cardiothoracic ITU.

**Methods:** The inclusion criterion was cardiothoracic patients previously in a critical care area. Unplanned admissions from other trusts and aortic surgery patients were excluded. Data was collected about timing and physiological parameters at initial discharge and on readmission. Patients were followed to discharge.

**Results:** No patients were discharged prematurely based on physiological parameters.

Patient Group	Number Patients	LOS on ward (SD) (Days)	LOS ITU (SD) (Days)	Respiratory Failure	Renal Failure	Others	Mortality Rate
Cardiac	31	6.29 (+/-6.75)	6.17 (+/5.75)	11	5	15	10.3%
Thoracic	11	2.36 (+/-1.63)	10.1 (+/-14.4)	7	2	2	45%

[Results]

**Discussion:** Readmission to ITU following cardiothoracic surgery increases mortality. Thoracic patients do particularly poorly. Cardiac mortality rates were lower than those quoted<sup>2</sup> and respiratory failure was the most common cause of readmission in both groups.

Analysis of physiological parameters did not show any consistent predictor of readmission, although it is difficult to draw conclusions from such a small data set. Thoracic patients with renal failure had the worst outcome. An accelerated recovery program involving proactive chest physiotherapy might reduce respiratory failure. The short duration between discharge and readmission in thoracic patients might suggest a more cautious step down could reduce readmissions.

Data will continue to be collected and more information on pulmonary function tests and echocardiography will be included.

#### References:

1. Rosenberg AL, Watts C. Patients readmitted to ICUs: a systematic review of risk factors and outcomes. *Chest* 2000; **118**:492-502
2. Litmathe J, Kurt M, Feindt P et al. Predictors and outcome of ICU readmission after cardiac surgery. *Thor Cardiovasc Surg* 2009; **57**:391-4

## 12AP5-7

### Risk factors for long intensive care unit stay after cardiac surgery. A multivariate analysis

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**Background and Goal of Study:** Prolonged intensive care unit (ICU) stay after cardiac surgery influences outcome and quality of life. There is no consensus definition of prolonged stay in this setting and local factors may play a critical role. In order to identify patients with longer ICU stay as soon as possible, we studied preoperative, intraoperative and early postoperative risk factors.

**Materials and Methods:** We performed a retrospective analysis of prospectively collected data recorded in our Cardiac Anaesthesia Database. For the present study we included all patients operated on of mayor cardiac surgery

for the period 2002-2010. Prolonged ICU stay was defined as an ICU stay equal or longer than 10 days which corresponds to the 90th percentile of our cohort.

We studied preoperative (demographic, comorbidities and treatment), intraoperative (surgical and transfusion) and early (first 24 hours) postoperative variables. Variables associated with a prolonged ICU stay in a univariate analysis were entered into a backward logistic regression model.

**Results and Discussion:** 317 out of 3114 cases had an ICU stay equal or longer than 10 days. 1236 patients had complete data for all the variables studied, 100 with a prolonged ICU stay. Independently associated variables

with the outcome were: preoperative: basal hemoglobin value (OR, 95% confidence interval [CI]) (0,8 0,7-0,9), diuretic therapy (2,3[1,3-4]), left ventricular ejection fraction (0,98[0,97-0,99]), surgical priority (emergent vs other) (3,3[1,2-9,5]); intraoperative: cardiopulmonary bypass time (1,011[1,005-1,017]), and postoperative: >24h mechanical ventilation (8,1[4,9-13,3] and new neurological deficit (6[2,4-15,3])

**Conclusion(s):** In our cohort only basal hemoglobin was a modifiable factor to avoid long ICU stay. Efforts to prevent this outcome should be concentrated on treating preoperative anemia if possible, and weaning from mechanical ventilation the day of surgery.

## Resuscitation and Emergency Medicine

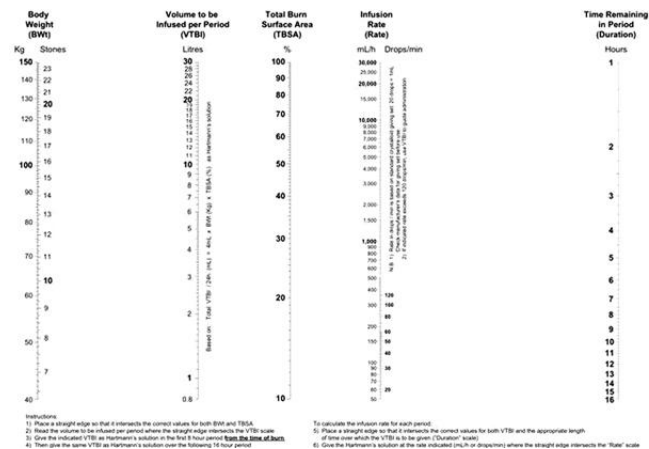
### 13AP1-1

#### Validation of a nomogram to aid fluid resuscitation in adult burns

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**Background and Goal of Study:** We performed a double blinded randomised study to compare the accuracy and speed of three different techniques (pen & paper, electronic calculator and a novel graphic device: "nomogram") for calculation of resuscitation fluid requirements for adults in the first 24hr of burn injury, based on the Parkland formula. We also assessed acceptability of each technique using visual analogue scores and qualitative analysis of free text responses.



[The Parkland Formula Nomogram for Adult Burns]

**Materials and Methods:** 28 participants performed 252 calculations using a series of computer generated simulated patient data sets.

**Results and Discussion:** For nomogram, calculator and pen & paper: Magnitude of error [low ( $\geq 25\%$ ), medium ( $\geq 50\%$ ), high ( $\geq 75\%$ ): [5.9%, 1.2%, 0%], [17.9%, 14.3%, 8.3%], [25%, 16.7%, 9.5%].

Comparison	25% Error	50% Error	75% Error
Calculator vs Nomogram	p=0.015	p=0.001	p=0.002
Calculator vs Pen & Paper	p=0.258	p=0.670	p=0.787
Nomogram vs Pen & Paper	p<0.001	p<0.001	p=0.001
Overall	p=0.002	p<0.001	p=0.002

#### [Likelihood Ratio Test Results]

Calculation time [sec; mean (SD)]: 94(34), 73(31), 214(103); p< 0.001. The mean (SD) of the difficulty scores for calculator, nomogram and pen & paper were 17(14), 23(17) and 70(21) out of 100. Of the 28 participants 15 preferred the calculator, 12 preferred the nomogram and 1 scored calculator and nomogram equally.

**Conclusion:** The nomogram was significantly more accurate at all levels, almost as quick as an electronic calculator and deemed easy to use. It is

also extremely low cost and robust. We therefore suggest that the Parkland formula nomogram is a suitable method for calculation of resuscitation fluid requirements in adult burns; particularly for clinicians with limited experience of burns or for those working in difficult environments. It also provides a rapid means of detecting and preventing large errors that we have shown can occur when an electronic calculator or pen & paper are used as the primary method of calculation.

### 13AP1-2

#### Universal termination-of-resuscitation rules for refractory out-of-hospital cardiac arrest for mixed levels of providers

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**Background:** Prehospital termination-of-resuscitation (TOR) rules have been introduced for emergency medical technicians (EMT) providing advanced life support (ALS) care and defibrillation-only EMT providing basic life support (BLS) care to identify non-survivors after out-of-hospital cardiac arrest (OHCA). These TOR rules can reduce unnecessary transport to hospital and increase availability of resources for other patients. Universal TOR rules may be desirable for EMT providers of all levels responding to patients with OHCA. Here, we developed and validated new universal TOR rules for mixed levels of providers, such as the Japanese emergency medical service (EMS) system, responding to OHCA.

**Methods:** We analysed 98,170 OHCA adult patients with presumed cardiac events, using a prospectively recorded nationwide Utstein-style database in Japan over 5 years (2005 - 2009). Main outcome measures were specificity and positive predictive value (PPV) of the newly developed TOR rules for predicting 1-month survival with unfavourable neurological outcome, or cerebral performance category (CPC) = 3 - 5. Multivariate logistic regression analysis (MRA) and recursive partitioning analysis (RPA) were used to develop new rules for refractory OHCA patients using the Utstein-style data from 4 years (2005 - 2008, n = 77,786). External validation was also performed on an independent set of Utstein-style data from 2009 (n = 20,384).

**Results:** MRA showed that no return of spontaneous circulation (ROSC) before arrival at hospital had the strongest association with 1-month survival with unfavourable neurological outcome [odds ratio (OR) 42.2; 95% CI = 28.2 - 46.8]. Unshockable initial rhythm (OR 2.9; 95% CI = 2.4 - 3.5) was also independently associated with prognosis. RPA also indicated that these 2 variables were suggestive factors for outcome. Two variables were incorporated into newly developed TOR rules. The rules showed 94.1% specificity (95% CI = 93.3 to 94.8), and 99.6% PPV (95% CI = 99.6 to 99.7) for identifying survivors with unfavourable outcome. Area under the receiver operating characteristic curve (AUC) was 0.856. For external validation data, specificity, PPV and AUC were 95.6% (95% CI = 93.8 - 96.9), 99.8% (95% CI = 99.7 - 99.9) and 0.845, respectively.

**Conclusion:** For mixed levels of providers, cardiac arrest patients may be considered for out-of-hospital TOR following BLS or ALS resuscitation attempts when there has been no ROSC and unshockable initial rhythm.

### 13AP1-3

#### Quality of chest compression and perception of exertion during CPR (ERC 2010) with and without ventilation of non-medical personal

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**Background and Goal of Study:** The actual guidelines for cardio-pulmonary resuscitation (ERC 2010) allow chest compression only CPR (COCP) or conventional CPR (CPR) with 30:2 chest-compression: ventilation.

Additionally the first-aider is supposed to perform a compression depth (DKT) of 5 - 6 cm and a compression rate (DKR) of 100 - 120/min. Quality of both methods and perception of exertion has not yet been tested.

Aim of the study was to evaluate DKR and DKM plus perception of exertion (PE) and heart rate (HR) of the first-aider as a sign for quality of the chest compression and for the individual exertion of the first-aider.

**Materials and Methods:** After ethic vote approval 20 persons without medical education performed chest compression only CPR and CPR with 30:2 compression : ventilation rate in randomized order with a rest period of 1 hour between the 2 methods in a manikin (Laerdal Skill Resusci Anne). DKR and DKT were noted minutely (T1 - 10), perception of exertion was also noted minutely with a modified Borg Scale.

Heart rate was noted before starting chest compression (T0), minutely during chest compression (T 1 - 10) and 5 minutes after chest compression (T 11 - 15). Data are mean  $\pm$  standard deviation.

**Results:** DKT was not lower than 45 mm during the whole scenario in the CPR-group. After T2 the DKT in the COCP-group was significantly lower than in the CPR-group (45,7 $\pm$ 5,7 mm vs. 49,3 $\pm$ 3,7 mm) and was always lower than the postulated 50 mm. The DKR was not significantly different between the 2 groups. Also the HR was not significantly different but reached its highest value at T4 (COCP) and T7 (CPR) respectively. Perception of exertion was also not different between the 2 groups with a trend to earlier exertion in the COCP-group (T4 vs T5).

**Conclusion:** Quality of chest compression is significantly better with compression to ventilation rate of 30:2 than in the chest-compression only-group. Also physical strain seems to be lower in the CPR-group.

### 13AP1-4

#### Low quality and excellent outcome? Assessment of the quality of CPR in the TV drama "Emergency Room"

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**Introduction:** Earlier studies have demonstrated that outcome of patients with cardiac arrest in TV dramas is often more favourable than in reality [1], but the quality of cardiopulmonary resuscitation (CPR) has not been assessed yet. The aim of this study was to analyze quality of CPR in a 10-yr period of the TV drama ER.

**Methods:** 174 episodes of ER from 2000 to 2005 (season 8 to 11) and from 2005 to 2010 (season 12 to 15) were analyzed independently by three emergency physicians. Data on resuscitation scenes (patients' characteristics, cause of cardiac arrest, initial rhythm, performed resuscitation efforts) were recorded. Data was compared to actual corresponding AHA guidelines on CPR published in 2000 [2] and 2005 [3], respectively.

**Results:** Overall, 136 scenes in 174 episodes were identified where CPR was performed. The mean age of patients (66% male, 34% female) treated for cardiac arrest was 29.7 $\pm$ 19.2 years. Trauma was the leading cause for cardiac arrest (56.6%) and open chest compressions were performed in 19.9% of all cases.

Return of spontaneous circulation (ROSC) could be achieved in 33.8%, ICU admission was achieved in 6.9%, and 5.1% of all resuscitated patients could be discharged alive. Vital parameters were checked in all patients. Obviously wrong performed chest compressions occurred in 11 patients, whereas ventilation frequency and tidal volume were shown obviously wrong in 5.1% and 18.44%, respectively. Hand position for chest compression, compression frequency and compression depth were only shown correct in 55.1%, 35.3% and 8.1%. Epinephrine was not used in 36.0% of all cases.

**Conclusion:** It is well known that the content of medical TV dramas significantly influences the opinion and the courses of action of laypersons [3]. Even if the outcome shown on TV is comparable to reality in this series, resuscitation efforts shown in the TV drama ER are clearly diverging from the respective recommendations of the AHA guidelines on CPR. This might sustainably influence the quality of CPR efforts by laypersons in a negative way.

#### References:

1. Diem JS et al. Cardiopulmonary resuscitation on television: miracles and misinformation. *New Engl J Med* 1996;334:1578-1582.
2. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2000;102(8 Suppl):I1-I370.
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### 13AP1-5

#### Can trained CPR providers maintain targeted rate and depth of chest compressions throughout cardiopulmonary resuscitation?

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**Background and Goal:** The ERC 2010 guidelines on cardiopulmonary resuscitation [1] recommend a higher chest compression rate than previously (now 100-120/min, previously about 100/min), a deeper compression depth (now 5-6 cm, previously 4-5 cm), and recommend exchanging the BLS-provider every 2 minutes. However, it is unknown whether adequate compression depth can be sustained over a 2 minute interval when aiming to comply with the novel guidelines. We therefore evaluated the performance of trained volunteers performing chest compressions and tested the hypothesis that compression depth declines over time.

**Methods:** 24 volunteers from our in-hospital resuscitation team were asked to perform four 2-minute blocks of uninterrupted chest compressions according to the 2010 guideline on a patient simulator (SimMan 3G, Laerdal). A metronome set to 110 bpm was used to guide compression frequency. Between each block, participants rested for 2 minutes, simulating a resuscitation where a second person would perform compressions every other block. Frequency and compression depth were recorded by the simulator software and compared over time (repeated measures ANOVA, post test for linear trend or Bonferroni were applicable, mean [95% CI]).

**Results and Discussion:** Compression rate was well maintained around 110/min at all time points (means range between 110 and 115/min, no significant differences). However, no participant consistently achieved adequate compression depth throughout all blocks. Mean compression depth decreased over time during the first block from 43mm [39-46mm] to 39mm [37-42mm] ( $p < 0.001$ ) and remained lower at the beginning of the second block (40mm [37-43mm],  $p < 0.01$ ) as compared to the beginning of the first block, suggesting that a 2 minute resting period is insufficient for full recovery. Similarly to the first block, compression depth also decreased throughout all other blocks.

**Conclusions:** Trained CPR providers were unable to achieve recommended compression depth at a compression rate of 110/min, and the performance even further significantly declined over time. This implies that CPR performance needs to be monitored and corrected constantly, and supports the recommendation that CPR providers need to be exchanged regularly. However, a 2 minute recovery interval is insufficient, and therefore chest compression blocks should, if available, be alternated by more than two persons.

#### References:

1. ERC guidelines, Resuscitation 2010; 81: 1219ff.

### 13AP1-6

#### Effects of underlying surface on compression depth during cardiopulmonary resuscitation

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**Background and Goal:** Adequate compression depth during cardiopulmonary resuscitation is considered crucial for survival and favorable neurologic outcome. The surface underlying the patient may possibly influence compression depth, as a portion of the applied force is transmitted to the surface and may compress a compliant surface rather than contribute to chest compression. Therefore, it is generally recommended to reduce compliance by placing a backboard under the patient when lying on a mattress. However, the actual impact of surface compliance and whether using a backboard improves compression depth is controversial [1,2]. We therefore compared compression depths on different surfaces with a resuscitation simulator.

**Methods:** 24 volunteers from our in-hospital resuscitation team participated in the study. Each volunteer performed 2-minute blocks of chest compressions on a full-scale patient simulator (SimMan 3G, Laerdal) on 4 different surfaces in random order. The tested surfaces were: 1. the floor, 2. a standard hospital

bed mattress, 3. the bed's headboard used as backboard between simulator and mattress, and 4. a standard spineboard used as backboard. Compression depths, measured as absolute displacement of anterior "chest" wall towards the "back" of the manikin were recorded and were compared between the surfaces as well as within each block over time using repeated measures 2-way ANOVA. Data are presented as mean [95% confidence interval].

**Results:** While we observed a decrease in compression depth during the 2-minute blocks, no significant differences were observed between different surfaces at corresponding time points. Compression depths at the beginning of a 2 minute interval were: floor 41mm [39-43mm], mattress 43mm [40-45mm], headboard 39mm [36-42mm], spineboard 40mm [36-43mm]. At the end of the 2-minute block, compression depths were as follows: floor 38mm [36-40mm], mattress 37mm [35-40mm], headboard 39mm [36-41mm], spineboard 38mm [35-40mm].

**Conclusions:** Decreases in compression depth over time were expected and are likely due to fatigue. However, in contrast to common belief, we did not observe differences in compression depth on different surfaces.

Our data do not support the common practice to place a backboard under the patient, and this practice should be critically reevaluated as it may delay or interrupt CPR.

#### References:

1. Tweed M et al. Resuscitation 2001; 51: 179-183
2. Perkins GD et al. Intensive Care Med 2006; 32: 1632-1635

### 13AP1-7

#### Does the Q-CPR chest compression pad reliably determine compression depth during cardiopulmonary resuscitation?

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**Background and Goal:** High quality chest compressions are crucial during cardiopulmonary resuscitation (CPR) [1]. Chest compression pads (CCP) placed between the patient's chest and the rescuer's hands are increasingly used to provide real-time feedback over CPR quality.

However, these devices only indirectly measure compression depth by accelerometry and dynamometry, and only limited data on their accuracy are available. Especially if CPR is performed on an elastic surface, e.g. a mattress, these devices may likely overestimate compression depth because a portion of the applied force is transmitted to the underground and does not contribute to chest compression. We therefore compared CCP derived compression depths with those recorded by a patient simulator on different surfaces, and propose a method to improve accuracy when CPR is performed on compliant underground.

**Methods:** Using a full-scale patient simulator (SimMan 3G, Laerdal), which records absolute compression depth, 16 volunteers from our in-hospital resuscitation team performed cardio-compressions on different surfaces (floor, mattress) in random order. A CCP (Q-CPR, Laerdal) was placed between the volunteer's hands and the simulator's "sternum", and a second ("posterior") sensor was taped to the simulator's back opposite to the sternal sensor. Q-CPR compression depths determined by the anterior sensor as well as a "corrected" compression depth, calculated as the difference between the depths recorded by the anterior and posterior sensor, were compared to SimMan derived compression depth using Bland-Altman analysis.

**Results:** With the manikin on the floor, Q-CPR slightly underestimated compression depth (bias -3.9mm, 95% limits of agreement (LOA) -8.9 to +1.0mm). On the mattress, Q-CPR substantially overestimated compression depth (bias +12.6mm, LOA 4.5 to 20.8mm). "Corrected" Q-CPR depth did not overestimate compression depth, and bias was comparable to measurements obtained on the floor (bias -4.3mm, LOA -9.0 to 0.5mm).

**Conclusions:** The Q-CPR sensor determines compression depth with minimal bias when CPR is performed on the floor, but may substantially overestimate compression depth when the patient is lying on a mattress. This may lead to incorrect feedback, and hence too shallow compressions. Correcting Q-CPR derived compression depth by a second, posterior sensor improves accuracy when CPR is performed on compliant surfaces.

#### References:

1. Schober et al, Minerva Anestesiol 2011; 77:129-31

### 13AP1-8

#### LUCAS compared to manual chest compressions are more effective during simulated CPR in helicopter rescue - a prospective, randomized, cross-over study

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**Background and Goal of Study:** High-quality chest compressions are of paramount importance for survival and neurological outcome after cardiac arrest.

However, even healthcare professionals have difficulty performing effective CPR. Chest compressions often are too shallow, compression rates too slow and hands-off intervals too long. During transport, chest compression effectiveness may be further reduced due to movements of the vehicle, confined space and prevailing safety regulations. Mechanical chest compression devices may play an important role in maintaining good quality CPR during transport.

We compared LUCAS and manual chest compressions in a simulated cardiopulmonary resuscitation scenario during helicopter rescue.

**Materials and Methods:** This prospective, randomized, cross-over, manikin study was conducted at the simulation centre of the Bavarian Mountain Rescue Service in Bad Toelz, Germany. 25 ALS-certified paramedics with no previous experience using LUCAS were enrolled. A Resusci Anne® manikin with Skill Reporting System® was employed. The paramedics performed the scenario twice, once with LUCAS and once with manual CPR. The scenario was divided into three parts: 5 min of CPR on scene, 8 min during the simulated helicopter flight and 2 min for the transport to the trauma department. In the LUCAS group the candidates performed manual chest compressions until LUCAS was positioned. After starting LUCAS, mechanical chest compressions continued until termination of the scenario. In the manual group the candidates performed manual chest compressions in rotation with a emergency physician every two minutes.

**Results and Discussion:** LUCAS compared to manual chest compressions were more frequently correct (99 vs. 59%,  $p < 0.001$ ), and were more often performed correctly regarding depth (99 vs. 79%,  $p < 0.001$ ), pressure point (100 vs. 79%,  $p < 0.001$ ) and pressure release (100 vs. 97%,  $p = 0.001$ ). Hands-off time was shorter in the LUCAS than in the manual group (46 vs. 130 sec,  $p < 0.001$ ). Time until first defibrillation was longer in the LUCAS group (112 vs. 49 sec,  $p < 0.001$ ).

**Conclusion(s):** LUCAS compared to manual chest compressions were more frequently correct. Also, chest compression depth, pressure point and pressure release were more often correct with LUCAS than with manual CPR. In the LUCAS compared to the manual group, hands-off-time was considerably shorter, whereas time to the first defibrillation was longer.

### 13AP2-1

#### Low plasma C-reactive protein as a diagnostic tool for heat stroke rather than infection-induced hyperpyrexia

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**Background and Goal of Study:** Heat stroke (HS) is a life-threatening condition, manifested by systemic inflammation and multiorgan failure. Rapid recognition and treatment are life-saving. However, HS may be confused with infection-induced hyperpyrexia, and delay of appropriate treatment may increase morbidity and mortality. We report a clinically-based characterization of HS by low plasma C-Reactive Protein (CRP) level, and propose its usefulness in distinguishing this type of hyperpyrexia from infection-associated high core temperature.

**Materials and Methods:** After IRB approval was obtained, records of patients admitted to general Intensive Care Unit (ICU) between August 2008 and August 2010 with core temperature  $\geq 39.0^{\circ}\text{C}$  due to HS or meningo-encephalitis were reviewed. Among other data, patients' demographics, CRP on admission and 24-48 h later, serum creatinine and creatine phosphokinase (CPK) levels were retrieved.

**Results and Discussion:** Twenty-three patients were admitted to the ICU with high-core temperature: twelve patients, age 21-67, had HS; 11 individuals, age 31-81, had meningo-encephalitis.

None of the HS individuals had infection. Eight HS patients were previously healthy; in 8 patients the event occurred post-exercise. Mean admission CRP levels were  $2.74 \pm 3.85$  mg/l in the HS group compared to  $128 \pm 73.6$  mg/l in the meningo-encephalitis patients ( $P = 0.00001$ ); the mean 24-48 h-CRP levels were  $16.83 \pm 20$  mg/l vs.  $136.5 \pm 88.4$  mg/l, respectively ( $P = 0.0004$ ). There

were no clinically significant differences between laboratory parameters indicative of end-organ damage and severity of disease in the HS vs. the meningitis group. Three HS patients underwent computed tomography and/or lumbar puncture before starting intensive cooling, due to misdiagnosis; two of them died subsequently.

**Conclusion(s):** Low serum CRP levels characterize non-infectious heat stroke. This readily available laboratory test could diagnose non-infectious hyperthermic patients upon admission, saving precious time until treatment and avoiding unnecessary diagnostic tests.

### 13AP2-2

#### Treatment with moderate hypothermia after intrahospitalary cardiac arrest due to ventricular tachycardia / ventricular fibrillation

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**Background and Goal of Study:** Currently, moderate hypothermia for therapeutic reasons (MHT) is only used in extrahospitalary cardiac arrests due to ventricular tachycardia / ventricular fibrillation (VT/VF). It is also recommended in intrahospitalary cardiac arrests due to VT/VF, despite there is no Grade I scientific evidence to demonstrate its efficacy in these patients. Goal: To demonstrate the efficacy of HTM in intrahospitalary recovered cardiac arrests used in patients in coma.

**Materials and Methods:** A prospective study begun in 2007, with aleatorisation of patients (total of 43) who had suffered intrahospitalary cardiac arrest, recovered and were in coma, after VT/VF. They were classified into either 1) Hypothermia Group (HG=22); or 2) Normothermia Group (NG=21). Both groups were monitored with EKG, IAP, SatO<sub>2</sub>, ET/CO<sub>2</sub>, BIS, CO, CI, SVR, urine output, muscle relaxation, and lab tests (standard biochemical variables, coagulation, hemogram and arterial blood gasometry every 6h). Patients were kept sedated and under muscle relaxation during 48 hours. In the HG, patients were maintained at 33° during the first 24 hours, undergoing the heating phase during the next 24h, until the patient reached 36°. Afterwards, weaning was performed, with the patient being kept at 36° for another 24h. In the NG, patients were kept for 76h in normal ranges between 36°-37°. Demographic data, time of CPR manoeuvres, survival at discharge and Glasgow Outcome Scale (GOS) at discharge from the ICU and from the hospital were also recorded.

**Results and Discussion:** There are no statistically significant differences between demographic data, CPR manoeuvres or number of defibrillations between both groups (Table 1).

	AGE	START TIME PCR	TOTAL TIME PCR	Nº DEFIBRILLATIONS
HYPOTHERMIA GROUP	53,11 ± 19,855	2,63 ± 2,997	27,19 ± 16,775	3,86 ± 2,742
NORMOTHERMIA GROUP	64,00 ± 14,110	2,21 ± 2,681	25,06 ± 13,998	3,18 ± 1,940

[Table 1]

There exists a better survival at discharge in the HG (57, 14 %) vs. NG (47,61 %), without it being statistically significant.

In referral to the neurologic outcome, there do exist statistically significant differences in favour of the HG, with favorable neurologic recovery ( $p < 0,05$ ).

**Conclusion(s):** HTM better short term neurologic outcome of patients with intra-hospital cardiac arrest due to VT/VF

This study must be performed in a greater number of patients to confirm results.

### 13AP2-3

#### Are we ready 24/7 in accident and emergency for trauma patients?

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**Background and Goal of Study:** The anaesthetic management of trauma patients in the resus room of Accident and Emergency (A&E) requires equipment for safe monitoring, and induction, intubation and ventilation.

Studies have shown that anaesthetic equipment can be missing in A&E (Morton 2000[i]) and that equipment failure or absence, is involved in nearly 13% of anaesthetic critical incidents (Cassidy 2011[ii]), and poorer outcomes in resuscitation (Cooper 1997[iii])

We set out to find if the A&E at a London teaching hospital had appropriate anaesthetic equipment to support trauma patients around the clock before becoming a major trauma centre.

**Methods:** Using a checklist, based on AAGBI guidelines[iv], which sets out required equipment and checks, a tri-daily survey was done on each resus bay for three weeks. The study focused on breathing equipment and completion of anaesthetic machine checks

**Results and Discussion:** A total of 107 surveys were returned, (possible 300 - 85 bays in use, 108 not done due to staffing time pressures).

Of these only 14% met all criteria to be ready for a trauma call. However, on an individual basis items were ready 84% of the time. The main issues were non-availability of filters, incomplete machine checks and disorganised bays making it hard to locate equipment.

The anaesthetic teams checked the bays whilst the A&E nurses restocked equipment. Therefore items missing during a check were often not replaced, and not realised until required. Clearer identification of store areas was suggested, so all staff could locate and restock.

Incomplete machine checks were another problem; due in part to bays being used when staff came to perform checks, this could be helped by better communication between the A&E and anaesthetic teams. Training A&E staff to complete the checks was considered but was not possible due to staffing issues.

Different equipment storage between bays made it hard to locate items, so a standard trolley layout was proposed.

Re-survey was scheduled once the trauma centre was running.

**Conclusion:** This survey showed that the anaesthetic facilities in A&E were not fully ready for the trauma centre start.

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1. Morton, T., Brady, S. and Clancy, M. (2000) *Anaesthesia*, 55:485-8.
2. Cassidy CJ, Smith A, Arnot-Smith J. (2011) *Anaesthesia*. 66(10):879-88
3. Cooper S, Cade J. (1997) *Resuscitation*. 35(1):17-22
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### 13AP2-4

#### Vascular access skills during cardiopulmonary resuscitation in hazardous environments

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**Background and Goal of Study:** Rapid vascular access and safe drug application are of prime importance during cardiopulmonary resuscitation. Life support in hazardous environments during intentional or unintentional releases of toxic or infectious substances requires personal protection equipment (PPE) for medical first responders and receivers.

Different levels of PPE are known to have a varying impact of low- and high-dexterity skills [1]. As battery operated intraosseous infusion systems for management of vascular access during chemical, biological and radio-nuclear (CBRN) disasters have recently been propagated, we aimed to compare their feasibility with standard IV cannulation and drug application.

**Materials and Methods:** The study received National Research Ethics Service approval by the South London REC Office 3 and Trust Research and Development approval from the London Ambulance Service NHS Trust.

We compared the treatment times of conventional intravenous (IV) access and intraosseous (IO) vascular access (EZ-IO, San Antonio, USA) during simulated cardiopulmonary resuscitation using a SimMan (Laerdal Medical, UK). Fifteen paramedics carried out a standardized scenario, either unprotected or wearing full CBRN-PPE. Each subject was issued with correctly sized pairs of CBRN butyl rubber gloves of 0.35mm wall thickness (Bluecher, Germany).

**Results and Discussion:** Treatment times for IO-access and IV-access did not differ in the controls ( $60 \pm 4$  seconds versus  $58 \pm 6$  [sec, Mean±SD]) nor in the CBRN-PPE group,  $63 \pm 5$  versus  $60 \pm 6$ ).

Treatment times for drug application were equally unaffected (Table 1, Treatment times [sec, Mean±SD]).

	IO Access	IV Access	IO Drug application	IV Drug application
Control	60 ± 4	58 ± 6	41 ± 5	44 ± 8
CBRN-PPE	63 ± 5	60 ± 6	44 ± 4	45 ± 6

[Table 1]

**Conclusions:** Choosing appropriately sized CBRN butyl rubber gloves appears important to master high dexterity skills like vascular access during ALS. CBRN butyl rubber gloves are available in different wall thicknesses (0.6 to 0.2mm). Thicker CBRN gloves are more durable and preferred for military

tasks, thinner gloves offer significantly more tactile qualities and might explain the high success rate of IV-cannulation compared to other studies. Furthermore, our results suggest that IO-access by battery operated drill systems appear as an excellent alternative to standard IV-access for first responders operating in CBRN-PPE.

#### References:

1. Castle N et al. *Anaesthesia*. 2011; 66:983-8

### 13AP2-5

#### Helium ventilation is safe and feasible in ICU patients admitted after cardiac arrest

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**Background and Goal:** Most patients admitted to the intensive care unit (ICU) after cardiac arrest die or have an unfavourable neurological outcome due to brain damage. Currently, the only treatment to reduce brain injury after cardiac arrest is mild hypothermia. Helium inhalation has shown promising results as a neuroprotective agent in animal models of cerebral infarction. If helium inhalation ameliorates neurological damage by reducing reperfusion injury in humans as well, this could be of great benefit to patients. As no studies exist that investigate the use of helium ventilation in patients after cardiac arrest we investigated whether this treatment is safe and feasible.

#### Material and Methods:

**Design:** Single centre open-label intervention study, in a mixed 30 bed academic ICU, approved by the local Medical Ethics Committee. Inclusion criteria: admission after a witnessed cardiac arrest, presenting with ventricular fibrillation or tachycardia, return of spontaneous circulation within 30 minutes, treatment with hypothermia.

**Exclusion criteria:** Pre-existing neurological disorders or the need for a  $\text{FiO}_2 > 50\%$  or  $> 10$  mmHg PEEP on ICU admission. Helium was administered during 3 hours as a 1:1 mixture with oxygen, using a Servo-i ventilator. An independent data safety monitoring board reviewed all problems arising from the helium ventilation itself and all fatalities. Poor outcome was assessed with the Glasgow Outcome Score at 30 days: death and vegetative state were defined as poor outcome. Data are presented as mean  $\pm$  SD or numbers and proportions.

**Results and Discussion:** In total 25 patients were included, 20 (80%) male, age  $64.8 \pm 12.1$  years, APACHE-II  $20.0 \pm 8.6$ , SAPS-II  $53.6 \pm 18.6$ . Helium treatment was started  $4:57 \pm 0:54$  hours after arrest. In one patient the treatment was stopped due to inadequate ventilation using the preset limits. This was not due to the helium ventilation and no adverse events due to helium ventilation were noted. Overall, nine (36%) patients had a poor outcome.

**Conclusion:** In this small study, we encountered no problems associated with helium treatment in patients admitted to the ICU after cardiac arrest. This opens the way for studies investigating the hypothesis that helium treatment reduces neurological injury in these patients.

### 13AP2-6

#### Decrease in cerebral oxygenation at induction of therapeutic hypothermia seems related to decreased arterial CO<sub>2</sub> tension

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**Background:** After cardiac arrest (CA), therapeutic hypothermia (TH) is the only therapy that improves neurological outcome and survival. However, hypothermia can alter  $\text{CO}_2$  production and solubility. This alteration can have an influence on cerebral perfusion and oxygenation in post-CA patients. The FORE-SIGHT absolute cerebral oximeter uses 4 wavelengths of laser light to determine the levels of oxygenated and deoxygenated hemoglobin in the cerebral microvasculature. In this way, absolute cerebral oxygen saturation ( $\text{SctO}_2$ ) can be measured continuously and non-invasively. In this study, cerebral oxygenation and  $\text{pCO}_2$  was measured during induction and maintenance of TH after CA.

**Methods:** After IRB approval and with written informed consent, data were collected from 23 patients admitted to the hospital after CA. Therapeutic hypothermia (TH) ( $33^\circ\text{C}$ ) was induced by endovascular (Coolgard®, Alsium) or surface (Arctic Sun®, Medivance) cooling. All patients were sedated (propofol/

remifentanyl) for the duration of hypothermia. NIRS-sensors were bilaterally applied to the frontotemporal area before the start of TH. Arterial blood gas values were collected every hour.

**Results:** Twenty three patients were admitted to the intensive care unit after cardiac arrest. Cerebral tissue oxygenation values started at  $68\% (\pm 6)$ .  $\text{SctO}_2$ -values decreased to  $59\% (\pm 3)$  within the first four hours after induction of TH. The decrease in cerebral oxygenation during induction of TH was could not be related to a change in hemodynamic parameters (MAP before induction of TH:  $79$  mmHg  $\pm 19$ ; at  $33^\circ\text{C}$ :  $82$  mmHg  $\pm 9$ ), nor to a change in  $\text{SpO}_2$  (start:  $99\% \pm 1$ ; 4h:  $97\% \pm 3$ ), or  $\text{pO}_2$  (start:  $136.1$  mmHg  $\pm 73$ ; 4h:  $119$  mmHg  $\pm 30$ ). However,  $\text{SctO}_2$  values showed a correlation with  $\text{PaCO}_2$ . At the start of  $\text{SctO}_2$  monitoring,  $\text{PaCO}_2$  was  $50.2$  mmHg ( $\pm 9$ ) but decreased to  $36.1$  mmHg ( $\pm 8$ ) within four hours. Ventilatory management (tidal volume and ventilatory frequency) was not adjusted during monitoring.

**Conclusion:** Non-invasive monitoring of cerebral oxygenation showed a decrease in  $\text{SctO}_2$  during the first hours after inducing TH post-cardiac arrest. The observed decrease in  $\text{PaCO}_2$  with ensuing cerebral vasoconstriction could be responsible for the decrease in cerebral oxygenation.

### 13AP2-7

#### Cardioprotection by remote ischemic post-conditioning (RIPoC) applied immediately after cardiac arrest: an animal study

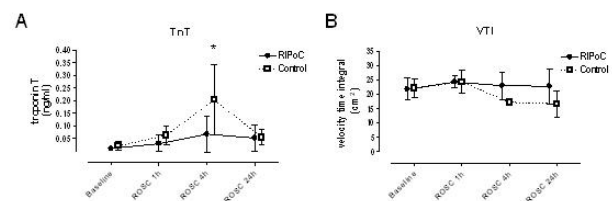
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**Background:** The post-cardiac arrest syndrome is attributed to global ischemia and reperfusion injury [1]. Only a limited number of patients survive successful resuscitation. Recently, postconditioning applied by short periods of limb ischemia following coronary occlusion has shown cardioprotective effects [2]. The aim of the present study was to examine cardioprotective effects of remote ischemic post-conditioning (RIPoC) applied during immediate post-cardiac arrest period.

**Materials and Methods:** After IRB approval, 22 anesthetized pigs were studied. 8 minutes of electrically induced cardiac arrest was followed by resuscitation according to the ILCOR guidelines. After return of spontaneous circulation (ROSC), animals were randomized into two groups: 1. *RIPoC-group* (4 cycles of 5 min occlusion of femoral arteries and 5 min reperfusion) 2. *Control-group* (4 cycles of sham occlusion). Four hours after ROSC animals were weaned from respirator and studied for additional 20 hours. Serum troponin level was measured to quantify myocardial damage and velocity time integral (VTI) was measured by aortic Doppler. Statistical analysis was performed by Mann-Whitney Test and ANOVA for repeated measurements. A  $p < 0.05$  was defined significant.

**Results and Discussion:** A total of 13 animals were successfully resuscitated and randomized into groups (RIPoC:  $n=7$ ; Control:  $n=6$ ). In each group one animal did not survive the study period. Duration of CPR, cumulative defibrillation energy and catecholamine use was comparable between groups. Cardiac damage, as represented by peak troponin level, was significantly alleviated in RIPoC group. A distinct (not significant) reduction of VTI was observed in the Control group 4h and 24h after ROSC.



Characteristics of A) serum troponin T-TnT and B) aortic velocity time integral -VTI before cardiac arrest and after return of spontaneous circulation - ROSC in both groups. \*  $p < 0.05$

[Figure 1]

**Conclusion(s):** The present study indicates possible cardioprotection by remote ischemic post-conditioning (RIPoC) applied in immediate post-cardiac arrest period.

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## Acute and Chronic Pain Management

### 14AP1-1

#### Intrathecal administration with CREB antisense oligodeoxynucleotide attenuates neuropathic pain induced by chronic constriction injury of sciatic nerve

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**Background and Goal of Study:** The aim of this study was to investigate the effects of intrathecal administration with cyclic AMP response element-binding protein antisense oligodeoxynucleotide (ODN) on neuropathic pain behaviors. As a constitutive transcription factor, CREB has been proved to be involved in the maintenance of neuropathic pain, though the specific mechanism is not clear.

The nociceptive behaviors induced by inflammation and neuropathic pain of animal models have been shown accompanied with the upregulation of pCREB.

**Materials and Methods:** A mouse model of neuropathic pain was induced by chronic constriction injury of sciatic nerve (CCI). 24 male C57BL/6 mouse successfully receiving intrathecal catheter implantation without motor dysfunction were randomly divided into 4 groups (n=6):

Saline group (Group NS),  
CREB sense ODN group (Group S),  
CREB missense ODN group (Group M),  
CREB antisense ODN group (Group A).

Mice in Group NS, S, M and A were intrathecally treated with Saline 5 $\mu$ l, Sense ODN 5 $\mu$ g/5 $\mu$ l, Missense ODN 5 $\mu$ g/5 $\mu$ l and Antisense ODN 5 $\mu$ g/5 $\mu$ l once daily on Day 1-6 after CCI respectively. Paw withdrawal mechanical threshold (PWMT) and paw withdrawal thermal latency (PWTL) were tested on Day 1 before CCI and Day 1, 3, 5, 7, 10, 14, 17, 21 after CCI.

**Results and Discussion:** Mice in Group A maintained the pain thresholds in the baseline and lasted at least 7 days after CCI [7 d, PWMT: (0.81  $\pm$  0.20 VS 1.00  $\pm$  0.19)g, P>0.05; PWTL: (5.96  $\pm$  0.69 VS 6.93  $\pm$  1.08)s, P>0.05]. The withdrawal thresholds in the ipsilateral hindpaws of the mouse were significantly lower than baseline in group A on day 10 after CCI [10 d, PWMT: (0.56  $\pm$  0.19 VS 1.00  $\pm$  0.19)g, P< 0.05; PWTL: (3.93  $\pm$  0.28 VS 6.93  $\pm$  1.08)s, P< 0.05].

Compared with group NS [10 d, PWMT: (0.56  $\pm$  0.19 VS 0.37  $\pm$  0.08)g, P< 0.05; PWTL: (3.93  $\pm$  0.28 VS 3.14  $\pm$  0.45)s, P< 0.05], group S [10 d, PWMT: (0.56  $\pm$  0.19 VS 0.38  $\pm$  0.13)g, P< 0.05; PWTL: (3.93  $\pm$  0.28 VS 2.14  $\pm$  0.41)s, P< 0.0001], and group M [10 d, PWMT: (0.56  $\pm$  0.19 VS 0.38  $\pm$  0.08)g, P< 0.05; PWTL: (3.93  $\pm$  0.28 VS 2.64  $\pm$  0.40)s, P< 0.0001], the withdrawal thresholds of group A was significantly elevated on day 10 after CCI. These effects lasted up to at least day 21 after CCI.

**Conclusion(s):** Intrathecal treatment with CREB antisense ODN in the development of neuropathic pain induced by CCI completely improved pain behaviors during the course of injection, and the effects of relief pain lasted at least 15d after no injection.

### 14AP1-2

#### Effects of Akt3 gene knockout on neuropathic pain induced by chronic constriction injury of sciatic nerve

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**Background and Goal of Study:** Protein kinase B, also known as Akt, is a serine/threonine kinase and plays a critical role in the modulation of cell development, growth, and survival. A body of recent work has identified that Akt contributes to neuropathic pain and inflammatory pain.

The aim of this research was to investigate the effects of Akt3 gene knockout on neuropathic pain behaviors induced by chronic constriction injury of sciatic nerve (CCI).

**Materials and Methods:** Experimental animals were divided into two groups: Akt3 knockout mice group (Group Akt3<sup>-/-</sup>, n=12), wild type group (Group WT, n=12). After mice were randomly numbered, the right sciatic nerve of mice received the operation of chronic constriction injury. Paw withdrawal mechanical threshold (PWMT) and paw withdrawal thermal latency (PWTL) were tested on Day 1 before operation and Day 1, 3, 5, 7, 10, 14, 17, 21 after CCI.

**Results and Discussion:** The basic values of PWMT and PWTL displayed no significant differences between the two groups (p > 0.05). At day 1 after operation, compared with basic value, the PWMT and PWTL of the right paw in both Group Akt3<sup>-/-</sup> and group WT were significantly decreased (p < 0.05), and

at least lasted up to day 21. The PWMT and PWTL of the right paw in Group Akt3<sup>-/-</sup> was significantly lower than Group WT (p < 0.05). The PWMT and PWTL of the left paw in Group Akt3<sup>-/-</sup> and Group WT had no obvious difference (p > 0.05). However, compared with left paw, the PWMT and PWTL of the right paw among the two groups were obviously lower (p < 0.05).

**Conclusion(s):** The neuropathic pain induced by CCI was aggravated significantly in Akt3 knockout mice.

### 14AP1-4

#### The analgesic action of minocycline in a rat model of neuropathic pain corresponds with reduced brain-derived neurotrophic factor expression in the dorsal horn

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**Background and Goal of Study:** Minocycline, a second-generation tetracycline, reduces neuropathic pain (NP) behaviour in animal models, however the underlying mechanism is poorly understood. In the past decade brain-derived neurotrophic factor (BDNF) emerged as a modulator of nociceptive responses through suppression of inhibitory mechanisms and enhancement of excitatory synaptic output within the dorsal horn. We hypothesized that minocycline exerts its analgesic effect by inhibiting spinal BDNF expression.

**Material and Methods:** Sprague-Dawley rats underwent a chronic constriction injury (CCI) of the left sciatic nerve under isoflurane/N<sub>2</sub>O anaesthesia as described by Bennett and Xie. NP was confirmed 7 days after surgery using a cold plate test (4°C, cut-off for NP: >20s lift/5min). Hereafter rats were randomised to receive saline (control) or minocycline 25mg/kg orally BID till day 21. NP behaviour was measured on day 7, 14 and 21 with a cold plate test (number of left hind paw lifts per 5 minutes).

Afterwards, rats were sacrificed for quantitative BDNF-immunocytochemistry of the spinal cord at the L5 level. Counts of BDNF-immunoreactive axon profiles in laminae I and II of the ipsilateral (left) and contralateral (right) dorsal horns were made on digital images. Earlier studies showed that BDNF is present in both dorsal horns of untreated rats and does not increase in the contralateral dorsal horn upon CCI surgery of the left sciatic nerve.

Therefore the difference between the counts of ipsilateral and contralateral axon profiles serves as a measure for the effect of CCI on spinal BDNF expression. Behavioral data were analyzed using a one-way ANOVA with Tukey's *post hoc* test. Immunocytochemistry data were analyzed with Student's unpaired one-tailed t-test followed by Kolmogorov-Smirnov's *post hoc* analysis. Results are presented as mean  $\pm$  SEM.

**Results and Discussion:** Placebo- and minocycline groups consisted of 9 and 8 animals respectively. Rats in the minocycline-treated group lifted significantly less frequent on day 14 (9.2  $\pm$  1.9; p < 0.01) and on day 21 (6.6  $\pm$  1.3; p < 0.05) compared to rats in the control group (22.1  $\pm$  2.3 and 16.6  $\pm$  3.8 respectively). On day 21 minocycline significantly reduced BDNF-immunoreactive counts in the ipsilateral dorsal horn (369  $\pm$  104; p < 0.05) compared to control (918  $\pm$  287).

**Conclusion:** Minocycline reduces neuropathic pain behaviour in a rat CCI model by suppressing spinal BDNF expression.

### 14AP1-5

#### Amitriptyline reduces neuropathic pain independent of spinal brain-derived neurotrophic factor expression in a rat chronic constriction injury model

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**Background and Goal of Study:** Tricyclic antidepressant drugs (TCA) are among the first line treatments for neuropathic pain (NP). Their main action involves re-uptake inhibition of serotonin and noradrenalin. Brain-derived neurotrophic factor (BDNF) plays an important role in the development of NP by causing disinhibition of the spinal dorsal horn leading to increased excitatory output. We investigated if the TCA amitriptyline influences spinal BDNF expression in a chronic constriction injury (CCI) model.

**Material and Methods:** Sprague-Dawley rats underwent a CCI of the left sciatic nerve under isoflurane/N<sub>2</sub>O anaesthesia as described by Bennett and Xie. NP was confirmed 7 days after surgery using a cold plate test (4°C, cut-off for NP: >20s lift/5min). Hereafter rats were randomised to receive saline (control) or amitriptyline 5mg/kg subcutaneously BID till day 21. NP behaviour



was measured on days 7, 14 and 21 with a cold plate test (number of left hind paw lifts per 5 minutes). Afterwards, rats were sacrificed for quantitative BDNF-immunocytochemistry of the spinal cord at the L5 level. Counts of BDNF-immunoreactive axon profiles in laminae I and II of the ipsilateral (left) and contralateral (right) dorsal horns were made on digital images. Earlier studies showed that BDNF is present in both dorsal horns of untreated rats and does not increase in the contralateral dorsal horn upon CCI surgery of the left sciatic nerve. Therefore the difference between the counts of ipsilateral and contralateral axon profiles served as a measure for the effect of CCI on spinal BDNF expression. Behavioral data were analyzed using a one-way ANOVA with Tukey's *post hoc* test. Immunocytochemistry data were analyzed with Student's unpaired one-tailed t-test followed by Kolmogorov-Smirnov's *post hoc* analysis. Results are presented as mean  $\pm$  SEM.

**Results and Discussion:** Rats in the control group (n=9) showed no significant difference in number of lifts on the cold plate throughout the experiment. However, rats in the amitriptyline group (n=8) lifted progressively less frequent with increasing treatment time from day 7 (21.5  $\pm$  2.6) till day 21 (14.4  $\pm$  2.1;  $p < 0.05$ ). On day 21 there was no difference in BDNF-immunoreactive counts in the ipsilateral dorsal horn between control animals (918  $\pm$  287) and amitriptyline treated rats (529  $\pm$  125;  $p > 0.05$ ).

**Conclusion:** Amitriptyline reduces NP behaviour in a rat CCI model in a BDNF-independent mechanism.

### 14AP1-6

#### Role of the spinal NR2B-containing NMDA receptors in a rat model of trigeminal neuropathic pain

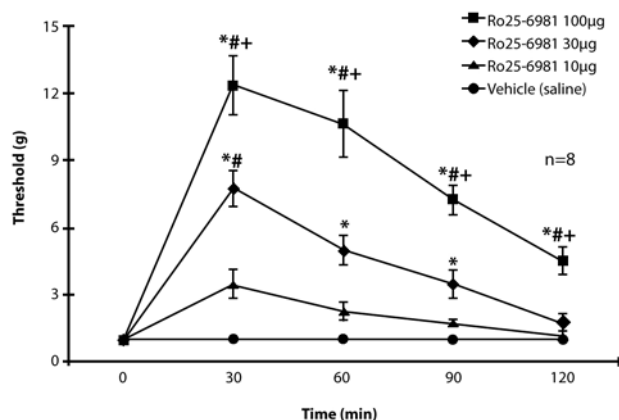
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**Background and Goal of Study:** Trigeminal nerve injury may induce severe pain that is very challenging to treat. The N-methyl D-aspartate (NMDA) receptor is essential for the hyperexcitability of spinal dorsal neurons in nerve injury-induced neuropathic pain.

Several experimental studies have demonstrated the antinociceptive efficacy of spinal administration of the NR2B-selective NMDA receptor antagonists. There is little evidence for the role of spinal NR2B-containing NMDA receptors in the trigeminal neuropathic pain. Chronic constriction injury to the infraorbital nerve (ION-CCI) has proven a useful model for trigeminal neuropathic pain. The present study evaluated the potential antiallodynic effects of intrathecal administration of a NR2B-selective NMDA receptor antagonist 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 10 after surgery. A polyethylene (PE-10) catheter was implanted for upper cervical spinal injection of drugs. The rats were allowed to recover for 5 days. The time course of the antiallodynic effects and the dose-response effects of intrathecally administered NMDA receptor antagonists MK801 and memantine, and a NR2B-selective NMDA receptor antagonist Ro25-6981 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 MK801, memantine and Ro25-6981 increased mechanical thresholds in a dose dependent manner ( $P < 0.05$ ) (figure 1).



[Figure1]

**Conclusion(s):** The results indicated that spinal NR2B-containing NMDA receptors may play an important role in a rat model of trigeminal neuropathic pain.

### 14AP1-7

#### Morphologic changes of spinal cord by intrathecal Palonosetron-HCl in rats

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**Background and Goal:** It is well known that intravenous palonosetron-HCl, a second generation antagonist of 5-HT<sub>3</sub> receptor can prevent chemotherapy induced nausea and vomiting (CINV) and postoperative nausea and vomiting (PONV). Serotonin type 3 receptors (5-HT<sub>3</sub> receptor) are abundant in lower brainstem and substantia gelatinosa of spinal cord, which provides theoretical rationale of neuraxial administration of 5-HT<sub>3</sub> receptor antagonist for CINV, PONV, and opioid induced nausea and vomiting.

But the reports of neuraxial administration of palonosetron-HCl has not been found. Before neuraxial drug administration is accepted for clinical use, the safety should be proved.

This study was conducted to determine whether this route of palonosetron-HCl administration produces neuraxial injury.

**Materials and Methods:** Male Sprague-Dawley rats were catheterized intrathecally with aseptic technique through atlanto-occipital membrane and the catheter tip was advanced caudally to the first lumbar vertebra under general anesthesia. After 7days, 20µl of normal saline (N group, n = 6) and 20µl (1µg) of palonosetron-HCl (P group, n =6) were injected intrathecally once a day for two weeks. Then we evaluated neurotoxic changes of spinal cords morphologically by light microscopy (LM) and electron microscopy (EM) and we also evaluated behavioral changes in both groups.

**Results and Discussion:** One of N group and 3 of P group show abnormal behavior during intrathecal drug injection but not in other period. N group does not show abnormal findings by LM and EM. P group shows many vacuoles in the white matters especially dorsal funiculus by LM and myelinated axon with separation of inner lamellae of myelin creating fluid filled spaces within the myelin, thinly myelinated and swollen axon, and hypertrophied and degenerated mitochondrias by EM.

**Conclusion:** The results suggest that chronic intrathecal administration of palonosetron-HCl causes nonspecific neurotoxic changes in spinal cord of rats.

#### References:

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### 14AP1-8

#### Kainic acid injection into RVM inhibits thermal hyperalgesia in a rat model of neuropathic pain

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**Background and Goal of Study:** Neuropathic pain is resistant to the conventional analgesics and therefore remains to be a major clinical problem. The lack of effective medicine is partly due to the broadness of involved neural regions other than primarily damaged site. The rostral ventromedial medulla (RVM) is a major brain area to modulate pain perception via its descending axonal projection.

Although recent studies suggest that the facilitation of nociceptive transmission in the spinal cord by the RVM contributes to neuropathic pain, the underlying mechanisms are largely unknown.

We examined the effects of kainic acid (KA)-induced RVM damage on neuropathic pain behavior and the expression of molecules implicated in pain modulation in the RVM neurons.

**Materials and Methods:** Seven-week-old male Sprague-Dawley rats were used in all experiments. A neuropathic pain model was produced by chronic constructive injury (CCI) of the left sciatic nerve with the right one being left intact.

Mechanical allodynia and thermal hypersensitivity were assessed for the neuropathic pain state in CCI rats. Paw withdrawal in response to mechanical and thermal stimuli was measured using von Frey filaments and the plantar test, respectively. KA was locally injected into medial portion of the RVM 7 days after CCI, when the hyperalgesia had been established. Immunohistochemistry for mu opioid receptor (MOR), neurokinin-1 receptor (NK-1 R), and tryptophan hydroxylase (TPH) in RVM was performed 14 days after CCI.

**Results and Discussion:** In CCI rats, the thresholds of paw withdrawal to the mechanical and thermal stimuli were significantly decreased on the ipsilateral, but not the contralateral, side at least for 14 days. KA injection almost fully relieved the thermal hyperalgesia. The attenuation of the thermal hyperalgesia continued at least over the next 7 days after a single KA injection. In contrast, the mechanical allodynia was significantly, but slightly, alleviated 5 and 7 days after KA injection. KA injection by itself did not affect the nocifensive responses to the mechanical and thermal stimuli on the intact side.

In association with this analgesic effect, immunohistochemistry revealed that KA injection significantly reduced the number of MOR, but not NK-1 R, and TPH, -immunoreactive neurons in the RVM.

**Conclusion:** Our results suggest that a subset of the RVM neurons expressing MOR may contribute to the maintenance of thermal hyperalgesia in neuropathic pain.

## 14AP2-1

### Morphine nebulized by supersound atomizer for postoperative pain relieve in gynaecologic and obstetric patients

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**Background and Goal of Study:** To evaluate the efficacy and safety of morphine nebulized by supersound atomizer for the management of postoperative pain in Gynaecologic and Obstetric (OG) patients.

**Materials and Methods:** Eighty American Society of Anesthesiologists grade I - II patients scheduled for elective mixed OG surgeries were randomly and single-blindly located into 4 groups.

Patients in each group received different analgesia therapy 30min before the end of the surgeries, as inhaling morphine 15 mg in Group M1, inhaling morphine 20 mg in Group M2, inhaling normal saline 10 ml in Group N and intravenous PCA in Group PCA. Open-label rescue analgesia of intramuscular pethidine 100 mg or intravenous PCA was also available as needed. Pain scores were measured at baseline, 15 min, 30 min, 60 min, 120min, 3h, 4h, 6h, 8h and 24h after the extubations using 10-point visual analog scale (VAS), vital signs, adverse events, and the uses of rescue analgesia were also recorded.

**Results and Discussion:** The VAS scores of Group M2 were significantly lower than those of Group N and Group PCA. The VAS scores of Group M1 were significantly lower than those of Group N in 3 h postoperatively, which were significantly higher than those of Group PCA all the time. The morbidities of postoperative, nausea and vomiting in Group M1 and Group M2 were significantly higher than those in Group N and Group PCA. The rescue analgesia was more often performed in Group M1 and Group N than in Group M2 and Group PCA.

**Conclusion(s):** Inhalation of morphine nebulized by supersound atomizer via intratracheal tube noninvasively may produce safe and satisfying analgesic effect in postoperative pain model of OG patients.

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## 14AP2-2

### No change in constipation or other clinical effects by adding naloxone to oral oxycodone treatment (Targiniq®) for 3 days of postoperative pain. A randomised, double-blinded, prospective trial

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**Background and Goal of Study:** Constipation is a frequent side effect of opioids, and may occur already during the first days of administration(1). Targiniq®, an oxycodone prolonged-release (PR) formulation combined with the opioid antagonist naloxone PR, aims to prevent opioid-induced constipation without impairing the analgesic efficacy. These effects and side effects of oxycodone PR/naloxone PR are shown during prolonged use in patients with chronic pain or cancer(2, 3). The main purpose of our study was to compare constipation in healthy patients receiving oxycodone PR with oxycodone PR/naloxone PR for short-term postoperative pain management.

**Materials and Methods:** This randomized, double-blind, prospective study included 85 women undergoing elective laparoscopic hysterectomy for non-

malignant etiology. Patients with chronic pain, psychiatric disorders or use of non-steroidal anti-inflammatory drugs (NSAIDs), steroids, antiemetic, laxantia, opioids or other analgesics were excluded. The surgery was done in general anaesthesia with propofol and remifentanyl. The two groups received either oxycodone PR 10 mg or oxycodone PR 10 mg/naloxone PR 5 mg as part of premedication and as a pain regimen twice daily for 3 consecutive days. As rescue analgesic the patients received patient controlled analgesia with oxycodone IV the first 24 h postoperatively. Beyond 24 h the patients had access to oxycodone quick-release tablets. All patients received paracetamol and NSAIDs. Constipation, pain and other side effects were registered at 0.5, 1, 2, 3, 4, 24 h, day 3 and 7 after surgery.

**Results and Discussion:** Demographic, pre- and perioperative variables and use of rescue analgesics were similar in the groups. There were no significant differences in any variable related to constipation. In the oxycodone PR/naloxone PR group 25 % had no defecation during the first 72 h postoperatively, compared to 20 % in the oxycodone PR group (mean  $1.2 \pm 1.1$ . vs.  $2.1 \pm 2.4$  defecations, ns.). Other opioid-induced effects showed no significant differences.

**Conclusion:** Addition of naloxone to oxycodone PR tablets in a pain regimen given twice daily the first 3 postoperative days had no significant clinical effects on constipation or other variables during the first week after hysterectomy.

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3. Holzer P et al. *J Opioid Manag*. 2009;5:145-51.

## 14AP2-3

### The effect of cannabinoid receptor 2 agonist JWH015 on the hyperalgesia induced by remifentanyl

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**Background and Goal of Study:** Cannabinoids bind to cannabinoid receptors type 1 and 2 and produce analgesia in several pain models, but central side effects from cannabinoid 1 receptors limit their clinical use. Previous studies have demonstrated the pain relief effects of cannabinoid 2 receptor agonist in inflammation pain, incision pain, bone cancer pain and neuropathic pain models. The aim of this study was to investigate the effects of cannabinoid receptor 2 (cannabinoid receptor 2, CB2R) agonist JWH015 on the hyperalgesia induced by remifentanyl in a rat model of postoperative pain.

**Materials and Methods:** Sixty SD rats were randomly divided into 10 groups (n=6): control group (C1/C2), incisional pain group (I1/I2), incisional pain plus JWH015 group (Q1/Q2), remifentanyl group (R1/R2), and JWH015 plus remifentanyl group (QR/QR). Rats in group Q1/QR and I1/FR were intrathecal injection with 10µg JWH015 (diluted in 10µl 20% DMSO solution) and intraperitoneal administration with 100µg JWH015 (diluted in 10µl 4% DMSO solution) respectively 30 min before plantar incision, while rats in group C, I and R were received with the same volume of DMSO solution. Plantar incision surgery was operated in rats of group I, R, Q1/Q2, and QR/QR. In group R and QR/QR, remifentanyl (0.04 mg/kg) was infused subcutaneously to rats with a pump for 30 min at the moment of surgical incision. The paw withdrawal mechanical threshold (PWMT) and paw withdrawal thermal latency (PWTL) at 24 h before incision and at 2 h, 6 h, 24 h and 48 h after incision were tested to evaluate the behavioral changes.

**Results and Discussion:** Compared with group C and baseline, the level of PWMT and PWTL decreased at 2 h, 6 h, 24 h and 48h after incision in group I ( $P < 0.01$ ), and compared with group I, the significant decrease of PWMT and PWTL were observed after incision in group R ( $P < 0.05$ ). Compared with group R, the significant increase of PWMT ( $7.78 \pm 1.09$ ) and PWTL ( $17.28 \pm 1.58$ ) were observed from 6 h after incision in group QR ( $P < 0.05$ ). And the increase of PWMT ( $7.79 \pm 0.72, 9.50 \pm 1.17, 7.86 \pm 1.16$ ) and PWTL ( $16.23 \pm 1.50, 19.53 \pm 1.63, 18.10 \pm 0.93$ ) were observed at 6 h, 24 h and 48 h after incision in group FR ( $P < 0.05$ ).

**Conclusion(s):** Intrathecal and intraperitoneal administration of JWH015 in this investigation dose could relief remifentanyl-induced hyperalgesia in a rat model of postoperative pain.

## 14AP2-5

### Effect of spinal opioids on PCA morphine requirements following major abdominal surgery

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**Background and Goal of Study:** For analgesia following major abdominal surgery, spinal opioids offer an attractive alternative to thoracic epidurals and are being increasingly used in this area for their parenteral opioid-sparing effects. The aim of this study was to evaluate the effect of spinal opioids on post-operative morphine requirements in patients undergoing major open abdominal surgery in our hospital.

**Materials and Methods:** Over a 12-month period (01/04/2010-31/03/2011), we retrospectively analysed our acute pain database for all ASA 1-4 patients undergoing surgery involving a midline laparotomy incision. Data analysed included: patient demographics; PCA duration; 0-24h, total morphine dose; and use of spinal opioid. Patients on opioids prior to surgery, and patients with non-standard PCA prescriptions or who received additional forms of analgesia were excluded. All patients received PCA morphine post-operatively as a standard prescription (1mg IV bolus, 5-min lockout, no continuous infusion) plus regular paracetamol. Spinal opioid was administered intrathecally as 0.2-0.3mg of preservative-free morphine prior to induction of anaesthesia.

**Results and Discussion:** 232 patients met the inclusion criteria - 202 received PCA morphine alone, 30 received spinal opioid and PCA. Data is expressed as median values (IQR) or percentages, "no spinal opioid" vs "spinal opioid". Demographic profiles were similar: age 61 (48-70) vs 67 (55-74) yr; males 44.6% vs 53.3%. The majority of patients were ASA 2-3. Morphine requirements - Table 1.

	No spinal opioid (n=202)	Spinal opioid (n=30)	p value
PCA Duration (h)	45 (30.8-69.6)	47 (18.2-96.4)	0.791
Morphine dose 0-24h (mg)	56 (35-90)	48.5 (33.5-71.5)	0.298
Total morphine dose (mg)	89 (49.5-163.5)	99.5 (56.5-160)	0.092

[Table 1 - Morphine requirements]

Spinal opioids are well established in orthopaedic and obstetric anaesthesia, where they provide good analgesia for 24 h post-operatively. A recent meta-analysis suggested that patients undergoing abdominal surgery receive the same benefit [1], however only two of the trials included looked specifically at major laparotomies. Our results are contrary to this - we found no significant difference in PCA morphine requirements following spinal opioid compared to PCA alone.

**Conclusion:** The evidence supporting the use of spinal opioids following major abdominal surgery is relatively small. Further, larger trials are required in order to fully establish their role in this area.

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## 14AP2-6

### Comparison of intravenous boluses of piritramide and morphine. Did we use the correct ratio of analgetic potency?

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**Background and Goal of the Study:** After replacement of intravenous piritramide by morphine for postoperative analgesia, we got the impression that, using the morphine, it took more time to reach an adequate level of analgesia.

**Methods:** Adult patients for routine gynaecological surgery, or for laparoscopic cholecystectomy, were included. All patients received the same form of general anaesthesia.

On arrival in the postoperative care unit (PACU), pain scores were registered using the Visual Analogue Scale (VAS). With VAS > 3, the patient received piritramide or morphine, administered intravenously using a blinded syringe, which was prepared in the hospital's pharmacy. The starting dose was 5 mg of piritramide, or 3.5 mg of morphine.<sup>1</sup> This ratio is based on the analgetic potency of piritramide compared to morphine, which is presumed to be 0.7.<sup>2</sup> An additional dose of piritramide 3.5 mg, or morphine 1.75 mg was administered, if 15 minutes after injection VAS still was > 3. Four additional dosages could be administered. The protocol was finished when the patient had reached VAS ≤ 3.

**Results and Discussion:** Of the 182 patients, who have participated in the study, 22 patients were excluded as they were completely pain free on arrival

in the PACU. This resulted in 81 piritramide patients, and 79 morphine patients. After 75 minutes, which is 15 minutes after the fourth additional dose, VAS < = 3 was reached in 88 % of the piritramide patients and in 77 % of the morphine patients (log-rank test p = 0.001). These results suggest a more rapid response following the intravenous dosages of piritramide directly postoperative. It could also be a consequence of incorrect morphine dosages, or from the interval times of 15 minutes. The dosages were based on the analgetic ratio 0.7 of piritramide versus morphine.

However, this ratio is the result of quite old intramuscular studies, while in the present study the dosages were injected intravenously and directly postoperative. Further, the relative onset time of an intravenous dose of morphine is supposed to be 6 minutes.<sup>3</sup> This would mean that the interval time of 15 minutes in the present study was too long. Therefore, it is possible that with higher bolus dosages of morphine, or shorter interval times, the difference with piritramide would not exist any more.

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## 14AP2-8

### Comparison of morphine versus morphine plus bolus tramadol for postoperative analgesia in morbidly obese patients

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**Background and Goal of Study:** In morbidly obese patients, PCA with morphine has been proven to be an acceptable strategy for postoperative pain management. However, this patient population is at great risk for respiratory depression, the most serious complication of morphine PCA. Unlike morphine, tramadol has no clinically relevant effects on respiratory parameters at recommended doses in adults. The aim of this study is to determine the morphine-sparing effects of tramadol and to evaluate the effects on opioid-related adverse effects in obese patients after major abdominal surgery.

**Materials and Methods:** The study was conducted on 16 ASA I-III patients with BMI > 30kg/m<sup>2</sup> who underwent major abdominal surgery under standardized general anaesthesia. They were randomly allocated in two groups. Group A received postoperative analgesia with PCA with morphine (M) while Group B received PCA with morphine plus bolus doses of tramadol (T), 50mg every 8h. PCA settings were the same: morphine 1mg/ml with a lockout interval 10 min. All patients received i.v morphine 20 microg/kg of ideal body weight before the end of surgery. Study end-points included morphine consumption over the first 48hr after surgery, quality of pain control measured by visual analogue pain scale (VAS) six-hourly, incidence of opioid side effects including nausea and vomiting, sedation, pruritus and/or respiratory depression and patient satisfaction after 48 hr.

**Results and Discussion:** Both Groups were similar with respect to age, body mass index and gender. Patients obtained adequate analgesia with both regimens (VAS < 4). Average morphine usage during the day of surgery (DOS) was 45.125 ± 3.44 mg for Group A and 33.37 ± 5.09 mg (p=0.139) for group B. On first and second postoperative days (POD1 and POD2) morphine consumption differ statistically significantly between groups (POD 1: 46.875 ± 2.99 mg for group A and 34.37 ± 5.09 mg for group B p=0.004 POD2: 41.625 ± 2.615 mg for group A and 31.25 ± 15.06 for group B). Tramadol deescalated the total morphine needs 26% (133.75 ± 8.31 for Group A and 98.75 ± 15.06 for Group B p=0.027). Arterial gases and vital signs were maintained without significant changes. Nausea vomiting and sedation scores were the same in both groups.

**Conclusion(s):** In morbidly obese patients, tramadol combined with PCA morphine induced a significant morphine-sparing effect, while it did not alter the incidence of opioids side effects after major abdominal surgery.

## 14AP2-9

### Assessment of the effect of Dexmedetomidine in the management of postoperative pain when combined with fentanyl in the patient-controlled analgesia

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**Background and Goal of Study:** The aim of this study is to evaluate the opioid sparing effect of dexmedetomidine when added to patient-controlled analgesia (PCA) and satisfaction with postoperative analgesia.

**Materials and Methods:** In this double-blinded, randomized, controlled study, 40 patients undergoing open colectomy were allocated to receive ei-

ther fentanyl 25 µg ml<sup>-1</sup>) alone (Group F) or fentanyl 25 µg ml<sup>-1</sup>) plus dexmedetomidine 5 µg ml<sup>-1</sup>) (Group D) for postoperative i.v. PCA, which was programmed to deliver 1 ml per demand with a 8 min lockout interval and no background infusion. Cumulative PCA requirements, pain intensities, PCA-related adverse events were recorded for 24 h after operation. The satisfaction with postoperative analgesia was evaluated at 24 h after operation. The duration of PACU stay, time to ambulation, time to oral intake and hospital stay were investigated, too.

**Results and Discussion:** Compared with Group F, patients in Group D required 24% less fentanyl during the 0-24 h postoperative period and reported lower pain levels during first postoperative day. The 2-24 h incidence of nausea, sedation, hypertension, dizziness and pruritus were not different between two groups. The satisfaction was higher with Group D than Group F (full satisfaction, 53% vs 80%) but not significant ( $p = 0.245$ ). There were no significant difference between two groups in duration of PACU stay, time to ambulation and oral intake, hospital stay.

**Conclusion(s):** The addition of dexmedetomidine to i.v. PCA resulted in fentanyl sparing and high satisfaction. But, this has no effect on opioid-related complication, duration of PACU stay, time to ambulation, time to oral intake and hospital stay.

## 14AP2-10

### P38-inhibitor blocks WDR neurons hyperexcitability induced by intraoperative high doses of fentanyl

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**Background and Goal of Study:** Fentanyl is still commonly used for intraoperative pain management. However, it has also been shown to worsen postoperative pain through a NMDA receptors activation mechanism.

Increases in the activity of dorsal horn neurons (DHNs), spinal stress-activated mitogen-activated protein kinase (MAPK) p38 (in spinal microglial cells) are key factors necessary for the development of central sensitization associated with chronic pain.

The aim of the present study was to evaluate whether systemic fentanyl administration in rats during surgery might lead to an increase of postoperative WDR neurons hyperexcitability and to evaluate the effect of P38-inhibitor on this hyperexcitability recorded one day after surgery and fentanyl.

**Materials and Methods:** Sprague-Dawley male rats were given peri-operative four fentanyl (80 µg/kg, s.c. Q15min) or saline injections. After the second injection, some groups of rats underwent incision of the left hind paw. Thermal and mechanical sensory hypersensitivities were evaluated 4h, and 6h hours after the surgery and at D1. On D1, different groups of animals were used to record the activity of the DHNs via in vivo electrophysiology and to study the phosphorylation of p38 (p-p38) by immunohistochemistry in the spinal cord.

**Results and Discussion:** As previously described, fentanyl analgesia was followed by mechanical and thermal hypersensitivity in rats with or without surgery. On D1, at the cellular level, an increase in p-p38 was observed in the ipsilateral dorsal horn of the spinal cord of incision or fentanyl animals and was more extensively increased in fentanyl-incision group. Also, on D1, increased activity of DHNs was recorded after mechanical stimulation in incision and fentanyl groups as compared to control animals.

The activity of DHNs was dramatically enhanced in animals treated with fentanyl during surgery. The intrathecal administration of the p38 inhibitor SB 203580 (10 µg) strongly reduced the enhancement of mechanical sensory hyperexcitability of WDR neurons at the spinal level in incision + fentanyl-treated animals.

**Conclusion(s):** Our data suggest the involvement of MAPK P38 in postoperative acute spinal sensitization so called 'postoperative fentanyl-induced hyperalgesia'.

## 14AP2-11

### PHANOS - physostigmine and postoperative opioid consumption

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**Background and Goal of Study:** Postoperative pain management still needs improvement. Experimental and clinical studies have shown that cholinergic mechanisms play an important antinociceptive role.

Can a continuous infusion of a cholinesterase inhibitor reduce postoperative opioid consumption?

**Materials and Methods:** We conducted a prospective, double-blind, randomised, placebo-controlled pilot study in 18 patients undergoing nephrec-

tomy. All patients were premedicated with 3.75 - 7.5 mg midazolam 60 to 90 minutes before induction. General anaesthesia was induced using propofol and remifentanyl and maintained with sevoflurane and remifentanyl. 20 to 30 minutes before the end of surgery, 0.02 mg/kg hydromorphone was administered.

On arrival to the Post-Anesthesia Care Unit, both groups received 2 PCA pumps. One with hydromorphone, set to deliver a 0.2 mg bolus with a lockout time of 10 minutes and a maximum dose of 4 mg in any 4-h period and one delivering either physostigmine at a rate of 1 mg/h for 24 hours or placebo. All patients additionally received 4 x 1 g metamizol per day. For the first 24 postoperative hours, patients were assessed by the ward nurses: every hour for the first 4 hours, every 2 hours for the next 8 hours, and every 4 hours afterwards. The following parameters were documented: VAS at rest and on movement, degree of sedation, breathing rate, heart rate, blood pressure, and hydromorphone consumption. Other symptoms such as nausea, vomiting or increased salivation were also documented.

**Results and Discussion:** 14 patients completed the study. Mean hydromorphone consumption at 24 hours was 3.74 mg in the physostigmine group versus 5 mg in the placebo group. In the male subgroup, the difference between 24-h hydromorphone consumption in the physostigmine group and the placebo group reached significance: 8.9 mg vs. 3.92 mg,  $p=0.04$ . There was no difference with regard to documented VAS, but sedation was significantly reduced in the physostigmine group. Nausea and vomiting occurred in 4 out of 7 patients in the physostigmine group and in none of the patients in the placebo group.

**Conclusion(s):** Physostigmine application in the immediate postoperative period may help to reduce opioid consumption and sedation, thus potentially speeding up recovery. Based on the data from this pilot study, we plan to test our hypothesis in a calculated sample size of 100 patients.

## 14AP3-1

### Analgesic efficacy of continuous parietal ropivacaine infusion for postoperative pain after spine surgery

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**Background and Goal of Study:** Continuous wound infusion of local anaesthetics is an efficient analgesic technique in many surgeries. We have evaluated its efficacy at mid and long terms in lumbar arthrodesis on degenerative spine (EudraCT n°2008-005696-10).

**Materials and Methods:** Patients aged 18 to 75 years, scheduled for lumbar fusion  $\leq 3$  levels without preoperative morphine treatment, were included in a superiority, randomized, double-blind, monocenter clinical trial conducted on 2 treatment groups of 25 patients each. Postoperative (PO) analgesia associated intravenous acetaminophen plus morphine.

Analgesic efficacy of a continuous infusion of 8 ml/h ropivacaine 2mg/ml (R group) compared with saline (S Group) through a parietal catheter during first PO 48 hours was assessed using lumbar and radicular visual analogue scale (VAS) scores at rest and at mobilization at mid (2<sup>nd</sup> month: M2) and long terms (6<sup>th</sup> month: M6). Assessment at M2 of lumbar VAS score at mobilization was the primary outcome. Qualitative variables were expressed as sample size and percentage. Quantitative variables were expressed as sample size, mean with standard deviation or median with interquartile range. Comparisons between groups used a nonparametric Wilcoxon test, with  $P \leq 0.05$  as statistically significant.

**Results and Discussion:** 50 patients were included (6 excluded because of dural tears): 42 patients followed until M2 and 40 at M6.

There was no significant difference between groups concerning evolution of radicular VAS scores at M2 and M6. Mean lumbar VAS scores at rest were low in both groups. Evolution of lumbar score at mobilization is represented in table 1.

Inclusion	R group n=24	S group n=19	p
Mean(SD)	60.2 (26)	67.4 (17)	
Median score(Q1;Q3)	65 (43;80)	70 (50;80)	
<b>M2: primary outcome</b>	<b>R group n=24</b>	<b>S group n=18</b>	
Mean(SD)	21 (19)	32.2 (24)	0.0951
Median score(Q1;Q3)	20 (0;30)	30 (25;40)	
<b>M6</b>	<b>R group n=23</b>	<b>S group n=17</b>	
Mean(SD)	23 (21)	36.2 (24)	0.0788
Median score(Q1;Q3)	20 (0;40)	40 (20;60)	

[Evaluation of Lumbar VAS scores at mobilization]

Radicular VAS scores change similarly in both groups as a direct benefit of surgery. Median lumbar VAS scores at mobilization are lower in R group at M2 and M6 but not significantly.

**Conclusion:** Continuous parietal ropivacaine infusion could not be adapted to spine surgery and does not decrease lumbar pain at mobilization at mid and long terms.

### 14AP3-2

#### A randomized controlled trial of perioperative pregabalin administration for acute and chronic pain after radical modified mastectomy (RMM)

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**Background and Goal of Study:** Pain after surgery remains a significant clinical problem as it impairs recovery adversely and may lead to the transition to chronic pain. Pregabalin has anticonvulsant, antihyperalgesic and anxiolytic properties. Recently it has been used for the prevention of acute and chronic postoperative (post-op) pain<sup>1,2</sup>. Aim of this study was to examine if the perioperative administration of pregabalin reduces analgesic requirements and the incidence of chronic pain after RMM.

**Materials and Methods:** In a double-blind study, forty (40) patients (pts), scheduled for RMM under general anaesthesia, were randomly assigned to receive pregabalin 75mg (group T), the night- the morning (1h before surgery) and for 8 days after or placebo (group P) respectively.

In postanesthesia care unit (PACU) pts were given tramadol IV and in the ward paracetamol p.os on demand until the 8<sup>th</sup> post-op day. Verbal Analogue Scale(0-10), Prince Henry Hospital Pain Score<sup>3</sup> (0-4), Ramsay Sedation Scale(0-4) and Nausea Scale (0-3) were assessed pre-op and at 2, 4, 8, 24h and the morning until the 8<sup>th</sup> day post-op.

Other adverse effects were recorded. Three and 6 mo later, pts were assessed for chronic pain according to DN4 test<sup>4</sup>. Data were statistically analysed with Mann-Whitney test and  $\chi^2$  test ( $p < 0,05$ ).

**Results and Discussion:** Demographic data were comparable in both groups. Tramadol requirements were reduced in group T [18,42(29,86)mg] in comparison with group P [110,53(89,099)mg] ( $p < 0,001$ ).

In PACU, paracetamol consumption was [236,84(348,346)mg] in group T and [921,05(651,135)mg] in group P( $p=0,001$ ). PHHPS score was significantly reduced in group T vs group P at all times. VAS score was also reduced in group T, 8h after surgery( $p < 0,001$ ). The incidence of chronic pain 3 months after surgery was for the group T:26%(5/19) and for the group P:89%(17/19) ( $p < 0,001$ ), while 6 months after, for the group T was:21%(4/19) and for the group P was:47%(9/19)( $p=0,065$ ). Pre-op and during the first post-op 24hs, somnolence was slightly higher in group T( $p=0,04$ ). Side effects were similar in both groups.

**Conclusion(s):** Perioperative pregabalin seems to reduce post-op analgesic requirements and the incidence of chronic pain in RMM 3 months after surgery, without significant side-effects.

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### 14AP3-3

#### How does persistent postoperative pain correlate with preoperative pain and acute postoperative pain?

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**Background and Goal of Study:** In the Netherlands, 52% of all surgery is performed on an ambulatory basis. Previous studies have shown an incidence of acute postoperative pain of 20-40% after outpatient surgery. Other studies have shown that the prevalence of persistent postsurgical is 10-14%. This study evaluates the correlation between persistent postoperative pain and both preoperative and acute postoperative pain.

**Materials and Methods:** Over a period of eighteen months, 1275 patients undergoing outpatient surgery were prospectively included in this study. They were asked to complete three questionnaires; one week before surgery, four days after surgery and a year after surgery. They also received a prescription for acetaminophen and Zaldiar at the preoperative outpatient clinic. Pain was measured at an 11-point numeric rating scale (NRS). Moderate to severe pain was defined as an NRS  $> 4$ .

**Results and Discussion:** In our study the prevalence of moderate to severe pain was 31,0% in the preoperative phase, 19,7% four days after surgery and 14,8% one year after surgery.

Of the patients with moderate to severe pain one year after the operation, 65,1% experienced an NRS  $> 4$  preoperatively ( $r = 0,308, p < 0,001$ ) and 42,3% experienced an NRS  $> 4$  four days after the surgery ( $r = 0,237, p < 0,001$ ).

**Conclusion(s):** Our study showed that the prevalences of preoperative, acute postoperative and persistent postoperative pain are comparable to previous studies, despite the regular prescription of acetaminophen and Zaldiar. We also demonstrated a correlation between persistent postoperative pain and both preoperative and acute postoperative pain.

### 14AP3-4

#### Post-thoracotomy chronic pain - comparison of two locoregional techniques for postoperative analgesia: thoracic epidural and thoracic paravertebral block

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**Background and Goal of Study:** Chronic pain post thoracotomy is defined as pain that develops after surgical intervention and lasts at least 2 months; other causes for the pain have to be excluded, in particular pain from a condition preceding the surgery.<sup>1</sup>

The goal of this study is to compare two methods of locoregional postoperative analgesia, thoracic paravertebral block (TPVB) and thoracic epidural block (TEB) in the incidence of post thoracotomy chronic pain.

**Materials and Methods:** Retrospective study with an initial sample of 239 patients submitted to posterolateral thoracotomy due to neoplastic etiology and TPVB or TEB from 2005 to 2010. A voluntary telephone interview was conducted, from July to August 2011. Exclusion criteria: Death-66; Unable to contact-48, Non-cooperation-4; Preoperative pain-6; Chronic pain with malignancy recurrence-4;

Patients analyzed: n = 111.

Statistical analysis in SPSS using the Levene test, chi-square, Fisher and T for independent variables. Significance level  $< 0.05$ .

**Results and Discussion:** The homogeneity of the groups was verified in terms of age ( $63 \pm 10.6$ ), sex (M-66% F-34%) and radiotherapy (9.9%).

The overall incidence of pain after thoracotomy at 3, 6 months and at the time of the interview was 30.6%, 27% and 26.1% respectively.

Within the first postoperative week, no differences in assessment of acute post-thoracotomy pain by numerical scale of pain (NSP) and subjective opinion of quality of analgesia were observed in TPVB group as compared to TEB group ( $p=0.59$ ;  $p=0.074$  respectively).

At 3, 6 months and the time of the interview, there was also no difference in the incidence of chronic pain (TPVB:TEB - 27.4%:34.7%  $p=0.41$ ; 25.8%:28.6%  $p=0.74$ ; 25.8%:26.5%  $p=0.93$  respectively) and its intensity evaluated by the NSP (TPVB:TEB -3.88:3.18  $p=0.24$ ; 3.13:2.93  $p=0.72$ ; 2.93:2.92  $p=0.98$  respectively).

No correlation was found between NSP within 1 week postoperatively and the incidence of chronic pain.

The patients of both groups with chronic pain had similar analgesic requirements (TPVB:TEB - 33.3%:42.9%  $p=0.59$ ) and pain consultant referral (TPVB:TEB - 13.3%:14.3%  $p=0.94$ ).

**Conclusion(s):** Both techniques, TEB and TPVB, achieved similar incidence and intensity of chronic pain after thoracotomy which is consistent with existing literature.<sup>2</sup>

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### 14AP3-5

#### Postsurgical chronic pain after midline laparotomy in colon surgery: incidence, characteristics and related factors to its appearance

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**Background and Goal of Study:** Many factors has been described 1 in relation to development of chronic postsurgical pain (CPSP). There are not studies of CPSP in colon surgery with midline laparotomy approach. Our aim is to determine the incidence, characteristics and factors related to the appearance of CPSP in this type of surgery.

**Materials and Methods:** Retrospective review of patients operated of colon surgery by midline laparotomy between February 2008 and June 2010 through a standardized telephone questionnaire (call between 3 and 18 months after surgery). Patients were asked about presence of CPSP, characteristics, intensity (numerical verbal scale (NVS 0 to 10) and categorical numerical scale (type Likert), and analgesic treatment efficacy.

We have analysed the possible predisposing factors to the development of CPSP like gender, type of surgery (right hemicolectomy, sigmoidectomy and rectal resection), type of anaesthesia (total intravenous anaesthesia, combined anaesthesia and balanced), surgeon (3 different surgeons), duration of surgery, postoperative pain control (NVS maximum during the first 48 hours) and necessity of reoperation or chemotherapy using bivariate analysis.

**Results and Discussion:** Included 156 patients: 131 respondents, 16 not located and 6 died. Incidence of CPSP: 24.4%. Characteristics of CPSP: 53% referred as discontinuous and of mild-moderate intensity in 90.6% (NVS median 5 [range 3-7]). Burning was the most frequent symptom (47%) and allodynia was present in 62.5%.

The 43% of the cases were treated with paracetamol with little pain relief. Regarding the bivariate analysis of factors associated with the appearance of CPSP, were statistically significant the poor control of acute postoperative pain (no CPSP group [media±SD] 3.85±2.28 vs CPSP group 6.52 ±2.24  $p < 0.001$ ) and the responsible surgeon (surgeon A pain incidence 38% vs surgeon B 23% vs surgeon C 14%  $p = 0.017$ ). The remaining factors didn't achieve differences statistically significant.

**Conclusion(s):** The CPSP is common after midline surgery. It's an intermittent pain of mild to moderate intensity with neuropathic features and responds poorly to analgesic treatment. The surgical skill of the surgeon and the poor control of postoperative pain are the factors related to the appearance of CPSP

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### 14AP3-6

#### Prevalence of postoperative pain in neurosurgery

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**Background and Goal of Study:** The belief that neurosurgery is almost never associated with severe postoperative pain because the brain tissue has no pain perception *per se* seems very common. The use of opioids has always been very limited due to its effect on neurological examination that could mask a possible neurological complication.

Few studies evaluate the incidence and severity of postoperative pain in these patients<sup>1-3</sup>. The aim of our study was to assess the prevalence of pain in our center.

**Materials and Methods:** Prospective observational study in 98 patients undergoing neurosurgery. Data collected: type of surgery and analgesia scheduled by the anesthesiologist according to the guidelines. Pain intensity was assessed by visual analogue scale (VAS) at 12 and 24 hours postoperatively. Need for extra analgesia and adverse effects were also recorded.

**Results and Discussion:** Out of 98 patients, regular scheduled analgesia with Paracetamol(P) + Dexketoprofen(D) + Methadone(M) or Tramadol(T) as rescue therapy was given in 53 cases; P+D in 15; D+T in 12; P+T in 5; and a PCA (patient controlled analgesia) in 2 cases. 11 cases received another analgesic treatment. Extra analgesia was needed in 24 patients. 10 patients had nausea and/or vomiting, of which 9 had received morphine. In 10 and 5 patients we were unable to assess pain at 12 and 24 hours respectively, due to low consciousness or sedation and mechanical ventilation. 8 patients were lost during the study (early hospital discharged). VAS (mean±SD) was 2.3±2.2 at 12 hours and 1.5±2 at 24 hours. 21 patients (26%) and 13 patients (15.3%) had a VAS>3 at 12 and 24 hours respectively. Surgeries that showed a higher VAS in the first 12 hours were the interventions on the lumbar spine (VAS=3 ± 2.2, 50% of patients with VAS>3) and craniotomies (VAS 2.8 ± 2.3, 26% of patients with VAS>3).

**Conclusions:** Studies show that 41-84% of patients undergoing neurosurgery have moderate to severe pain within 24 hours<sup>2</sup>. In our center, the prevalence of VAS>3 is 26% at 12 hours and 15.3% at 24 hours, lower than the results reported in the literature. The use of opioids is safe, without the appearance of adverse effects, but its use is associated with an increased incidence of nausea and vomiting, which is not desirable, especially in this patient group<sup>3</sup>.

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### 14AP3-7

#### The effect of local infiltration of ropivacaine on the incidence of chronic neuropathic pain after modified radical mastectomy

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**Background and Goal of Study:** The aim of this prospective, randomized, double blind clinical trial, was to investigate the effect of local infiltration of ropivacaine on the incidence of chronic neuropathic pain, after radical mastectomy with axillary dissection.

**Materials and Methods:** Patients scheduled for modified radical mastectomy were infiltrated before wound closure with 10 ml ropivacaine 7,5 mg/ml (group A) or isotonic saline (group B) according to randomization. Three ml of the solution was infiltrated around the route sheath of brachial plexus and the rest of it in the 1<sup>st</sup> to 7<sup>th</sup> intercostal spaces. Postoperatively, VAS pain scale and tramadol consumption were recorded. The chronic pain in 6 months postoperative time was assessed via DN4 scale by telephone in order to estimate possible neuropathic pain.

**Results and Discussion:** Thirty-five patients were enrolled in the study and six of them were excluded (failure to be contacted by phone). Fourteen and fifteen patients were included in the ropivacaine and saline groups respectively. No difference was documented either in acute postoperative pain and tramadol consumption or in chronic neuropathic pain.

The only statistical significant difference concerns two particular DN4 neuropathic pain scale questions; the 3d question -pain like electric shocks- (40% group B - 0% group A,  $p=0,0008$ ) and the 5<sup>th</sup> one - pain associated with pins and needles- (66,7% group B-21,4% group A,  $p= 0,014$ ) were recorded.

**Conclusion(s):** Ropivacaine infiltration does not seem to attenuate chronic neuropathic pain regardless of the incidence of acute postoperative pain, after modified radical mastectomy. The fact that group B patients presented with statistical significant percentages of pain featuring neuropathic characteristics, depicts the need for further clinical trials.

### 14AP3-8

#### Chronic post-operative pain one year after carpal tunnel release surgery

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**Introduction:** Chronic post-operative pain (CPOP) has been assessed after major orthopedic surgeries (knee and hip replacements), but not after carpal tunnel release surgery.

The purpose of this study was to describe the evolution of nocturnal and diurnal pain during the year following this surgery, and to look for factors associated with CPOP.

**Materials and Methods:** Cohort of adult outpatients operated by one single surgeon, under regional anaesthesia. Patients completed a questionnaire in the recovery room, and then by phone 3 days and 12 months later. Using a multivariate analysis, the association between CPOP and the following parameters was tested: preoperative demographics, regional anaesthesia protocol, pain during regional anaesthesia, surgery and the first 3 postoperative days, postoperative complications.

**Results:** Between November 2006 and June 2010, 324 of 389 patients could be included. The nocturnal and diurnal pains disappeared on the evening of the procedure in 55% (180/324) and 50% (163/324) of patients respectively.

At one year, 12% of patients (40/324) complained of pain which was similar to the preoperative one. In addition, 22% (71/324) of patients suffered from ... new pain (different from the preoperative one), which could be considered as CPOP.

Patients with CPOP had a worse functional score (QuickDASH) than other patients.

After logistic regression, the presence of postoperative pain from D0 to D3 ( $p = 0.02$ ), the occurrence of minor post-operative complications ( $p < 0.001$ ) and the lack of hypnotic approach during surgery ( $p = 0.01$ ) were associated with the occurrence of CPOP.

**Conclusion:** This study shows that 22% of patients have CPOP one year after carpal tunnel surgery. This incidence is similar to the one observed after major surgeries. This study also suggests for the first time that the absence of hypnosis during the surgical procedure might be linked with the occurrence of CPOP.

**14AP3-9****Chronic pain in thoracic surgery. Retrospective epidemiological analysis of thoracotomy patients**

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**Background:** Postsurgery persistent-chronic pain is a well known identity in different surgery procedures. In thoracic surgery the incidence of persistent pain rounds about 25-60%. Thoracotomy is supposed to be one of the procedures at high risk to lead to postoperative severe persistent pain. About 82-90% of patients report symptoms directly on the site of surgery and refer to it as a dull pain, burning or numbness. Thoracotomy incisions are prone to the development of subacute and chronic postoperative pain because of the possibility of direct intercostal nerve and rib injury from the spreading of the interspace by the thoracic retractor. Relative role of possible pathogenic factors (type of surgical incision etc.), preemptive analgesia technique and correlation with acute postoperative pain are still unclear. The aim of this study was to investigate the incidence of chronic post-thoracotomy pain and identify possible risk factors associated with the development of chronic post-operative pain.

**Methods:** All patients who had undergone lobectomy or pneumonectomy at our institution in the year 2010 were contacted six months after operation and were asked about persistent pain symptoms. This result was compared with epidemiological data, surgery records, and acute pain measurements by the Acute Postoperative Pain Service.

**Results:** 81 ASA I-III patients were enrolled in the analysis: 77 lobectomies and 4 pneumonectomies. Prevalence of chronic pain was 27% (mild-moderate in 85% of cases). For postoperative analgesia was used epidural catheter in 57 patients (77%); paravertebral catheter in 11 (14%) and morphine PCA in 6 patients (8%); in 7 cases this data is missing. It was found no correlation between chronic pain and postoperative VAS, analgesia technique, ASA score. There was a statistically significant association between mean duration of surgery and presence of chronic pain ( $178 \pm 56$  vs  $151 \pm 50$  min,  $p=0.038$ ).

**Conclusions:** Our study confirms that chronic post-thoracotomy pain is a common problem. The results from our study suggest that chronic post-thoracotomy pain may be associated with duration of intervention. Further studies are needed to evaluate this association and its clinical relevance.

**14AP3-10****Acute and chronic pain following mastectomy with preventive continuous paravertebral block**

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**Background and Goal of Study:** The continuous paravertebral block (CPB) before surgery provides an adequate anesthetic and analgesic control with less opioid doses and the post mastectomy pain syndrome (PMPS) could be reduced with this practice.

We study the effectiveness of CPB infusion in perioperative analgesia and the control subsequent chronic pain.

**Materials and Methods:** We perform a prospective clinical trial with 40 patients in two groups, both subjected to breast surgery (mastectomy with or without lymphadenectomy). The first group: Control pain with intravenous opioids (Tramadol 1mg/Kg). Second group: preventive CPB infusion (Ropivacaine 0,2% 6-11 ml/h). The demographic characteristics in both groups were similar and therefore comparable. We measured the incidence of peak pain with VAS score (VAS>4) in each group and the impact of PMPS after two years of surgery.

**Results and Discussion:** The peak pain incidence without CPB was 54% (frequently at end of surgery and the first postoperative day) but only 18% had peak pain with CPB. The hemodynamic instability had a higher incidence ( $p < 0,05$ ) in the first group. The patients recovery, deambulation, satisfaction and circadian cycle were fastest with CPB. The hospital discharge was similar in both groups. We compared quantitatively in the next two years the number of cases that developed chronic pain in relationship with mastectomy. No one of the patients with CPB had been developed PMPS, but opioid iv. control pain had two cases (good control with gabapentine). The main complication in the immediate postoperative opioid group were nausea and vomiting increased with intraoperative sevoflurane.

**Conclusion(s):** We concluded that mastectomy needs an strict control peaks pain. This is not adequate with iv opioids, however preventive CPB allows a good pain control during and after surgery with minimal respiratory complications (unlike epidural block), more hemodynamic stability and pa-

tient satisfaction. The use of the CPB may reduce the risk of PMPS in reconstructive breast surgery (in a second time).

**References:**

1. Boughhey JC et al. *Anesth Analg* 2007 103:703-708.

**14AP4-1****Hyperbaric oxygenation alleviates CCI-induced neuropathic pain and decreases neuronal apoptosis in spinal cord**

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**Background and Goal of Study:** Increased apoptotic changes in spinal cord has been hypothesized to be responsible to the development of chronic constriction injury (CCI) induced neuropathic pain. The beneficial effect of hyperbaric oxygen treatment (HBOT) in pain disorders has been observed. We previous reported that HBOT alleviated CCI-induced neuropathic pain and reduces endoneuronal TNF- $\alpha$  production. The present study tested our hypotheses that 1) CCI-induced neuropathic pain may be associated with increased apoptotic cells in spinal cord; 2) HBOT may alleviate CCI-induced neuropathic pain; and 3) alleviated pain may be associated with reduced apoptotic cells in spinal cord.

**Materials and Methods:** Sprague-Dawley rats were randomized into 3 groups: 1) CCI (n=8), 2) CCI + HBOT (n=8), and 3) sham (n=6). Mechanical allodynia was tested by von Frey filament daily following surgery. Meanwhile, the HBOT rats were treated at 2.4 ATA for 60 minutes once a day. After 7 days post-CCI, animals were sacrificed and the spinal cords were harvested. The lumbar 4-5 region of the spinal cord was cryosectioned at 10  $\mu$ m and the incidence of apoptotic cells was investigated using the TUNEL technique.

**Results and Discussion:** By 7 days post-CCI, mechanical allodynia had developed in the ipsilateral paw ( $4.31 \pm 0.10$ ) compared to the contralateral paw ( $5.26 \pm 0.10$ ) and sham animals ( $5.17 \pm 0.08$ ),  $p < 0.05$ , respectively. HBOT significantly improved mechanical allodynia ( $4.69 \pm 0.11$  vs  $4.31 \pm 0.11$ ,  $p < 0.05$ ). In comparison to Sham, CCI-induced neuropathic pain was associated with significantly more apoptotic cells in the dorsal horn of the spinal cord at day 7, being  $19.25 \pm 2.44$  vs.  $10 \pm 0.45$ ,  $p < 0.05$ . HBOT reduced CCI-induced apoptotic cells to the level seen in sham animals, being  $8.25 \pm 0.90$  vs.  $10 \pm 0.45$ ,  $p = ns$ . The apoptotic cells were neurons verified by Nissl stain. The present study demonstrates that CCI-induced neuropathic pain was associated with increased neuronal apoptosis in the dorsal horn of the spinal cord. HBOT alleviated CCI-induced neuropathic pain and reduced apoptosis in the dorsal horn of the spinal cord.

**Conclusion:** The present study suggests that the spinal apoptotic changes may contribute to the development of CCI-induced neuropathic pain. The beneficial effect of HBOT in CCI-induced neuropathic pain may be, at least in part, due to its inhibitory role on spinal apoptosis.

**14AP4-3****Methylation of BDNF genes in rat orofacial neuropathic pain model ~possible biomarker of neuropathic pain in the future~**

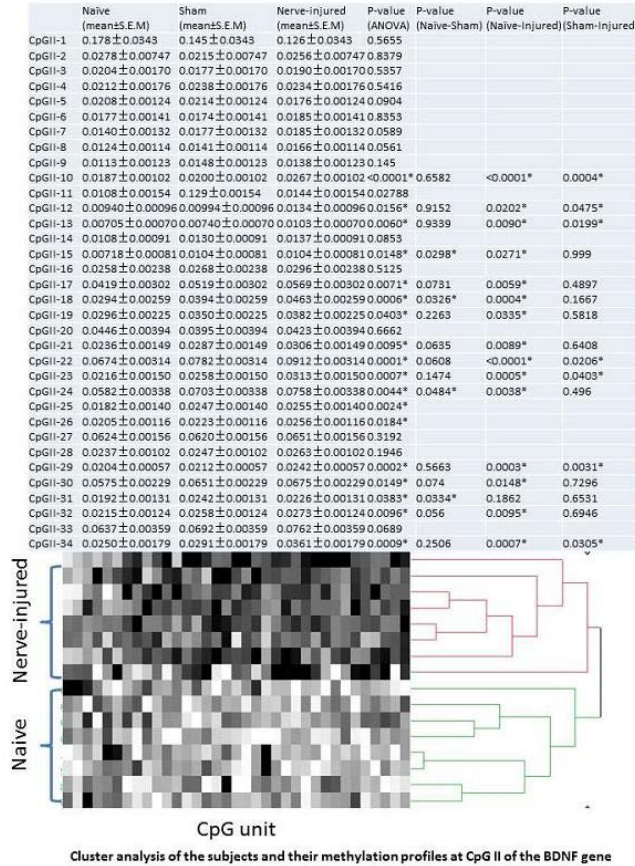
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**Background and Goal of Study:** Pain is a subjective symptom and the mechanisms are unclear. Neuropathic pain is diagnosed by patient symptoms rather than an objective test. One of the most important requirements is an objective useful biomarker. Brain-derived neurotrophic factor (BDNF) can potentiate pain transduction and is well known that DNA methylation affects transcription of BDNF. Towards that end, we examined the methylation profile of the BDNF in trigeminal ganglion after infra-orbital nerve (ION) injury as an orofacial neuropathic pain model to identify an appropriate epigenetic biomarker for the objective diagnosis of neuropathic pain.

**Materials and Methods:** We used ION loose ligation model using SD rats (N=8 each). 28 day after surgery when injured animal expressed pain behavior, the trigeminal ganglion samples were taken from each animal. All methylation analysis was performed using Solid4 system (Life Technologies, CA). Clustering analyses were performed using JMP 9.0.1 software, with the Ward's method. The difference in the methylation rates was compared by one-way ANOVA and statistical differences were resolved post-hoc using Tukey-Kramer multiple-comparison test ( $p < .05$ ).

**Results and Discussion:** 28 days after injury, pain threshold values from injured rats were statistically significantly lower than from sham and naïve rats. The methylation rates are shown in table and analyses of the dendrogram from methylation profiles of exonII promoter region demonstrated that clas-

sification of nerve injured rats and naïve controls at the first branch completely matched the condition (Fig). Our results indicate that classification based on the DNA methylation profiles of BDNF gene may be a valuable diagnostic biomarker for neuropathic pain.



[Figure 1]

**Conclusion(s):** Based on analyses of the methylation profiles within the CpG island at the promoter of the BDNF gene in trigeminal ganglion, we could accurately classify animals into two groups (nerve-injured and naïve).

## 14AP4-4

### Effects of intrathecal injection rapamycin on neuropathic pain behaviors in mice

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**Background and Goal of Study:** mTOR is an critical downstream target of Protein Kinase B/Akt, which has a close relationship with neuropathic pain and inflammatory pain hypersensitivity. mTOR mediated local protein synthesis is a key component in central and peripheral sensitization. It would be logical to hypothesize that mTOR inhibitor rapamycin-sensitive pathways play an important role in persistent pain-like states at the spinal level. The aim of this study was to investigate the effects of continuously intrathecal injection Rapamycin on neuropathic pain behaviors in Mice.

**Materials and Methods:** 48 male adult C57/BL6 mice receiving intrathecal catheter implantation successfully without motor dysfunction and serious weight loss, were choosed randomly and divided into sham-operation group (Group sham, n=24) and chronic constriction injury model group (Group CCI, n=24). After operation, each groups were further randomly divided into 3 group. Group I received nothing, group II was intrathecally injected with Rapamycin 1µg/5µl on day 1 to 6 after operation, group III was intrathecally injected with 20%DMSO 5µl at the same time (sham, CCI, sham+R, sham+V, CCI+R, CCI+V, n=8). Bilateral Mechanical Paw Withdrawal Threshold (WMT) and Thermal Paw withdrawal Latency (TWL) were tested on day 1 before CCI and day 1,3,5,7,10,14,17,21,28 after operation.

**Results and Discussion:** Compared with that of sham group, both WMT and TWL [7d,MWT: (1.02±0.12)g, (0.42±0.12)g, F=51.01, p< 0.05; TWL:

(7.03±0.71)s, (3.26±0.66)s, F=38.27, p< 0.05] of CCI group were significantly decreased after CCI on the ipsilateral side. When intrathecally injected with Rapamycin 1µg/5µl on day 1-6 after CCI, the mechanical allodynia was relieved obviously [7d,MWT: (0.42±0.18)g, (0.86±0.25)g, F=6.56, p< 0.05], and the effect at least continued to 10d.

On the contrary, effects of Rapamycin on thermal hyperalgesia just showed a trend of inhibition, there was no statistical difference. In addition, the pain behaviors of sham group and contralateral paw did not change (p>0.05).

**Conclusion(s):** Rapamycin can relieve the neuropathic pain behaviors in mice after CCI, mainly the mechanical allodynia, but not thermal hyperalgesia.

## 14AP4-5

### Antinociceptive interaction between intrathecally administered morphine and carbachol in rats

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**Background and Goal of Study:** Intrathecal morphine is well known to have antinociceptive effects. A cholinergic agonist, carbachol has also antinociceptive effects. The present study investigated the interaction between intrathecally administered morphine and carbachol in two different nociceptive models in rats expecting synergistic effects.

**Materials and Methods:** Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test and for their paw flinches by formalin injection after intrathecal different doses of carbachol administration. The 50 % effective dose (ED50) was calculated. The ED50s of morphine in each test were derived from our previous study (1). The combination of each 1/2, 1/4, 1/8, or 1/16 ED50 was administered. The interaction was tested by an isobolographic analysis. Eight rats were used in each dose group. Behavioral side effects were also investigated.

**Results and Discussion:**

	Tail flick	Formalin phase 1	Formalin phase 2
Morphine (µg)	1.4 (1.1-1.9)	7.1 (5.5-9.0)	3.7 (2.5-5.3)
Carbachol (µg)	0.51 (0.21-1.24)	0.20 (0.039-1.04)	0.008 (0.0004-0.17)
Morphine in combination (µg)	0.11 (0.015-0.77)	0.2 (0.06-0.66)	0.14 (0.02-1.14)
Carbachol in combination (µg)	0.04 (0.005-0.26)	0.0005 (0.00013-0.0015)	0.0003 (0.00004-0.0025)

[Table]

ED50 values are shown as mean and 95% confidence interval (in parenthesis). The ED50 of the combination was significantly lower than the ED50 of each single agent in both the tail flick test and the formalin test. Motor disturbance and allodynia observed with morphine or carbachol were not observed with combination.

**Conclusion(s):** Intrathecal morphine and carbachol had synergistic antinociceptive effects on thermal induced acute nociception and inflammatory induced acute and facilitated nociception.

**References:**

1. 4th Congress of World Institute of Pain, 2007

## 14AP4-6

### Antinociceptive effect of NMDA receptor antagonist and opioid receptor agonist on vincristine-induced peripheral neuropathy in rats

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**Background:** Vincristine-induced peripheral neuropathy is a major dose limiting side effect. The mechanisms underlying this dose-limiting side effect are currently unknown and there are no validated drugs for its control. The aim was to study the involvement of opioid and NMDA receptor on vincristine-induced peripheral neuropathy model in rats.

**Methods:** Male Sprague-Dawley rats weighing 220-240g were used in all experiments. Rats subsequently received daily intraperitoneal (i.p.) injections of either vincristine sulfate (0.1 ml/kg/day i.p.) or saline (0.1 ml/kg/day i.p.) over 12 days, immediately following behavioral testing.

For assessment of mechanical allodynia, mechanical stimuli using von Frey filament was applied to the paw and measured a withdrawal threshold. The ef-



fects of N-methyl-D-aspartate (NMDA) receptors antagonist (memantine; 2.5, 5, 10 mg/kg i.p.), opioid agonist (morphine; 2.5, 5, 10 mg/kg i.p.) and vehicle (saline) were evaluated.

**Results:** Mechanical allodynia developed over the course of ten daily injections of vincristine relative to groups receiving saline at the same times. Intraperitoneal morphine reduced significantly the paw withdrawal threshold compared to vehicle and produced dose-responsiveness. This effect was blocked by naloxone.

Only highest dose of memantine (10 mg/kg) was able to increase the mechanical threshold and returned to basal values. Subanalgesic doses of morphine (2.5 mg/kg) and memantine (2.5 mg/kg) produced an additive effect on mechanical allodynia reaching an antinociceptive effect.

**Conclusions:** Our results confirm that: the activation of opioids receptor produced analgesia; the blockade of NMDA receptors produce antinociception at high doses and low doses of memantine enhancing the effect of opioids.

## 14AP4-8

### Postincisional neuropathic chronic pain after abdominal surgery: comparison effectiveness between Lidocaine 5% patch vs Oral Pregabalin

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**Background and Goal of Study:** The incidence of incisional neuropathic pain is very high and poorly studied. Most surgeons do not identify neuropathic pain by DSM4 (allodynia, itching, burning, cramping, loss of sensation over the scar ...). Often patients have a second surgery to fix your pain because all tests are negative for organic pathology. Incisional neuropathic pain should be treated early, but which is the most effective treatment?

**Materials and Methods:** We compared 60 patients with neuropathic postincisional surgery with randomized clinical trial in two groups for lidocaine 5% patch and 300 mg oral pregabalin in prospective study 6 months and 1 year. The distribution was: laparotomy 27, cesarea 9, inguinal hernia 7, laparoscopic 3, appendicitis 5. All the patients the demographic characteristics are similar therefore comparable. Control group (N=32) received 300 mg of oral pregabalin and Study group (N=28) received Lidocaine 5% patch max 3 patch under scar by 12 hours/d, both on track for a year. Reporting VAS score pre and post treatment, patient satisfaction-fulfillment and Allodynia (0 to 5). We investigate if any treatment is more favorable

**Results and Discussion:** A 6 month ago the reduction of incidence of chronic neuropathic pain (VAS>4) was higher with Lidocaine patch (Study group 43%. Control group 67%). Better fulfillment without oral treatment and mayor satisfaction and tolerance. A 34% that received pregabalin had dizziness and 8% left pregabalin by adverse effects. Two patients had skin erythema reaction secondary patch. At follow-up to one year the reduction of the incidence of pain with the lidocaine patch was 33% higher than pregabalin.

**Conclusion(s):** Lidocaine patch is an effective method for reducing the symptoms of postincisional neuropathic pain with easy application under the scar without interfering with other drugs of the patients. Facilitates fulfillment and leads to greater satisfaction.

This new treatment not only be used in post-herpetic neuralgia or diabetic neuropathy but also, when neuropathic pain is located in incisional surgical area. With a probable diagnosis of painful scar prior to diagnostic testing or reintervention, can be applied lidocaine patch and reducing healthcare costs and increasing quality of life of patients.

## 14AP5-1

### The prophylactic effects of gabapentin on postoperative sore throat after thyroid surgery

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**Background and Goal of Study:** Postoperative sore throat (POST) is considered a usual complication after tracheal intubation, especially thyroid surgery. Gabapentin is a widely studied multimodal perioperative drug that can be used to treat acute postoperative pain.

We hypothesized that prophylactic administration of gabapentin would be effective in reducing POST. The aim of this prospective, randomized, double-blind study was to evaluate the prophylactic effect of gabapentin on reducing POST in patients after thyroid surgery.

**Materials and Methods:** Seventy-one patients that underwent elective thyroid surgery received either gabapentin (Neurontin™ 600mg) or placebo orally one hour before anesthesia. The incidences of POST and VAS scores

and adverse effects were determined at 1hr, 6hr, 12hr, and 24 hr after surgery at rest and during movement (swallowing and coughing). Furthermore, any complications (somnia, dizziness, headache, nausea) associated with gabapentin use and the total amount of rescue analgesics injected during 24 hours after surgery were recorded.

**Results and Discussion:** The incidence of POST during rest in the gabapentin group (47%,  $p=0.038$ ) was significantly lower than in the placebo group (71%). However, the incidences of POST during movement were not significantly different in the two groups (83% vs. 91%,  $p=0.305$ ). At postoperative 1h, 6h, 12, and 24h postoperatively, the gabapentin group had a statistically lower mean VAS score at rest than the placebo group ( $p=0.024$ , 0.006, 0.026, and 0.005, respectively) But during movement, VAS scores were only significantly different at 1h postoperatively ( $p=0.019$ , 0.503, 0.781, and 0.301, respectively). In addition, the rate of rescue analgesics during 24 hours after surgery was not different in the groups. And, in terms of the incidence of side effects, those of somnolence, dizziness, headache, and nausea, were not different in the two groups.

**Conclusion(s):** Gabapentin (Neurontin™ 600 mg) administered 1 hour before the induction of anesthesia was found to reduce the incidence and intensity of postoperative sore throat at rest without inducing significant adverse events during the 24 hours after thyroid surgery. However, it did not reduce the incidence or intensity of postoperative sore throat during swallowing or coughing.

## 14AP5-3

### Efficacy of scheduled time ketorolac administration compared to continuous infusion for post-operative pain after abdominal surgery

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**Background and Goal of Study:** Ketorolac tromethamine is a non steroidal anti inflammatory drug and its efficacy on acute pain control after abdominal surgery has been well documented. It has a rapid onset and it can be given both for intra operative and for post operative pain management. In this study, we evaluated if there was any difference in the relief of post operative pain when ketorolac was administered with continuous infusion in comparison with 8 hour time intervals.

**Materials and Methods:** 60 ASA I patients, enrolled for laparotomic gynecological surgery, were randomly assigned to 2 groups.

Group A patients were connected after surgical incision to a 24h analgesic infusor (48ml, 2ml/h) containing morphine (20mg) and ketorolac (90mg).

Group B patients were connected after surgical incision to a 24h analgesic infusor (48ml, 2ml/h) containing morphine (20mg). In this group, Ketorolac was given in bolus after the end of surgery and every 8 hours for the first 24 hours. Furthermore, all patients received paracetamol (1 gr i.v.) 30 minutes before extubation and every 6 hours for the first 24 hours.

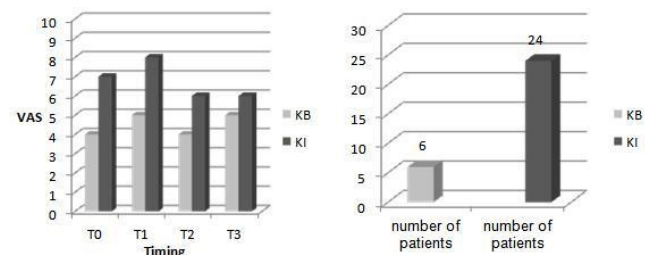
Post-operative pain scores were assessed using the Visual Analogue Scale (VAS) at rest and after coughing every 4 hours for 24 hours. With a VAS value higher than of 6, patients received tramadol (100 mg i.v.).

**Results and Discussion:** Post-operative pain scores showed a better pain relief for patients in group B.

Furthermore, the requirements of rescue analgesic were less in group B [tramadol was used for only 6 patients] than in group A [tramadol was used for 24 patients].

No adverse effects were registered in either group.

**Conclusion(s):** For post-operative pain Ketorolac administration at fixed-times offers greater benefits in comparison with continuous infusion



[Figures]

Left: differences of VAS of both groups; we observed that for group KB (ketorolac bolus) values were significantly ( $p < 0.05$ ) lower than for KI (ketorolac infusion).

Right: post-operative analgesic requirement

## 14AP5-4

### Efficacy of continuous preperitoneal infusion of ropivacaine 0,5% in postoperative pain after abdominal hysterectomy. A randomized, double-blind, placebo-controlled study.

#### Preliminary data

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**Background and Goal of Study:** The continuous wound infiltration with local anesthetics may be beneficial in a multimodal approach to postoperative pain by blockade of parietal nociceptive afferents<sup>(1,2)</sup>. Our aim was to evaluate the efficacy of continuous preperitoneal infusion of ropivacaine in pain relief after abdominal hysterectomy.

**Materials and Methods:** With approval of Hospital Ethics Committee and after written informed consent was obtained, 22 women age 30- 65, ASA I-II had participated in double-blind, placebo controlled trial and scheduled for abdominal hysterectomy, with midline incision, under general anesthesia.

A multiholed catheter was placed by the surgeon in the preperitoneal space at the end of the surgery. The patients (pts) were randomly assigned to receive infusion through the catheter, with elastomeric pump, either 5 ml/h ropivacaine 0,5% for 24h, after bolus wound infiltration of 15 ml lidocaine 2% (group R, n=11), or the same protocol with 0,9% NaCl (group C, n=10).

Verbal Analogue Scale (VAS 0-10), Prince Henry Hospital Pain Score<sup>3</sup> (PHS 0-4) and Nausea Scale (0-3) were assessed at 0, 2, 6, 12, 24h after surgery. Also bradycardia, hypotension, vomiting, headache, fever, agitation, drowsiness or confusion were recorded post-op with 2h interval.

The first 24h post-op the pts were given on demand tramadol IV 1 mg/kg, if VAS  $\geq 4$  (max 600 mg daily) and parecoxib IV, as rescue medication. Statistical analysis was made with Mann-Whitney, T- test and  $\chi^2$  test ( $p < 0,05$ ).

**Results and Discussion:** Demographic data were comparable in both groups. Total tramadol consumption in the first 24h was significantly lower in group R ( $145,46 \pm 56,81$  mg) vs group C ( $247,5 \pm 115,74$  mg) ( $p=0,029$ ). The number of pts that required pain medication (VAS  $\geq 4$ ) was lower at 0h ( $p=0,044$ ), 6h ( $p=0,016$ ) and 24h ( $p=0,013$ ). VAS score during the first 24h tended to be lower in group R vs group C ( $p=0,08$ ). No side effects were observed.

**Conclusion(s):** These preliminary results show that continuous preperitoneal infiltration of ropivacaine 0,5% at 5 ml/h during first 24h, delivered via Pain-fuser catheter, after abdominal hysterectomy, reduced opioid consumption, improved pain relief and is safe, without any statistically significant, local or systemic, side effect.

#### References:

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3. Torda T. A., et al. *Br. J. Anaesth.* 1995 ;74 :35-40

## 14AP5-6

### Acute pain service after caesarean section in general anaesthesia in two large perinatological centers - one year review

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**Introduction:** For the patients underwent Caesarean Section (CS) Acute Pain Service (APS) was established in two perinatological centers of our hospital. The main reason was to provide very specific and individual approach to the pain relief during and after CS. We perform almost 6500 spontaneous labours and 1000 CS per year altogether with preference of neuraxial blockades (66%).

**Methods:** Study was approved by the Ethical Committee of Faculty Hospital Brno. We aimed to enroll patients underwent Caesarean Section under general anaesthesia (GA) in the period May 2009- April 2010. Center I usually use non-opioid (NO) analgesia combining paracetamol 1000 mg and metamizol 2g intravenously (iv) and diclofenac 100 mg rectally in predefined times, center II usually provide opioid (OP) analgesia using continual infusion of piritramid 3 mg per hour iv for postoperative analgesia.

We administer additional NO drugs if VAS  $>4$ . During postcaesarean period we routinely observe and record blood pressure, pulse rate, Visual Analogue Scale (VAS), the additional analgesics consumption and complications. Collected data was evaluated by descriptive statistic (MS Excel 2007) and Mann-Whitney t-test (Statistica 10).

We compared average VAS and number of Additional Analgesic Requests in both centers in first 24 hours after CS.

**Results:** In the period May 2009- April 2010 we enrolled 120 patients in NO branch and 40 patients in OP branch after CS performed in GA. Average VAS score in first hour after CS in OP branch was 3.51, in NO branch 3.33. In the period 1-12 hours after CS it was 1.94 in OP and 3.48 in NO. Between 12 and 24 hours after SC it was 1.68 in OP and 2.99 in NO. Average analgesic requests (AAR) in OP branch was 0.08 in the period 1-12 hours and 0.18 in the period 12-24 hours. AAR in NO branch was 1.47 in the period 1-12 hours and 1.22 in the period 12-24 hours after CS. There is statistically significant difference in VAS and AAR between 1 and 24 hours after SC ( $p < 0.001$ ). There was no serious complication recorded during study period.

**Conclusion:** We conclude sufficient analgesic effect (VAS under 4) in both branches of study with more effective analgesia in OP branch in the period 1-24 hours postoperatively. Main disadvantage of continual opioid administration is need of infusion pump and continual monitoring of vital signs in intensive care unit.

## 14AP5-7

### Comparison of Tramadol requirements for postoperative analgesia in smokers and non-smokers patients

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**Background and Goal of Study:** Smokers are characterized by increased requirements of postoperative analgesia with  $\mu$ -opioid agonists compared with non-smokers. The possible mechanism of hyperalgesia for smokers is not related to  $\mu$ -opioid receptors. Tramadol enhances inhibitory effects on pain transmission both by opioid and monoaminergic mechanisms. The aim of the study is to compare the postoperative analgesic requirements for tramadol in smoker and non-smoker population.

**Materials and Methods:** 30 ASA I-II patients scheduled for radical prostatectomy were allocated to 2 groups.

Group A: Non-smokers (15 )

Group B: Smokers (15 )

At the beginning of wound closure, all patients received an equal initial bolus dose of tramadol (2,5mg/kg) i.v. Pain intensity was measured using the Visual Analogue Scale (VAS score) in the postanesthesia care unit by a blinded investigator. The PCA dose was set at 1ml/bolus (10mg/ml), with a lockout interval of 5min. VAS scores patient vital signs and adverse effects were assessed every 6 h for 48 h postoperatively, while satisfaction was assessed 6 h, 24 h and 48 h postoperatively. Data of PCA demand, dose delivered and total dose consumed were retrieved from the PCA device.

**Results and Discussion:** Both groups achieved effective postoperative analgesia. Pain intensity by VAS score was not statistically different between groups. There were no statistically significant differences between the groups on satisfaction score assessments. 4 patients in GroupA and 6 in GroupB complained of persistent nausea, and rated the satisfaction score as "poor" in 24 h. Group B showed a statistically higher frequency in demand than the non-smokers group (total times  $45.6 \pm 7.229$  vs  $28.8 \pm 3.85$  P =0.033) (Table 1). Tramadol consumption in Group B, however, was significantly more than in the Group A ( $456 \pm 72.24$  mg vs  $288 \pm 38.5$  mg) (P < 0.005).

Group	6h	Day 1	Day2	TOTAL
PCA Demand				
Smokers	$6.1 \pm 0.737$ $p=0.464$	$24.5 \pm 4.743$ $p=0.02$	$16.4 \pm 2.95$ $p=0.039$	$45.6 \pm 7.229$ $p=0.033$
Non-Smokers	$3.7 \pm 0.483$	$15.0 \pm 2.211$	$10.1 \pm 1.663$	$65.2 \pm 38.5$
Tramadol consumed (mg of tramadol)				
Smokers	$61.0 \pm 7.37$ $p=0.463$	$245.0 \pm 47.43$ $p=0.002$	$164.0 \pm 29.51$ $p=0.039$	$456.0 \pm 72.24$ $p=0.0033$
Non-smokers	$37.0 \pm 4.83$	$150.0 \pm 22.1$	$101.0 \pm 16.6$	$288.0 \pm 38.5$

[Frequency of PCA Demand (Attempt) and Doses of PCA]

**Conclusion(s):** In alleviating postoperative pain, tramadol is an alternative drug to morphine for PCA treatment. Smokers seem to have greater tramadol needs compared to non-smokers. However further studies with larger populations are needed.

### 14AP5-8

#### The effect of transversus abdominis plane (TAP) block with and without added clonidine on post Cesarean delivery wound hyperalgesia and post surgical pain

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**Background and Goal of Study:** The ultrasound guided transversus abdominis plane (TAP) block is a novel analgesic technique to treat Cesarean delivery pain. It appears that a local anesthetic only, single injection TAP block conveys no benefit compared to intrathecal morphine, the current standard. To date, no trials have investigated ways to prolong the duration of a single injection TAP block and its impact on wound hyperalgesia (WHA), considered a risk factor for chronic pain after Cesarean delivery. We hypothesized that the anti-WHA effects of clonidine added to bupivacaine for a single injection TAP block would reduce 48 hour WHA and the incidence of persistent postsurgical pain (PPP).

**Methods:** Ninety healthy volunteers participated in this double blind randomized controlled trial comparing 3 different TAP injections performed after Cesarean delivery under spinal anesthetic: Placebo = TAP block with NaCl 0.9% (20.5ml) per side. BupTAP = TAP block with bupivacaine 0.375% (20ml) and NaCl 0.9% (0.5ml) per side. CloTAP = TAP block with bupivacaine 0.375% (20ml) and clonidine 75 mcg (0.5ml) per side. The primary outcome was the area of punctate mechanical hyperalgesia surrounding the wound per length of incision at 48 hrs (wound hyperalgesia index(WHI)). Secondary outcomes were hemodynamic parameters, pain scores, analgesic consumption and PPP at 3, 6 and 12 month assessed by the Short-Form McGill Pain Questionnaire 2 (SF-MPQ2).

**Results and Discussion:** The WHI at 48 hrs in the Placebo group was (median, 25<sup>th</sup>-75<sup>th</sup> percentiles): 1.07 (.48-3.26) vs. 1.27(.59-2.95) in the BupTAP group and lowest in the CloTAP group 0.74 (.09-2.25). These differences did not reach statistical significance ( $p=0.59$ ). Hemodynamic parameters, postoperative pain scores and chronic pain assessment did not differ. Incidence of breakthrough medication requests at 48 hrs was 30% in the Placebo group, 24% in the BupTAP group and 11.5% in the CloTAP group. Repeat Cesarean delivery WHI 48 hrs: Placebo group (median, 25<sup>th</sup>-75<sup>th</sup> percentiles): 1.22 (0.14-3.74) vs. 0.73 (0.51-1.32) in the BupTAP group and 0.74 (0.58-2.758) in the CloTAP group.

**Conclusions:** Clonidine added to bupivacaine in a TAP block does not reduce 48 hrs WHI in healthy primiparous parturients. A trend in 48 hrs WHI reduction in the repeat Cesarean delivery population with high pre-operative scar hyperalgesia was observed in the BupTAP and CloTAP groups, but the study was not powered for this subgroup analysis.

### 14AP5-9

#### The impact of intravenous clonidine on management of acute postoperative pain following colorectal surgery

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**Background and Goal of Study:** The use of centrally acting alpha2-adrenergic agonist clonidine reduces postoperative opioid consumption after major abdominal surgery. We have investigated the potential of clonidine, administered intravenously at induction of anaesthesia, to improve early postoperative analgesia in subjects undergoing colorectal surgery.

**Materials and Methods:** 93 ASA I-III subjects scheduled for colorectal surgery have been enrolled in this prospective study. At induction of anaesthesia they have been randomly assigned to two groups to receive intravenous clonidine (group C, n=48), respectively saline (group S, n=45). General anaesthesia has been standardized in all patients.

Patient-controlled analgesia with intravenous morphine (1.5 mg bolus, 10 min lockout time) has been instituted for acute postoperative pain management. Postoperative pain intensity (visual analog scale) at rest and during coughing, level of sedation (Ramsay scale), hemodynamic profile (blood pressure and heart rate) have been recorded at 1, 2, 6 and 24 h after procedure. Total morphine consumption during first postoperative day has been assessed, too. Statistics has been performed using Student's t test,  $p < 0.05$  being significant.

**Results and Discussion:** Demographic details have been similar in both groups. Pain scores at rest and during coughing have been significantly lower in group C at 1h ( $p < 0.05$ ), respectively 6h postoperatively ( $p < 0.01$ ), the following recorded values being comparable.

Ramsay scores have been slightly higher in group C compared to group S

1h postoperatively, thereafter level of sedation being similar in both groups. Hemodynamic monitoring has revealed insignificant differences between the two groups. The total morphine consumption assessed at the end of the study period has been significantly reduced in group C compared to group S ( $p < 0.05$ ).

**Conclusion(s):** Preoperative intravenous administration of clonidine has been associated with significantly decreased pain level and lower morphine requirement during first 24h after colorectal surgery, without impairment of conscious state or adverse hemodynamic changes.

### 14AP5-10

#### Effect of intraoperative nefopam on acute pain management after major abdominal surgery

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**Background and Goal of Study:** Nefopam, a centrally acting analgesic, has been used extensively as an adjuvant to opioid analgesia in patients undergoing major abdominal surgery, despite the lack of valid clinical trial data. The goal of this study is to determine whether the administration of a single dose of nefopam before the end of surgery could considerably improve acute postoperative analgesia after major abdominal procedures.

**Materials and Methods:** After informed consent and with local institutional approval, 78 patients classified as ASA physical status I-III, aged 21-75 years and undergoing elective major abdominal procedures have entered this prospective study.

The subjects have been randomly assigned to receive 20 mg nefopam (group N, n=38) or placebo (group P, n=40) approximately 15 min before the end of surgery performed under standard general anaesthesia. For acute postoperative pain relief patient-controlled analgesia with morphine (doses of 1 mg, 6 min lockout period) and paracetamol (1 g iv every 6h) has been administered in both groups. Pain score (VAS) at rest every 4h, time to first bolus request and total morphine consumption during first postoperative day have been recorded. The incidence of nausea, dizziness, as well as patient satisfaction have been evaluated, too. Student's t test has been used for statistical analysis,  $p < 0.05$  being considered significant.

**Results and Discussion:** Demographic data have been comparable in both groups. VAS has been significantly reduced in group N versus group P at 4, 8, 12h postoperatively ( $p < 0.001$ ).

For the following time intervals acute postoperative pain has been better controlled in group N, although VAS scores are similar to those corresponding to group P. The time to the first bolus request has been prolonged in group N ( $p < 0.001$ ). Total consumption of morphine has been significantly less in group N versus group P (17.5+/-6.5 mg versus 31.0+/-7.1 mg,  $p < 0.001$ ).

Patients in group N have experienced lower incidence of nausea and dizziness episodes than those in group P ( $p < 0.05$ ). The rate of patient satisfaction has been significantly increased in group N compared to group P ( $p < 0.05$ ).

**Conclusion(s):** Our study suggests that 20 mg nefopam administered intraoperatively improves the quality of acute postoperative analgesia and increases patient satisfaction, while reducing morphine requirements and the risk of serious adverse events after major abdominal surgery, when compared to PCA only.

### 14AP5-11

#### Effectiveness of the paravertebral block for analgesia after breast cancer surgery

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**Background and Goal of Study:** Major surgery for breast cancer is associated with high incidence of nausea, vomiting and postoperative pain. Thoracic paravertebral block (PVB) is carried out successfully for pain management after breast surgery.

The purpose of this study is to evaluate the efficacy and adverse effects of PVB in women undergoing breast surgery.

**Materials and Methods:** This prospective, randomized, comparative, single-blind study was conducted after approval by the local ethics committee. Forty patients who underwent radical mastectomy were included in the study after informed consent according to the following criteria: Age > 20 and < 65 years, ASA class I or II. The non-inclusion criteria were: refusal of the patient, infection of the injection site, bleeding disorder, BMI > 35, hypersensitivity to local anesthetics, chronic analgesics or antiemetic treatment. Exclusion criteria were: anesthetic complications and technical difficulties.

Patients were randomized into 2 groups: G1 (n = 20): 1.5mg/kg of bupivacaine 0.5% for metameric T4 into the paravertebral space and G2 (n = 20): did not have paravertebral block. Complementary analgesia by paracetamol and morphine was administered to both groups.

We found the VAS at rest and in motion at 1, 2, 3, 9, 12 and 24 hours after surgery, the first analgesic request, the incidence of nausea and vomiting and adverse effects of paravertebral block.

**Results and Discussion:** Demographic characteristics and duration of the intervention were comparable between the 2 groups. The average VAS at rest and movement were lower in group 1 up to 24 hours after surgery. The median (range) time of the first analgesic request was 94.5 minutes for group 1 versus 25.5 minutes for group 2,  $P < 0.05$ . The amount of morphine in SSPI was lower in group 1 ( $2.05 \pm 0.22$  mg vs  $5.35 \pm 2.11$  mg,  $P < 0.001$ ). The consumption of analgesics in 24 hours was significantly lower in the paravertebral block group. The incidence of nausea and vomiting was significantly higher in group 2 than in group 1. There were no complications associated with the implementation of the paravertebral block.

**Conclusion(s):** As part of a multimodal analgesia, paravertebral nerve blocks can provide excellent postoperative analgesic pain relief with less adverse effects and could also reduce the incidence of postoperative nausea and vomiting.

## 14AP6-1

### Analgesic efficacy of L-bupivacaine delivered by wound catheter after abdominal surgery

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**Background and Goal of Study:** A modality of postoperative analgesia places a catheter to infuse local anesthetic into wounds at the end of the procedure.

The role of continuous preperitoneal infusion of levo-bupivacaine for pain relief and postoperative recovery after open colorectal resections was evaluated in a randomized, double-blinded, placebo-controlled trial.

**Materials and Methods:** Following local institutional review board approval and obtaining written informed consent, a multiholed wound catheter (15 cm length) (Painfusor Catheter, Baxter) was placed by the surgeon in the preperitoneal space at the end of surgery in patients scheduled to undergo elective open colorectal resection by midline incision.

A standardized general anesthetic was administered. They were randomly assigned to receive through the catheter either 0.25% L-bupivacaine (5 ml bolus followed by an infusion of 5 ml/h during 48 h) (group LA) or the same protocol with 0.9% NaCl (group S) with a portable infusion pump (Infusor LV, Baxter). In addition, all patients received an infusion of Tramadol and ketorolac with a portable infusion pump (Infusor LV, Baxter) and patient-controlled intravenous morphine analgesia (GEMSTAR, Hospira).

Information was collected preoperatively; patient demographics (age, weight, and height), postoperative pain scores (using visual analogue scale at 4, 8, 12, 24, 36 and 48 h), analgesic demand with PCA and side-effects were registered. Results in text and table are expressed as mean (SD) or median (range) as appropriate. Data were analyzed using the Student's t-test or analysis of variance with the Bonferroni correction,  $\chi^2$  and Mann-Whitney U-test as appropriate. A value of  $p < 0.05$  was considered statistically significant.

**Results and Discussion:** Thirty seven patients were evaluated (n=15 group LA, n=18 group S, 4 patients, two patients from each group were excluded). There were no significant differences between the groups. Compared with preperitoneal saline, L-bupivacaine infusion did not reduced morphine consumption during 48 h (9 mg (0-18) vs 11 mg (2-21) ;  $p=0.39$ ). Pain scores were not reduced during 48 h after surgery in group LA and S. No side effects were observed.

**Conclusion(s):** With this protocol continuous preperitoneal administration of 0.25% L-bupivacaine at 5 ml/h during 48 h after open colorectal resection is safe but we have not demonstrated any significant clinical advantage.

## 14AP6-3

### Postoperative pain control in view of the coagulation profile changes in cirrhotic patients undergoing liver resection

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**Background and Goal of Study:** Epidural catheters are of concern for cirrhotic patients. Aim is to study coagulation changes associated with liver surgery among cirrhotic patients as well as to compare patient controlled epidural analgesia (PCEA) with intravenous patient controlled opioids (IVPCA).

**Patients and methods:** After ethics committee approval and informed consent, fifty patients with hepatic cirrhosis (Child A) scheduled for right hepatic resection were studied prospectively and randomised into two equal groups. A group managed with thoracic PCEA using a mixture of bupivacaine 0.125% + 2  $\mu$ g/ml of fentanyl versus a group with IVPCA fentanyl. Both standard coagulation tests (SCT) and rotational thromboelastometry (ROTEM) were used to study coagulation profile changes.

**Results:** Age and sex were comparable between both groups ( $P > 0.05$ ). Mean age  $55.9 \pm 6.9$  ys, males 55% for PCEA. During cough and movement PCEA group suffered less pain on visual analogue scale ( $P < 0.05$ ). PCEA group were less sedated with Ramsay sedation score of  $2.9 \pm 1.14$  vs  $3.6 \pm 0.51$  for IVPCA group on first day ( $P < 0.05$ ), but four PCEA patients complained of lower limb numbness delaying early ambulation.

Mean epidural catheter stay was  $5.88 \pm 1.27$  days. Two demanded fresh frozen plasma units to normalize high INR before catheter removal. Nausea/vomiting were reported more frequently with IVPCA ( $P < 0.05$ ). There was no difference between two group in ROTEM and SCT results. In PCEA ROTEM results were in normal range, while PT and INR showed temporary hypocoagulability postoperatively with a peak of  $16.8 \pm 1.5$  seconds and  $1.4 \pm 0.18$  respectively. In contrast clot time (CT) or clot formation time (CFT) parameters in ROTEM were within normal. Mean peaks of CT (INTEM), CFT (INTEM), CT (EXTEM) and CFT (EXTEM) were  $41.5 \pm 4.1$  seconds,  $158.15 \pm 19.07$ ,  $109.10 \pm 25.8$ ,  $86.2 \pm 15.7$  and  $149.7 \pm 25.2$  mms respectively. Fibrinogen and maximum clot firmness (MCF) of INTEM and EXTEM were also normal range with peaks of  $316.5 \pm 49.9$  mg/dl,  $60.1 \pm 7.5$  and  $57.8 \pm 4.3$  mm respectively. No significant correlations between ROTEM and other SCT ( $p > 0.05$ ).

**Conclusion:** In view of ROTEM and pain scores epidural catheters appears to be safe and more efficient for cirrhotic patients undergoing liver resection despite hypocoagulability reported by SCT. Further studies are needed to explore the interrelationship between SCT and ROTEM. Coagulation monitoring is essential when epidural catheters are used in cirrhotics.

## 14AP6-4

### The efficacy of combined somatovisceral blockade with ropivacaine and morphine after laparoscopic cholecystectomy

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**Background and Goal of Study:** Although the intensity of pain after laparoscopic cholecystectomy is less than open procedure, some patients experience considerable discomfort.

The aim of the study was to evaluate the efficacy of combined intraperitoneal (IP) and port site instillation of ropivacaine, with the addition or not of morphine, on postoperative pain relief.

**Materials and Methods:** 48 patients ASA I or II were divided, in double blind fashion, in 3 groups of 16 individuals. All patients were anaesthetised with a similar technique and received titrated fentanyl 3mg/kg, 1 g paracetamol and 40 mg parecoxib iv. Following removal of gallbladder, at the patients of group A the subhepatic gallbladder bed parenchyma (IP) as well as the trocar and port sites were instilled with saline 0,9%. They also received morphine 0,03mg/kg iv. In group B, the patients received IP 10 ml ropivacaine 0,75% with morphine 0,03 mg/kg and 10 ml ropivacaine 0,75% at the port sites. The patients of group C, received IP 10 ml ropivacaine 0,75%, 10 ml ropivacaine 0,75% at the port sites and morphine 0,03mg/kg iv.

The intensity of pain was measured at 1, 6, 12, 24, 48 h (VAS score) and its quality was estimated (shoulder, parietal or visceral pain). The consumption of rescue analgesia (50 mg pethidine im) was recorded.

**Results and Discussion:** The cumulative pain scores postoperatively were consistently greater at group A in comparison with the other groups and the difference of VAS score was maximum at 1 h postoperatively (median VAS score was 36 at group and A and 27 and 21 at group B and C respectively). Mean total opioid doses of analgesics consumed was 1,56 compared to 0.81 and 0,87 at groups A, B, C respectively. The parietal component of pain was diminished in groups B and C. The visceral component of pain predominated at the patients of all groups which complained for increased pain (VAS=7). No clinical evidence of local anaesthetic toxicity was recorded.

**Conclusion(s):** The instillation of ropivacaine for postoperative pain relief after laparoscopic cholecystectomy is moderately effective, especially the parietal component. Marked interpatient variability of pain scores was recorded and this fact may indicate that other factors as residual pneumoperitoneum may be involved.

The technique is simple and safe and may be a part of multimodal analgesia. The use of morphine at the solution does not seem to increase the efficacy in our study.

## 14AP6-5

### Continuous infusion of local anaesthesia compared to spinal morphine as pain treatment for hysterectomy: a prospective, randomized and double blinded study

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**Background:** Spinal morphine has been the "gold-standard" for the treatment of pain after abdominal hysterectomy. However, puncture of the dura mater bears the risk of postspinal headache and the stay in the PCU can be prolonged.

**Goal of Study:** To compare the analgesic efficacy of subfascial, continuous infusion of bupivacaine with spinal morphine after total hysterectomy with a midline incision

**Materials and Methods:** Patients were randomized to receive either :Spinal morphine 0.2mg +bupivacaine 5 mg (SG) or continuous infusion of bupivacaine 2.5 mg/ml - 4 ml/hour (BG). All patients received paracetamol 1 gr x 4 and diclofenac 50 mg x 3 as all three days of the study period. Local anaesthesia was infiltrated subcutaneously in all patients, but only those receiving saline had their dura punctured for spinal analgesia

Pain and nausea were scored by a VAS (visual analogue scale) by a person blinded to the analgesia given to the patients. The VAS scores were performed at the arrival to the PCU, 1,2,5,8,10 hours after arrival to PCU, three times a day the first and second day after surgery. Rescue analgesia was iv or subcutaneous morphine. The amount morphine needed was evaluated after 5 hours, after 24 hours, the first and the second day after surgery. The use of Aldrete score  $\geq 9$  decided the time of discharge from the PCU.

**Results:** The study was accepted by the ethic committee.. After a written informed consent, 44 patients were included in the study, 22 having spinal morphine (SG) and 22 receiving continuous local infusion of bupivacaine (BG). VAS scores at 5 hours were significantly lower in the spinal group ( $p < 0.001$ ) The need of rescue morphine was similar for the first 5 hours, the first 6-24 hours and the first day after surgery in both groups

The second day after surgery the need of rescue morphine was significantly higher in the spinal group ( $p < 0.001$ ) as was the severity of nausea ( $p = 0.007$ )

**Conclusion:** The continuous infusion of bupivacaine should be preferred in patients undergoing hysterectomy. The analgesic effect is similar or slightly better than spinal morphine. The patients can be discharged earlier from the PCU and have no risk of post spinal puncture headache. They also experience less pain and have less risk of nausea the second day after surgery

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## 14AP6-6

### Heterogeneity in meta-analyses of post-operative treatment of acute pain: a review

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**Background:** Heterogeneity and its causes must be assessed in meta-analyses (MAs). Especially in MAs dealing with post-operative treatment of acute pain, the type of surgical procedure is a source of heterogeneity.

**Objective:** To assess how heterogeneity is assessed and taken into account in MAs evaluating the efficacy of post-operative treatment of acute pain, and whether the type of surgery is considered as a source of heterogeneity.

**Data sources:** Issue 3, 2011, of the electronic database of the Cochrane library (Cochrane database of systematic reviews and Database of Abstracts of Reviews of Effects) of MAs pooling results of randomised or quasi-randomised controlled trials that assessed the efficacy of treatment for acute post-surgical pain alone.

**Data extraction:** Data were extracted by use of a pretested, standardized data abstraction form.

**MA partition:** We established a rating of the post-operative pain level of surgical procedures by an expert survey. For each MA, we considered the different pain level ratings associated with the trials included in the MA and calculated the standard deviation of these ratings.

We then divided MAs into 2 groups: *hetero group* (MAs showing heterogeneous postoperative pain level) and *homo group* (MAs showing homogeneous postoperative pain level).

**Results:** We included 61 MAs. Heterogeneity was assessed in all MA. However, only 72.1% of reports discussed surgical procedure as a source of clinical

heterogeneity (85.0% and 62.5% respectively in the homo and hetero group). Only 26 of 55 MAs describing subgroup analyses considered surgical procedure as a subgroup. When performed, the analysis usually compared post-operative pain from dental surgery to other kinds of surgeries.

**Conclusion:** MAs of post-operative treatment of acute pain should explore clinical heterogeneity associated with the kind of surgical procedures for better implications for practice.

## 14AP6-7

### Continuous paravertebral catheters and minimally invasive cardiac surgery

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**Background and Goal of Study:** Surgery is increasingly performed using minimally invasive approaches including cardiac surgery. At the same time, it seems that in most institutions, epidural analgesia remains the technique of choice to provide effective peri-operative analgesia. In this regard, paravertebral blocks, a lesser invasive technique than epidural, have been demonstrated to be equianalgesic to epidural blocks.

We are reporting our experience with the use of continuous paravertebral blocks (CPVBs) in patients undergoing minimally invasive cardiac surgery (MICS).

**Materials and Methods:** Between 9/1/2008 and 11/30/2011, a total of 30 patients underwent MICS (Maze procedure, mitral valve replacement, or single vessel CABG procedures with CPVBs) with CPVBs.

In each patient, CPVBs were performed prior to surgery. Depending on the type of surgery, the paravertebral catheters were placed unilaterally or bilaterally at levels T3 or T4. During the placement of each catheter, a bolus with 15 ml of ropivacaine 0.5% followed by an infusion of either lidocaine 0.25% (bilateral) or bupivacaine 0.0625% (unilateral) was infused. To assess the effectiveness of this approach, data were compared to a similar group of patients who did not benefit from a regional technique (control).

**Results and Discussion:** The use of CPVBs was associated with a 56% increase in the rate of extubation prior to leaving the operating room compared to the control group.

In addition, the length of hospital stay was reduced by one day on average with an associated shorter ICU stay. Pain reduction at the 24 hour mark was reduced 44% compared to the control group.

**Conclusion(s):** Our data support the concept that the combination of CPVBs and minimally invasive cardiac surgeries facilitate a fast-track surgical pathway.

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## 14AP6-8

### Effectiveness of multidisciplinary clinical approach on enhanced recovery after surgery in patients with inflammatory bowel diseases

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**Background and Goal of Study:** Inflammatory bowel diseases (IBD) require surgery in approximately 70% of cases. The anxiety reduction and better pain control seems to improve the quality of life (QoL) after hospital discharge (1). Multi-modal analgesia with antineuropathic pain drug like pregabalin, may be important for optimal perioperative care.

**Materials and Methods:** Fifty patients (18-60 ys), ASA physical status II undergoing surgery for IBD were randomly assigned to orally receive either placebo capsules (PL group) or pregabalin (150 mg) (PG Group) two hours before surgery.

At the preoperative visit, each patient received two self-administered tests: STAI-Y (State and Traits Anxiety Inventory form Y) and Euro-QoL. All patients received general anaesthesia, PONV prophylaxis (dexamethasone 8 mg and ondansetron 8 mg every 12 hours) and postoperative patient-controlled analgesia (PCA) with a background infusion of morphine (bolus 1 mg, lockout interval 30 min), plus paracetamol 1gr/three times a day. During 24 postoperative hours the number of bolus doses and rescue doses were registered.

Visual analogue pain scores (VAS) were assessed at 1, 2, 4, 8, 12, 24 hours after surgery.

The incidence of adverse reactions (PONV, sedation, dizziness) was also recorded. STAI-Y as well as Euro-QoL questionnaire were further administered 3 months after hospital discharge.

**Results and Discussion:** No differences regarding age, sex, types of surgical procedure between two groups were found. Over a 24 hours period, the morphine consumption in the PG group was lower than in the PL group ( $10 \pm 4$  vs.  $3 \pm 2$ ,  $p < 0.05$ ), as well as the need of bolus doses and the rescue doses. VAS scores were significantly lower in the PG group than in the PL group in the first 4 postoperative hours. Incidence of adverse effects was lower in PG group compared with PL group. STAI scores showed that 100 % of patients have high preoperative level of anxiety; 73% of them in the "state" dimension while 88% in the personality "traits" dimension. At 3 months the self-perceived QoL was improved in all patients ( $81 \pm 15$ ) than pre-operative ( $60 \pm 18$ ); PG group showed better scores in self-perceived QoL compared with PL group ( $73 \pm 16$  vs.  $86 \pm 11$ ,  $p = 0.035$ ).

**Conclusion(s):** Most of patients with IBD have a preoperative high trait of anxiety. A single preoperative dose of pregabalin seems to enhance the recovery after surgery for IBD in term of pain, anxiety and QoL.

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## 14AP6-9

### Sub-dissociative doses of Ketamine as an adjuvant to Tramadol in continuous postoperative analgesia after abdomino-pelvine major surgery

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**Background and Goal of Study:** Tramadol is quite efficient in continuous analgesia after abdomino-pelvine surgery. This prospective, randomised, double blind, placebo controlled study evaluates the efficacy and safety of the association of Ketamine to Tramadol as a preemptive dose, followed by continuous infusion.

**Materials and Methods:** Two equivalent groups of 30 patients received general anesthesia for elective abdomino-pelvine major surgery (hysterectomy, Wertheim's operation). Predefined postoperative analgesia was based on Paracetamol, Metamizol, Dexketoprofen and Tramadol - 2,5 mg/kg loading dose before emergence, followed by continuous infusion of  $3 \mu\text{g}/\text{kg}/\text{min}$ . Ketamine was added as an iv bolus of 0,5 mg/kg before incision, followed by continuous infusion of  $2 \mu\text{g}/\text{kg}/\text{min}$  for 24 hours, while patients in control group received iv saline bolus and respectively continuous infusion of saline, added to Tramadol regimen.

Pain intensity (VAS scale), analgetic consumption, rescue opioid (Pethidine 0,4 mg/kg iv boluses), adverse reactions (nausea, vomiting, respiratory depression, sedation, dyplopia, psychotrope or vegetative effects) were recorded for the first 24 hours, as well as cognitive disturbances (TRAIL MAKING test part B).

The statistic significance in the evolution of these variables was evaluated using T Student test for central tendency (average) and dispersion indices (standard deviation, dispersion quotient).

**Results and Discussion:** Ketamine group patients had a significant better analgesia, in terms of mean VAS score ( $1.64 \pm 0.38$  vs  $2.47 \pm 0.59$ ), pain-free hours ( $12.38 \pm 2.62$  vs  $7.69 \pm 1.78$ ), lower Pethidine doses ( $15.45 \pm 3.82$  vs  $21.65 \pm 4.76$  mg),  $p < 0.05$ , and better sleep (qualitative self assessment) than control subjects. Side effects were comparable.

**Conclusions:** The association of sub-dissociative dose of Ketamine to Tramadol is feasible, safe and effective in postoperative continuous analgesia for major abdomino-pelvine surgery.

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## 14AP6-11

### Postoperative analgesia in colorectal surgery with levobupivacaine infusion administered by subaponeurotic multiperforated catheter

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**Objectives:** The aim of this study was to evaluate the differences regarding the consume of analgesics, the amount of pain killers administered, early movements, level of analgesia satisfaction in patients with colorectal cancer to whom postoperative analgesia was made with 0.25% levobupivacaine administered by an elastomeric pump through a preperitoneal multi-perforated catheter.

**Material and Methods:** A prospective randomized double-blind study has been done in 60 patients, that were randomized in two groups of thirty patient each one. In all of them a subaponeurotic catheter was inserted. The group of cases which corresponds to patients who, after the colorectal cancer surgery and the placing of the multi-perforated catheter, received 0.25% levobupivacaine at 7 ml/h, as a continuous perfusion for 72 h.

A control group which corresponds to patients who, after the colorectal surgery in the placing of the multi-perforated catheter received saline solution at 7 ml/h as a perfusion for 72 like first group.

In both groups parenteral analgesia was used during the first 72 hours after surgery (propacetamol 1g, dexketoprofen 50 mg, metamizol 2 g and morphine 5 mg)

Postoperative pain was assessed by VAS. The amount of parenteral analgesics administered and satisfaction of analgesia was assessed.

The statistical study was done by shapiro-wilk test. Squared chi and t-student test.

#### Results:

Propacetamol / desketoprofeno consume was higher in saline group at 48, 60 y 72h

Metamizol consume was higher at 12, 24, 36, 48 60 and 72 h

Morphine consume was higher at 12 and 24 h

VAS in rest and movement was higher in all time intervals

Satisfaction of analgesia was good or very good in levobupivacaine group versus saline group that was bad.

**Conclusion:** Infusion of levobupivacaine by subaponeurotic multiperforate catheter is a very good alternative of analgesia in colorectal surgery the parenteral analgesics consume is slower in this group.

## 14AP7-1

### Objective assessment with salivary $\alpha$ -amylase activity of the effects of stellate ganglion block in the patients with cervical radiculopathy

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**Background and Goal of Study:** Although visual analogue scale (VAS) is used for the subjective assessment of pain, it is desirable that more objective methods could be developed. It is known that salivary  $\alpha$ -amylase reflects sympathetic nerve activity under psychological stress. This study was carried out to clarify whether salivary  $\alpha$ -amylase activity is useful for the objective assessment of pain relief in the patients with cervical radiculopathy undergoing stellate ganglion block (SGB).

**Materials and Methods:** After institutional approval and informed consent, 40 patients who were suffered from neck-shoulder pain associated with cervical radiculopathy were randomly divided into two groups according to nerve block treatment.

Group A (n=20, male 11 patients, female 9 patients,  $48 \pm 8$ yr, mean  $\pm$ SD) received SGB and group B (n=20, male 10 patients, female 10 patients,  $52 \pm 6$ yr) received trigger points injection (TPI). SGB or TPI was produced by 6 ml of 1% mepivacaine for a total of 5 times (twice per one week). VAS and the concentration of salivary  $\alpha$ -amylase (Amylase monitor, CM-2,1, Nipro Co. Ltd, Tokyo, Japan) were measured before (T0) and after every T1, T2, T3, T4, and T5 of each nerve block.

The consumption of non-steroidal anti-inflammatory drug (NSAID) was measured at T0 and T5 in each group. Statistical significance ( $P < 0.05$ ) was determined using Wilcoxon and Mann-Whitney U test.

**Results and Discussion:** In group A, VAS was mean 74 (range 60, 78) at T0 and showed a significant decrease at T1 [48 (36, 50),  $p < 0.01$ ], T2 [46 (28, 48),  $p < 0.01$ ], T3 [38 (28,39),  $p < 0.01$ ], T4 [33 (25, 36),  $p < 0.01$ ], and T5 [28 (16, 30),  $p < 0.01$ ].

The concentration of salivary  $\alpha$ -amylase was mean 89 (range 46, 97) KU/ml and showed a significant decrease at T1 [67 (36, 78) KU/ml,  $p < 0.05$ ], T2 [82 (47, 111)], T3 [76 (38, 96),  $p < 0.05$ ], T4 [79 (58, 124)], and T5 [56 (28, 84),  $p < 0.05$ ].

In group B, VAS and the concentration of salivary  $\alpha$ -amylase showed no change throughout the time course. The consumption of NSAID in group A was significantly lower than that in group B at T5. The concentration of salivary  $\alpha$ -amylase would reflect the reduction of the sympathetic nerve activity and radicular pain relief due to SGB.

**Conclusion(s):** The results suggest that salivary  $\alpha$ -amylase activity would be useful for the objective assessment of radicular pain relief in the patients with cervical radiculopathy undergoing SGB.

## 14AP7-2

### Intrathecal injection of Tanshinone IIA attenuates bone cancer pain by inhibition of spinal tumor necrosis factor- $\alpha$ expression in a mouse model

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**Background and Goal of Study:** Recent studies show that tanshinone IIA has antinociceptive activity and can inhibit production of TNF- $\alpha$  in inflammatory disease. Tanshinone IIA is isolated from Danshen which is a traditional herbal medicine in Oriental medicine. TNF- $\alpha$  is a proinflammatory cytokine which has been demonstrated to play an important role in nociceptive hyperalgesia. However, its roles in bone cancer pain were not well understood.

The present study aimed to investigate whether intrathecal administration of tanshinone IIA develop an antinociceptive effect on bone cancer pain by regulating spinal TNF- $\alpha$  expression.

**Materials and Methods:** C3H/HeNcrIVr mice were inoculated into the intramedullary space of the left femur with Osteosarcoma NCTC 2472 cells to induce ongoing bone cancer pain. Thermal hyperalgesia was assessed with the paw withdrawal thermal latency (PWTL) to radiant heat. Quantitative real-time reverse transcription-polymerase chain reaction and Western blot experiments examined messenger RNA and protein expression of spinal TNF- $\alpha$  during the development of bone cancer pain. The authors further investigated the effect of intrathecal treatment (once daily injections on the days 10-14 after inoculation of sarcoma cells) with tanshinone IIA on the nociceptive behavior and spinal mRNA and protein expressions of TNF- $\alpha$  associated with bone cancer pain.

**Results and Discussion:** Inoculation of sarcoma cells induced progressive thermal hyperalgesia and resulted in up-regulation of spinal TNF- $\alpha$  expression on days 10, 14, and 21 postinoculation. Intrathecal administration of tanshinone IIA (20 $\mu$ g and 40 $\mu$ g) attenuated cancer-evoked thermal hyperalgesia and reduced spinal TNF- $\alpha$  expression.

However, this study showed that while tanshinone IIA relieves hypersensitivity without overt behavioral side effects, but the relief effect is minor. The reason may be that bone cancer pain has complex mechanisms, and therefore it requires a multiple treatment for bone cancer pain.

In addition, whether tanshinone IIA has an effect on other pain pathways is still unknown.

**Conclusion(s):** Tanshinone IIA can be analgesic in the model of bone cancer pain, and inhibition of spinal TNF- $\alpha$  expression during the development of bone cancer pain may be, at least in part, a kind of analgesia mechanism.

**Acknowledgements:** This study supported by National Natural Science Foundation of China Grant 81070892 and 81171048.

## 14AP7-3

### Inhibition of calcium/calmodulin-dependent protein kinase II (CaMKII) attenuates bone cancer pain via spinal KIF17/NR2B signal transduction in mice

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**Background and Goal of Study:** It has been reported that N-methyl-D-aspartate (NMDA) receptor 2B subunit(NR2B) has a vital role in bone cancer pain, while the underlying mechanisms in detail are substantially unknown. KIF17 is a kinesin motor which transports NR2B. The upregulation of NR2B and KIF17 transcription is confirmed by an increase in the amount of phosphorylated cAMP-response element-binding protein (CREB), which is activated by calcium/calmodulin-dependent protein kinase II (CaMKII). Consequently, we presume that CaMKII-mediated KIF17-NR2B signal transduction might contribute to bone cancer pain.

**Materials and Methods:** To verify this hypothesis, we first built a mouse model of bone cancer pain induced by intramedullary injection of Osteosarcoma NCTC 2472 cells. The spontaneous lifting behavior and mechanical allodynia was measured, and the expression of spinal p-CaMKII, NR2B and KIF17 was evaluated by western blot.

**Results and Discussion:** At 7, 10 and 14day postoperatively, the expression of p-CaMKII, NR2B and KIF17 was significantly increased in tumor group. Intrathecal administration of KN93, a CaMKII inhibitor, downregulated the three proteins and reversed the bone cancer pain in a dose and time dependent manner.

**Conclusion(s):** These data suggest that CaMKII-KIF17-NR2B signal pathway may participate in the genesis and development of bone cancer pain.

**Acknowledgements:** This study supported by National Natural Science Foundation of China Grant 81070892 and 81171048.

## 14AP7-4

### Effect of intrathecal injection of KN93, a CaMKII inhibitor, on the expression of spinal NR2B in a mouse model of bone cancer pain

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**Background and Goal of Study:** The aim of this research was to investigate the effect of intrathecal injection of KN93, a CaMKII inhibitor, on the expression of spinal NR2B in a mouse model of bone cancer pain.

**Materials and Methods:** Thirty-six male C3H/HeJ mice weighing 20-25g were randomly divided into 3 groups: sham group (Group S, n=8), bone cancer pain group (Group BP, n=8) and KN93 group (Group K, n=20). The mouse model of bone cancer pain was established by intra-femur inoculations of osteolytic NCTC 2472 cells in Group BP and Group K. At day 14 postoperatively, mice received intrathecal injection of 60nmol KN93 in 20%DMSO or vehicle respectively.

Eight mice were selected randomly from each groups at 1d before inoculation, at 1h before administration and 1,2,4,24h after administration(T0-5) for measurement of paw withdrawal threshold(PWT) to mechanical stimuli by von Frey filaments. Other 3 mice were sacrificed at the corresponding time point and the spinal cord was obtained for determination of NR2B expression by western blot.

**Results and Discussion:** PWT was significantly decreased in group BP and Group K, except group K at T3( $p > 0.05$ ), and NR2B expression was up-regulated at T2-5 in Group BP and Group K as compared with sham group( $p < 0.05$ ). Compared with group BP, PWT was increased and NR2B expression was down-regulated at T2-4 in group K. In contrast to T1, PWT at T2-4 up-graded in group K( $p < 0.05$ ), but no significant difference was observed in other groups( $p > 0.05$ ).

**Conclusion(s):** Intrathecal injection of KN93 can attenuate bone cancer pain through inhibiting NR2B in the spinal cord in mice.

**Acknowledgements:** This study supported by National Natural Science Foundation of China Grant 81070892 and 81171048.

## 14AP7-5

### Opioid induced bowel dysfunction in acute pain; oral oxycodone versus iv morphine observational study; cost and incidence of side effects

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**Background:** Opioid-induced bowel dysfunction (OBD) is a common problem associated with the use of opioids for pain management. Symptoms of OBD include constipation and gastroesophageal reflux. The most common and debilitating of these symptoms is constipation.

**Aim:** The Bowel Function Index (BFI) is a clinician-administered, patient-reported, 3-item questionnaire to evaluate opioid-induced constipation in acute pain pts. The aim of this audit is to compare the severity of OBD in oxycodone group versus the morphine one.

**Materials and Methods:** A prospective study was conducted on 53 pts undergoing elective gynaecological procedures. We compared 25 pts using PCA morphine (30-140 mg) versus 28 pts using oral oxycodone (30-150 mg) regarding bowel dysfunction. The targeted Numerical Analogue Score was 0 to 2. BFI (numerical analogue scale 0 -100), calculated as the mean of three variables (ease of defaecation, feeling of incomplete bowel evacuation, and personal judgement of constipation) was used to evaluate bowel function in our cohort of pts with postoperative pain. All patients received standard general

anaesthesia and postoperative paracetamol and diclofenac. Rescue laxatives (lactulose) and antiemetics (ondansetron) were used when required.

**Results and Discussion:** Demographic data were comparable between both gps. In Morphine gp, 66.7% had PONV versus 42.8% in Oxycodone gp. There was no significant difference in the BFI ( $P > 0.121$ ) between our gps. Rescue laxative use and antiemetics were similar in both gps ( $p > 0.298$ ,  $> 0.128$ ), respectively). Opioids are often reduced in dosage or even discontinued as a result of impaired bowel function, leading to insufficient pain treatment. The total monthly cost per patient (pt) with severe constipation is significantly higher than cost for pt with no constipation (1525 vs 1034). Morphine has been used as the standard opioid for many years. The recently emerged more expensive Oxycodone group is claimed to be better in terms of analgesia and side effects

**Conclusion(s):** We did not find a significant difference in the incidence of Opioid Induced Constipation (OIC) between morphine and Oxycodone. There is an urgent need for more studies looking at cost of illness with OIC and to investigate the role of oral oxycodone/haloxone PR tablets in improving OBD.

## 14AP7-6

### Analgesia for abdominal hysterectomy in a cancer center

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**Background and Goal of Study:** Patients undergoing total abdominal hysterectomy (TAH) often have significant postoperative pain despite the use of concurrent multimodal pain strategies<sup>1</sup>. Our Acute Pain Unit (APU) created analgesic protocols divided into two groups: conventional analgesia (endovenous drugs in a schedule regimen) and non conventional analgesia (Patient Controlled Analgesia, PCA, or epidural analgesia). Our anesthesiologists can also choose other analgesic strategy (non protocol analgesia). Our goal is to evaluate the pain scores at 24 hours and patients' expectations concerning postoperative pain, in patients undergoing TAH with different analgesic strategies.

**Materials and Methods:** In a retrospective study we analyzed data from our APU's database about 299 patients undergoing TAH in 2010. The analyzed parameters were: ASA status, type of anesthesia, analgesic strategy, pain scores at 24h and patients' expectations.

**Results and Discussion:** The majority of women undergoing TAH were classified as ASA II. General anesthesia was done in 231 patients, combined anesthesia in 64 and regional anesthesia in 4. Conventional analgesia was chosen in 89 patients, whereas non conventional analgesia was used in 173 (109 with PCA technique and 64 with epidural analgesia). Pain scores at rest at 24h revealed that 90.3% of patients had none or mild pain (numeric rating scale 0-2). In the PCA group this value was 93.5%, with 92.2% in the epidural analgesia group and 86.5% in the conventional analgesia group. The differences between the three groups were not statistically significant ( $p > 0.05$ ). The majority of patients (60.2%) described their expectations as better (12.3% were unable to answer this question). In the PCA group this value was 55.0%, with 67.2% in the epidural analgesia group and 57.3% in the conventional analgesia group. The differences between the three groups were not statistically significant ( $p > 0.05$ ).

**Conclusion(s):** Low levels of pain at rest were achieved at 24h, regardless of analgesic strategy. Pain was lower than expected in the majority of patients. Keeping an updated database is important for the evaluation of different analgesia strategies. Efforts should be made to improve analgesic evaluation regarding dynamic pain<sup>2</sup>.

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## 14AP7-7

### Intradiscal pressurized physiologic saline injection drastically reduced pain from cervical and lumbar disc herniation

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**Background:** Chronic neuropathic pain from disc herniation often resists conventional epidural or sympathetic blockade. Before considering invasive therapies such as surgical discectomy, we performed less invasive, transcutaneous injection of local anesthetics, steroids and physiologic saline into the herniated disc ("Intradiscal pressurized injection therapy") to induce nucleolysis.

**Methods:** Forty-one patients, suffering from persistent pain in the extremities or the back from diagnosed cervical (n=12) or lumbar (n=29) disc herniation,

were enrolled after informed consent. Under fluoroscopy with a radiopaque agent, they were percutaneously injected with a mixture of 3ml of 1% lidocaine and 4mg of dexamethasone at the herniated disc without special devices. After that, we also injected 20-30ml of physiologic saline. We evaluated all pain measurements using the 0-100 visual analog scale (VAS) before and after the treatment periodically until about a year later.

**Results:** VAS reduced statistically significant after treatment ( $p < 0.0001$ ). Twenty-seven patients relieved pain by more than 50% in VAS, which lasted as long as 112 days in average. Even in less responsive patients (n=12) with less than 30% reduction in VAS, pain relief lasted as long as 17 days in average after the treatment. Five patients underwent the second treatment with the same procedure, which relieved pain even more effectively than the first trial. Such relief of pain began before the reduction in size of the herniated disc was observed with magnetic resonance imaging. There were no complications from the present therapy.

**Discussion:** The intradiscal pressured injection therapy is expected to induce nucleolysis of the herniated disc both by physical dissipation and by facilitating immunity-mediated reaction. Because of its safety, this therapy should be considered first before more invasive therapies are applied in patients with persistent pain from disc herniation.

**Conclusion:** Intradiscal pressurized physiologic saline injection drastically reduced pain from cervical and lumbar disc herniation.

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## 14AP7-8

### The role of blockades in combined chronic pain treatment after hip joint replacement

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**Background and Goal of Study:** Many patients with hip osteoarthritis suffer from chronic pain syndrome. However, despite the successes achieved by the next operational treatment, long-term positive results after joint replacement observed in only 76-89% of operated patients (Hailer N.P et al., 2010). Lack of examination and mistakes of previous treatment lead us for this investigation.

**Materials and Methods:** Since 2003 in Pain Department 40 (age  $57 \pm 4.7$ ) patients with chronic pain syndrome after hip arthroplasty were included in this investigation. All had hip joint replacement from 1 year to 4 years. All time after operation they suffered from pain, were treated using different kind of NSADs and anxiolytics, because were under depression. Pain intensive was  $7.4 \pm 2.6/10$  (VAS 1-10/10), duration more than 6 month. 12% of them have severe scoliosis deformities of spine (3rd. by Cobb), 77% have protrusion or herniated disks, confirmed by MRI, 8% have spondilosis more than 5mm. in lumbar segment, 3% have non well done operation (confirmed by X-ray examine). All patients were randomized in to 2 groups: group A receive trigger point injection (0,125% solution of marcaine in combination with diprospan and saline), group B receive different kind of central segmental blocks (0,125% solution of marcaine in combination with diprospan and saline). All patients received conventional therapy (NSADs and myorelaxants).

**Results and Discussion:** Pain intensity decreased in the first day to  $6.4 \pm 1.2/$  VAS in group A and to  $3.2 \pm 2/VAS$  (in B) and increased after 48 hours to  $7 \pm 0.5/$  VAS (A group) and  $4.5 \pm 1.5/VAS$  (in B). The second blockades decreased pain to  $5.5 \pm 2.3$  (A group) and to  $2.5 \pm 1.0$  (in B) and prolonged the pain-free interval to 72 h. (A group) and to 96 h. (in B). It took between 3 and 5 blocks (A group), as opposed to 2 up to 3 blocks (max) in B group for significantly pain relief to  $1.4 \pm 0.1/10$  (VAS). After treatments patients feel well, no need of NSADs and anxiolytics. Only 3% (not well operated) need to be reoperated. In our study we observed that patients before hip replacement must be carefully evaluated for comorbidity.

**Conclusion(s):** Using different kind of blocks in treating patients at the first visit was a treatment method and decrease level of pain significantly during the first days, increase quality of life and motivation to recovery.

## 14AP7-9

### Testosterone and cortisol modulate pain sensation

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**Background and Goal of Study:** Stress activates the hypothalamic pituitary adrenal (HPA) axis and suppresses the hypothalamic pituitary gonadal (HPG) axis. It is not known whether pain is affected by stress-related testosterone



and cortisol. Therefore, we investigated whether stress can affect pain perception by modulating the activities of the HPA and the HPG axes.

**Methods:** Forty-three healthy male medical students were recruited in this study. The same pain experiments were conducted twice, once during rest two days before stress exposure and once during stress.

Stress was induced by having the participating medical students perform anesthetic technique tests. Participants were asked to rate their anxiety before pain stimulation both in the resting and stress conditions.

Before applying pain stimulation, blood pressure and heart rate were measured in the arm in both conditions. Electrical pain was applied to the wrist using an electrical stimulator. The pain threshold was defined as the lowest electrical current required for the participants to report a sensation of pain. Participants were asked to rate their pain sensation after electrical stimulation at 20 mA (2Hz) for 15 sec. Salivary testosterone and cortisol levels were measured during resting and stress conditions.

Ratings were assessed using the Numerical Rating Scale (NRS) ranging from 0 to 100 (0 = no pain and anxiety; 100 = maximum imaginable pain and anxiety).

**Results:** Stress significantly increased anxiety ratings, heart rate, systolic blood pressure, and salivary cortisol levels, but decreased salivary testosterone levels. In relation to pain sensation, stress increased pain ratings and decreased pain thresholds. Salivary testosterone levels were positively correlated with pain thresholds during stress ( $r=0.339$   $p=0.026$ ), and the level of salivary cortisol was negatively correlated with pain thresholds during stress ( $r=-0.346$ ,  $p=0.023$ ).

**Conclusions:** Our results indicate that testosterone can decrease and cortisol can increase pain induced by electrical stimulation. These results suggest that stress can increase pain ratings and decrease pain thresholds by activating the HPA axis and by deactivating the HPG axis.

These results also suggest that clinical pain, similar to electrical pain, may be relieved by managing stress and controlling consequent stress-related testosterone and cortisol levels.

## 14AP7-10

### The results of thoracoscopic sympathectomy in the treatment of pain associated with chronic pancreatitis

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**Background and Goal of Study:** Purpose of the study was to explore the possibilities thoracoscopic sympathectomy in the treatment of pain in chronic pancreatitis.

**Materials and Methods:** Thoracoscopic sympathectomy was performed in 58 patients with chronic pancreatitis and severe pain. Pain syndrome before surgery, a week after the sympathectomy and in the long-term period was estimated by the Visual Analogue Scale Pain Intensity Assessment (VAS). A questionnaire was sent to 58 patients. Long-term results in terms of  $7,8 \pm 2,8$  years were observed and studied for 28 patients.

**Results and Discussion:** 13.5% of patients rated pain before the operation as a "moderate pain", 53.8% and 32.7%, as "severe pain" and "very severe pain" correspondingly. Average VAS amounted to  $7,7 \pm 2,3$ .

The results of the sympathectomy were rated by patients as "excellent" in 23% of cases, "good" in 55.8%, "satisfactory" in 17.3% and "poor" in 3.8% of cases. The complete disappearance of pain was observed in 80.7% of patients (VAS 0 points) 7.8% (VAS 2-3 points), 1.9% (VAS 6 points). 8 patients (13.8%) had postoperative complications such as atelectasis, pleurisy and pneumonia. Long-term results were studied in 28 (48.3%) patients.

Repeated operations after sympathectomy due to recurrent pain were performed to 21 (75%) patients. Average period of observation among the pa-

tients responding to the questionnaire (14 (50%)) was  $6,8 \pm 3,7$  years. The level of pain at the time of the survey according to VAS was  $2,9 \pm 1,8$ . 11 (78.6%) patients reported a second operation on the pancreas after sympathectomy. A pancreatic-duodenal resection in this group was performed on 3 patients, pancreaticojejunostomy on 2, cystojejunostomy on 2, contralateral sympathectomy on 2, an external drainage of the pancreatic cyst on 2, and left-sided pancreatic resection on one patient correspondingly. 14 (50%) patients died during the observation period - in this group repeated operations due to recurrent pain were performed to 9 (64.2%) patients.

**Conclusion(s):** Thoracoscopic sympathectomy in case of chronic pancreatitis is a palliative method of pain relief with a marked analgesic effect in the short-term period. Further clinical course of chronic pancreatitis accompanied by a recurrence of pain and other complications require more radical treatment.

## 14AP7-11

### Use of regional anesthesia in the case of complex regional pain syndrome: evaluation of the daily practice in a general hospital

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**Background and Goal of Study:** The Complex Regional Pain Syndrome (CRPS) is a relatively frequent pathology, generally occurring after both trauma or surgical procedure and which severity is sometimes out of proportion to the related event. CRPS commonly leads to pain and disability with frequent psychological consequences. In the field of CRPS, therapies are developed and among them, regional anesthesia (RA) takes a peculiar place, which the importance remains to define. Our goal was to demonstrate the efficiency of RA in cases of shoulder-CRPS, from the day-care experience of a general hospital.

**Materials and Methods:** We realized a retrospective analysis of 16 patients medical files, whom were taken care for a shoulder-CRPS. After CRPS diagnosis, using IASP criterias, and multidisciplinary consultation, an ultrasound-guided interscalenic block with a catheter was realized during 5 days (D). After catheter efficiency testing, a 0.2% ropivacaine infusion was started at  $4\text{ml}\cdot\text{h}^{-1}$  rate, with ability of an additional bolus of 4ml every 20 min. Patients data, complications and potential side effects were collected, as well as clinical symptoms of CRPS, pain assessment with visual analogue scale (VAS), passive and active joint mobility and muscular strength from D1 to D5. Results are expressed as median values [IQR]. A  $p < 0,005$  was considered as significant.

**Results and Discussion:** Patients were 51 [33-67] years old (12 women, 4 men), and mean duration of CRPS was 13 [6-24] months. Any side effect was identified. During mobilization a significant decrease of VAS values was observed between D1 ( $6.5 \pm 2.1$ ), D3 ( $4.4 \pm 2.2$ ;  $p=0.0042$ ) and D5 ( $5.1 \pm 1.8$ ;  $p=0.003$ ). In the flexion-extension axis, shoulder amplitude was increased from D1 to D5 for passive ( $115^\circ$  [53°] vs  $148^\circ$  [33°];  $p=0.002$ ) and active ( $90^\circ$  [38°] vs  $130^\circ$  [48];  $p=0.0007$ ) mobilization.

The same improvement was observed in the adduction-abduction axis for passive ( $100^\circ$  [50°] vs  $128^\circ$  [45°];  $p=0.002$ ) and active ( $88^\circ$  [50°] vs  $108^\circ$  [55°];  $p=0.0007$ ) mobilization.

**Conclusion(s):** RA allows an improvement of symptoms in a complex pathophysiology. RA efficiency, by its own and specific action on some CRPS pathways, suggest an increasing use in a global and polymodal patients taking care. Moreover, it is important to specify RA place among the CRPS treatments. A large prospective study of RA benefit could permit a real progress in the field of interest of CRPS.

## Education, Research and Presentation

### 15AP1-1

#### Medical students' perception of a portfolio assessment process in anaesthesiology

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**Background and Goal of Study:** The educational value of portfolios consisting in a promotion of a deep, reflective and student-centred learning is well known. There are concerns regarding portfolio assessment relating to its reliability, practicability and student acceptance of the process. The aims of this study were to identify and analyse students' attitudes to the portfolio assessment process in our practical course of Anaesthesiology.

**Materials and Methods:** During 2010 and 2011 medical students of our optional course of Anaesthesiology used a structured portfolio during a practical period of 60 hours in the OR, ICU and pain clinic. They were asked to collect educational evidences (making preoperative assessment, complimenting informed consents, learning technical skills with a predefined minimum of anaesthetic procedures to be done, performing medical treatments potoperatively in critical ill patients, understanding acute and chronic pain management as well as anaesthetic care at the labour) under supervision from the tutor. A voluntary questionnaire containing open and multiple choice questions was used to obtain feedback from our medical students at the end of the course. A Likert scale from 0-5 (0=poor, 5=excellent) was used. Data are presented as percentages, means or absolute values.

**Results and Discussion:** A total of 46 5<sup>th</sup>-year medical students (31 women, mean age 23.4 years) filled in the questionnaire at the end of their practical period (95.6% response rate). 76% of them didn't have any portfolio experience before; 65% didn't know anything about portfolio at all. The Likert scale mean scores of the recorded variables were the following: it is easy to fill in the portfolio (3.5), it is useful for achieving practical outcomes (4.3), it was a positive experience (3.7), opinion about the tutor as a guide (4.3), would you recommend the use of a portfolio (3.47) and thinking in choosing Anaesthesiology as your future speciality (3.43). All students and tutors agreed that there was too much paperwork and the process was time-consuming.

**Conclusion(s):** The portfolio was very well accepted among our students and it helped them to improve learning. Paperwork should be kept within manageable limits. Providing evidence for achieving all learning outcomes and skills, not just theoretical knowledge, using a portfolio is useful for reflective clinical practice.

### 15AP1-2

#### Impact of pre-training evaluation and feedback on skills retention of basic life support in medical students

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**Background and Goal of Study:** Although pre-training evaluation and feedback have been proved to improve medical students' skills of basic life support (BLS) immediately after training, their impacts on BLS skills retention are unknown. This study is to investigate effects of pre-training evaluation and feedback on medical student's BLS skills retention.

**Materials and Methods:** Two hundred and thirty seven 3<sup>rd</sup> year undergraduate medical students were randomly enrolled into two groups, the control group (C group) and pre-training evaluation and feedback group (EF group). According to the time of reevaluation of BLS skills retention after training, each group was subdivided into three subgroups, as C1 subgroup and EF1 subgroup (one month later), C3 subgroup and EF3 subgroup (three months later), C6 subgroup and EF6 subgroup (six months later). After a 45-minute BLS lecture, BLS skills were evaluated (pre-training evaluation) in both groups before training. And then, the C group received 45 minutes training. 15 minutes of group feedback related with students' performance in pre-training evaluation was given only in the EF group and a 30-minute training was then instructed. BLS skills in both groups were assessed immediately after training (post-training evaluation). BLS skills were reevaluated one month, three months and six months later in related subgroups respectively to assess skills retention. Skills evaluation was two-rescuer BLS skills in a 5-minute mock cardiac arrest scenario, and students' performance was recorded with two video cameras and scored by a blinded certified instructor using a 45-item checklist. The mark in skills evaluation was converted to a percentage and was compared between the two groups using ONE WAY ANOVA test, and a P value less than 0.05 was considered as statistically significant.

**Results and Discussion:** No difference was observed between the two groups in pre-training evaluation. Higher mark was observed in EF group (85.2±7.3 vs. 68.2±13.2 in C group) in post-training evaluation. Compared with marks of each group in post-training evaluation, follow-up marks in C6 subgroup and EF6 subgroup were lower. Higher follow-up marks were observed in each EF subgroup, compared with their paired C subgroup.

**Conclusion(s):** BLS skills were retained at least for three months after first training in both groups. Higher mark was sustained for six months in EF group after training.

### 15AP1-3

#### The comparison of six transthoracic lung ultrasonic findings to diagnose a pneumothorax during one lung ventilation

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**Background and Goal of Study:** Ultrasound guided nerve block or central venous puncture is now getting popular in our anesthesia practice to reduce the risk of complications. Pneumothorax is a rare, but possible complication related to these interventions even if the ultrasound was used. However, the pneumothorax itself can also be diagnosed by the ultrasound. During lung surgery, situation similar to the pneumothorax does occur. We therefore examine the efficacy of ultrasonic lung findings for diagnosing pneumothorax during lung surgery requiring one lung ventilation.

**Material and Methods:** In 20 elective surgery patients, transthoracic lung ultrasonography was performed before and during lung surgery. The lung sliding sign, comet tail artifact, M-mode, lung pulse and power sliding were used to determine no pneumothorax, and the reverberation artifact was used as a sign of the pneumothorax. Ultrasound procedure was videotaped for post procedure analysis. Both sensitivity and specificity was calculated in each cases.

**Results and Discussion:** Lung sliding and M-mode procedure had high sensitivity and specificity in diagnosing a pneumothorax. (Sensitivity/Specificity: Lung Sliding 100%/100%, Comet-Tail Artifact 85%/95%, Lung Pulse 70%/85%, Reverberation artifact 45%/10%, Power Sliding 70%/90%, M-mode 100%/100%) Especially M-mode is useful to diagnose pneumothorax because both the judgment of ultrasonic images and the handling of ultrasound equipment is easy for beginners. Reverberation artifact also had high sensitivity, but its specificity was too low to determine a pneumothorax.

**Conclusions:** Among six ultrasonic lung findings, lung sliding and M-mode procedure is the most useful as a screening method of differentiating a pneumothorax. In addition, US during lung surgery provide important opportunity to gain diagnostic skill of the pneumothorax.

### 15AP1-4

#### Implementation of a unified teaching model of anaesthesiology in Catalonia (2005-2011)

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**Background and Goal of Study:** The theoretical program of the Anaesthesiology speciality is very wide. For every single hospital it is a huge effort to do it alone. In our country there is no final exam. In the 90s a new unified educational model for Anaesthesiology was designed and implemented in Catalonia, including an annual exam and a final exam at the end of the residency. The aims of this study were to evaluate the session assistance of the residents, to analyse the exam results and to obtain the feedback of the residents about the new teaching model.

**Materials and Methods:** This is a prospective, observational and descriptive study with Anaesthesiology residents in Catalonia from 2005-2011. Three consecutive courses according to the different levels of residency years were created. The whole program was available on the web of the Catalan Society of Anaesthesiology (SCARTD). Attended sessions (if more than 70%) were certificated, signature control was carried out. A final voluntary multiple choice exam consisting in 3 parts of 20 questions each took place. The exam was passed with a minimum of 65% of correct answers. The exam results were analysed. A structured questionnaire for satisfaction evaluation was designed by the tutors.

**Results and Discussion:** A total of 366 residents from 21 different centres and 79 tutors participated in this study. Mean session assistance was 82% of

the residents. The global session and tutor evaluation scores were 8 out of 10; 94% of the residents considered the themes treated during the sessions as adequate. 90% of the residents took the exam, 68% of them passed it. In the last 3 years the percentage of passed residents increased progressively to 81%.

**Conclusion(s):** The session assistance and the exam participation were high. A progressive increase of passed exams was observed. Common sessions, assistance control and the final exam were well accepted. A unified way of teaching allowed us to achieve a more homogenous education and it was a great help in tutor mentoring and in warranting a standard formation. These results encourage us to apply and improve this teaching model in the future.

**Reference:**

1. European Board of Anaesthesiology. Training Guidelines in Anaesthesia or the European Board of Anaesthesiology Reanimation and Intensive Care. *Eur J Anaesth* 2008;25: 528-30.

## 15AP1-5

### Design of a unified rotation program in anaesthesiology in Catalonia

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**Background and Goal of Study:** In Spain the speciality program of Anaesthesiology is old and non-specific. Every single teaching hospital tries to adapt such program according to its own possibilities, observing significant inter-hospital differences. Recently, the number of residents has increased in Catalonia. Some surgical specialities (cardiac, thoracic or neurosurgery) are allocated in a few centres. This fact causes many external rotations with great difficulties to organise them and saturating the docent capacity of the receptor centres. One unified design and planning of all rotations could facilitate its distribution and homogeneity. The aims of this study were to evaluate the most relevant formation programs, to analyse all rotations in Catalonia, to unify educational objectives and the rotation programs and to extend such program to all educational units in Catalonia.

**Materials and Methods:** Study period: from 2007 to 2010. A total of 10 different educational programs were reviewed. All tutors were allocated into 8 working groups. The main part of the work was sent per email to reduce meetings to a minimum. For every rotation the basis content was designed and validated. Approval of the new program by the tutors and the Board of the Catalan Society of Anaesthesiology (SCARTD) was requested.

**Results and Discussion:** A total of 35 tutors participated in this project. 78% of the Catalan residents carry out external rotations during their residency. A global number of 17 rotations were designed; a minimum of anaesthetic techniques for every surgical rotation was defined as well as the duration in months and the number of patients to be treated. This program was thought as a guide. Approval by the Board of the SCARTD took place in 2008; it was printed in 2009 and diffused during 2010.

**Conclusion(s):** All educational units of all teaching hospitals in Catalonia participated in this project. A consensus for common criteria was achieved. It should be mandatory to define the global number of anaesthetic techniques to be performed by a resident during each rotation, and not only the rotation duration. A better design and distribution of external rotations can help us to adequate and optimise the docent capacity in Catalonia. Unified rotations can lead to a more homogenous formation of our Anaesthesiology residents in the future.

## 15AP1-6

### Looking for the ideal surgeon: 3 different points of view

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**Background and Goal of Study:** Our daily practice in the OR is characterised by a deep interaction between different professional categories. The aim of the study was to analyse the different points of view of nursery, anaesthesiologists and surgeons about the professional attributes that the ideal surgeon should have.

**Materials and Methods:** By a voluntary and anonymous questionnaire the opinions of 50 nurses, 50 anaesthesiologists and 50 surgeons of our tertiary university hospital were analysed. Participants were asked to rank from 10 to 1 the ten most important attributes of the ideal surgeon out of 17 choices previously defined by the authors. Variables registered were: gender, age, professional category (anaesthesiologist, surgeon and nurse), professional

experience and working place (ICU, OR, pain clinic). Additional comments were encouraged to be added. Results are presented as percentages, means or absolute values.

**Results and Discussion:** 150 questionnaires were recorded and analysed, 50 in each professional group. The mean age of all participants was 37.9 years (22-63 years), 63.3% of the responders were women (n=95): 82% in the nursery group, 68% in the anaesthesiologist's and 40% in the surgeon's ( $p < 0.001$ ). The most valued attributes ( $> 5$ ) were: to have surgical criterion (9.10), manual skills (6.72), medical knowledge (6.44), knowledge of surgical techniques (6.27), confidence in decision-making (5.83), systematic work (5.49) and teamwork (5.05). For anaesthesiologists, the most punctuated attributes were to have surgical criterion (9.53) followed by manual skills (7.43) and knowledge of surgical techniques (6.18). The most valued characteristics by surgeons were to have surgical criterion (9.38), medical knowledge (6.73) and surgical techniques knowledge (6.61). For nurses, the highest scores observed were to have surgical criterion (8.39) followed by medical knowledge (6.71) and confidence in decision-making (6.63). Less valued attributes at all of a surgeon were their teaching ability (2.77) and continuous formation (2.11).

Additional comments added were to be conscious of the own limitations and to be honest when planning surgical programs and surgical times.

**Conclusion(s):** Our OR staff accepted very well the questionnaire about ideal attributes of a surgeon and it generated a great discussion. The most valued attribute by the 3 professional groups was to have surgical criterion, that means to distinguish when to operate and when not.

## 15AP1-8

### Preparation for the European Diploma of Anaesthesiology - part 1 and results in 2010 and 2011: the Madrid Center experience. The show must go on

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**Background and Goal of Study:** A training course of preparation for the European Diploma of Anaesthesiology part-1 (EDA-1), consisting of a basal knowledge evaluation and 5 thematic MCQs mocks, was organized to prepare future candidates.

This study was designed to evaluate the results of the training and the influence of the training on the EDA exam results in Madrid.

**Material and Methods:** The 2011 results of the preliminary evaluation, and the 2010 and 2011 mocks results in pharmacology (Pa), physiology (Py), physics (Ps), general anaesthesia (GA), and specialized anaesthesia (SA) were analyzed. The number of trainees who passed (participation to at least 80% of the mocks) was compared. Finally, the results of trainees in the EDA-1 and 2 exams in 2010 and 2011 was reported. ANOVA or  $\chi^2$  tests were used when appropriate. Results are presented as median[Range].  $p < 0.05$  was considered significant.

**Results and Discussion:** 47 and 48 trainees participated to the training in 2010 and 2011: 18(38%) and 29(60%) passed respectively ( $p=0.04$ ). Marks of preliminary evaluation were 64[53; 77]%, which corresponds to a pass-rate of 20.5% (considering 70% as the mean pass-mark).

Marks did not change between 2010 and 2011 (see table 1). In 2010, GA, SA and Ps results were higher than those of Pa y Py. In 2011, only Ps results were lower than those of GA and SA.

In 2010, 11 trainees presented the EDA-1 exam and 7(72%) passed, versus 17 in 2011, of whom 11(64,7%) passed ( $p=1,00$ ). This represents a 54,5% increase of inscription of trainees to the EDA-1. The pass rate of EDA-1 in trainees is 10-20% above the average pass rate of the Madrid Center for EDA-1 in 2010 and 2011. Seven of the 8(87,5%) trainees who had passed the EDA-1 in 2010, passed EDA-2 exam and will receive the European Diploma of Anaesthesia in the Euroanesthesia congress in Paris. This represents a pass rate 10% above the pass-rate for Spain Center for EDA-2 in 2010.

**Conclusion:** The participation to the training for the EDA-1 in Madrid has gained in performance and assistance of trainees in the last two years, as well as the number of candidates and results to the EDA-1 and EDA-2 exams show a positive trend. Our results show that Ps is the more difficult basic science topic. This kind of courses permits to emphasize topics that seem to be harder for our trainees.

	Pharmacology	Physiology	Physics	General Anaesthesia	Specialized Anaesthesia
2010	59,5[17; 79]%	69,5[54; 88]%	62[47; 76]%	70,6[70; 82]%	70[58; 79]%
2011	65[0; 79]%	65[44; 80]%	62[39; 78]%	69,5[49; 78]%	70[60; 78]%

[Table 1: Marks of the mocks (Median[Range])]

## 15AP1-9

### Self-organization of on call duties days by residents.

#### Implications of the year of training

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**Background and Goal of Study:** In our training system, anesthesia residents are scheduled to rotations in different areas (Operating Room, Intensive Care Unit and Pain Treatment), based on experience and available areas. However, distribution of their daily duties, (there are 6 residents daily on call duty), it is solely at the discretion of the residents autonomy. The days on night duty are chosen in order of preference by four year residents (R4) and then consecutively by R3, R2 and R1 with the supervision of the tutor. Our goal was to analyze the distribution homogeneity on call days, and if the residents use this autonomy of decision to increase their training or their leisure time.

**Methods:** In our institution there are a total of 40 residents (10 per year). Legally, according to Europeans law, the resident is entitled to be free the day after being on duty. This duty day is an extra income apart from salary, which is higher on weekends and bank holidays. With the assistance of a computer program implemented in our department (Lya2®, Sistema de Informacion, SL, Barcelona, Spain), we have retrospectively analyzed a period of seven months (April 1<sup>st</sup> to November 30<sup>th</sup>, 2011) and evaluated the following parameters: total number of duties, duties on Thursday and Fridays, duties on weekends, per resident and year of residency. Data were recorded into Microsoft Office Excel 2007® (Microsoft Corporation, Redmond, USA) spreadsheets (Chi-square, STATA®, StataCorp, Texas, USA).

**Results and Discussion:** During the study period, residents carried out a total of 1542 duties. 408 (26,4%) were covered by R4, 414 (26,8%) by R3, 379 (24,6%) by R2 and 341 (22,2%) by R1. Total Thursday and Fridays by group is shown in table 1. Differences between weekends and holidays duties by group were no statistically significant. R1 weren't taken into account for this study, as they did not have any possibility to choose and they are on call in the emergency department.

**Conclusion:** Thursday is the preferred day to be on duty by senior residents. Duties on Thursdays imply a longer free weekend. It's important to study if this organization of their duties has a clinical impact in their training.

#### References:

1. Kirk D, et al. *Journal of Surgical Education*. 2008; 65:290-296.
2. Antiel R, et al. *Mayo Clin. Proc.* 2011; 86(3): 185-191.
3. Rybock JD. *N Eng J Med*. 2009;361(9):930-931.

## 15AP1-10

### Is regional anesthesia training for resident in agreement with guidelines: a French survey

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**Introduction:** Regional anesthesia (RA) took a large place in daily practice. In 1997, a French inquiry reported lack in practice among the residents (Reg Anesth 1997; 22:218-22). Clinical studies and guidelines provide advices for good practice and resident training (AFAR 2006; 25: 89-95), with a minimal level of practice of 30 realizations for specific RA techniques at end of training. Ten years later, we report the results of a survey about RA formation among the French residents in the last year of training.

**Methods:** We perform a postal survey of practice in September 2007, with two follow-ups. This inquiry, made up of 3 parts, was sent to all the French residents in anesthesiology. All questions were single choice. First part included epidemiological data, second part studies data about peripheral RA techniques and third part studies practical data about neuraxial RA techniques. Results are expressed as percentage.

**Results:** We obtain a reply rate of 29,7% (372 answers on 1251 questionnaires).

The epidemiological data give the following results: 92.2% of residents have theoretical RA courses and 38.2% have received an advanced and/or expert training, 57.2% have opportunity to have anatomical dissection, but only 33.3% have used this. In the last year of initial training, 98% have specific regional anesthesia courses, 71% currently used neurostimulation alone. The step of 30 acts for each recommended techniques was reached in 98% for epidural anesthesia, 90% for spinal anesthesia, 80% for axillary block and 72% for femoral block. For the other techniques, step was reached in less of 50%. Confidence for a lonely practice was of 90% for all studied techniques, except for peribulbar and interscalene blocks.

**Discussion:** A good theoretical training is dispensed among all the French residents, however only a few part of them used anatomic and dissection

courses. A change for better in practice is observed along the residency, except for interscalene block, sciatic block and epidural anesthesia for general surgery.

For perimedullar anesthesia, a reached confirmed level of practice is reached for a major part of resident in the fifth training year, and an expert level is rarely showed, only for epidural analgesia in obstetric. However, a great difference is observed for peripheral techniques at the end of training, with a too small level of confirmed practice.

## 15AP2-1

### Prospective survey of the motivations and the impact of a French educational program for difficult airway management (FRTID)

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**Background:** The French difficult airway management guidelines recommend a specific learning program for improvement of technical and non-technical skills[1]. Since 2008, a biannual national training (FRTID) was organised in Nantes and Paris. The physician (anaesthetist, intensive care or emergency physician) might aspire to become a referent for airway management in their hospital. The aim of this prospective study was to describe the initials motivations for this training and long-term consequences for physician practices.

**Materials and Methods:** All participants (n=207) were given a questionnaire before (T0), at the end (T1), 6 (T6) and 12 months (T12) after each FRTID session since 2008. Motivations for this educational program were classified among 9 proposals (rank 1 to 9). Their projects for airway management developments and physician practice changes were recorded as well as the actions implemented. Finally, their top motivations to benefit once again a similar educational program were researched. Data were expressed as median values[25th-75th percentiles] for rank motivation and numbers of participants(%) for the others parameters. Data were analyzed with Kruskal-Wallis and  $\chi^2$  tests.  $p \leq 0.05$  was statistically significant.

**Results and Discussion:** The response rates were 66%(T0), 42%(T1), 44%(T6) and 30%(T12). The rank of 2 motivations increased between T0 and T12, respectively 4[2-6] vs. 3[2-4] ( $p=0.0009$ ) for "full-scale simulation for medical education" and 4[3-6] vs. 3[2-4] ( $p=0.0013$ ) for "to use news devices/ to learn technical skills". The motivation "to become referent" was constant at any time (5[3-6]). At T1, 86% of participants expressed a wish of changing their practices and 80% were planning to develop difficult airway management in their institution. The prospective survey confirmed a practice change in 91%(T6) and 97%(T12) ( $p=0.0016$  vs. T1) of cases respectively. The development of actions was effective for 80%(T6) and 74%(T12) of the physicians (ns).

	Meeting organisation	Learning for physicians/ paramedics/residents	New airway management team	Change of device algorithm	Modification of anaesthetic record
T6 (n=73)	66(90)	61(84) / 58(79) / 31(42)	20(27)	65(89)	14(19)
T12 (n=46)	43(93)	39(85) / 38(88) / 22(48)	8(17)	44(95)	16(35)

[Actions for airway management (n[%])]

**Conclusion:** The main motivations were the education of technical skills especially simulation, that seemed to improve difficult airway management education and diffusion of the French guidelines. The further action development by the participants corresponded to the primary outcome of FRTID.

#### References:

1. Ann Fr Anesth Réanim 2008;27:54-62

## 15AP2-2

### Educational impact of workshops and full-scale simulation after the referent's difficult airway management education training (FRTID)

Brisard L., Pean D., Magne C., Combes X., Langeron O., Lejus C., and LESiMU of Nantes, France  
*Hôtel-Dieu-H.M.E University Hospital Center, Department of Anaesthesiology and Intensive Care, Nantes, France*

**Background:** The FRTID is a French certified national program about difficult airway management that took place in Nantes and Paris since 2008[1]. Educational program included workshops and simulation training sessions.

Our aim was to analyse the factors of medical practice changes through a prospective evaluation of the Nantes sessions.

**Materials and Methods:** The theoretical knowledge of each participant (anaesthetists, intensive care or emergency physicians) were self-assessed before and after the program. The adult devices (AD, n=506), paediatric devices (PD, n=147), adult (AS, n=272) and paediatric (PS, n=107) simulation sessions were evaluated using a questionnaire (five items and a closed-ended question) given to each participant (n=207). High-fidelity manikins were used for all simulation sessions except a low-fidelity paediatric simulator in 2011. Data were medians on a 1 to 10 scale [25-75%] and analysed by Kruskal-Wallis, Mann-Whitney or Fisher's exact test. Independent factors associated with a practice change project were determined using a multiple logistic regression with odds ratio(OR) and its 95% confidence interval(CI).  $p \leq 0.05$  was statistically significant.

**Results and Discussion:** Finally, 1032 evaluations were recorded. Theoretical knowledge improved significantly after FRTID(5[4-7] vs. 8[7-9];  $p < 0.0001$ ). The PS obtained the highest score for "acquisition of new information"(9[8-10];  $p=0.03$  vs. other workshops), "objectives consistent with the subject"(10[9-10];  $p=0.016$ ) and total score(50[45-50];  $p=0.006$ ). The highest scores were reached in 2011 ( $p < 0.001$  vs. other years), including for "quality of resources"(10[9-10],  $p < 0.001$ ). A project of practice change was expressed by 65.9% of participants with no difference between workshops, simulation sessions and years. Two items were associated with a practice change project: "acquisition of new information" [OR=1.25, 95%CI 1.16-1.35,  $p < 0.0001$ ] and "interest for the subject" [OR=1.19, 95%CI 1.06-1.33,  $p=0.0026$ ].

**Conclusion:** The FRTID workshops influenced the projects of practice change. Initial theoretical knowledge scores were low and affected the educational impact of simulation who didn't have more influence for practice change than a simple workshop[2]. High-fidelity manikin wasn't a necessary condition for an educational benefit.

#### References:

1. Fischler et al. *Ann Fr Anesth Réanim* 2008;27:54-62
2. SM Alessi. *J Computer Based Instruction* 1988,15:40-7

## 15AP2-3

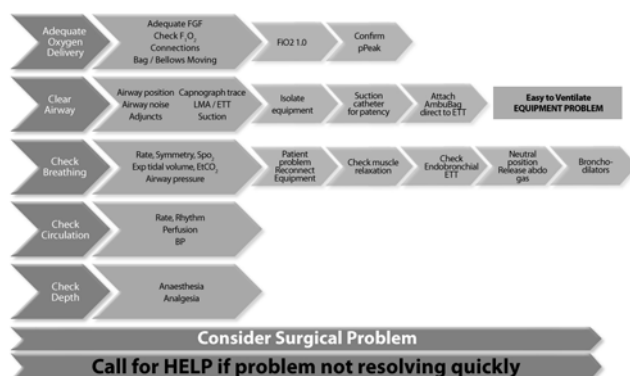
### Anaesthetic critical incident drills - design and evaluation of a low fidelity simulation based training package for novice anaesthetists

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**Background:** The UK Curriculum for CCT in Anaesthetics, requires novice anaesthetic trainees to demonstrate knowledge and skills to manage 12 critical incidents (CI) such as "unexpected increase in peak airway pressure"<sup>1</sup> and advises using simulation for Direct Observation of Procedural Skills (DOPS) assessment. Few hospitals in Scotland have sophisticated simulation equipment and so the goal of this project was to create a simulation based educational resource for use in every anaesthetic department to teach, rehearse and assess required skills.

**Methods:** Key basic drills were developed for each CI and the teaching package was designed to run with a laptop, anaesthetic machine and intubation head part task trainer and included a trainer guide.



[Example Drill]

Tactical decision games (TDG) were designed to stimulate discussion and as a basis for running the simulations.

The package was piloted in 3 hospitals with separate trainers for each site. Trainee evaluation consisted of rating on a likert scale 1 (strongly disagree)

to 5 (strongly agree) and free text responses. Trainer evaluation was free text responses.

**Results:** 12 Trainees took part. Increased confidence in managing CI, and usefulness of Key basic drills was scored 4 or 5 by all trainees and 92% would be comfortable being assessed with the package. Trainees valued the TDG and inclusion of a real anaesthetic machine. Trainer feedback included "easy to follow, set up and run".

**Conclusion:** The package has been effective from a trainee and trainer perspective. It is easy to set up and run at departmental level with minimal training that can be achieved by local cascading. It provides a framework on which trainees are comfortable to be assessed. Following the success of the pilot, this package will be disseminated across Scotland, with ongoing evaluation and development.

#### References:

1. Curriculum for a CCT in Anaesthesia, Edition 2, August 2010, Version 1.2. The Royal College of Anaesthetists. Available at [www.rcoa.ac.uk](http://www.rcoa.ac.uk)

## 15AP2-4

### Confidence in skill acquisition amongst CT1 anaesthetic trainees in Birmingham

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**Background and Goal of Study:** Initial anaesthetic competencies (IAC) are signed off at around three months into training<sup>1</sup>, signifying that the trainee is ready to join the on-call rota. The IAC includes proficiencies such as induction of general anaesthesia, RSI and anaesthetic emergencies. No formal testing of ability at the end of the IAC period exists, but all evidence must be signed by a senior anaesthetist and reviewed by an affiliate of the RCoA who ultimately deems competence. This study aims to obtain an anaesthetic trainee's view of skill attainment in the first few months and how much this prepares them for independent practice when on-call.

**Materials and Methods:** Data was collected via anonymous paper questionnaires distributed to CT1 anaesthetic trainees at QEHB and emailed to other CT1s in the West Midlands deanery. Questionnaires were issued at regular intervals during the initial period of training. These investigated the IAC and trainees' confidence in core competency acquisition.

**Results and Discussion:** At three months all trainees felt confident enough to carry out procedures independently without a senior colleague in the same room, but there were variations in how nearby they felt their senior should be. Having been signed off as competent 50% felt equally confident at all procedures yet 50% felt less confident in some areas than others; noticeably RSI, but all felt ready to join the on-call rota. Confidence in skill acquisition is both objective and subjective and despite IAC achievement trainees may not feel skilled enough in expected procedures. Rota staffing demands and pressure to be equal to peers may play a role in forcing trainees onto the on-call rota prematurely.

**Conclusions:** Shadowing of on-calls and regular simulation sessions have proved very beneficial to CT1s at QEHB and should be offered in all Trusts to every anaesthetic trainee. This would not only increase confidence in procedures to which trainees have had less than adequate exposure, but would introduce the on-call environment and its associated expectations to which they would shortly be joining. Introduction of formal or semi-formal IAC testing would ensure initial standardisation across the board, but perhaps the three month IAC period should be lengthened to increase supervised exposure to less commonly performed anaesthetic practices and therefore increase overall confidence.

#### Reference:

1. RCoA, 2010. The programme of training leading to a CCT in Anaesthetics.

## 15AP2-5

### Defibrillator is the key factor - CPR-D coordinators' attitudes towards resuscitation

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**Background and Goal of Study:** Previous studies have shown inadequate organisation of CPR training (1). Defibrillation is hesitated due to individual or organizational attitudes (2).

The purpose of this study was to survey the attitudes of CPR coordinators towards CPR-D.

**Materials and Methods:** A questionnaire (2) was distributed to all CPR coordinators attending a seminar focusing on up-dated resuscitation guidelines. 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. Three scales were constructed (*Hesitation*, *Nurse's Role*, *Non-technical skills*). Cronbach's alpha were adequate (0.92-0.57). Statistics: Student's t-test, ANOVA, Pearson Correlation.

**Results and Discussion:** The questionnaire was returned by 124 participants, 17 of them were male (13.7%) and the mean age was 42 years. Majority of the respondents organised basic CPR-D education (83.3%), nearly all agreed that the educational session followed the current Clinical Practice Guidelines. Only 30% of the participants had received education about defibrillation during their undergraduate studies and a similar number of them about recognizing the rhythms. Participants having received education about defibrillation during their undergraduate studies graded themselves higher on the scale *Non-technical skills* [ $F(2, 123) = 4.799, p < 0.01$ ] compared to those who had not.

The more self-secure the participants felt as group workers the less they hesitated defibrillation (scales *Non-technical skills* and *Hesitation*,  $p < 0.01$ ). Those who graded their education concerning the rhythms as sufficient felt more sure of their *Non-technical skills* compared to their peers [ $F(2, 123) = 8.976, p < 0.001$ ]. The type of defibrillator was also one factor affecting the scale *Non-technical skills* [ $F(2, 122) = 3.924, p < 0.05$ ]. The participants who graded themselves high in the scale *Nurse's Role* emphasized leadership skills more than the others [ $F(4, 106) = 2.681, p < 0.05$ ].

**Conclusions:** Some CPR-D trainers feel insecure of defibrillators. Knowledge related to the use of defibrillators affected the respondents perceived non-technical skills. The train-the-trainers courses should focused more on practical scenarios with defibrillators and non-technical skills.

#### References:

1. Skrifvars MB et al. *Acta Anaesthesiol Scand* 2002; 46: 458-63.
2. Mäkinen M et al. *Resuscitation* 2009; 80: 1399-1404.

## 15AP2-6

### Does simulation change ones self-assessment?

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**Background and Goal of Study:** Simulation have taken a central role in the education and assessment of residents and practicing physicians<sup>1</sup>. Repetitive practice involving medical simulations is associated with improved learner outcomes<sup>2</sup>. This training permits individualized learning with positive impact on self-efficacy<sup>3</sup>.

The goal of this study is to assess the impact of a simulation course on Anesthesia residents and attendants perspective of their instruction, training, experience and overall performance in critical events.

**Materials and Methods:** For this prospective study, has been developed a high-fidelity simulation training on difficult airway and respiratory insufficiency. Before and after completing the course, all participants completed a survey and provided their professional history review. The surveys were designed to assess, using a numerical visual scale of 11 points (0-10), the self-perspective of instruction, training and experience on difficult airway, cardio-pulmonary resuscitation (CPR), operative room (OR) emergencies and crisis resource management (CRM). To determine pre-post course and resident-attendant changes the paired t-test was performed ( $p$  value  $< 0.05$  was considered significant using SPSS® 17.0).

**Results:** Twenty-six attendants and sixty-seven residents underwent the training. In residents, we found a significant pre-post improvement in difficult airway training ( $p=0,043$ ) and experience ( $p=0,021$ ), OR emergencies training ( $p < 0,0001$ ) and experience ( $p=0,011$ ) and CRM training ( $p=0,014$ ) and experience ( $p=0,012$ ). In attendants, we found a significant pre-post improvement in difficult airway training ( $p=0,048$ ), CPR training ( $p=0,041$ ) and experience ( $p=0,009$ ), OR emergencies training ( $p=0,019$ ) and CRM instruction ( $p=0,011$ ), training ( $p=0,002$ ) and experience ( $p=0,029$ ) and a decrease difficult airway experience ( $p=0,045$ ). There was also a significant difference in residents and attendants CPR training ( $p=0,003$ ). The overall performance increased significantly in both groups ( $p=0,022$ ).

**Conclusions:** Simulation training may affect positively the participants assessment of their overall and specific performance. This study alerts for the need of simulation practice integration in curriculum features.

#### References:

1. *Anesthesiology* 2010; 112:1041-52;
2. *Medical Education* 2010; 44: 50-63;
3. *Mount Sinai Journal Of Medicine* 76:330-343, 2009.

## 15AP2-7

### Simulation based teaching curriculum for perioperative transesophageal echocardiography for anesthesia residents: plotting a learning curve

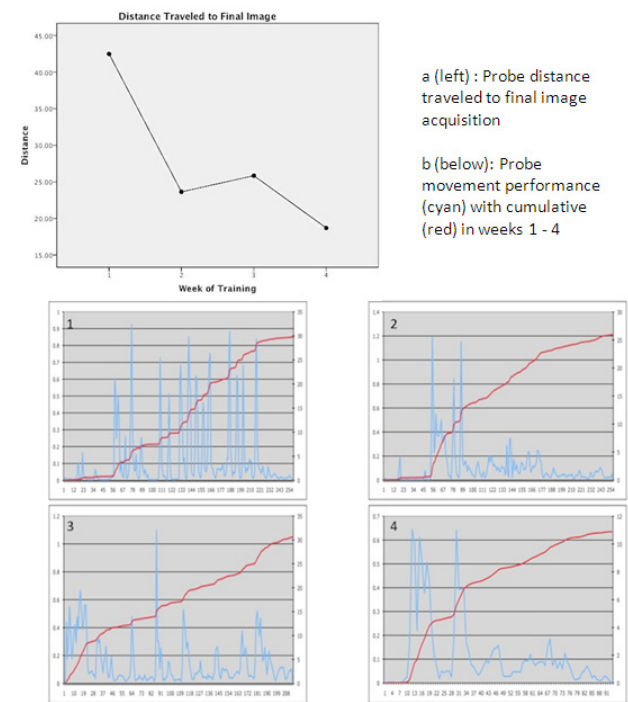
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**Background:** Simulation training has been utilized to reduce the initial learning curve in procedures requiring hand eye coordination such as laparoscopic surgery. Transesophageal echocardiography (TEE) requires development of similar skills. A simulation based TEE curriculum was developed for the anesthesia residents. The aim of the study was to demonstrate improvement in image acquisition skills.

**Material and Methods:** The study included anesthesiology residents ( $n=18$ ) with minimal prior experience in echocardiography. The basic echo curriculum comprised of eight sessions for every group of six residents each. Components of the curriculum included

- Didactic lectures on basic principles of ultrasound, image acquisition and structure identification.
- Hands on training on the simulator (Vimedix CAE Healthcare) featuring a fully functional TEE probe and mannequin..
- Evaluation: At baseline and after each teaching session with TEE Metrics software which can measure probe manipulations in x, y and z coordinates.

**Result and discussion:** There was a progressive decrease in the number of probe manipulations required to obtain a target image. All the residents were able to achieve the predefined acceptable level of expertise at the end of the curriculum.



[Probe manipulation improvement]

Figure 1 demonstrates the improvement in probe manipulation in terms of distance (1a) and movement (1b) over the course of training. We found a significant difference between the first and fourth week among the novices ( $p < 0.05$ ). Note also the reduction in rapid movement (tall spikes) as the training progressed (fig 1b).

**Conclusion:** Simulation based TEE curriculum was demonstrated to significantly improve image acquisition skills which are a key element of perioperative echocardiography.

This study charted the learning curve for image acquisition and helped define the time line required to reach an acceptable level of proficiency which is useful in designing a formal curriculum for residency.

## 15AP2-8

### Matching technical and non technical skills: the key for a safe performance

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**Background and Goal of Study:** Evidence suggests that non technical (NT) performance of a team operating in critical settings is crucial for efficacy of care and this could correlate with patient outcome.

The aim of our study was to assess whether good technical performances of a team are associated to good non technical skills. We provide preliminary results of our observations.

**Materials and Methods:** Four simulated scenarios of a critical situation (cardiac arrest in post cardiac surgery ICU patient) were analyzed. Different teams involved had to accomplish specific tasks on the basis of an interventional protocol for the specific clinical situation and received prior specific theoretical training. The scenarios were observed from a technical point of view by an anesthetist, assessing whether organization and therapeutic tasks were accomplished or not. NT performance was assessed by a Likert scale questionnaire with 15 items investigating areas of leadership, teamwork, communication and order. A psychologist and two anesthetist were responsible of NT evaluation.

**Results and Discussion:** Technical scores were expressed as a percentage of completed tasks. Four different teams were analyzed and reported technical scores of 67%(T1), 79 (T2), 95% (T3) and 95%(T4) with a mean of 84% that shows a mean good technical level of teams. Non technical score for each scenario was calculated as the sum of mean value of the three evaluators score for each NT item, with a mean of 47.6 on a 75 maximum score (T1 37,0-T2 39,0-T3 51,3-T4 63,0). The correlation index between the two distribution of data was 0,86, revealing that a better technical performance of the team was associated to a better use of NT skills and behavior during scenarios. We made a preliminary analysis of internal consistency of the NT questionnaire: the Cronbach alpha was 0,63 in leadership items, 0,77 in teamwork, 0,77 in communication and 0,85 in order. This suggests acceptable framework of questionnaire in most NT areas except for leadership.

**Conclusions:** Even if observed in a small study group, these preliminary results show that better NT performances of teams operating in critical settings was associated to higher levels of technical results. These data encourages to develop further investigation in this field in order to establish whether a cause and effect correlation exists between these two aspects. Psychometric data underline the need to implement items of leadership area in the questionnaire.

## 15AP2-9

### Portuguese physicians are moving towards simulation training and patient safety

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**Background and Goal of Study:** Medical professionals and educators recognize that simulation based medical education can contribute considerably to improving medical care by boosting clinical performance and enhancing patient safety<sup>1</sup>. It is paramount to ensure that each patient receives optimal treatment in a safe, effective, and timely manner<sup>2</sup>. It is surprising that medical simulation is not routinely integrated into the training curricula of all health-care professionals.

The goals of this study are to assess the value that portuguese physicians give to simulation based medical education and determine how a simulation training experience can change this approach.

**Materials and Methods:** For this prospective study, has been developed a high-fidelity simulation training with two critical care scenarios. All participants provided their professional history and completed a survey prior to and after finishing the course. The value given to simulation as a teaching tool was

assessed using a 5 points Likert scale rating (1 = in total disagreement, 5 = in total agreement) on 5 dimensions: dimension 1 - non-technical skills are determinant in critical situations; dimension 2 - team training with simulation should be part of Anesthesia residency curriculum; dimension 3 - team training with simulation should be part of Anesthesia attendants re-certification program; dimension 4 - team training with simulation improves clinical daily practice; dimension 5 - team training with simulation may have an impact on patients outcome. To determine pre-post course changes the Fisher's exact test was performed (p value < 0.05 was considered significant using SPSS® 17.0).

**Results:** Ninety-three physicians underwent the training. All participants agreed totally, before and after the course, on dimensions 1, 2 and 3. On dimension 4, 32% agreed totally before the course and 77% after the course (p < 0.0001). On dimension 5, 27% agreed totally before the course and 55% after the course (p < 0.0001).

**Conclusions:** Portuguese physicians give a major relevance to simulation based medical training. Simulation impact on clinical practice assessment may be improved after training. This study underlines the need and acceptance of simulation training curriculum integration.

#### References:

1 - Med Teacher. 2005 May;27(3):193-9; 2 - Chest. 2011 Oct;140(4):854-8.

## 15AP2-10

### Are we teaching the teachers? Training in the use of ultrasound guidance for central venous catheterization

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**Background and Goal of Study:** Ultrasound guidance (USG) for elective placement of central venous catheters (CVC) has been considered gold standard practice for a number of years<sup>1</sup>. Anaesthetists and intensivists should be trained in the use of ultrasound for these procedures<sup>2</sup>.

However, what constitutes adequate training and who should provide it is rarely addressed. The aim of this project was to explore the use of USG for CVC insertion in our institution, specifically to gain insight into whether anaesthetists receive ultrasound training and how confident they feel about their practice.

**Materials and Methods:** A semi-structured survey, aimed at investigating training in ultrasound use for CVC insertion was distributed to anaesthetists in three Scottish hospitals. The resulting data was both quantitative and qualitative in nature. Both consultant and trainee anaesthetists were invited to take part in the survey.

**Results and Discussion:** Of the 100 surveys distributed 52 were returned. Overall, 18 (34%) respondents always used USG for visualised insertion of CVC, 24 (46%) used it sometimes and the remaining 10 (19%) never did so. With regards to ultrasound use for anatomy check prior to CVC insertion, 26 (50%) always carried out a check, 20 (38%) sometimes did so and only 6 (11%) never performed anatomy checks. Anaesthetists were asked about whether they had received training in the use of ultrasound for direct visualization of CVC insertion. 30 (61%) had been trained: 10 consultants and 20 trainees. Of those trained 30% (9/30) had received formal training, while the remainder had been taught the use of ultrasound by a peer. Of the respondents taught by peers, 90% (19/21) were taught by a fellow anaesthetist. Of these only 63% were confident about exact location of needle tip when using USG in real time.

**Conclusion(s):** Although there is currently a great emphasis on training new anaesthetists to safely carry out central venous catheterisation, this survey suggests that more time should be taken to train consultants, many of whom were never trained in USG guided CVC insertion.

#### References:

1. Hind, D., et al., Ultrasonic locating devices for central venous cannulation: meta-analysis. *BMJ*, 2003. 327(7411): p. 361  
2. National Institute for Clinical Excellence. Guidance on the use of ultrasound locating devices for placing central venous catheters. TAG No. 49 2002 September

## Patient Safety

### 17AP1-1

#### Shortened pre-operative anaesthetic visit times may still compromise patient care and quality of consent

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**Background and Goal of Study:** Pre-operative visiting is a cornerstone of anaesthetic care: establishing a rapport between anaesthetist and patient, providing an explanation of the procedure and obtaining appropriate consent. Anaesthetists at Derriford believed that increased same-day surgical admissions shortened these visits and compromised the process.

In 2008 we audited our visits using a questionnaire based on the Association of Anaesthetists of Great Britain and Ireland (AAGBI) guidelines (2001) and found that anaesthetic complications were not adequately discussed with patients. In 2011 we re-audited to compare current practice against the updated AAGBI guidelines (2010) and 2008 data.

**Materials and Methods:** Patients on admission wards during May 2011 were invited to complete a questionnaire after their pre-operative anaesthetic visit. Items covered oral examination, length of visit and the extent of anaesthetic-related information received, together with patient demographic details. Responses were compared to those received in 2008 using chi<sup>2</sup> tests.

**Results and Discussion:** 103 patients were audited: 64% female, 63% aged between 30-69 years and 92% requiring a general anaesthetic, a similar profile to the 2008 sample.

Despite 81 visits lasting less than 10 minutes, most patients felt they received sufficient time with their anaesthetist (100) and were less anxious after the visit (81). Only two patients reported that the anaesthetist did not explain the anaesthetic procedure, while 8 claimed no or partial understanding thereof. 29 patients reported no oral examination.

Two-thirds of patients were told about post-operative nausea, vomiting and pain which rose slightly from 2008 but non-significantly. Rarer complications such as awareness (21%), anaphylaxis (22%) and death (16%) were discussed more frequently than in 2008 showing some significance ( $p=0.03$ ,  $0.07$  and  $0.05$  respectively). The proportion of patients who reported no risks being discussed fell significantly from 16% to 5% ( $p=0.012$ ).

**Conclusion(s):** Anaesthetic complications could be discussed at pre-assessment clinics but we still feel it is the anaesthetist's duty to reinforce common complications and to examine the patient's mouth pre-operatively. Shorter anaesthetic visits, whilst acceptable to patients, may still compromise patient care and quality of consent.

#### References:

1. Pre-operative Assessment and Patient Preparation, The Role of the Anaesthetist, AAGBI Guideline Jan 2010.

### 17AP1-3

#### An audit on intrahospital transfers of critically ill patients

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**Background and Goal of Study:** Patient safety during intrahospital transfers has not received as much attention in the literature as interhospital transfers. Indeed our institution does not have a specific guideline for transfer of critically ill patients. The purpose of this audit was to assess the logistics, quality and safety of intrahospital transfers requiring input from on-call anaesthetists within a 800-bed hospital.

**Material and Methods:** A prospective audit of 100 intrahospital transfers was carried out within Mater Dei Hospital, between 13-07-11 and 20-09-11. Coordination and collection of data was carried out by one of the authors (P. Trapani Galea Feriol) who interviewed the on call anaesthetists after a 24 hour shift using the data collection form. Statistical analysis (chi squared test when appropriate) was carried out to demonstrate a statistically significant relationship between clinical incidents and the following variables: different time of day, referring clinical area and number of staff accompanying the anaesthetist.

**Results and Discussion:** Of the 100 patient transfers requiring anaesthetic cover studied, the commonest reason for requesting an anaesthetist was to accompany a ventilated patient (43%). Most transfers occurred between 14.00 and 20.00 hours and 70% of transfers lasted less than 30 minutes. Analysis of data regarding accompanying personnel revealed that 45% were not accompanied by a porter. In 24% of transfers the anaesthetist was only supported by one paramedic member of staff with a median of 2 paramedic personnel accompanying a transfer (range 1-3). Clinical incidents (defined according to the

2011 Clinical Incident Management Policy DoH Western Australia) occurred in 10% of transfers. Statistical analysis did not reveal any statistically significant relationship between clinical incident frequency and number of people accompanying a transfer ( $p=0.50$ ) or time of day ( $p=0.41$ ).

**Conclusion:** This study confirmed that intrahospital transfers may be associated with a clinically significant clinical incident rate, although we did not demonstrate a statistically significant association with any variable studied. This has stimulated interest to draw up a local transfer checklist and improve education and training to optimise safety for intrahospital transfers.

#### References:

1. ANZCA Minimal Standards for intrahospital transport of critically ill patients 2010; Clinical Incident Management Policy Department of Health 2011 Australia.

### 17AP1-4

#### Herbal medicine consumption and knowledge of patients in the preanesthetic consultation

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**Background and Objectives:** The recent increase of the use of herbal medicines for the treatment of chronic illnesses acquires great interest for the physicians. Our goal is to evaluate the use and knowledge of herbal medicines by patients attending the preanesthetic consultation.

**Methods:** 500 surveys were conducted in order to assess the consumption of herbal medicines, knowledge of them by consumers and their relation to the perioperative period.

**Results:** Of the 419 valid questionnaires, the 26.02% of patients surveyed said they use some kind of herbal medicine and the 49.30% of them, consumed it more than a year ago, with a daily consumption of 57.26%. The 38.53% were taking herbal medicines with antiplatelet or oral anticoagulants. The 68.77% of consumers did not consider herbs as medicines, 87.68% reported having little or no knowledge about the herbal medicines that they took, the 82.54% did not report consumption of them in previous preanesthetic interviews and 66.43% did not stop its use before surgery.

**Conclusions:** In our sample, the consumption of herbal medicines was found to be a common practice in patients attending the preanesthetic consultation. Herbal medicine have shown potential adverse effects and drug interactions with drugs commonly used in the perioperative period. The knowledge and the search about their consumption by the anesthesiologist during the preanesthetic consultation is very important.

#### References:

1. Izzo AA, Ernst E. Interactions between herbal medicines and prescribed drugs: a systematic review *Drugs*. 2001;61(15):2163-75
2. Frost EA. Herbal medicines and interactions with anesthetic agents. *Middle East Journal Anesthesiology*. 2006 Jun; 18(5):851-78
3. Noah S. Herbal remedies and anticoagulant therapy. Review Article. *Thrombosis Haemostasis* 2005;93:3-7
4. Ang-Lee MK, Moss J, Yuan CS. Herbal medicines and perioperative care. Review. *The Journal of the American Medical Association*, July 11, 2001;286:208-216

### 17AP1-5

#### Distractions, interruptions and their impact on patient safety.

#### Anaesthetists' perceptions and existing coping strategies

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**Background and Goal of Study:** Distractions and interruptions can disrupt the flow of work and may affect anaesthetists' performance. Patient safety literature suggests that high reliability organisations have developed inherent resilience to risk and its management'. We aimed to explore the way anaesthetists see distractions in their work and document the strategies they use to deal with them.

**Method:** We conducted 15 semi-structured interviews with consultant anaesthetists. Questions focused on types of distractions at different stages of the anaesthetic, their frequency and effects, as well as ways of dealing with them. The data were analysed using a grounded theory approach<sup>2</sup>.

**Results and Discussion:** Most interviewees identified induction and emergence as the most critical times, when distractions are most potentially dangerous. The majority of interviewees saw the anaesthetic room as one of the places most prone to distractions. They argued that other healthcare professionals are the main source of distractions, both members of their team and those unrelated to the care of that particular patient. Music and teaching junior



colleagues were also mentioned as potential sources of distractions, albeit on a smaller scale. The vast majority of interviewees indicated that distractions are not a major concern to them, as they are able to either eliminate the source or work despite it. Existing strategies are outlined below.

- Learning to manage one's attention
- Ignoring people
- Being organised - not having to move between theatre and anaesthetic room
- Not getting involved in tasks which do not need an anaesthetist
- Asking people with non-urgent queries to return later when you are not so busy

**Conclusion:** Our data shows that the majority of our interviewees considered distractions and interruptions as part of their everyday life, and although potentially risk enhancing, they felt that they were able to manage them effectively. It appears that dealing with distractions and interruptions effectively is a key professional skill in anaesthesia though this seems to be informally taught as part of workplace learning, in contrast to the formalised approaches in other high-risk industries.

#### References:

1. Reason J. Human error: models and management. *Br Med J* 2000; 320: 768-70.
2. Miles MB, Huberman AM. Qualitative data analysis. Sage Publications, 1994.

## 17AP2-1

### The effect of Trendelenburg position and intrathoracic pressure on the subclavian cross-sectional area and distance from subclavian vein to pleura in anesthetized patients

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**Background and Goal of Study:** While maneuvers increasing intrathoracic pressure have been known to increase the cross-sectional area (CSA) of the internal jugular vein, their impact on the subclavian vein (SCV) has not been investigated.

**Material and Methods:** A total of 30 patients were evaluated by ultrasonography during SCV catheterization. CSA of SCV and the distance between SCV and pleura ( $D_{SCV-pleura}$ ) were measured during following maneuvers: volume controlled ventilation, end-expiratory airway opening for 10 seconds and inspiratory hold for 10 seconds with airway pressure of 20 cm H<sub>2</sub>O in supine position (S-control, S-0, and S-20); the same maneuvers in 10° Trendelenburg position (T-control, T-0, and T-20). The difference > 20% in their pairwise comparisons of CSA and  $D_{SCV-pleura}$  was defined as clinically relevant.

**Results and Discussion:** CSAs of S-20 ( $1.02 \pm 0.20$  cm<sup>2</sup>) and T-20 ( $1.14 \pm 0.28$  cm<sup>2</sup>) were statistically greater than those of S-control ( $0.93 \pm 0.17$  cm<sup>2</sup>) and S-0 ( $0.93 \pm 0.20$  cm<sup>2</sup>) ( $p < 0.001$ ) and those of T-control ( $1.03 \pm 0.22$  cm<sup>2</sup>) and T-0 ( $1.04 \pm 0.23$  cm<sup>2</sup>) ( $p < 0.001$ ), respectively, but the difference in between CSAs of T-20 and S-0 (22.6%) was >20%.  $D_{SCV-pleura}$  of S-20 ( $0.61 \pm 0.15$  cm) and T-20 ( $0.60 \pm 0.14$  cm) were statistically shorter than those of S-0 ( $0.70 \pm 0.16$  cm,  $p < 0.001$ ) and T-0 ( $0.69 \pm 0.14$  cm,  $p < 0.001$ ), respectively, but these differences of  $D_{SCV-pleura}$  were not >20%.

**Conclusion:** Combined application of inspiratory hold and Trendelenburg position increases the CSA of SCV in a clinically relevant degree. Further investigation may be indicated to determine its contribution for facilitating the success rate of catheterization as well as increasing the risk of procedural injury.

#### Reference:

1. Lobato EB, Florete OG, Jr., Paige GB, Morey TE. *J Clin Anesth* 1998;10:1-5.

## 17AP2-2

### Seizures during carotid endarterectomy under cervical plexus block

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**Background:** Carotid endarterectomy (CEA) under regional anesthesia allows continuous monitoring of cerebral perfusion based on the patient's neurological status. The cervical plexus block is a safe technique and complications are rare.<sup>1</sup> However, supplementation of local anesthetic by the surgeon is commonly required during CEA under regional anesthesia,<sup>1</sup> particularly during dissection of the carotid sheath.

This is a case report of seizures development during elective CEA under cervical plexus block.

**Case report:** Male patient, 62 years old, ASA III, hypertension, diabetes mellitus, history of a previous stroke without sequela that has been proposed for CEA. A deep and superficial cervical block with ropivacaine 0.75% (2.6 mg / kg) was successfully performed without complications. After 90 minutes,

during manipulation of the internal carotid artery, which wasn't clamped, the patient reported pain and the surgeon infiltrated 5 mL of lidocaine 1% in the internal carotid sheath. Immediately the patient became non-reactive and initiated tonic-clonic seizures, which ceased after 5 mg of midazolam IV. General anesthesia was induced and the medical team judgment was to keep on the surgery. Patient remained with hemodynamic stability and carotid clamping lasted 14 minutes. In the postoperative period the patient didn't have any neurological deficit and no further complications occurred.

**Discussion:** Seizures developed 1h30m after the cervical block and the dose of ropivacaine was lower than the toxic dose. Therefore, the hypothesis of intra-vascular injection and local anesthetic toxicity are unlikely, as well as cerebral ischemia because the carotid artery wasn't yet clamped. The temporal relationship between the lidocaine injection and onset of seizures was highly suggestive of accidental direct injection of lidocaine into the internal carotid artery.

#### References:

1. *Anesth Analg* 2000; 91:781-6; *Anesth Analg* 1999;89:885-6

**Learning points:** Seizures occurring during CEA is a potential disaster, because it may compromise the airway, raise cerebral oxygen consumption, and exacerbate cerebral ischemia.

<sup>2</sup> We call attention to the possibility of this complication, with multiple causes, and the need of permanent attention by the anesthesiologist.

## 17AP2-3

### Sedation in dental practice: prevalence and experience of dentist doctors

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**Background and Goal of Study:** The practice of sedation by dentists is a common practice in Portugal. However, no studies have been performed about the techniques used for sedation, incidence of complications and safety of this practice in an environment outside the hospital.<sup>1,2</sup> The aim of this study is to identify the sedation techniques used by dentists and the safety of this practice in an environment outside the hospital.

**Material and Methods:** For a period of six months (January to June 2010) 240 hospitals and clinics in the area of Oporto registered in the Health Regulatory Authority were contacted to respond to an anonymous telephonic questionnaire.

**Results and Discussion:** A response rate of 25% was obtained. Among physicians who responded 66% were male and 34% female, 42% worked in dental offices, 52% in clinics and 6% in hospitals. 14% perform sedation in their clinical. This practice was performed in 75% of the cases by the dentist, 13% by a nurse and 13% by an anesthesiologist. All of them have reported to use sedation at all ages and the major indication for its use was phobia. In children, 67% reported the use oral sedation, 22%, intravenous sedation and 11% inhalatory sedation. In adults, 33% reported the use inhalatory sedation, 11% intravenous sedation and 56% oral sedation. 70% stated that they had received training for sedation after graduation. 29 % reported having a local referral for sedation, within a maximum distance of less than 30 min.

**Conclusions:** The results indicate that the need to perform sedation techniques is common in clinical practice in dentistry. However, most professional's don't perform it due to the absence of reference centers for these patients. Some dentists have received medical education and began to use these techniques without the presence of an anesthesiologist.<sup>2</sup> This is an important issue of patient's safety and, therefore, it seems urgent to invest in the regulation and supervision of these matter.

#### References:

1. *Resuscitation* 1999;41:159-167
2. *Aust Dent J*. 1995;40:98-103

## 17AP2-4

### Influence of night-shift working on the physical strain of intensive care nurses and on the quality of cardio-pulmonary resuscitation

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**Background and Goal of Study:** Actual guidelines of cardiopulmonary resuscitation (ERC 2010) postulate a chest compression of 5 - 6 cm with a frequency of 100 - 120/min. Night-shift workers on an intensive care unit are heavily stressed physically and it is not published what their perception of exertion and their quality of chest compression is after an 8-hour night-shift. Aim of the study was to identify average compression rate (ACR) and average

compression depth (ACD) plus perception of exertion and heartrate (HR) of intensive care nurses before and directly after night-shift working.

**Materials and Methods:** After ethic vote approval 18 intensive care nurses performed chest compression only CPR directly before and directly after a night shift working for 10 minutes in a manikin (Laerdal Skill Resusci Anne). ACR and ACD were noted minutely (T1 - 10), perception of exertion was also noted minutely with a modified Borg Scale. Heart rate was noted before starting chest compression (T0), minutely during chest compression (T1 - 10) and 5 minutes after chest compression (T11 - 15). Data are mean  $\pm$  standard deviation.

**Results:** ACD before night shift (bN) was only at T1 in the postulated area of 5 - 6 cm and at T2 and T3 significantly lower as after night shift (aN). From T4 to T10 DKT was decreasing in both groups (ACD-T10: bN 36.4mm  $\pm$  14.4mm vs aN 35.9mm  $\pm$  13.5mm).

No significant differences were found in the ACR. HR was in mean 10/min higher in the bN-group, but obviously no significance was obtained. Perception of exertion was also not significant between the groups, from T4 to T10 nurses reached a Borg Scale level  $\geq$  15 (exhausted) in the bN group and from T5 to T10 in the aN group.

**Conclusion:** Quality of CPR before a night-shift is better than after night-shift in the first 3 min. Subjective perception of exertion starts 1 min earlier after night-shift, but no significant differences in the HR were found.

## 17AP2-5

### Anaesthesia incident reporting in the UK: comparison of a generic national and a specialty-specific reporting system

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**Background:** The UK National Patient Safety Agency set up its generic National Reporting and Learning Service (NRLS) in 2003 to gather incident reports from across the National Health Service. In 2008 a specialty-specific portal (SSP) was developed for anaesthesia jointly with the NPSA and the Royal College of Anaesthetists.

Our aim was to compare quality of reporting and ease of extracting learning from the two systems.

**Method:** All 318 incident reports submitted to the SSP in the year from 1 October 2009 were compared with a random sample of 318 of the 5315 anaesthetic-classified reports submitted via the generic NRLS in the same time period. The degree of patient harm reported, and the mean word count in the free text description of incidents, were noted. Random samples of 250 incident reports from each source were compared for accuracy of reporter's classification of specialty, incident type and severity of patient harm. Two researchers independently examined the free text of 25 incidents from each source for contributory factors from Vincent's 'London protocol' for systems analysis of incidents [1] including patient factors, team factors and organisational influences.

#### Results:

	Specialty-specific portal	Generic system
No of deaths reported	7/318 (2.2%)	22/5315 (0.4%)
Degree of patient harm allocated	279 (88%)	310 (97%)
Mean free text word count	76.6	55.3
Correct specialty classification	195/246 (79%)	148/248 (60%)
Correct degree of patient harm	206/246 (84%)	207/248 (83%)
Correct incident category	215/246 (87%)	200/248 (81%)

[Comparison of SSP and generic systems]

Agreement between raters on contributory factor categories for the SSP data was complete for 5 and partial for 14 incidents. For the NRLS data, agreement was complete for 3 and partial in 12 incidents. Free text details were insufficient to assign contributory factors for 1 and 2 incidents respectively (no overlap) for the two researchers for the SSP data and 10 incidents (6 and 8 incidents respectively, with 4 common to both) for the NRLS data.

**Conclusion:** Incidents reported through the SSP were more accurately classified and more detailed than those submitted using the generic system. However, detail is still often insufficient to be confident and consistent about attributing contributory factors and thus realising the full learning potential of reporting.

#### Reference:

1. Vincent C et al. Br Med J 1998; 316: 1154-7.

Acknowledgement: National Patient Safety Agency and Safe Anaesthesia Liaison Group of the Royal College of Anaesthetists.

## 17AP2-6

### Health care professionals knowledge of local anaesthetic safety

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**Background:** The Association of Anaesthetist of Great Britain and Ireland (AAGBI) published their update to the safety guideline on the management of local anaesthetic toxicity in December 2010 (1). It describes the use of 20% lipid emulsion (Intralipid™) as an integral part of the care pathway. This information is well known within the field of anaesthesia, however we were unsure of how much further this information had spread. Health care professionals use local anaesthetic, often in large doses, on a regular basis on the delivery suite. We sampled a cross section of obstetricians, midwives and anaesthetists to ascertain their level of knowledge regarding the safe use of local anaesthetic drugs and treatment of adverse events.

**Method:** The investigators asked health care professionals working on delivery suite, regularly using local anaesthetic, a series of questions using a paper-based questionnaire. Responders were asked to indicate which agents they used. They were then questioned about the recommended safe dose of the agent(s), the signs of local anaesthetic toxicity, the knowledge of intralipid™ as a recommended treatment and their knowledge of where this preparation is kept.

**Results and Discussion:** This project was registered with the hospitals audit department (CASE). 78 responses were collected (6 midwives, 8 anaesthetists and 64 obstetricians) Sampling coincided with an obstetric training day, hence the bias towards obstetricians within this sample.

	Midwives n=6	Obstetricians n=64	Anaesthetists n=8
Correct dose of LA known; n (%)	0 (0%)	18 (28%)	8 (100%)
Signs of toxicity known; n (%)	1 (17%)	46 (72%)	8 (100%)
Knowledge of Intralipid use; n (%)	0 (0%)	12 (19%)	8 (100%)
Location of Intralipid known; n (%)	0 (0%)	16 (25%)	8 (100%)

[Local Anaesthetic knowledge]

**Conclusion(s):** Our data supports the concept that anaesthetists are fully conversant with the safe use of local anaesthetics. Whilst all groups of health care professionals recognised some signs of life threatening local anaesthetic toxicity, the variation between groups was marked. Knowledge of the correct dose, use of Intralipid™ rescue therapy and how to access Intralipid™ was poor in all but the anaesthetic group. As a result of this sample we are adding this information to the multi-disciplinary training days held within our hospital. We plan to further sampling once this education has been put in place.

#### References:

1. [http://www.aagbi.org/sites/default/files/la\\_toxicity\\_2010\\_0.pdf](http://www.aagbi.org/sites/default/files/la_toxicity_2010_0.pdf)

## 17AP2-7

### Evaluation of cardiopulmonary unplanned events during ERCP: A comparison of deep sedation and general anaesthesia

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**Background and Goal of Study:** To evaluate ERCP-related cardiac troponin I (cTnI) release, ST ECG changes, hemodynamic changes, myocardial ischemia and hypoxemia in a series of consecutive patients undergoing ERCP under deep sedation or general anaesthesia.

**Design:** Prospective randomized study.

**Materials and Methods:** This prospective randomized study was designed to include 100 patients undergoing ERCP under general anaesthesia (group G) or deep sedation (group S). All patients were assessed preoperatively by the anesthesiologist who was also responsible for sedation or general anaesthesia. An electrocardiogram (ECG), cTnI, creatine kinase (CK) and amylase were measured before and 24 hours after the procedure. Blood pressure (BP), heart rate (HR), oxygen saturation (SpO<sub>2</sub>), end tidal carbon dioxide (TECO<sub>2</sub>), 5 lead ECG with ST analysis and bispectral index (BIS) were monitored continuously during each procedure. Patients were sedated with a combination of propofol infusion plus meperidine, while general anaesthesia with intubation was achieved with propofol infusion, meperidine and rocuronium. All patients were placed in prone position. To reduce duodenal motility hyoscine butylbromide or glucagon were administered.

**Results and Discussion:** Up to now data were collected from 36 consecutive ERCPs performed by one endoscopist to 36 unselected patients (aged 30-94 years). 16 (8male, 8 female) and 20 patients (10male, 10 female) were included in group G and group S respectively. A post ERCP rise in cTnI levels was documented in 4 out of 16 patients in group G (25%) and in 15 out of 20 patients (75%) in group S. New ECG ST changes  $\geq 0.1$  mV were occurred in 2 out of 16 patients in group G (12.5%) and in 14 out of 20 patients in group S (70%). Episodic arterial hypoxemia ( $SpO_2 < 90$ ) occurred in 7 out of 20 (35%) in group S, and in no patient in group G. One procedure in group G and two in group S were associated with the development of post ERCP pancreatitis. 8 patients in group G (50%) and 18 in group S (90%) developed hypertension. Tachycardia was recorded in 12 (75%) and in 17 (85%) patients in group G and S respectively.

**Conclusion(s):** Modification of sedation plan could reduce myocardial stress and consequently reduce the number of cardiopulmonary unpleasant events during ERCP

## 17AP2-8

### Drug errors from Thailand Anesthesia Incidents Study (Thai AIMS): analysis of 1,996 incident reports

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**Background:** The Royal College of Anesthesiologists of Thailand arranged the Thai Anesthesia Incidents Monitoring Study (Thai AIMS) to investigate the clinical course, outcome, contributing factors and suggested preventive strategies for anesthesia related adverse events including drug errors.

**Methods:** As part of the Thai AIMS, perioperative anesthesia incident reports of adverse events were collected on an anonymous and voluntary basis from 51 participating hospitals across Thailand between January 1 to June 30, 2007. Three anesthesiologists reviewed relevant data of drug error incidents. A descriptive statistics was used.

**Results:** Among 1996 incident reports of the Thai AIMS database, there were 82 incidents of drug errors (4.1%). Most of drug errors incidents occurred in maintenance phase (57.3%), general anesthesia (87.8%), in the operation theatre (91.5%).

One-fifth (95% of incidents occurred under emergency condition. Common anesthetic drugs involved were nondepolarizing neuromuscular blocking agent (23.1%), opioids (21.9%), antibiotics (17.1%), succinyl choline (7.3%) and induction agents (6.1%) respectively. Giving the wrong drug (35.4%), overdosage of drug (32.9%), problems with labeling (14.6%) and wrong concentration (9.8%) were the most common types of drug errors.

Of the 25 substitutions with 14 syringe swap (17.1%) and 6 ampule swap (7.3%), 60% involved the different pharmaceutical class of drug. Only 10.9% of incidents resulted in intubation, mechanical ventilation, unplanned admission to intensive care unit. A total of 79.2% were considered as preventable; and 39% were due to system error. Haste (42.7%), was considered as most common contributing factors while vigilance (72%) and having experience (30.5%) were considered as common factors minimizing the incidents.

**Conclusion:** Practice guidelines especially using of class specific colour labeling quality assurance activity, improvement of communication and training were suggested as strategies for prevention of drug errors in Thailand.

## 17AP2-9

### Case report: brachial plexus injury during DaVinci thyroidectomy

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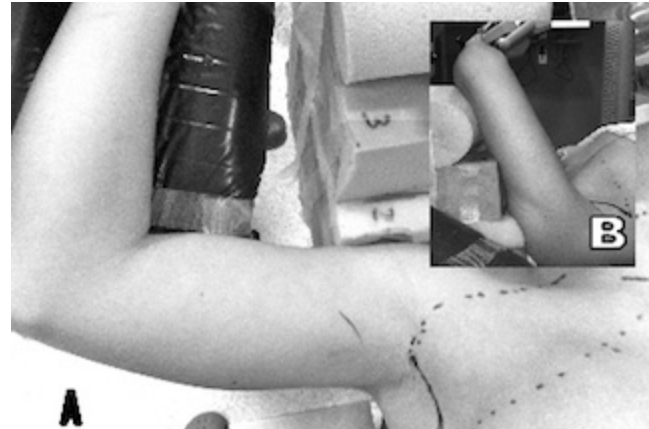
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The aim of this case report is to encourage postural changes during DaVinci thyroidectomy in order to avoid brachial plexus injury. We present a case of a 48-year-old female that was hemithyroidectomized due to a multinodular goitre. The surgery last 4 hours; the patient stayed in the same position as stated in DaVinci S manual: supine, right elbow was cephalad positioned to expose the axilla, with the elbow bent at 90 angle so that the wrist was over the forehead with the palm facing up and sandwich the forearm between 2 pieces of foam and support forearm with a table arm board approximately 15cms above the face.

After anaesthetic awakening, a brachial plexus injury was diagnosed. Corticosteroids and B complex vitamin treatment was started. A Doppler-US was carried out to rule out thrombotic disease. Because of the symptoms persistence, a neurophysiologic study was performed and it confirmed the diagnosis. Fur-

thermore NMR excluded the existence of any musculoskeletal abnormalities. The plexus injury could be due to the extension of the plexus, or even that robotic arm could have pushed the elbow and hyperextended the shoulder. Thus, we decided to change the patient position in other surgical interventions and a foam was added. Firstly, during dissection of the subcutaneous plane to prepare the approach for the robot, the limb is positioned in supine; right elbow is cephalad with the shoulder bent at 45 angle (A).

In the second part of the intervention in which the robot is used, the patient is positioned as is indicated in the manual of the DaVinci S and foam is added so that the arm can not be move (B).



[Images A and B]

As it is described above, we conclude that the position indicates on the DaVinci S manual developed brachial plexus injury which could be avoided if postural changes are made during surgery and a special foam is employed to limit the hyperextension of the arm.

## 17AP2-10

### Description of anatomical and functional characteristics of the internal jugular vein using ultrasound

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**Background and Goal of Study:** Anatomical variants of the internal jugular vein (IJV) are the main cause of difficulties and failure of the central venous catheterization (1)(2).

The aim of this study is to evaluate the position of the IJV to the artery and the effect of the anaesthetic technique, the position and changes in ventilation in the anatomy of the IJV.

**Materials and Methods:** Ultrasound was performed in 50 patients. Measurements were made at both sides of the patient's head, with a head rotation of 30°. The probe was positioned transverse on the neck at the level of the cricoid cartilage. Demographic data, type of surgery, anaesthetic technique and ventilation mode (controlled-spontaneous) were collected. The position of the IJV to the artery, the distance from the skin to the IJV and the area in cm<sup>2</sup> was also evaluated. Measurements were made in inspiration and expiration and in supine and Trendelenburg position (30°).

**Results:** The average distance between the skin and the IJV during inspiration was  $1.1 \pm 0.1$  cm for the left IJV and  $1.1 \pm 0.08$  cm for right IJV. During expiration the values were  $1.1 \pm 0.07$  cm for the left jugular vein and  $1.1 \pm 0.06$  cm for the right. The left side artery to IJV position had a higher anatomical variability than right side (62% external, 18% anterior, 12% anterolateral and 4% medial vs 72% external, 8% anterior and 8% anterolateral). Venous puncture area was significantly increased during trendelenburg position only in patients under general anaesthesia with respect to supine position.

**Conclusion(s):** In a high proportion of patients (30-40%) the IJV is not external to carotid artery, especially in the left side. The Trendelenburg position increases the venous puncture site only in patients undergoing general anaesthesia and not when loco-regional techniques were elected. Ultrasound can help to reduce complications and failures in cannulation of the IJV (3)(4)(5).

## 17AP3-1

### Review of anaphylaxis associated with anaesthesia in Northern Ireland from 1999-2010

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**Background:** In Northern Ireland cases of suspected anaphylaxis associated with anaesthesia are referred to the Regional Immunology service. The aim of this audit was to examine the method of the follow-up testing available within Northern Ireland and the patterns of anaphylaxis within Northern Ireland between 1999 and 2010.

**Methods:** Anaesthetists involved in the acute management of suspected anaphylaxis were requested to complete a standard referral form including chronological sequence of events.

Three samples of clotted blood were requested, the first within one hour of the onset of the reaction and 2<sup>nd</sup> and 3<sup>rd</sup> samples at 6 and 24 hours. Mast cell tryptase (MCT) was measured using Pharmacia UniCAP<sup>®</sup> Tryptase fluoroimmunoassay (Pharmacia Diagnostics). A level greater than 14.0 mcg/l was taken to be elevated. Specific IgE was reported as grade 0 to 6 depending on the level identified in the assay.

Patients were referred for skin prick testing (STP) based on the history of their reaction, grade of reaction and the mast cell tryptase levels and were carried out in accordance with the European Academy of Allergy and Immunology guidelines (Allergy 1989).

**Results and Discussion:** 254 adverse reactions were reported from January 1999 to December 2010. Demographics as shown in Table 1.

Female/Male	61/32	65.5% (Females)
Age (years)	52.4 (mean)	18.47 (SD)
MCT within 1st Hour (mcg/l)	57.8 (mean)	106.92(SD)

[Demographics, Table 1.]

Among the referred, 93 (36.6%) patients had MCT > 14 mcg/l on the first sample. Also 10 patients with MCT < 14 mcg/l, had positive SPT to the agent they were exposed.

Results of 54 patients who had positive SPT were available for analysis. Majority of the rest of the patients had negative SPT, however advice included avoiding the most likely agent. Neuromuscular blocking agents (NMBAs) accounted for 37 (68.5%) of the allergic reactions, followed by antibiotics, 7 (12.9%), colloids, 5 (9.24%), chlorhexidine, 3 (5.5%) and the miscellaneous group (3.96%) included latex and contrast media.

**Conclusions:** Mast cell tryptase levels remains the initial investigation in cases of suspected anaphylaxis, however we found 18.5% of patients with positive SPT had no rise in MCT levels. Majority of the anaphylaxis associated with anaesthesia are due to muscle relaxants. Of the NMBAs Rocuronium was identified as the causative agents in 59.4% cases.

#### Reference:

Anaphylaxis during anaesthesia. Plaud B, Donati F, Debaene B. *Br J Anaesth* 2002; **88**:604-5

## 17AP3-2

### Sevoflurane and propofol safety for electroconvulsive therapy

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**Background and Goal of Study:** The primary objective of electroconvulsive therapy (ECT) is the length of the seizure, and it seems not to be altered by sevoflurane or propofol sedation, so it could be reasonable to choose the safer one.

The objective of this randomized single blinded study is to compare safety of 8% sevoflurane or 2 mg kg<sup>-1</sup> propofol for electroconvulsive therapy.

**Materials and Methods:** This prospective, randomised, single-blind, crossover study was conducted to compare the effects of propofol and sevoflurane. Analysis of 68 treatments in 8 patients was conducted. The incidence of apnea (manual ventilation needed) pre and postoperatively, nausea and vomiting and shivering were measured.

There was a washout period of two to three days in between procedures. The induction time, quality of induction, haemodynamic changes, seizure duration, recovery time and need of ventilation were measured and analyzed.

**Results and Discussion:** Eight ASA II women with major depression not responding to other therapy were included. 10 ECT were administered to two patients and 8 to six patients. Results are shown in Table 1. All patients suffered postoperative apnea. \* p < 0,05

Group	Apnea (%) <sup>*</sup>	Shivering (%)	Nausea-Vomiting (%)	Eyelash (sec) <sup>*</sup>	Discharge (min)	Seizure duration (sec)
Propofol	94,1	20,6	14,7	85,6	17,1	26,4
Sevoflurane	14,7	11,8	8,8	212,5	18,5	26,5

[Table 1]

**Conclusion(s):** Both sevoflurane and propofol are suitable for ECT, with similar safety, although sevoflurane seems better to maintain spontaneous breathing.

#### References:

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## 17AP3-3

### Evaluation of sedation practices for gastrointestinal endoscopy by Greek gastroenterologists and their knowledge in basic resuscitation and airway management

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**Background and Goal of Study:** Gastroenterologists often provide analgesia and sedation during endoscopy procedures. The aim of our study was to record and evaluate within the two-day seminar on First Aid and Sedation, which was organized by our department at the Annual Conference of the Professional Union of Greek Gastroenterologists, their practice in analgesia and sedation and the incidence of events related to the airway.

**Material and Methods:** The study involved 105 doctors and 65 nurses. All participants were asked to complete a questionnaire on the type of analgesia and sedation they use, the complications they observed and more. Statistics: Mean values (mean), standard deviations (SD), medians, Pearson's  $\chi^2$  test, Fisher's exact test, Student's t-test, Mann-Whitney, parametric control analysis of variance (ANOVA), non-parametric Kruskal-Wallis test.

**Results and Discussion:** The average age of respondents was 36,1±9,3 years. 67.6% of them use during gastrointestinal procedures analgesia/sedation (Midazolam 27% of them, Propofol 1%, Midazolam and Propofol 3%, Midazolam and Fentanyl 6%, Midazolam, Propofol and Fentanyl 5%). 54.6% of them had never been trained in the management of the airway and 28.8% in resuscitation. 9.2% of the participants witnessed cardiac arrest of the patient during endoscopy procedure. Other events reported were apnea (10%), SpO<sub>2</sub> desaturation (12%), bradycardia and hypotension (34%), allergic reaction (2.1%), seizures (2.1%) and tachycardia (6.4%).

**Conclusion:** The high rate of events during gastrointestinal endoscopic examinations under analgesia-sedation and the low level of education in airway management and resuscitation, indicates the necessity of education and certification of those who apply analgesia-sedation for gastrointestinal endoscopic procedures.

## 17AP3-4

### Evaluation of gastroenterology and endoscopy medical and nursing staff who provide sedation, in basic resuscitation and airway management

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**Background and Goal of Study:** Gastroenterologists often provide analgesia and sedation during endoscopy procedures. The aim of our study was to record and evaluate within the two-day seminar on First Aid and Sedation, which was organized by our department at the Annual Conference of the Professional Union of Greek Gastroenterologists, the knowledge and skills in resuscitation and airway management of Gastroenterology doctors and nurses who provide analgesia and sedation.

**Material and Methods:** Participants were gastroenterology and endoscopy medical and nursing staff. They were asked to complete a questionnaire about their knowledge in basic resuscitation and the use of automated external defibrillator. The ability of participants to handle the airway and to resuscitate as provided by the algorithm of the European Resuscitation Council, was evaluated on adults resuscitation mannequins. Statistics: Pearson's  $\chi^2$  test, Fisher's exact test, Student's t-test, Mann-Whitney, parametric control analysis of variance (ANOVA), non-parametric Kruskal-Wallis test.

**Results:** The questionnaire was completed by 170 people, 105 doctors and 65 nurses (mean age 36 years). Despite the fact that many of them had not been trained previously in basic resuscitation and airway management tech-

niques, the majority of them knew what the basic life support and automated external defibrillation is. Half of them would not apply mouth to mouth ventilation in unfamiliar person, but most of them would apply mouth to mouth ventilation to children or familiar adult. Regarding the management of the airway, the majority of them showed an inability to put the victim in recovery position while half of them failed to ventilate with a laryngeal mask.

**Conclusion:** The results of our study suggest the need for continuous and intensive training of Gastroenterology doctors and nurses who provide sedation in resuscitation and airway management techniques.

### 17AP3-5

#### Intraocular pressure changes during robotic assisted radical prostatectomy with total intravenous anaesthesia

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**Background and Goal of Study:** Robotic assisted radical prostatectomy (RARP) is one of the newest and most advanced surgical treatment of prostate cancer with advantages of decreased blood loss and faster surgical recovery. But the procedure requires specific positioning; steep Trendelenburg position. Laparoscopic surgery with head-down position is associated with nonphysiologic effects as increase in the intraocular pressure (IOP). However, IOP changes during RARP with steep Trendelenburg position are not certain, and the effects of anaesthesia, head-down tilt, pneumoperitoneum have not been clearly separated. The aim of this ongoing study was to investigate IOP changes during RARP performed under TIVA.

**Materials and Methods:** Following approval by the institutional review board, informed consent was obtained from 20 patients (ASA I-III) scheduled for elective prostatectomy. Patients with preexisting eye disease, history of eye surgery, elevated IOP (>30 mmHg), age older than 80yr were excluded. Anaesthesia was induced with propofol (2-3 mg/kg), remifentanyl (1 µg/kg), rocuronium (0.6 mg/kg) and maintained with propofol (6-10 mg/kg/hr) and remifentanyl (0.05-0.2 µg/kg/hr), infusions were adjusted to keep mean arterial blood pressure within 20% of its preinduction value. The IOP (Tono-pen XL® tonometer) was measured at defined intervals during the procedure; before induction-supine (T1), entubated-supine (T2), after insufflation-supine (T3), in steep Trendelenburg (T4), after desufflation-steep Trendelenburg (T5), repositioning supine (T6), and 1hr after awakening in supine position (T7).

**Results and Discussion:** For both eyes a significant decrease was observed in IOP after anaesthesia induction (T2) compared with baseline measurements (T1) ( $p < 0.05$ ). Following CO<sub>2</sub> insufflation and Trendelenburg positioning IOP increased consequent with literature findings but this increase was not statistically significant. At the end of the procedure repositioning the patients to supine position resulted with a significant decrease in IOP, probably as a result of desufflation and ceasing pneumoperitoneum.

**Conclusion(s):** In this ongoing study, we examined the effects of TIVA, steep Trendelenburg position during laparoscopy with CO<sub>2</sub> insufflation on IOP changes in patients undergoing RARP Total intravenous anaesthesia seems to be protective against increases in intraocular pressure with pneumoperitoneum and steep Trendelenburg position.

### 17AP3-6

#### Does the transportation of patients from the operating room to the post-anesthetic care unit should be done with supplemental oxygen?

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**Background:** After a surgery, the transportation of patients from the operating room (OR) to the post-anesthetic care unit (PACU) is normally done without supplemental oxygen. Unless the patient is at a high risk of developing hypoxemia, the oxygen supplementation is not used. The goal of this study was to compare the changes in oxygen saturation when patients leave the OR and when they arrive in the PACU, and to identify the risk factors associated to the development of hypoxemia.

**Methods:** We prospectively observed 50 patients of both genders, 38 men and 12 women, between 19 and 82 years old (mean 62), physical status ASA I, II and III, who underwent vascular and general surgeries, and were submitted to balanced general anesthesia. Oxygen saturation was measured just before the patient left the OR and as soon as they arrived in the PACU. The time of the transportation was also recorded. The hemoglobin saturation was classified as normal ( $\geq 95\%$ ), mild hypoxemia (between 91% and 95%), moderate (between 86% and 90%), and severe ( $< 85\%$ ).

**Results:** Moderate and severe hypoxemia occurred in 8% and 4% respectively. The mean of the transport duration was 6 minutes. There was a greater incidence of this occurrence during the transport of female patients (16.6%), and patients with physical status ASA III (29%). The mean of ages was 64 years old. All of the patients that presented moderate and severe hypoxemia, were smokers (42.9%), or obese (75%), and in two cases the duration of surgery was superior to 4 hours.

**Conclusions:** Although the small number of patients observed in this study, we can conclude that there are factors that could be associated with the development of hypoxia during the transportation of patients from the OR to the PACU. The option of using supplemental oxygen during the transportation to the PACU should be considered separately, patient by patient, and should be guided by the presence of these risk factors in order to reduce the morbidity, mortality, and the incidence of hypoxemia in the early post-operative period.

### 17AP3-7

#### Reducing the number of cancelling surgery, increasing the patient safety

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**Background and Goal of Study:** Cancelling or delay surgery brings time consumption, patients and families' unpleasantness, resource wasting, and even poor prognosis caused by extended starvation and progression of disease. All these factors make the decision of anesthesiologist being difficult. Some factors could be avoided. In order to reduce the unnecessary/avoidable cancellations, we investigated cases in our institution from January, 2009 to December, 2010.

**Materials and Methods:** During a period of 23 months, we recorded 123 cases (over 57451 cases) retrospectively which were cancelled or delayed at the first scheduled time. We collected the data from medical chart and the coordinator of quality assurance in our anesthesiology department. The reasons, postponed duration, surgical departments, outcome, the ration of transferring anesthetic methods, outcome with disease progression, and patient's characteristics were analyzed.

**Results and Discussion:** The overall incidence was 0.2% and there were seven categories of reasons for cancellation: change of medical condition, surgical plan, insufficient fasting duration, systemic error, airway problems, incomplete pre-operative evaluation, and family relative factors.

The higher proportion of cancelling cases were found in orthopedic (**0.16% in orthopedic surgery, 0.03% in all**), genitourinary (**0.3% in GU surgery, 0.04% in all**) and endoscopic examination (**0.2% in endoscopic**).

From categories of reasons, the incidence of unexpected change of medical status (**59.3%**) (such as malignant hypertension, severe arrhythmia, etc) was significant higher than other factors. The following reasons were families relative factors including change of decision and absent from discussion about illness condition. Interestingly, 20 cases were cancelled after anesthesia induction, and 75% could be preventable for cancellation.

**Conclusion(s):** This results may help us improving the quality of operation room and the safety of patient care. Although some causes seem to be an uncontrollable factor, but we still could reinforce communication between branch departments.

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### 17AP3-8

#### Wrong side peripheral nerve blocks; a ten year review

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**Background and Goal of Study:** As the use of peripheral nerve blocks is becoming more frequent, the number of blocks performed on the wrong side has become a serious concern, warranting closer attention. In the state of Pennsylvania alone, it is estimated that "wrong-site" blocks represent 29% of all reports of wrong-site procedures in the surgical suites, the largest cohort of wrong-site procedures within a single specialty. Over time, wrong-site blocks have increased significantly from less than 20% of all reported cases to more than 40%, suggesting that the implementation of best-practice strategies to prevent wrong-site blocks lags behind other efforts to prevent wrong-site surgery.

**Materials and Methods:** We reviewed the number of peripheral nerve blocks performed by the division of Acute Interventional Perioperative Pain and regional anesthesia at the University of Pittsburgh Department of Anesthesiology between the time period of July 1, 2002 - June 30, 2011.

**Results and Discussion:** During the period of July 2002 to June 2011, the division of regional anesthesia and Acute Interventional Perioperative Pain within the Department of Anesthesiology at the University of Pittsburgh performed 135,090 blocks. Of those, 7 blocks were performed on the wrong side, with at least 1 near-missed wrong-side block reported. None of the wrong side blocks caused any significant injury for the respective patient nor were any sequelae observed as result of the "wrong-site" placement. Following the last wrong side block in June 2011, a policy in training was developed ("Time-out" protocol) and implemented throughout the University of Pittsburgh Department. Education and training for physicians, nurses, and other applicable hospital staff. Six months later, the skin was broken for block at the wrong site. Root cause analysis revealed the previously defined guidelines were not followed;

- (1) two successive nurses participated in the "Time-out,"
- (2) patient was not positioned before the "Time-out,"
- (3) the site of the block was not marked at the end of the time-out.

**Conclusion(s):** Prevention of blocks on the wrong side requires  
 (1) implementation of policy and training,  
 (2) team work,  
 (3) commitment from every member of the team.

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## 17AP3-9

### Residual neuromuscular block in a post-anesthesia care unit

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**Background and Goal of Study:** Residual neuromuscular block (RNMB) is an important postoperative complication of neuromuscular blocking drugs. The aim of this study was to access the incidence of RNMB in a post-anesthesia care unit (PACU).

**Materials and Methods:** This observational prospective study was approved by the Centro Hospitalar São João Ethics Committee and written informed consent was obtained. The study was conducted in a PACU during a three-week period. RNMB was defined as train-of-four (TOF) ratio < 0.9 and objectively quantified using acceleromyography in 202 eligible patients at PACU admission. From the 357 patients consecutively admitted in the PACU during the study period, 202 had inclusion criteria that included use of muscle relaxants as anesthetic management. Demographic data, perioperative variables, length of hospital and recovery room stay and critical respiratory events were recorded. Descriptive analyses were carried and the Mann-Whitney test, Chi-square or Fisher's exact test were used for comparisons.

**Results and Discussion:** RNMB incidence in the post-anaesthesia care unit was 30.2%. Patients with RNMB had a higher incidence of critical respiratory events (51% vs 16%,  $P < 0.001$ ) and of each event considered independently: airway obstruction (5% vs 4%,  $P = 0.029$ ), mild-moderate hypoxemia (23% vs 2%,  $P < 0.001$ ), severe hypoxemia (7% vs 1%,  $P = 0.033$ ), respiratory failure (8% vs 1%,  $P = 0.031$ ), inability to breathe deeply (38% vs 12%,  $P < 0.001$ ) and muscular weakness (16% vs 1%,  $P < 0.001$ ). RNMB was more common after high risk surgery (53% vs 33%,  $P = 0.011$ ) and was more often associated with post-operative hypoactive emergence defined by the Richmond Agitation and Sedation Scale (21% vs 6%,  $P = 0.001$ ). Length of hospital stay and length of recovery room stay were not different in RNMB patients.

**Conclusion(s):** These findings suggest that RNMB is common in PACU and is associated with postoperative critical respiratory events.

## 17AP3-10

### Chlorhexidine 2%/alcohol 70% wipes effectively decontaminate ultrasound equipment compared with routine practice (soap and water)

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**Background and Goal of Study:** Point of care ultrasound equipment may readily become contaminated with bacteria despite using recommended cleaning techniques[1]. Chlorhexidine 2%/alcohol 70% wipes (Sani-Cloth® CHG 2%, PDI Ltd, UK) have proved efficacious and importantly have a residual effect of over six hours[2]. A residual effect is important for devices handled between cleaning in the clinical environment but where ongoing cleanliness is desirable. The wipes are cheap costing a few cents each. We audited a new

chlorhexidine/alcohol cleaning regime compared with our routine soap and water cleaning. No single cleaning regimen is recommended by Sonosite[3].

**Materials and Methods:** Swabs were taken from the monitor, cables, handles and probes of three ultrasound machines (in theatres, emergency department and ICU) and were blindly cultured using standard techniques. A change of practice was then introduced whereby Sani-Cloth wipes were used following use. The swabs were later repeated at least 6 hours following cleaning. The primary end point of total colony count was compared using a 2 tailed Wilcoxon rank sum test for matched pairs. We also undertook accelerated aging on a probe to confirm the suitability of the wipes for routine use.

**Results and Discussion:** The total colonies cultured after standard cleaning compared to Sani-Cloth CHG 2% wipes were 418 v 20 ( $p < 0.018$ ). Subgroup analysis showed total colony counts on probes of 19 v 0 ( $n = 8$ ); handle: 173 v 10 ( $n = 8$ ), cable: 21 v 2 ( $n = 8$ ) and monitors: 205 v 8 ( $n = 3$ ). Accelerated ageing (120 wipes in 15 days) showed no deterioration in appearance or function of the probe.

**Conclusions:** Sani-Cloth CHG 2% wipes are simple, cheap and effective at reducing colonisation of ultrasound equipment. The known residual effect of these wipes may be important in maintaining the cleanliness of the equipment over time in the clinical environment and requires further study. Regular cleaning with Sani-Cloth CHG 2% wipes does not appear to affect the integrity or appearance of the probe. We recommend Sani-Cloth CHG 2% cleaning before and after each use.

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## 17AP3-11

### Cardiac arrest and mortality during anesthesia in a university hospital of Brazil. Overview of 27,997 cases

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**Background and Goal of Study:** The increasing knowledge and efforts to improve the anesthetic practice through the introduction of new medications, techniques, equipments and materials have substantially reduced the mortality associated with anesthesia. The main goal of this study was to analyze the incidence of severe adverse effects (SAE) and its relationship to perioperative characteristics in order to create guidelines that may have an impact in the reduction of both morbidity and mortality.

**Materials and Methods:** A retrospective study was done in the hospital of the Federal University of São Paulo - Brazil. Anesthesia reports from May 2009 to August 2011 were analyzed, excluding the reports that were incompleated. The non-parametric data was represented by median and quartile, using Spearman's Coefficient. Categorical data was represented by absolute and relative frequency and compared using the Chi-square test. It was considered an alpha risk  $\leq .05$  of committing error type I.

**Results and Discussion:** A total of 27,997 anesthesia reports were analyzed, with 20,078 cases included in this study. There were 83 reports of CPR (.4%) and 66 deaths (.3%), being pulseless electric activity (PEA) de most frequent cause of CPR (54.7%). The median age was 35 years (18-55). The majority physical status of the patients with SAE were P4 (34.6%) or P3 (29.5%). The surgeries associated with the highest rate of SAE were: cardiac surgery (29.3%), gastroenterology surgery (25.6%), and thoracic surgery (11%), and in 68.4% of the cases, urgent surgery. The participation of the medical resident in the intra-operative environment has shown no association with SAE ( $p = .223$ ), however the duration of anesthesia has shown direct relationship with the occurrence of SAE ( $p < .0001$ ).

**Conclusion(s):** The results found are consistent with the major causes related to intra-operative mortality cited by the medical literature. However, the higher incidence of SAE might reflect the condition of this hospital as reference for complex procedures, trauma, transplants and severe patients.

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## Perioperative Care of the Elderly

### 18AP1-1

#### Intraoperative cerebral perfusion does not influence the occurrence of postoperative cognitive dysfunction

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**Background and Goal of Study:** Postoperative cognitive dysfunction (POCD) affects up to 40% of patients > 60 years 1 week after major non-cardiac surgery. Inadequate intraoperative cerebral perfusion is often suspected in patients who present with postoperative cerebral complications. We hypothesized that cerebrovascular autoregulation is less efficient and cerebral oxygenation lower in patients developing POCD, thus making their cerebral perfusion more susceptible for hypotension or decreases in oxygen transport capacity.

**Materials and Methods:** 86 patients ≥65 yrs undergoing elective major non-cardiac surgery under standardized general anaesthesia (thiopental, sevoflurane, fentanyl) were included. Cerebral blood flow velocity (FV) was non-invasively assessed in the middle cerebral artery using transcranial Doppler. Cerebral oxygenation was measured with near-infrared spectroscopy (NIRS) and expressed as a tissue oxygenation index (TOI). Cerebrovascular autoregulation was determined using the Mx-index, which is based on the correlation of changes in mean arterial pressure (MAP) and FV. Higher values represent less efficient autoregulation. Data represent mean values during the surgical procedure. Cognitive function was assessed preoperatively and 7 days postoperatively using the CERAD-Neuropsychological Assessment Battery. POCD was defined as a postoperative decline >1 z-score in at least 2 cognitive domains.

**Results and Discussion:** 19 data sets were excluded due to missing FV data, data from 67 patients were analyzed. Results see table 1.

	No POCD (n=33) Mean±SD	POCD (n=34) Mean±SD	p-value
Age (yrs)	70±5	74±7	0.02
MAP (mmHg)	74±9	75±11	0.86
ETCO <sub>2</sub> (kPa)	4.62±0.33	4.56±0.31	0.43
MACAEQ	1.18±0.17	1.18±0.17	0.98
FV (cm/s)	38.5±16.8	43.3±14.9	0.22
Mx	0.49±0.16	0.53±0.16	0.29
TOI (%)	67±6	67±5	0.89
Desat >20% (min)	6.4±18.9	3.0±12.8	0.39

[Table 1]

MACEQ: age corrected MAC equivalents, Desat >20%: time during which cerebral oxygenation decreased >20% from baseline.

**Conclusion(s):** There was no difference between the two groups regarding cerebral autoregulation and oxygenation, suggesting that these factors do not influence the occurrence of POCD. Only age was significantly different between patients with and without POCD.

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### 18AP1-3

#### Audit of postoperative care and 30-day mortality after emergency laparotomy

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**Background and Goal of Study:** Emergency laparotomy is a common surgical procedure, often carried out in a high-risk population, and has a relatively high mortality rate. Little data is available concerning outcome. Preliminary data from the UK National Emergency Laparotomy Network (NELN) audit has shown an overall 30-day mortality of 15.3% (unpublished). Using the NELN dataset, we aimed to evaluate outcome in all patients aged 18 and above undergoing unscheduled laparotomy in our hospital, to enable future comparison to national outcomes.

**Materials and Methods:** A prospective study of all unscheduled major abdominal surgery via a laparoscopic approach or midline incision, for a 7-month period from November 2010, at the Western General Hospital, was undertaken. Data were recorded at time of surgery and patients were followed up to determine length of hospital stay and 30-day postoperative survival.

**Results and Discussion:** 245 patients underwent emergency laparotomy

(Table 1). The main anatomical sites of surgery were colon (57%) and small bowel (22%). 63% of cases were considered either urgent or immediate and 59% occurred in patients aged over 65 or ASA class 4 or 5 (high-risk group). Overall, 15 patients (6.1%) died within 30 days of surgery, 14 of whom were in the high-risk group. Of those who died, 13 had had immediate or urgent surgery. 96% of high risk patients were admitted to HDU or ICU postoperatively. Mortality in all patients admitted to ICU was 21%.

Cases	245
Age	69 (54-79)
Died within 30 days	15 (6.1%)
Admitted to HDU	185 (76%)
Admitted to ICU	43 (18%)
Length of hospital stay	18 (12-29)
Intraoperative cardiac output monitoring used	59 (24%)
Consultant surgeon present	238 (97%)
Consultant anaesthetist present	194 (79%)

[Table 1: Values are number (%) or median (IQR)]

The majority of emergency laparotomies are carried out on high-risk patients. Mortality was higher in the elderly, and increased with ASA class and urgency of surgery. High-risk patients had an increased ICU admission rate and longer hospital stay. No patients were denied access to HDU or ICU care, and a consultant surgeon and anaesthetist were present for the majority of cases.

**Conclusions:** We demonstrated a lower mortality than previously described elsewhere. We await publication of the UK NELN audit to facilitate full comparison of nationwide data to our own.

### 18AP1-4

#### Does laparoscopic surgery exert effects on postoperative cognitive function?

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**Introduction:** In laparoscopic surgery, hemodynamics and cerebral circulation fluctuate greatly, as they are affected by body posture during surgery and insufflation of the abdominal cavity.

We investigated the effects of changes in cerebral regional oxygen saturation (rSO<sub>2</sub>) induced by increased intra-pleural and abdominal pressure, and perioperative posture on postoperative cognitive function in patients who underwent a laparoscopic procedure.

**Methods:** The subjects were 35 patients scheduled for abdominal surgery. They were divided into the supine open laparotomy (group A), and head up position (group B) and head down position (group C) laparoscopic groups. Anesthesia was induced and maintained with propofol, fentanyl, remifentanyl, combined with epidural anesthesia. The pressure of intraabdominal insufflation using carbon dioxide (CO<sub>2</sub>) was standardized at 8-10 cmH<sub>2</sub>O. Cognitive function was evaluated using a mini-mental state examination (MMSE) before, and on the 3rd and 7th days after surgery. rSO<sub>2</sub> was measured using an INVOS 5100C oximeter monitoring system (Edward Lifesciences), with levels obtained before anesthetic induction as the baseline, then those 20% lower or higher than the baseline considered to indicate significant changes. For statistical analysis, a chi-square test was used. A value of p < 0.05 was considered to indicate a significant difference.

**Results:** Groups A, B, and C consisted of 12 patients with a mean age 71.6 years, 12 patients with a mean age of 70.1 years, and 11 patients with a mean age of 68.5 years, respectively. Operation time was significantly longer in groups B and C than group A (275, 265 and 205 minutes, respectively). Insufflation time was not different between groups B and C (227 and 218 minutes, respectively). The level of rSO<sub>2</sub> declined in 3 patients (25%) in group A, none in group B, and 5 (45%) in group C, whereas elevation of that level was not observed in any patient. MMSE score did not decline significantly in any of the 3 groups. No patients demonstrated a clinically obvious decline in functional cognition. Although rSO<sub>2</sub> decrease tended to be frequent in patients complicated with hypertension, it did not lead to a significant decrease in MMSE score.

**Discussion and Conclusion(s):** Our results revealed that cerebral circulatory disturbance and ischemia associated with CO<sub>2</sub> insufflation and associated with perioperative body posture did not exert great effects on postoperative cognitive dysfunction.

## 18AP1-5

### Recovery of elderly patients from four or more hours of desflurane or any other anaesthesia

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**Background:** The postoperative cognitive function is impaired in elderly patients especially after prolonged general anaesthesia. The fast recovery after desflurane anaesthesia was hypothesized to be clinically advantageous in this scenario. We compared emergence after desflurane and any other (sevoflurane, total intravenous anaesthesia (TIVA) and combined propofol-sevoflurane) anaesthesia in elderly patients undergoing four or more hours of anaesthesia.

**Methods:** Forty-five ASA I-II patients, 70 yr of age or older, undergoing surgical procedures lasting > 4 h were randomly assigned to receive desflurane (group D, n = 10), sevoflurane (group S, n = 13), TIVA (group T, n = 10) or combined propofol-sevoflurane (group C, n = 12, sevoflurane 0.5%) anaesthesia. Patients were given 1-2 µg/kg fentanyl i.v. and anaesthesia was induced with propofol 1-2 mg/kg i.v. and maintained with either desflurane 2-3% or sevoflurane 0.5%-1.5% (D and S group). In group T and C, anaesthesia was induced and maintained with propofol TCI at target blood concentrations of 0.8-2.5 µg/ml. In all group, anaesthesia was maintained with oxygen/air (FIO<sub>2</sub>) 40-50%. Early recovery times and presence of spontaneous speech (PSS) included patient's requests after immediately extubation were recorded.

**Results:** Early recovery times are given as median ± SD (D, S, T, C). The times to extubation (7.0 ± 2.6, 18.5 ± 7.1, 22.9 ± 5.9, 16.3 ± 7.1), eye opening (4.0 ± 1.2, 14.0 ± 6.5, 17.0 ± 5.9, 12.4 ± 5.7), squeezing fingers on command (5.9 ± 2.9, 16.8 ± 6.9, 21.2 ± 5.6, 14.9 ± 6.6) were significantly less (P < 0.05) for desflurane than for any other anaesthesia. Compared with any other anaesthesia, the PSS was confirmed in all patients for desflurane (D = 10, S = 5, T = 6, C = 8).

**Conclusions:** Emergence from prolonged general anaesthesia of elderly patients was significantly faster after desflurane.

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**Acknowledgement:** No one provided financial support for this study.

## 18AP1-6

### Postoperative bleeding as a risk factor for delirium, prolonged length of hospital stay and health care cost in total knee replacement

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**Background and Goal of Study:** Postoperative Delirium (POD) is an extremely costly disorder; it increased morbi-mortality, length of hospital stay (LHS) and health care cost<sup>1</sup>. Our goal was to analyze the incidence of POD after total knee replacement (TKR) and to evaluate postoperative bleeding (PB) and blood transfusion (BT) as possible risk factors associated to POD.

**Materials and Methods:** We designed a prospective, observational study considering consecutive patients scheduled for elective unilateral TKR in a tertiary university hospital and to stay in Post Anesthesia Care Unit (PACU) overnight (>12 hours). POD was diagnosed using the Confusion Assessment Method (CAM). All TKR were performed under intraoperative tourniquet, therefore, intraoperative loss was negligible; all patients had drains but not all were re-infused. PB was recorded as volume of visible wound drainage. 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:** Between April and November of 2011, 98 patients scheduled for TKR were analyzed, the mean age was 72,97 ± 10,43. 8 patients (8.16%) developed POD. The mean PB was 559,4 vs. 1085 ml in no POD vs. POD patients respectively (p=0,00027). Using ROC curve analysis a PB value of 778 ml was found to discriminate between POD and no POD patients (sensitivity 87,5%, specificity 66%) and to be a risk factor for POD (OR 8,73(1,6-46,3); p=0,008). BT was associated with an increased risk of POD (OR 17,23(2,01-147,08) p=0,002), while blood savage did not appear to be associated to POD. The mean PACU stay was 17.62 vs. 55.5 hours for no POD

vs. POD patients respectively (p < 0,0001). The mean LHS was 10.26 vs. 14.12 days in no POD vs. POD patients, respectively (p=0,0012). The BT, independently from POD, increased PACU stay (17,35 vs.27,33 hours; p=0,022) and the LHS (9,87 vs. 12 days; (p=0,0024)).

**Conclusion :** The present study suggests that PB and BT are risk factors for POD and enlarge LHS. <sup>1,2</sup> However, more prospective researches are necessary in order to evaluate factors in greater detail.

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## 18AP2-2

### Hip fracture epidemiological profile in elderly patients. Current analysis

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**Background and Goal of Study:** Hip fracture is a prevalent disease that mainly affects elderly population, with a high mortality and health care costs. Understanding its epidemiology profile is important to identify its implications in morbidity and mortality.

**Material and Methods:** We extracted data from records of Hospital Universitario Vall d'Hebron (Barcelona, Spain) between January 2007 and December 2008. Inclusion criteria were patients with hip fracture surgery and aged over 64. We analyzed the demographic characteristics, concomitant illness and treatment, type of fracture and surgery, anaesthetic technique, perioperative complications, transfusion rate, hospital stay, surgical delay and mortality. A statistical analysis was performed with descriptive and non-parametric test to compare the data.

**Results and Discussion:** We identified 834 patients with hip fracture, 765 of them filled the inclusion criteria. 78% were females; the mean age was 83 years (65 - 103), 59% of patients were ASA III and spinal anaesthesia was performed in 97.3%. The most common type of fracture was intertrochanteric (51.6%). Antiplatelet or anticoagulant therapy was documented in 35.5%: Aspirin 19.3%, acenocumarol 7.6% and clopidogrel 5.3%. Transfusion rate was 52.5% with a trigger Hb of 8.4 g/dL. Thirty days and 1 year mortality were 6.8% and 23.5% respectively. We found out that the average of surgical delay was 3.6 days and main causes were: antiplatelet/anticoagulant treatment, concomitant illness and operating room availability. There were not statistically significant differences in hospital stay (p 0.585) and infectious complications (p 0.112) with regard to surgical delay. However other complications as volume overload (p 0.011) and 30 days mortality (p0.028) increased. The average hospital stay was 14.6 days.

**Conclusion:** Hip fracture is a relevant health problem, responsible of high morbimortality and transfusions rate in elderly people. Mortality related factors: male, >65yrs, ASA III-IV, postoperative complications and anaemia. Surgical delay increases general complications and early mortality.

## 18AP2-3

### Intubating conditions and twitch height of adductor pollicis brevis muscle at 90 seconds after rocuronium 0.6 mg/kg in simulated rapid sequence induction: comparison between young adult and elderly

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**Background and Goal of Study:** The effects of a muscle relaxant may be different in the elderly for pharmacokinetic and pharmacodynamic reasons. The objective of this study was to evaluate the intubating conditions and twitch height of adductor pollicis brevis muscle at 90 seconds after rocuronium 0.6 mg/kg, and the duration of action in young adult and elderly patients.

**Materials and Methods:** Thirtyty young adults (20-40 yrs) and thirty elderly (65-80 yrs), ASA I -II . Neuromuscular transmission was monitored using acceleromyography (TOF watch®) at the adductor pollicis brevis muscle. Anaesthesia was induced with thiopentone followed by 0.6 mg/kg rocuronium. At 90 seconds after rocuronium administration, twitch response was recorded and then intubation was performed. Intubating condition was rated as excellent, good, fair or poor. The time to recovery of twitch height to 10% was recorded as the duration of rocuronium.

**Results and Discussion:** All patients in both groups were intubated successfully at the first attempt with excellent or good intubating conditions. Intubation



conditions and twitch height at 90 seconds were similar in both groups. 60% of young adult group and 65% of elderly group were rated as excellent intubating conditions ( $P=0.88$ ). Mean twitch height at 90 seconds after rocuronium in young adult and elderly group were 2.5% and 3.5% respectively ( $P=0.46$ ). The elderly patients when compared with the younger exhibited a significance increase in duration of rocuronium ( $64.45 \pm 19.65$  VS  $39.95 \pm 11.13$  mins;  $P < 0.001$ ).

**Conclusion(s):** The effect of rocuronium 0.6 mg/kg at 90 seconds after thiopentone provided excellent or good intubating conditions in both young adult and elderly patients. This technique could be applied to rapid sequence induction for patients with high risk of aspiration. However, with regard to the significantly prolonged duration of rocuronium, supplemental dose should be titrated under neuromuscular monitoring, and risk of residual neuromuscular blockade should be considered especially in short surgery.

## 18AP2-5

### Evaluation of the reversal of neuromuscular blockade induced by rocuronium with sugammadex in elderly patients

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**Background and Goal of Study:** Aging is known to be associated with alterations in drugs pharmacokinetics and dynamics. The object of this study is to evaluate the efficacy and safety of sugammadex to reverse rocuronium-induced neuromuscular blockade in elderly patients

**Materials and Methods:** A clinical study of 40 ASA I-3 patients, scheduled for elective surgery, was performed. Patients with impaired renal or hepatic function were excluded. Patients were allocated according to age in two groups: Group A: < 70 years old and Group B: >70 years old. Anaesthesia was induced with fentanyl, propofol 2mg/kg and rocuronium 0.6 mg/kg. Neuromuscular blockade was monitored using acceleromyography. Maintenance of anaesthesia was made with desflurane (MAC 1). Patients in both groups also received supplemental bolus doses of rocuronium (0,15 mg/kg) at the discretion of the anesthetists, in order to achieve zero response to train-of-four. At the end of the surgery, patients received sugammadex at a dosage of 2 mg/kg on reappearance of second twitch (T2) of train-of-four after the last dose of rocuronium. The main endpoint was the recovery time to a T4/T1 ratio of 0,9. Arterial blood pressure and heart rate were recorded just before, 5 and 10 minutes after the administration of sugammadex. Data were evaluated by t-test. Differences were considered significant if  $P < 0.05$ .

**Results and Discussion:** Although the time until recovery was shorter for Group A ( $85.00 \pm [7.33]$  seconds, and  $101.500 \pm [11.09]$  seconds respectively), the difference was not statistically significant ( $P=0.351$ ). No difference was recorded between the groups with respect to the values of the systolic blood pressure ( $157.77 \pm [14.03]$  mmHg for the older patients and  $144.1 \pm [10.3]$  mmHg for the younger ones,  $P=0.297$ ) as well as of the diastolic blood

pressure ( $87.4 \pm [9.106]$  mmHg and  $77.8 \pm [5.76]$  respectively  $P=0.193$ ). There was no statistical significant difference between groups with regard to the heart rate ( $85.5 \pm [8.527]$  bpm for group A and  $71.7 \pm [7.349]$  bpm for group B,  $P=0.962$ ). No signs of recurarization or treatment-related adverse effects were observed.

**Conclusion(s):** Sugammadex is safe and efficient also in patients over 70 years old, while its pharmacokinetics and dynamics are unaffected by age.

## 18AP2-6

### Intrathecal fentanyl and low dose L-bupivacaine in spinal anesthesia for surgical repair of proximal femur fracture in geriatric patients

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**Background and Goal of Study:** Spinal anesthesia has a better postoperative outcome compared to general anesthesia in geriatric patients who have concurrent diseases. Conventional spinal anesthesia is associated with high incidence of hypotension especially in the elderly. The synergism between intrathecal fentanyl and low dose of local anesthetics may make it possible to achieve reliable spinal anesthesia with minimal hypotension.

**Materials and Methods:** Forty elderly ASA II-III patients, aged  $\geq 70$  years undergoing surgical repair of proximal femur fracture were randomized into two groups. The first study group received L-bupivacaine 8 mg with fentanyl 25  $\mu$ g intrathecally (BF group) while the control group received L-bupivacaine 15 mg only (B group) using a 25G pencil point needle at L 2/3 interspace in lateral position, fracture side up. We were observed the quality of motor and sensory block using a modified Bromage scale (0-3) and pin prick test, hemodynamic stability and side effects: respiratory depression, shivering, nausea and itching. Groups and results were analyzed using Student's t, chi-squared, Mann-Whitney and Fisher's exact test with  $p < 0,05$  considered significant.

**Results and Discussion:** There were no differences between the two groups in demographic characteristics, ASA classification, duration of surgery and volume substitution. All patients had satisfactory anesthesia. The incidence of hypotension was more common in B group, nine patients and only two in BF group ( $p < 0, 05$ ). The degree of motor block was significantly lower in in the BF group ( $p < 0, 01$ ). Time of segmental regression to L<sub>1</sub> from maximal sensory level was significantly longer in the BF group ( $149 \pm 9,12$  minutes) than  $105,75 \pm 12,06$  minutes in the B group ( $p < 0,001$ ). Time of effective analgesia was significantly longer in the BF group ( $253 \pm 27,2$  minutes) than  $157 \pm 21,3$  minutes in the B group ( $p < 0,001$ ). The incidence of side effects was similar, except for a significantly higher of itching in the BF group ( $p < 0,01$ ).

**Conclusion(s):** The low dose of L-bupivacaine with addition of intrathecally fentanyl provide adequate spinal block, better hemodynamic stability with minimal side effects compared to the conventional dose of L-bupivacaine in the elderly.

## Airway Management

### 19AP1-1

#### Movement of the tracheal tube as a result of head rotation and tube fixation: a Thiel-embalmed cadaver study

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**Background and Goal of Study:** An orally intubated tracheal tube is usually fixed at the right angle of the mouth in clinical practice. Bronchoscopic and radiographic studies have demonstrated that movement of the head and different tube position in the mouth can alter the depth of the tracheal tube in the trachea.

To enhance our understanding of those facts, we directly fixed the tip of a tube in the trachea using a cadaver model and investigated the effects of head movement and different tube position on depth of the tube at the lip. We used Thiel-embalmed cadavers, which are the closest cadavers to living body.

**Material and Methods:** Four cadaver models (2 males and 2 females) were used in this study. The Thiel-embalming method is a well-known technique that confers cadavers spectacular flexibility and preserves natural colors. The trachea was orally intubated (ID of 8.0 mm for men and 7.0 mm for women) and exposed by thoracotomy. The tip of the tube was fixed 25 mm above the tracheal carina by forceps.

We measured the depth of the tube at the lip in different head positions and tube positions in the mouth. Data were obtained twice in each cadaver, and one-way ANOVA with Fisher's post hoc test was used for statistical analysis.  $P < 0.05$  was considered as statistically significant.

**Results and Discussion:** The depth of the tube at the right angle of the mouth was decreased by left rotation of the head ( $5.3 \pm 2.6$  mm; mean  $\pm$  SD) but not by right rotation ( $2.3 \pm 5.1$  mm). In the midline head position, tube positioning at the midline and left angle of the mouth increased the depth of the tube at the lip ( $11.0 \pm 4.3$  mm and  $2.8 \pm 1.7$  mm, respectively) compared to that of the tubed positioned at the right angle of the mouth.

**Conclusion:** Our novel Thiel-embalmed cadaveric study directly confirmed that left rotation of the head can advance the tip of the tube in the trachea and that different tube positioning in the mouth can result in alteration of tube depth in the trachea. These facts are informative for anesthesiologists to obtain appropriate position of the tube tip in the trachea in various clinical practices.

#### References:

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- Hartrey R, Kestin IG. Anaesthesia 1995; 50: 682-7

## 19AP1-2

### Fibreoptic intubation with and without Sellick's maneuver

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**Background and Goal of Study:** Cricoid pressure (CP) is performed during rapid sequence induction (RSI). It has been discussed whether this procedure should be omitted, as its effect has never been proven and since it may decrease the laryngeal view during conventional intubation. The aim of this study was to examine the effect of CP during endotracheal intubation (EI), using a flexible fiberoptic (FF), on the duration of EI and on the view of the larynx. Our hypothesis was that CP would reduce the view of the laryngeal inlet and prolong the EI procedure.

**Materials and Methods:** The study was a randomized double-blinded cross-over study comprising patients scheduled for elective back-surgery. Inclusion criteria was ASA I-II, no indication for RSI, BMI < 35, age ≥ 18, and no predicted or known difficult airway. The study was accepted by the Danish Regional Scientific Ethics Committee of the Capital Region.

The patients were anaesthetized in a standardized way using Remifentanyl, Propofol and Rocuronium. When full neuromuscular blockade was achieved the patient was intubated twice using a FF, once with and once without CP in a randomized way. The intubation time and the laryngeal view, using the Cormack-Lehane score system, were registered. If EI was not concluded within 180 seconds the EI was registered as failed.

The CP was standardized by applying pressure on an inflated blood pressure infant-cuff which was placed on the cricoid cartilage. By reading the pressure on a manometer a standardized and correct pressure of 30 Newton could be applied. The type of the CP applied was blinded to the anaesthetist.

**Results and Discussion:** Fifty patients were included after informed consent. 21 male and 29 female, mean age 53 (20-77), mean BMI 26.4 (SD 4.3). Three and 13 intubations without or with CP, respectively, were failed. The duration of EI without or with CP was 66.5 (SD 24.6) and 88.9 (SD 36.9) seconds, respectively ( $p < 0.001$ ). The Cormack-Lehane score of the laryngeal view were 2.4 (SD 0.9) and 2.8 (SD 0.9) ( $p = 0.002$ ). If the failed intubations were included the score was 2.5 (SD 1.0) without and 3.0 (SD 0.9) with CP ( $p < 0.001$ ).

**Conclusion:** The study showed that CP reduces the view and prolongs EI when a FF is used. A prolonged intubation time may increase the risk of pulmonary aspiration.

In the light of the present result and the dubious prophylactic effect of CP we suggest that CP is omitted during EI using FF in patients with an increased risk of aspiration.

## 19AP1-3

### Flexible fiberoptic versus hockey stick formed stylet as an intubation guide with the videolaryngoscope C-MAC with D-blade

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**Background and Goal of Study:** Fiberoptic intubation is still the gold standard in the management of the difficult airway. A good alternative for difficult intubation is the videolaryngoscope with indirect laryngoscopy. Visualisation of the glottis is often easy with these devices but entering the trachea with the endotracheal tube may be a problem because intubation must be performed in a curved way. Therefore special stylets were designed and different methods were described.

**Materials and Methods:** After ethic vote approval 40 patients without expected difficult airway were randomly assigned for videolaryngoscopy with the fiberoptic (FO) or a hockey stick formed stylet (HS) as introduction aid. One in videolaryngoscopy experienced anaesthetist performed all intubations. Every step of the intubation was noted by time and success. Data are mean ± standard deviation.

**Results and Discussion:** Success rate was 100% in both groups. Time from introducing the D-blade in the mouth to the first ventilation was significantly faster in the HS-group ( $56,3 \pm 11,9$  s versus  $37,7s \pm 8,6s$ ).

No complications like injuries of mouth or lips were noted in both groups. Also no postoperative complications like hoarseness or sore throat were noted 1 h after the operation or on the first postoperative day.

**Conclusion:** Combination of C-MAC with D-blade with a flexible fiberoptic as a guide for intubation may be an alternative for a hockey stick formed stylet.

## 19AP1-4

### Video-laryngoscope blade design and tracheal tube placement: comparison of the Airway Scope, C-MAC and AP Advance in simulated difficult airway

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**Background and Goal of Study:** The technique of video-laryngoscope guided tracheal tube placement varies with the blade design [1]. The video-laryngoscope blades can be broadly grouped into three types: blades with a tube channel to pre-load a tube, blades with a tube channel to guide the tube and blades with no tube channel. We compared the performances of the Airway Scope (AWS) (tube preloaded), AP Advance (difficult airway blade with tube guide) and C-MAC (difficult airway blade without tube channel) in a manikin set to simulate a difficult airway.

**Materials and Methods:** Thirty six anaesthetists took part in this randomised cross-over study. A Laerdal manikin was set to simulate a grade 3 laryngeal view. A mass balance and a force transducer were used to measure horizontal and vertical forces exerted respectively. For each video laryngoscope, we recorded time to tracheal tube placement (from handing over the device to removing it after placement of tracheal tube), forces exerted, presence of dental clicks (to indicate potential for dental trauma) and participant's impression of the ease of use (VAS: 0 mm - extremely difficult, 100 mm - extremely easy). SPSS v 16 was used to analyse the data. We used ANOVA and Friedman test for normally and not normally distributed continuous data respectively and Cochran Q test to analyse nominal categorical data.

**Results and Discussion:** Findings are presented in table 1. Values are mean (SD), median [IQR] and number (%) as appropriate (n=36).

	Airway Scope	C-MAC	AP Advance	p value
Intubation time (s)	21 (9)	28 (10)	23 (7)	= 0.001
Vertical Forces (N)	8 [0.3 - 19]	20 [1 - 28]	12 [0.8 - 19]	= 0.004
Horizontal Forces (N)	1.4 [1.1 - 1.6]	1.6 [1.3 - 1.9]	1.3 [1 - 1.9]	NS
Dental clicks	17 (47%)	20 (55%)	27 (75%)	= 0.01
VAS (mm)	75 (16)	65 (21)	66 (22)	NS

[Table 1.]

Mean (SD) number of years of anaesthetic experience was 8.3 (5.5). This study suggests that the Airway Scope had the shortest intubation time, least potential for dental trauma and exerted the smallest forces during laryngoscopy. Although the reported differences may not always be considered clinically relevant, in the 'can't intubate, can't ventilate scenario' even the smallest advantage may be vitally important.

**Conclusion(s):** This study suggests that the anatomically shaped blade of the Airway Scope has a number of advantages over the AP Advance and C-Mac blade designs.

#### References:

1. Niforopoulou P et al. *Acta Anaesthesiol Scand.* 2010; **54**: 1050-61.

**Acknowledgements:** None.

## 19AP1-5

### Optimal angle of a lightwand device (Trachlight™) to prevent high blood pressure, heart rate, and sore throat

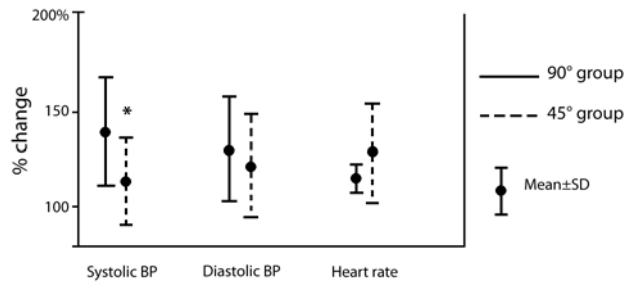
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**Background and Goal of Study:** Trachlight™ is usually used to bend wand at 90° angle according to a review<sup>1</sup>. On the other hand, we usually intubate endotracheal tube by laryngoscopy with sniffing position and pillow to get direct vision of vocal cord due to overlap oral, pharyngeal, and tracheal axes. We hypothesized that intubations with Trachlight™ bended at 45° to overlap these axes would generate a lesser haemodynamic response and sore throat than the conventional method bended at 90°. The aim of study was to compare the intubation times, haemodynamic response, and postoperative sore throat following tracheal intubation using two different angle 45° and 90° with Trachlight™.

**Material and Methods:** After getting the IRB and written informed consent, 22 adult ASA I and II patients requiring general anesthesia with orotracheal intubation were allocated into two groups (45° and 90° angle). Intubation was performed by a single experienced anaesthesiologist, using Trachlight™ with propofol 2mg/kg and rocuronium 1mg/kg iv. The haemodynamic responses; systolic, diastolic blood pressure (BP), and heart rate were measured nonin-

vasively at two min before and after intubation. We also recorded the number of attempts and total time for intubation. Postoperative sore throat following 24h were assessed using Wong-Baker face scale<sup>2</sup> (0~5 grade and 5 is maximum pain). Analyses were t-test and Wilcoxon test.

**Results and Discussion:** There was no significant characteristic, number of attempts, and total time for intubation between the groups. The percent change of systolic BP of 90° group is higher than that of 45° group ( $p=0.04$ ) indicated at figure 1. The face scale of sore throat for 90° group (median 2, range 0-4) is also higher than that of 45° group (median 0, range 0-3),  $p=0.02$ .



[Figure 1: The percent haemodynamics change of pre to post-intubation between the groups (\* $p<0.05$ )]

**Conclusions:** The Trachlight™ bended 45° is superior method to prevent unstable haemodynamics and sore throat than 90°.

#### References:

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2. *BMJ.* 2001 Feb 3;322(7281):261-5.

## 19AP1-6

### Learning curves for rigid intubation stylets

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**Background and Goal of Study:** Rigid intubation stylets such as the Bonfils (Karl Storz, Tuttlingen, Germany) and the SensaScope (Acutronic, Hirzel, Switzerland) are alternatives for managing difficult tracheal intubations. No learning curves are available for either device; previous reports suggest about 20 uses until proficiency for the Bonfils stylet (1) and 2 uses for the SensaScope (2).

We hypothesized that for experienced anaesthesiologists, no learning curve is measurable after 5 uses in mannequin, and no difference is seen between the devices.

**Materials and Methods:** Prospective semi-blinded (patient) RCT with ethics committee approval (ISRCTN14429285). 15 staff consultant anaesthesiologists with no prior experience with either device (but > 100 fibreoptic intubations) underwent 5 supervised intubation attempts on a mannequin. Then, with written informed consent, patients with normal airways were intubated with either SensaScope or Bonfils. Each participant intubated 10 patients per device (total of 300 patients). Outcome parameters were number of attempts necessary per trial and the time necessary of the successful intubation attempt per trial. Statistical analysis: for the attempts data we used a generalized linear mixed model, assuming poisson distribution; for the time data we used a general linear model, assuming normal distribution.

**Results and Discussion:** A median of 1.22 attempts was necessary until success for Bonfils, 1.28 attempts for SensaScope. In the regression model, there was no difference in attempts between devices ( $p=0.684$ ), and no evidence for less attempts over the 10 intubation trials (Bonfils:  $p=0.198$ , SensaScope:  $p=0.981$ ). In average, patients were intubated within  $55.8 \pm 21$  sec. (Bonfils);  $55.3 \pm 21$  sec. (SensaScope), without difference between devices ( $p=0.967$ ). Over the 10 trials, intubation time decreased by 1.42 sec. (Bonfils,  $p=0.046$ ) and by 1.61 sec. (SensaScope,  $p<0.001$ ).

**Conclusion(s):** We found no learning curve for experienced anaesthesiologists until successful intubation (necessary number of attempts), and no differences between the devices for both attempts and time necessary. Intubation time decreased statistically significantly, but clinically irrelevantly over the 10 first trials. In the future, we will look at learning curves for novices in anaesthesiology and look for differences in performance in patients with difficult airway

#### References:

1. Corbanese U et al. *EJA* 2009;26:622. (2) Biro P et al. *BJA* 2006;97:255

## 19AP1-7

### Utility of the new McCoy laryngoscope with built-in camera and viewfinder

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**Background and Goal of Study:** The McCoy laryngoscope is a well-known device to improve laryngeal view compared to the Macintosh laryngoscope in difficult airway. Recently, indirect laryngoscopes have been reported to be effective to manage routine and difficult airways. New McCoy laryngoscope with built-in camera and viewfinder was released and reported its potency in clinical use. In the present study, we tested our hypothesis that the indirect view with the McCoy laryngoscope through viewfinder improved the glottis view compared with the direct view.

**Materials and Methods:** Following institutional approval and written informed consent, twenty six patients (13 male and 13 female) scheduled for elective surgery requiring general anaesthesia were enrolled. Patients were aged 25-83 years old, and were designated ASA physical status 1-3. Head and neck positions of patients were not changed and external laryngeal manipulation was not applied during laryngoscopy. The size-3 McCoy laryngoscope with built-in camera and viewfinder (Machida Endoscopy Co., Ltd., Tokyo, JAPAN) was used in this study. The direct and indirect glottis view without (Macintosh configuration) and with hinged tip of the blade (McCoy configuration) were evaluated by percentage of the glottic opening (POGO) scores. For statistical analysis, paired t-test was used and  $P<0.05$  is considered as significant. Data are reported as mean  $\pm$  SD.

**Results and Discussion:** In the Macintosh configuration, the indirect view showed significantly higher POGO score ( $46.5 \pm 31.0\%$ ) than that of the direct view ( $38.5 \pm 26.0\%$ ). The indirect view in the McCoy configuration also significantly improved POGO score ( $61.2 \pm 32.0\%$ ) compared with direct view with the Macintosh configuration ( $46.5 \pm 31.0\%$ ). However, in the direct view, the POGO scores were not different between the both configurations. In addition, in the McCoy configuration, the POGO score with indirect view was significantly higher compared with the direct view ( $43.1 \pm 28.1\%$ ).

**Conclusions:** The built-in camera and viewfinder improved the glottis view not only in the Macintosh configuration but in the McCoy configuration. We conclude that the indirect view with the new McCoy laryngoscope is useful compared with the direct view, especially in the McCoy configuration.

## 19AP1-8

### Comparison of the single-use Ambu aScope2® versus the fiberoptic bronchoscope for tracheal intubation in patients with cervical spine immobilisation by a semi-rigid collar

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**Background and Goal of Study:** Difficult endotracheal intubation contributes to morbidity and mortality in anaesthesia. Despite the emergence of new videoscopes, fiberoptic bronchoscopy intubation remains a key technique for difficult airway management. Standard fiberoptic bronchoscopes are reusable and offer high quality vision, but are expensive to purchase, in addition to maintenance. Recently, a single-use flexible videoendoscope has been developed (Ambu aScope®). An updated device (Ambu aScope2®) has been commercialised with a better quality optical system.

We planned a prospective randomized controlled clinical study to compare the aScope2® to the standard fiberoptic bronchoscope for tracheal intubation in 100 patients with a simulated difficult airway.

**Material and method:** 100 patients, ASA physical status 1 or 2, scheduled for elective surgery with oro-tracheal intubation, were included and randomly assigned to the group "aScope2" or "fiberoptic bronchoscope".

Exclusion criteria were body mass index > 35, dental instability, previous difficult intubation or ear-nose-throat surgery. After induction of general anaesthesia and curarisation according to the standards of our Department, a semi-rigid Philadelphia Patriot® cervical collar was applied and intubation performed by the same experienced anaesthetist with the help of an aScope2® or a fiberoptic bronchoscope.

Patients' demographic and anatomical characteristics, time to identify the carina, time to intubate (time from touching the device to obtain an end-tidal CO<sub>2</sub>), the intubation success and numbers of additional manoeuvres necessary, the quality of the vision and the handling of the device were recorded.

**Results and Discussion:** Demographic and anatomical characteristics were identical in both groups and intubation was possible for all patients.

	Quality of vision			Ease of intubation			Time [s]	
	Excellent	Acceptable	Unacceptable	Easy	Intermediate	Difficult	to see carina	to intubate
Fiberscope	49	1	0	38	7	5	20.2±17.4*	54.4±25.6*
aScope2®	24	22	4	30	12	8	42.1±34.1*	79.8±34.6*

[Quality, ease and times required for intubation]

\*:significant difference ( $p < 0.05$ ).

**Conclusion:** Evolution of technology has led to the design and commercialisation of a single-use flexible optic device. In simulated difficult airway patients, oro-tracheal intubation was always possible with this device, although with less quality and longer times, comparing to a standard fiberoptic bronchoscope. It might represent an alternative in cases of non-available expensive fiberoptic bronchoscopes or specific situations.

## 19AP1-9

### Airtraq laryngoscopes in patients with facial trauma

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**Background and Goal of Study:** The Airtraq is a single-use laryngoscope designed to facilitate tracheal intubation of normal and difficult airway patients. We compared tracheal intubation performance of standard Macintosh laryngoscope with the Airtraq laryngoscope in patients with facial trauma.

**Materials and Methods:** Institutional ethics committee approval was obtained for this study and written informed consent was obtained from all patients. Forty-two adult patients (31M,11W) with facial trauma, ASA II-III, scheduled for maxillo-facial surgery, were enrolled in this prospective randomized study. All of these patients were classified Mallampati 3 or more at the preoperative visit. Anesthesia was induced with Sufentanil 0,2 mcg/Kg, Propofol 2 mg/Kg and Succinylcholine 1 mg/Kg. Patients were randomized to intubation with the Macintosh laryngoscope (group MAC, n=21pz) or the Airtraq laryngoscope (group TRAQ, n=21pz). Success rate, hemodynamics values, duration of tracheal intubation, and quality of airway management were evaluated and compared between the groups. Preoperative characteristics of the patients were similar in both groups.

**Results and Discussion:** Tracheal intubation was successfully carried in all patients in the group TRAQ. In the group MAC, four patients required intubation with the Airtraq laryngoscope. The increase in mean arterial pressure, heart rate during tracheal intubation was greater ( $P < 0.001$ ) in group MAC than in group TRAQ. The mean duration of tracheal intubation was significantly shorter with the Airtraq laryngoscope than with the Macintosh laryngoscope, 26 ( $\pm 16$ ) and 58 ( $\pm 23$ ) sec, respectively ( $P < 0.001$ ).

**Conclusion(s):** In this study, in patients with facial trauma the tracheal intubation time was shorter with the Airtraq laryngoscope than with the Macintosh laryngoscope. In addition, the Airtraq reduced the incidence of failure to intubate. In conclusion, we have demonstrated that the Airtraq laryngoscope achieves rapid and safe tracheal intubation of patients with facial trauma.

#### References:

1. Comparison of the Airtraq, Airway Scope, and disposable Macintosh laryngoscope blade. Nishiyama T.
2. Department of Anesthesiology and Critical Care, Higashi Omiya General Hospital, 5-18, Higashi Omiya, Minumaku, Saitama, 337-0051, Japan. nishit-ky@umin.ac.jp

## 19AP1-10

### Comparing the efficacy of Glidescope video laryngoscopy and Macintosh direct laryngoscopy for intubation of obese patients

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**Background:** Significant percent of population in developed countries suffers from obesity. This is also can be considered in developing countries. Obesity has a major health care problem for health care services.

Considering anatomic and physiologic differences in obese patients, they need special attention for airway management. Laryngoscopy and tracheal intubation is often considered more difficult than non obese patients. A few studies have been conducted to introduce a better and safer technique for airway management of these patients. Some new equipment and techniques have been developed. The objective of this study was to compare the efficacy of Glidescope video laryngoscopy and Macintosh direct laryngoscopy for intubation of obese patients.

**Materials and Methods:** In a randomized controlled clinical trial, 100 patients with mild to moderate obesity ( $BMI = 28-35$ ) who were candidate for non emergency surgery were allocated in two groups. Control group were intubated with Macintosh blade direct laryngoscopy and patients in study group intubated with Glidescope video laryngoscope. The rate of successful intubation and cardiorespiratory responses were compared in two groups.

**Results:** The mean BMI of patients in control and study group were  $31.8 \pm 0.19$  and  $32.3 \pm 0.28$  ( $p = 0.62$ ). The mean intubation time was  $14.19 \pm 1.03$  and  $25.43 \pm 1.27$  sec in control and study group respectively ( $p = 0.003$ ). number of tries for intubation in control group was significantly more than study group ( $p = 0.04$ ).  $SPO_2$  was higher and bucking rate was lower in study group. Alteration in cardiovascular parameters including HR, BP and RPP was less in study group.

**Conclusion:** Based on finding of this study, in patients with mild to moderate obesity intubation with Glidescope video laryngoscopy is more effective than Macintosh direct laryngoscopy.

## 19AP2-1

### Initial experience with the Baska mask, a novel supraglottic airway device, in female patients undergoing gynaecologic laparoscopic surgery

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**Background and Goal of Study:** The use of supraglottic airway devices during laparoscopic surgery has been reported in the literature(1). The Baska mask (Logikal, Australia) is a novel supraglottic airway. Key features include: a noninflatable cuff that may facilitate a better airway seal; a drainage system for pharyngeal contents which may reduce the risk of lung aspiration; and a bite block(2). We wished to review the performance of the Baska mask in females undergoing laparoscopic gynaecologic surgery.

**Methods:** Patients undergoing day case gynaecologic laparoscopy consented to participate. Demographic data and data regarding device performance were collected. Data included: device insertion success rate, the airway seal (reflected by leak pressure), the leak fraction, and severity of sore throat, dysphagia or dysphonia (0-10 verbal rating scale). The leak pressure was defined as the plateau airway pressure reached with fresh gas flow 6 l/min, and pressure adjustment valve set to 70cm H<sub>2</sub>O. The leak fraction was calculated as follows:  $(V_{insp} - V_{exp}) / V_{insp} \times 100$  and was based on values prior to the insufflation of gas into the peritoneal cavity.

**Results and Discussion:** Data are presented in regard to 10 patients. All underwent gynaecological laparoscopic surgery (diagnostic laparoscopy, tubal ligation or cyst removal) in head down position. The mean age was 43 years, mean BMI was 29, the mean duration of surgery was 34 min, and there were no intra or postoperative complications. The device insertion success rate was 90%, mean leak pressure was 40 cm H<sub>2</sub>O, mean leak was 7% of  $V_{insp}$ . No patient had significant (i.e. VRS >3) throat pain or dysphonia on leaving PACU or at 24hrs. One patient had significant dysphagia score in PACU, none at 24hrs. These preliminary results demonstrate that the Baska mask performs well in terms of insertion success rates, airway seal, leak fraction, intra and postoperative complications and patient comfort in this population.

**Conclusion(s):** The Baska mask demonstrates promise as a potential alternative to the endotracheal tube for short duration laparoscopic surgery in low risk patients. These initial findings need to be verified in randomised controlled trials.

#### References:

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2. <http://baskamask.net>

**Acknowledgements:** ProAct Medical, UK supplied the Baska mask devices used.

## 19AP2-2

### Intracuff pressure elevation of TaperGuard™ endotracheal tube is less than that of Hi-Lo™ tube during nitrous oxide exposure: a model trachea study

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**Background and Goal of Study:** Some studies have compared the newly introduced taper-shaped endotracheal tube (ETT) cuff to cylindrical cuff in terms of sealing effects, but the difference between the two cuff types in intracuff pressure elevation due to nitrous oxide (N<sub>2</sub>O) diffusion is still unknown. The aim of this study was to evaluate the difference in intracuff pressure el-

evation during N<sub>2</sub>O exposure between two types of cuffed ETTs: conventional high-volume low-pressure cuff and the novel taper-shaped cuff.

**Materials and Methods:** This was a simulation study using a model trachea connected to a mechanical lung. Two types of ETTs, Mallinckrodt Hi-Lo™ (HL: high-volume low-pressure cuff, Mallinckrodt, Ireland) and Mallinckrodt TaperGuard™ (TG: taper-shaped cuff, Mallinckrodt, Ireland) with internal diameters of 7.0 mm, 7.5 mm, 8.0 mm, and 8.5 mm were tested using 4 new tubes respectively. The intracuff pressure was set at 20 cmH<sub>2</sub>O at baseline, and then its elevation during mechanical ventilation using 66 % N<sub>2</sub>O was recorded. A manometer (VBM Cuff Pressure Gauge, VBM Medizintechnik GmbH, Germany) was used for intracuff pressure monitoring. The intracuff pressures at 5, 10, 15, 30, 45, and 60 minutes of N<sub>2</sub>O exposure were recorded. If the intracuff pressure reached the measuring limit of the manometer (120 cmH<sub>2</sub>O) before 60 min, the time at 120 cmH<sub>2</sub>O was recorded. In these cases, we calculated the predicted value by linear approximation to fill up the lack of raw data.

**Results and Discussion:** The cuff pressures of HL tubes were significantly higher than those of TG in all sizes (two-way repeated measure analysis of variance;  $p < 0.0001$ , respectively). According to prior studies, the taper-shaped cuffs seem to have better sealing effect due to its tendency to form fewer folds. The smaller intracuff pressure elevation of TG tubes as presented in this study was presumably because of the smaller N<sub>2</sub>O diffusion area due to its lower tendency to form folds.

**Conclusion(s):** The findings of this simulation study suggest that the intracuff pressure of TaperGuard™ tube may elevate less than that of Hi-Lo™ tube during general anesthesia using N<sub>2</sub>O.

### 19AP2-3

#### Seal effectiveness of three endotracheal tube cuff designs during positive pressure ventilation using in vitro model

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**Background and Goal of Study:** It is known that aspiration around the endotracheal tube cuff is associated with ventilator associated pneumonia. In this study, we evaluated the ability of three endotracheal tube cuff designs with subglottic suction port to prevent fluid leakage past the tube cuff using an experimental positive ventilation model.

**Materials and Methods:** An artificial trachea (22mm I.D. clear polyvinyl chloride tube) was mounted on tilted table of 45 degrees, and was connected to a 2 liters reservoir bag as a model lung. Three different ET tubes (Taper-guard EVAC; COVIDIEN; TG (tapering shaped cuff)), (Hi-Lo EVAC; COVIDIEN; HL (barrel shaped cuff)), (SACCET; Smith-Portex; SA (barrel shaped cuff)) were located in the trachea. The cuff was inflated to 25cmH<sub>2</sub>O. Ten milliliters of saline were injected over the top of the cuff in the trachea. We performed pressure controlled ventilation of pressure difference 10cmH<sub>2</sub>O and set PEEP in 0cmH<sub>2</sub>O (P0), 5cmH<sub>2</sub>O (P5). 20 minutes later, we collected the residual saline above the cuff and compared the amount of saline. Each group was measured five times. Data are expressed as mean±SD. ANOVA and bonferroni correction was used to compare data and  $P < 0.05$  was considered statistically significant.

**Results and Discussion:** The amount of saline above the cuff was TG 9.8±/0.2cc, HL 6.7±/1.0cc, SA 4.2±/1.6cc in group P0. There were significant differences between the tubes in P0. In group P5, the amounts were TG 9.9±/0.1cc, HL 9.7±/0.3cc, SA 9.5±/0.1cc, and there were no significant difference. The wrinkling of the cuff is produced at cuff expansion and it makes channel between cuff and trachea. These channels vary among materials and the shapes of the cuff, and the aspiration inflow in the trachea changes with nature of the channel. In this study, the aspiration inflows increased in order of TG, HL, SA without PEEP, but the difference decreased when we added 5cmH<sub>2</sub>O of PEEP. It is thought that a change occurs in an aspiration inflow by effect of the airway pressure during positive pressure ventilation.

**Conclusion:** The effect to prevent aspiration of tapering shaped cuff is promising. However, the superiority is reduced by a change of the airway pressure which is expected in clinical situation.

### 19AP2-4

#### Awake insertion of Air-Q™ (Laryngeal Airway) to 20 morbidly obese patients

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**Background and Goal of Study:** Bag valve mask ventilation and direct laryngoscopy are more likely to be difficult for obese patients compared with non-obese patients. We performed awake insertion of Air-Q™ (Laryngeal Airway) before general anaesthesia was induced, then anaesthetized and fiberoptic

assisted tracheal tube intubation was done using Air-Q as a conduit to obese patients undergoing bariatric surgery.

**Materials and Methods:** We performed awake insertion of Air-Q to 20 morbidly patients who were predicted to have difficult airway management. BMI's of the patients were 35-53, ages were 34-54 years old, undergoing bariatric surgery. The evaluating items of predicting difficult airway were Mallampati score, neck circumference, small jaw, and existence of sleep apnea.

First we sprayed 4% lidocaine into the patients' throats before pre-oxygenation. We administered midazolam and fentanyl until the patients became slightly sedated. We asked the patients to open their mouths as wide as possible and inserted Air-Q. We checked they had sufficient spontaneous respirations and the airway was secure. After we administered propofol, fentanyl and rocuronium, we started mechanical ventilation. Subsequently, we inserted the tracheal tube through Air-Q checking via fiberoptic assistance.

**Results and Discussion:** Awake insertions of Air-Q were performed safely and smoothly with all patients. Some patients gagged slightly, but none showed too much discomfort. Using Air-Q to secure the airway, fiberoptic assisted tracheal tube intubation was carried-out promptly.

**Conclusion(s):** For obese patients who are predicted to have difficult airway management, awake insertion of Air-Q and subsequent tracheal intubation through Air-Q can be a safe and effective procedure to secure the airway. This can be an alternative procedure to bag valve mask ventilation and direct laryngoscopy.

#### References:

1. R. Wender and A.J. Goldman Awake insertion of the fiberoptic intubating LMA CTrach™ in three morbidly obese patients with potentially difficult airways. *Anaesthesia* 2007;62:948-951

### 19AP2-5

#### A randomised trial comparing the i-gel™ airway with the laryngeal mask airway classic™ in children

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**Background and Goal of Study:** We performed this study to evaluate the clinical performance of paediatric-sized i-gels in children by comparing their efficacy with the LMA Classic in terms of insertion time, sealing pressures, glottic view via a fiberoptic bronchoscope and the incidence of complications.

**Materials and Methods:** Ninety-nine healthy children were randomly assigned to receive either the i-gel or the LMA Classic. The outcomes measured were airway leak pressure, ease and time for insertion, fiberoptic examination and complications.

**Results and Discussion:** Median (IQR [range]) time to successful device placement was shorter with the i-gel, 17 sec (13.8-20 [30]) than with the LMA Classic, 21 sec (17.5-25 [55]) ( $p < 0.001$ ). There was no significant difference in oropharyngeal leak pressure between the two devices. A good fiberoptic view of the glottis was obtained in 74% of the i-gel group and in 43% of the LMA Classic group. ( $p < 0.001$ ). There were no significant complications.

**Conclusion(s):** In conclusion, the i-gel airway provided a similar leak pressure but a shorter insertion time and improved glottic view compared with the LMA Classic in children.

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**Acknowledgements:** none.

### 19AP2-6

#### LTS II versus ProSeal in laparoscopy

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**Background and Goal of Study:** Laryngeal Mask Airway-ProSeal (LMA-ProSeal) и Laryngeal Tube Suction-II (LTS-II) are supraglottic devices which allow drainage of the stomach contents. In this prospective study we compare the conditions of securing a patent airway during laparoscopy.

**Materials and Methods:** We randomised 64 ASA I female patients, scheduled for laparoscopic gynaecological surgery. The two devices were placed after induction of anaesthesia with Propofol. Correct positioning was verified by a leak test. The ease of placement, adequacy of ventilation and ease of placement of a gastric drainage tube (and the number of attempts) were noted on a 3 point scale. Also the time from beginning to first tidal volume was taken down.

**Results and Discussion:** The two groups had no statistically significant differences in the demographic data and surgery details. Both devices were placed successfully from the first attempt in all women. The time to first tidal volume with ProSeal was 20.4 +/- 2.8 and with LTS II 19.2 +/- 3.6 sec. We found no clinical data for stomach distention, significant air leakage or regurgitation in any one of the women. Stomach drainage tube placement was successful in 93.3% (28 patients) with ProSeal and 100% with LTS II. All patients filled a questionnaire concerning complaints of dysphagia, throat irritation and voice change following surgery at 0h., 3h and 24 h. Complaints with LTS II were more severe and more frequent (4 pts vs. 1 pt. for ProSeal). Two cases of tongue oedema and cyanosis were noted in the LTS group.

**Conclusion(s):** As a whole both devices proved adequate and easy to handle in possible difficult intubation/ventilation situations and were able to secure the airway in a satisfactory manner. Both proved to be safe in laparoscopy. LTS II produced more dysphagia and throat discomfort, which does not however diminish its qualities as an emergency tool for airway management.

## 19AP2-7

### Double lumen endobronchial tube (DLT) sizes in routine practice

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DLT have 4 sizes, left and right sides. Guidance is required to obtain lung isolation without trauma or tube displacement. The pre-eminent formula using height and sex has few supporting data<sup>1</sup>. An alternative proposes using the smallest size for all patients<sup>2</sup>. We have audited the pre-eminent formula in clinical practice.

**Methods:** DLT were used in adults having elective thoracic surgery. Patients were intubated with a Mallinckrodt™ (Covidien, Mansfield) DLT. Left tubes were used except for left lung resection. Tubes were allocated according to height: women ≤160 cm 35F, >160 cm 37F, men ≤170 cm 39F, >170 cm 41F. Distance markings on the tube at the teeth was noted. The bronchial cuff was identified by fibre-optic bronchoscopy (FOB) and moved if necessary to correct position. Distance mark at teeth was noted again. Tracheal and bronchial cuffs were inflated to 22 cmH<sub>2</sub>O. Volumes were measured with a 5 ml syringe. Ease of insertion, adequacy of ventilation, oxygenation, and intra-operative airway complications were recorded.

**Results:** 191 patients were studied: M 63% F 36%, median age 60, median BMI 26 kg.m<sup>-2</sup>. 188 (98%) patients were intubated with the tube as intended. One patient could not be intubated with a 41F DLT but was intubated using a 37F tube. In two patients smaller tubes were used by trainees as a first response to difficulty. 4 smaller tubes were chosen at variance to the instruction. A bougie was required in 10 patients, an exchange catheter in 1. DLT used were: 35F 25 (13%), 37F 47 (25%), 39F 27 (14%), 41F 92 (48%), L 157 (82%), R 34 (18%). 75% required to be advanced (21%) or withdrawn (53%) under FOB guidance. Median ultimate position was 29 (range 25-33) cm. Median cuff volumes were: bronchial: 1.6 (range 0.4-5.8) 90<sup>th</sup> percentile 2.6 ml, tracheal: 3.8 (range 1.2-8.0) 90<sup>th</sup> percentile 5.2 ml. 11 (6%) patients developed intra-operative hypoxaemia < 94% requiring intervention: the tube was moved during repositioning in 3 (1.6%).

**Discussion:** Successful position was obtained in 98% of cases. Complications associated with under-sized tubes<sup>2</sup> were avoided. High quality imaging to obtain measurements<sup>3</sup>, were not required. Positioning DLT clinically without FOB<sup>4</sup> may be incorrect in three quarters of patients. 90% of cuffs may be sealed by air 2.6 ml in the main bronchus and 5.2 ml in the trachea.

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2. *Anesth Analg* 2008;106:379-83
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4. *Curr Opin Anaesthesiol* 2008; 21: 37-40.

## 19AP2-8

### A comparison of the i-gel with the LMA Supreme in non-paralysed anaesthetized children

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**Background and Goal of Study:** The aim of our prospective, randomised, controlled trial was to assess the applicability of the I-gel™ (Intersurgical Ltd, Wokingham, Berkshire, United Kingdom) (1) and LMA-S™ (LMA-S™, Laryngeal Mask Company, Henley-on-Thames, United Kingdom) (2) and I-gel™ in small children in routine clinical practice.

**Materials and Methods:** 40 children (ASA 1-3) were randomly allocated to

controlled ventilation with the I-gel™ (n=20) or LMA-S™ (n=20). A size 1 and 2 was used in children. Time of insertion, SpO<sub>2</sub>, etCO<sub>2</sub>, V<sub>TOT</sub> and P<sub>aw</sub> and airway leak pressure (ALP) of each device was measured. After insertion, the position of the 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). We evaluated ease of inserting of the gastric tube, occurrence of gastric inflation was assessed with a stethoscope placed on the epigastrium.

**Results:** Insertion of the I-gel™ was possible in 18 children in first attempt (90%) and in 1 children in second attempt (5%). In the LMA-S™ group, first attempt in 12 patients (60%) and second attempt in 2 patients (10%). Time of insertion was significantly shorter in the I-Gel™ group (median: 10 vs. 12 sec; range: 8-12 vs. 10-30 sec; P=0.002). Failure rate: I-Gel™ 1/20 vs. LMA-S™ 6/20 (5/10 size 1 and 1/10 size 2). Ventilation variables revealed sufficient ventilation and oxygenation with either device. Paw (I-Gel™, 15±4 cm H<sub>2</sub>O; LMA-S™, 15±3 cm H<sub>2</sub>O) and ALP (I-Gel™ 26±5 cm H<sub>2</sub>O; LMA-S™ 23±5 cm H<sub>2</sub>O) were comparable. Gastric inflation occurred in 2 children in LMA-S™ group and in 1 child in I-gel™ group. Gastric tube insertion was achieved in all cases. Fiberoptic scores of the position of the devices were comparable in both groups.

**Conclusion(s):** Both devices appeared to be simple and save alternatives to secure the airway. Use of the nasogastric tube should be recommended because aspiration is possible although the ALP is adequate. Significantly shorter insertions time and ease of insertion suggest that the I-gel™ may be the first choice for small children under 5 kg.

#### References:

1. *Anesth Analg* 2002; 95:1094-7
2. *Anesthesiology* 2009 Feb; 110(2):262-5

## 19AP2-9

### Ventilation with Laryngeal Mask Supreme and Laryngeal Tube S-D is more efficient than with bag-valve-mask ventilation — a prospective, randomized cross-over study registered at ClinicalTrials.gov ID NCT01452867

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**Background and Goal of Study:** In an emergency ventilation of a patient may be life-saving. Most rescuers are only basically skilled and will have difficulties with ventilation. Supraglottic devices may be more efficient than the traditional bag-valve mask ventilation. The objective of the study was to compare ventilation with Laryngeal Mask Supreme (LMA-S), Laryngeal Tube S-D (LTS-D) and bag-valve-mask (BVM).

**Materials and Methods:** Nurses (n=20) inexperienced in ventilating patients were trained in the use of LMA-S, LTS-D and BVM on manikins for one hour. Hundred and fifty patients (ASA I-II) scheduled for elective surgery were included upon written informed consent. After induction of anesthesia and neuromuscular block nurses applied a ventilation device and tried to manually ventilate the patient as shown by the chest rising clearly. Then a ventilator was connected to the airway device and the patient was ventilated with volume-control for one minute according to the ERC 2010 Guidelines. The nurses provided a subjective evaluation of the efficiency of ventilation and a recommendation of the device using a questionnaire with a scale from 0 to 10 (worse to best).

**Results and Discussion:** Ventilation with LMA-S failed in 2%, with LTS-D in 19.2% and with BVM in 33.3% of patients (p< 0.001). Mean tidal volume was 230±20 mL with bag-valve-mask, 470±120 mL with laryngeal mask and 470±140 mL with laryngeal tube (p< 0.001). Efficiency and recommendations of LMA-S were rated with 8.4 and 8.9, LTS-D with 7.9 and 6.4 and BVM with 6.5 and 5.1, respectively (p =0.001 and < 0.001).

**Conclusion(s):** In basically trained nurses ventilation with LMA-S and LTS-D is more efficient than with BVM.

## 19AP2-10

### Comparison between Single Use Flexible Reinforced Laryngeal Mask and Wired Endotracheal Tube in oral surgery

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**Background and Goal of Study:** The laryngeal mask airway has been increasingly used<sup>1</sup>. The introduction of the reinforced laryngeal mask airway challenged the endotracheal tube as the best airway device during oral surgeries<sup>2</sup>. The main objective of this study was to comparatively evaluate Single

Use Flexible Reinforced Laryngeal Mask (SUFRLM) and Wired Endotracheal Tube (WETT) in oral surgery of adult patients with regard to: surgical conditions, time of induction and emergence of anesthesia and time of discharge from the recovery room. In addition we also compared the postoperative incidence of dysphagia, dysphonia and sore throat between both devices.

**Materials and Methods:** Prospective randomized study conducted on 28 adult patients, 14 in each group, of ASA I - III, who were submitted to oral surgery under general anesthesia between January and December of 2011. Anesthesia was induced with fentanyl and propofol and no muscular relaxant was used. SUFRLM or WETT was inserted and cuff inflated. Anesthesia was maintained with O<sub>2</sub> and Sevoflurane. The data were collected by the anesthesiologist and the recovery nurse that was blind for the type of airway device used. The output data were processed by the SPSS statistical software, comparing dichotomous variables with Chi2 test, at a significance level of 0.05.

**Results and Discussion:** No statistical differences were found in what concerns to induction (SUFRLM 6.71 min Vs WETT 5.14 min,  $p = 0.27$ , CI 95% (0.48 - 3.6)) and emergence (SUFRLM 4.57 min Vs WETT 5.79 min,  $p = 0.277$ , CI 95% (0.46 - 1.03)) times. The recovery time in the WETT group was shorter than the SUFRLM group (SUFRLM 163.15 min Vs WETT 103.21 min,  $p = 0.01$ , CI 95% (28.3 - 91.57)). There were no statistical differences in the surgical conditions, the incidence of dysphonia or dysphagia and supplemental O<sub>2</sub> needs in the recovery room. The incidence of sore throat was higher in the SUFRLM group (SUFRLM  $n=5$  (35%) vs WETT  $n=0$  (0%),  $p = 0.014$ ).

**Conclusion(s):** The use of SUFRLM appears to be responsible for higher recovery times, and superior incidence of sore throat when compared with the WETT, in oral surgery in adults. Nevertheless we will continue studying this subject in order to achieve a more representative sample.

#### References:

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### 19AP3-1

#### The effect of cricoid pressure on glottic view improvement at laryngoscopy

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**Background and Goal of Study:** The effect of cricoid pressure on the view at laryngoscopy is unknown. However, cricoid pressure may make the best view at laryngoscopy.<sup>1</sup> Cricoid pressure is a superficially simple in practice but it is a complex manoeuvre which is difficult to perform optimally.<sup>2,3</sup> The aim of the present study was to evaluate the efficacy of cricoid pressure on laryngeal view improvement at laryngoscopy.

**Materials and Methods:** The investigation was carried out as a prospective randomized double blind study. A total of 84 patients undergoing standardized general anesthesia presenting for elective ophthalmic surgery in Farabi Hospital in 2010-2011 years. Then patients were randomly assigned to : Group I (with cricoid pressure) ( $n = 42$ ), group II (without cricoid pressure) ( $n = 42$ ) at laryngoscopy. Cricoid pressure was applied in an upward and backward direction with two fingers by the thumb and forefinger on each side of cricoid cartilage. All patients were assessed by one blind anesthesiologist for laryngoscopic views and their changes in each groups. Results were analyzed by X<sup>2</sup> test. A P value of  $< 0.05$  was taken as significant.

**Results and Discussion:** Demographic data were similar in two groups ( $p > 0.05$ ). The grades of the in first view at Laryngoscopy was not significantly difference in groups ( $p = 0.803$ ). The changes in glottic view show significant difference between two groups ( $p = 0.000$ ). The improved view was 69% in pressure group and 23.8% in without pressure group ( $p = 0.000$ ). The changes in glottic views was better with cricoid pressure in an upward and backward direction.

**Conclusion(s):** Use of cricoid pressure in an upward and backward direction with the thumb and forefinger on each side of cricoid cartilage, can provide the best view at laryngoscopy. It is safe and effective by trained anesthesiologist. These data suggest cricoid pressure particularly in an upward and backward direction, should be considered when the initial glottic view is not adequate for intubation.

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1. Randell T, Määttänen M, Kytälä J. The best view at laryngoscopy using the McCoy laryngoscope with and without cricoid pressure. *Anaesthesia*. 1998 Jun;53(6):536-9.
2. Jabalameli M, Hashemi J, Mazoochi M. The effect of different Sellick's maneuver on laryngoscopic view and intubation time. *Journal of Research in Medical Sciences* 2005; 10 (5):285-287.
3. Brimacombe J, Berry A. Review article: Cricoid pressure. *CAN J ANAESTH* 1997; 44: 4: 414-425.

### 19AP3-2

#### Consideration of the devices which can decrease the air leakage while in using LMA

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**Background and Goal Study:** Laryngeal mask airway (LMA) is the advanced airway management tools. But, when we use LMA under mechanical ventilation, we often encounter the air leakage. Therefore, we saw if we can't decrease the air leakage.

Then, we discovered that the air leakage while in using LMA could be decreased by pressing the body surface of the neck.

As the result of trial and error, we made new devices for decreasing the air leakage and evaluated the effect of them.

**Material and method:** We found that the air leakage could be decreased by compressing external side between infrahyoid region on both sides and upper border of thyroid cartilage percutaneously with two cylindrical gauze (2cm thick around, 5~8cm long).

Then, we made devices which can be fixed by wrapping them around their neck with Velcro.

We made varied sizes of them and put it which can decrease the air leakage most effectively on.

Eighty-one patients were undergone general anesthesia while in using LMA. When the air leakage occurred, we put it on. Then, we divided them into four groups based on amount of leaking air.

**Result:** Air leakage was occurred in thirty-nine patients. Among them, we used the devices in thirty-six patients belonging to three groups (group2,3,4). (amount of leaking air; group1: none, group2:  $79 \pm 43$ ml, group3:  $223 \pm 87$ ml, group 4: avaluative)

After using the devices, the air leakage decreased significantly for every group.

(amount of leaking air; group2:  $31 \pm 30$ ml, group3:  $26 \pm 18$ ml, group4:  $60 \pm 50$ ml) ( $P < 0.0005$ )

Furthermore, there were no problems of the breathing, blood circulatory and nerve system.

**Discussion:** According to a report, some people increased the amount of cuff when the air leakage occurred. But it was pointed out the possibility of tissue perfusion abnormality.

No one has reported whether the air leakage could be decreased by compressing the regions percutaneously.

The regions fall under near the outside superior border of the thyroid cartilage anatomically.

There were no complications. Therefore, it can be concluded that the devices are safe to use.

**Conclusion:** While in using LMA under mechanical ventilation, the devices can decrease the air leakage safely.

### 19AP3-3

#### Comparison of the Laryngeal Mask Airway Supreme™ insertion techniques: reverse insertion technique vs. standard insertion technique

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**Background and Goal of Study:** Laryngeal Mask Airway (LMA) is widely used for routine and difficult airway management, and also in emergency situations. "Thumb insertion" is a well known technique used when the anaesthesiologist is restricted to access patient's head end. The latest LMA, Supreme™ (SLMA), has an anatomical shaped design with holding tab so that the anaesthesiologist does not need to insert an index finger along with the LMA shaft. In addition, the insertion of the SLMA from patient side is not studied yet.

Thus, we conducted the manikin study to evaluate that SLMA is also useful when the performer is restricted to standard insertion approach. In this study, we compared the utility of SLMA with standard and reverse insertion techniques.

**Materials and Methods:** After institutional approval and written informed consent from participants, twenty seven anaesthesiologists in our department attempted insertion of SLMA with standard and reverse (approach from the side) insertion techniques on an airway management trainer manikin (Laerdal Medical, Stavanger, Norway). After brief introduction of the device and practice for inserting the SLMA into the manikin, participant performed two insertion with different techniques. For each technique, insertion time (the time that the participant hold the device to complete the first successful ventilation),

ease of insertion (scored with verbal rating scale; VRS), were evaluated. After insertion, ventilation status was evaluated. SLMA position was evaluated with the percentage of glottic opening (POGO) score by using a fiberoptic bronchoscope to observe the vocal cord via the outlet of the SLMA air conduit. For statistical analysis, paired t-test was used and  $P < 0.05$  is considered as significant. Data are reported as mean  $\pm$  sd.

**Results and Discussion:** The time for insertion showed no difference between both techniques ( $13.4 \pm 2.1$  sec with the standard technique, and  $13.9 \pm 2.4$  sec with the reverse technique).

However, the ease of insertion score was greater with the standard technique ( $94.4 \pm 5.4$ ) compared to the reverse technique ( $87.5 \pm 11.2$ ). The ventilation status and POGO scores were not significant between the two techniques.

**Conclusions:** Reverse insertion technique of LMA Supreme™ is equally effective compared with standard insertion technique. This technique can be used under emergency situations that the access to the patient head end is restricted.

### 19AP3-4

#### Evaluation of the LMA position using ultrasound in pediatric patients

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**Background and Goal of Study:** Although the LMA insertion is not difficult and the majority of cases with LMA fare well in ventilation, the fiberoptic assessment demonstrates a high incidence of LMA malpositioning. The fiberoptic grading of Rowbottom et al. is commonly used for positioning LMA, but the rotated degree of LMA is not considered in that grading. We hypothesized that the LMA can affect the position of the arytenoids/thyroid cartilages and it may be detected on ultrasound.

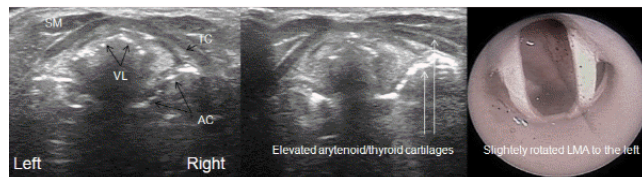
This study was designed to assess the predictability of detecting the rotated LMA according to the position change of arytenoids/thyroid cartilages using the ultrasound.

**Materials and Methods:** Children, aged 1 ms - 6 years, undergoing infraumbilical surgery were enrolled. Ultrasound was performed on the supraglottic and vocal cords area before and after the LMA insertion. Transverse images were obtained on the end-expiratory phases. LMA-position was evaluated with Bonfils fiberscope. Position grading was made as usual. If grade  $>3$  was showed, LMA was repositioned while observing with fiberscopy. If the face of LMA was rotated to one-side, the LMA was rotated to the opposite side a little. The ultrasound findings of pre- and post-LMA were compared. On fiberoptic images, conventional LMA grade and the degree of rotation were measured.

**Results and Discussion:** A total of 26 cases were completed in the study. In 9/26 cases, LMA was rotated to left or right side in a range of  $10-40^\circ$ . In 8/9 cases, ultrasound showed asymmetrical elevation of the arytenoids/thyroid cartilage after the LMA insertion.

LMA- grade	Number	Rotated LMA	US-detectable
I	13	6	5
II	6	2	2
III	3	0	0
IV	0	0	0
V	4	1	1

[Table1. Patients characteristics]



[Sonographic findings and fiberoptic finding]

**Conclusion(s):** Real-time ultrasound can be useful in positioning of the rotated LMA

### 19AP3-5

#### Real-time changes of pressure-volume curve provide objective information on efficiency of face mask ventilation during induction of anaesthesia: an observational study

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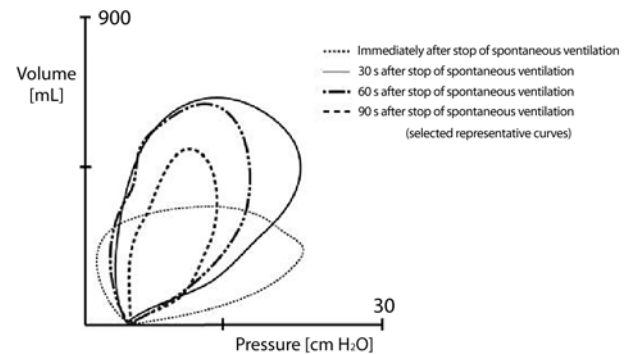
**Background and Goal of Study:** Face mask ventilation (FMV) is one of essential skills of anaesthetists. Opioids, sedatives and neuromuscular blocking agents (NMBA), as well as patient- and anaesthetist-related factors, influence efficiency of FMV. However, no objective methods to assess efficiency of FMV have been established. The purpose of the present study was to examine whether real-time visualization of pressure-volume curve (P-V curve) changes enables objective assessment of FMV during induction of anaesthesia.

**Materials and Methods:** Ten anaesthetists (trainees and staff-grade) ventilated lungs of 26 patients following induction of general anaesthesia. P-V curves continuously drawn on the spirometry display of Aisys Carestation (GE Healthcare, Helsinki, Finland) were video-recorded. Shape and tilt of diagonal line of P-V curves were graphically processed and analysed.

**Results:** 1) Changes of P-V curve were easily recognised in a real-time fashion. 2) P-V curve changed significantly during FMV in 11 patients (42%). 3) P-V curve changes corresponded well with the subjective "feel" of easier FMV after administration of NMBA. 4) In patients with subjectively more difficult but possible FMV, shape of P-V curves showed characteristic sequential increase of tilt angle, which reflected effects of drugs used for induction as well as gradually improving fitting of a face mask.

**Conclusion(s):** Real-time observation of the P-V curve during induction of anaesthesia provides objective information on the efficiency of FMV. Compared to other parameters used to assess FMV efficiency (e.g.  $V_{T1}/V_{T0}$  ratio,  $P_{max}$ ), P-V curve can be a visual objective proof of ease or difficulty of FMV.

#### Pressure-Volume curve changes in a face mask ventilated patient after loss of spontaneous ventilation during induction of anaesthesia



[PV curve changes during mask ventilation]

### 19AP3-6

#### Jet speed: subjective and objective review of speed at which anaesthetists can perform needle cricothyroidotomy and jet ventilation

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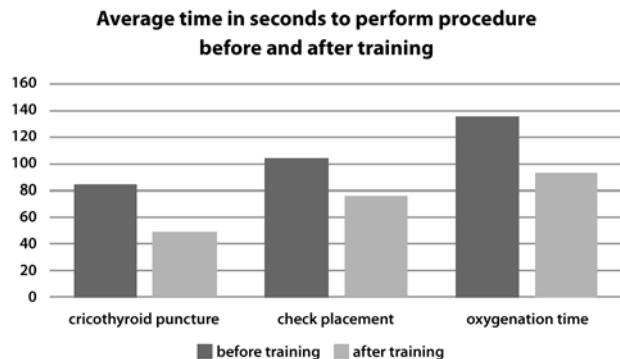
**Background and Goal of Study:** Needle cricothyroidotomy (NCTO) is an important rescue technique in can't intubate, can't ventilate scenarios [1]. NAP4 highlighted the difficulty in performing NCTO and lack of successful oxygenation [2]. This projects aim was to look at performance of anaesthetists of all grades in performing the procedure.

**Materials and Methods:** We constructed a model larynx from a sheep's larynx and trachea and medical adhesive tape and gained consent from participants. We instructed the participants to perform a NCTO and attempt to oxygenate. We then gave an example demonstration of how to perform a NCTO and use the Sanders jet ventilator. The participants were then asked to perform a NCTO and oxygenate again and the first and second times were compared. The candidates completed a questionnaire before and after the practical assessment.

**Results and Discussion:** The candidates ranged from 1<sup>st</sup> year trainees to senior consultants. 20% of anaesthetists had previously performed a NCTO



on either a manikin or a patient. The mean time to perform NCTO and oxygenation was 2 min 15 seconds which improved to 1 min 12 seconds on the second attempt after the guidance demonstration. 100% of candidates were more confident, with 16% improving by 4 points on the Likert scale.



[Time to perform procedures]

**Conclusion(s):** If NCTO is to remain on the CICV guidelines then it should be a core skill which every anaesthetist should be familiar with. 100% of candidates felt it should be part of formal training. This study shows improvement with time taken to perform the procedure and the confidence in those taking part. Those candidates would now feel more able to deal with a “can’t intubate can’t ventilate” scenario.

**Conflicts of Interest:** none.

**References:**

1. Difficult airway society (DAS) (2007) Guidelines [online] Available: <http://www.das.uk.com/guidelines/guidelineshome.html>
2. NAP4. Fourth National Audit Project of RCOA and DAS 2011 (see: <http://www.rcoa.ac.uk/index.asp?PageID=1089>)

### 19AP3-7

#### Left-molar approach of tracheal intubation saves eighteen degrees extension of the atlanto-occipital joint

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**Introduction:** The Left-molar approach of laryngoscopy (LtMA) improves glottic view in sporadic cases of difficult laryngoscopy (1) (2). We examined the distance reduction and the changes in the angle of head extension between conventional midline approach (MA) and LtMA.

**Methods:** After institutional approval and informed consent, 40 patients (20 female and 20 male) (ASA PS: I-II) scheduled for elective surgery were studied. Intravenous anaesthesia was induced and maintained.

A Macintosh standard curved blade was used and the flange of the blade was graduated in centimeters from the tip to measure the distance from the patient’s teeth to the glottis. On the tracheal intubation, a solid figure is assumed in the patient’s oral cavity, and apexes were named with symbols. Point A: upper incisor. B: left molar, the flange of the blade touched with LtMA. C: right molar, symmetrical opposite side point of B. P: the vallecula where the tip of the blade was placed. Q: midpoint of segment BC. In the tetrahedron ABPQ, AP is as a direct line of view to the glottis with MA and BP is as that with LtMA. Angle APQ is to save the extension of the atlanto-occipital joint. < Actual measurement > First, the blade was inserted with MA, the distance of AP was measured. Second, the blade was reinserted from the left corner of the mouth as LtMA and the length of BP was recorded.

After tracheal intubation, we measured the distance of BQ and AQ. In the tetrahedron ABPQ, segment PQ was calculated by Pythagorean theorem. And then the angle APQ is induced by the cosine theorem. Data are means +/- SD.

**Results:** In female patients, Age: 49 +/- 16 y.o. (24-79), Height: 157 +/- 9 cm, Weight: 53 +/- 10 kg. AP: 11.1 +/- 0.7 cm, BP: 9.5 +/- 0.6 cm, AP-BP=1.6 +/- 0.5 cm, Angle APQ=18.4 +/- 4.8 degrees. In male patients, Age: 52 +/- 15 y.o. (26-72), Height: 169 +/- 7 cm, Weight: 68 +/- 9 kg. AP: 12.6 +/- 0.7 cm, BP: 10.9 +/- 0.8 cm. AP-BP=1.7 +/- 0.5 cm. Angle APQ=18.5 +/- 3.8 degrees.

**Discussion:** LtMA technique gives higher probability of a glottic view than does MA one. Because the distance from the patient’s teeth to glottis with LtMA is 1.7 cm shorter than that with MA, and the laryngoscopist’s line of sight to the glottis falls to horizontal line with 18 degrees on average.

**Conclusion:** LtMA may relieve the strong extension of atlanto-occipital joint in patient with difficult laryngoscopy.

**References:**

1. Anesthesiology 2000; 92:70-4. (2) Anesthesiology 2005; 103: A1446.

### 19AP3-8

#### ‘Can’t intubate, can’t ventilate’: the use of sugammadex as a rescue technique - a case report

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**Background:** The scenario ‘Can’t intubate, can’t ventilate’ (CICV), with an estimated incidence of 0.01-2:10000 non-urgent cases<sup>(1)</sup>, requires immediate intervention. It is still the main cause of morbidity and mortality (1:176000 deaths/year) anaesthesia-related. The efficiency of Sugammadex 16mg/Kg in the immediate recovery of neuromuscular blockade after Rocuronium intubation doses has already been demonstrated<sup>(2)</sup>. As there are few reported cases, we present one where its use, as a rescue technique, solved a life-threatening situation without associated morbidity.

**Case report:** Forty-year old female patient, ASA III, obese, mental retardation since birth, presented for septoplasty and turbinectomy. Airway examination: Mallampatti view and mouth opening examination were not made as the patient did not cooperate, thyroid cartilage-mouth floor distance >6cm, cervical extension >90°.

Preoxygenation, induction with Remifentanyl perfusion and Propofol. Videolaryngoscopy with Glidescope® showed a Cormack and Lehane grade II. Easy facial mask ventilation, capnography trace obtained. Administration of Rocuronium. Repetition of videolaryngoscopy showed a grade IV. After repositioning the patient, we tried intubation using Machintosh and McCoy blades, stylet and gum elastic bougie - all turned to be unsuccessful. We retried bag and mask ventilation, but even with a two person-technique, it failed to improve the now impending CICV situation. When the patient begins to desaturate, 5 minutes after the relaxant administration, we used Sugammadex 16mg/Kg. After 57 seconds, bag and mask ventilation was already possible, TOF >90% after 1min15sec.

Gradual recuperation of the SpO<sub>2</sub>, tendencies electronically registered. As it was an elective procedure, we decided to wake the patient up and postpone it. We asked the family consent for presenting this case report.

**Discussion:** The difficult ventilation with bag and facial mask and laryngoscopy only after administration of the muscular relaxant may be explained by flaccidity of airway structures associated with some thoracic rigidity opioid-induced. This ending was only possible because of the use of Sugammadex, as it permitted gaining time, in association with the anesthetic-surgical team work.

**References:**

1. Anaesthesia, 2009, 64:601-608.
2. Anaesthesiology 2009; 110: 1020-5.

**Learning points:** Sugammadex showed to be useful as an emergency drug in a CICV scenario, as it permitted complete recovery of neuromuscular blockade in less than 1.30 minutes.

### 19AP3-9

#### Retrograde intubation revisited - naso-tracheal retrograde made easy with the epidural catheter

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**Introduction/Aim:** Despite advances in airway management retrograde intubation remains useful for securing the airway in head and neck cancer (HNC) pts (incl. naso-tracheal). We present 29 retrograde intubations (11/29 naso-tracheal) performed at one institution between 2004-2011 in HNC pts in whom the use of the intubating bronchofiberscope was difficult excess of saliva/ blood/mucus/necrotic masses obturating vision and unremovable with BFS suction).

**Material and Method:** 29 pts (17M, 12 W); mean age: 57 yrs (range: 39-73) qualified for HNC surgery with difficult airway (postop. anatomy, prior radiotherapy, trismus /intubation via missing molar gap/ or combination of these). With the pt in half-sitting position, after i.v. premedication with midazolam 1 mg, fentanyl 50 µg, local anaesthesia was induced by injecting 2 ml of xylocaine above the cricothyroid membrane, the larynx was located by air aspiration and another 2 ml of 2% xylocaine injected into it. The cricothyroid membrane was pierced by a Tuohy needle (anti-coring curve directed rostrally) and an epidural catheter (EC) was introduced via the larynx into the mouth. The pts were asked to assist the doctor by helping to retrieve the EC with their hand or, in trismus patients, with the tongue via a gap (e.g. missing molar). In case of naso-tracheal intubation another EC was introduced through the nose, retrieved through the mouth and the two were tied together.

The endotracheal tube was passed along the taut EC (via nose or mouth). As the end of the tube pushed the tautly held catheter the catheter was removed and the position of the tube assessed (Et CO<sub>2</sub>).

**Results:** Intubation was successful in 29 pts. One pt developed mild laryngospasm as the EC was passing between vocal chords, this resolved on i.v steroids, inhalational sevoflurane 3.0 vol% via face mask and catheter removal, after 4 min the procedure was successfully repeated.

**Conclusion:** In difficult airway patients in whom BFS is practically impossible (non-removable mass in the mouth) retrograde intubation is a solution and may be safely performed using an epidural catheter. Complications are few and easily resolved. The method does not call for any dedicated equipment nor technicalities [1] and may be performed in any conditions in a spontaneously breathing pt.

**References:**

1. Agro F, Brimacombe J, Doyle DJ. Retrograde nasotracheal intubation with a new tracheal tube: a feasibility study. *B J Anesth* 84(2):257-9 (2000)

## 19AP4-1

### Clinical significance of Retromental space for the discrimination of difficult laryngoscopy

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**Background and Goal of Study:** Retromental space is an area between line of vision and mentum. The aim of this study was to investigate whether there is difference in the retromental space between patients with difficult laryngoscopy and easy laryngoscopy.

**Materials and Methods:** Eleven male patients with difficult laryngoscopy (DL) during general anesthesia and age and body mass index-matched control (EL) (n=11) were included. Difficulty of laryngoscopy was estimated with Cormack-Lehane grade. Digital photographs of the lateral view of the head and neck were taken at various positions including the sniffing position, full neck extension in the sniffing position, laryngoscopy with a defined force (50 N). Three anatomical points (thyroid notch (T), maxillary incisor (I), and mandibular mentum (M)), were marked on the photograph. We compared the retromental space defined as TIM triangle between EL and DL group. Statistical differences between the groups were assessed by Mann-Whitney rank sum test. The predictability of TIM triangle and other parameters was assessed using the area under the receiver operating characteristic (ROC) curve.

**Results and Discussion:** The areas of TIM triangle were significantly greater in EL (18.6 cm<sup>2</sup>) than those in DL (14.4 cm<sup>2</sup>) at neck extension position (p < 0.05). In addition, during laryngoscopy with maximal force, the areas of TIM triangle were significantly greater in EL (26.7 cm<sup>2</sup>) than those in DL (18.7 cm<sup>2</sup>, p < 0.05). Receiver operating characteristic curve analysis showed that the areas of TIM triangle at neck extension had higher predictive value (AUC: 0.86) compared with Mallampati class (AUC: 0.72) or thyromental distance (AUC: 0.79).

**Conclusion(s):** Our results showed that patients with difficult laryngoscopy had significantly smaller retromental area at neck extension position and during laryngoscopy compared to EL group suggesting that small retromental space could characterize anatomical features of difficult laryngoscopy.

## 19AP4-2

### Comparison of hemodynamic responses to orotracheal intubation in hypertensive patients: laryngoscopy via Macintosh blade versus Glidescope video laryngoscope

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**Background:** Direct laryngoscopy usually leads to the hemodynamic stress response. In painful stimuli, hypertensive patients have more severe hemodynamic response in comparison to normotensive patients. Orotracheal intubation techniques could cause different hemodynamic responses. Current study compares hemodynamic responses to orotracheal intubation in hypertensive patients by direct laryngoscopy via Macintosh Blade versus indirect laryngoscopy via Glidescope videolaryngoscope.

**Methods:** In a randomized clinical trial, hemodynamic changes in 160 hypertensive patients were studied. Sixty three percent of patients were male with mean age 52.16 ± 12.83 years. Eighty patients underwent tracheal intubation via Glidescope and 80 patients were intubated with direct laryngoscopy with Macintosh blade. Non invasive systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were recorded before induction, after induction, during laryngoscopy, immediately after intubation and every minute for the first 5 minutes after successful intubation. Changes more than 30% from baseline were recorded.

**Results:** After induction, SBP and DBP in both groups were reduced in comparison with pre induction values; the difference was not significant between

groups. SBP, mean blood pressure (MBP) and HR during laryngoscopy as well as immediately and one minute after intubation was significantly lower in Glidescope group than Macintosh group. However, there was no difference in DBP between groups. In second minute after intubation, only MBP and HR and in third and fourth minutes after intubation, MBP were significantly lower in Glidescope group. Unlike previous studies, at fifth minutes after intubation SBP and DBP was lower in Macintosh group.

**Conclusion:** Indirect laryngoscopy with Glidescope videolaryngoscope in comparison with direct laryngoscopy with Macintosh blade has less hemodynamic responses in hypertensive patients and is a better choice in these patients.

## 19AP4-3

### Use of Glidescope® as a first-choice technique in Klippel-Feil syndrome airway management

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**Background:** Klippel-Feil syndrome (KFS) is characterized by the presence of a congenital synostosis of some or all of the cervical vertebrae [1] and a severe restriction of cervical motion that predicts difficult airway. Even minor distraction of the neck can be responsible for neurologic or cervical spine injury, so regional techniques, awake fiberoptic intubation or awake tracheostomy are recommended anesthetic approaches [1-2].

**Case report:** We report a case of periprosthetic femur fracture in a 23-year-old woman with KFS, ASA III, right congenital deafness, history of encephalocoele complicated with meningitis after birth and dilated cardiomyopathy, due to high dose of doxorubicin for an osteosarcoma. Weighed 65 kg and 1.50m in tall. Cervical mobility limited to 15 degrees of head turn to the left, 15 to right, and 10 of extension. Normal dentition, interincisive distance < 3 cm, sternomental distance < 12 cm, Mallampati impossible to evaluate due to limited mouth opening. After institution of standard ASA monitoring, BIS and TOF, awake intubation was performed with remifentanyl infusion (0.01-0.1ug/kg/min) and spontaneous ventilation maintained with FiO<sub>2</sub> = 100% face mask. We use 10% lidocaine spray and then Glidescope® lamina 2 was inserted and glottis perfectly visualised and a 6 mm tube inserted once confirmed position. Anaesthesia was induced with propofol 50 mg, rocuronium 20 mg. Maintenance with oxygen and sevoflurane (1 MAC). Femoral and cutaneous femoral nerve block using neurostimulator, 15 ml and 5 ml of Ropivacaine 0.5%, respectively.

**Discussion:** The unavailability of a fiberscope and unique circumstances posed a challenge to conventional rubric of difficult airway algorithm and forced an alternative management using videolaryngoscopy (Glidescope®) as first-choice technique, followed by periferic nerve block.

**References:**

1. Khawaja OM et al. *Crisis Resource Management of the Airway in a Patient with Klippel-Feil Syndrome, Congenital Deafness, and Aortic Dissection.* *Anesth Analg*, 2009. **108**: p. 1220-5.
2. Farid IS et al. *Multiple anesthetic challenges in a patient with Klippel-Feil Syndrome undergoing cardiac surgery.* *J Cardiothorac Vasc Anesth*, 2003. **17**: p. 502-5.

**Learning points:** We hope this case report gives practitioners clinical experiences on which to base their choice of airway management in patient with inherent challenges and in case of fibreoptic unavailability.

## 19AP4-4

### Tidal volume variation in an infant/adult test lung model during different supraglottic superimposed high frequency jet ventilation (SHFJV) settings

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**Background and Goal of Study:** Supraglottic SHFJV is a common minimal invasive ventilation technique, which ensures oxygenation and ventilation in specific endolaryngotracheal surgery. Undesirable vibrations of the operating field during supraglottic SHFJV may occur using the recommended pulsation rate namely 600<sup>1</sup> in the high frequency range of supraglottic SHFJV. The vibrations can downgrade the operating conditions and may compromise the outcome of the patient. Hence we doubled the high frequency range of the jet ventilation setting from 600<sup>1</sup> to 1200<sup>1</sup> to reduce undesirable vibrations. In previous studies we already showed that this movement doesn't cause high pulmonary pressures. The goal of this study was to assess, if doubling of the pulsation rate lead to inadvertent increase of the tidal volume in multiple supraglottic SHFJV settings in an experimental lung-trachea model.

**Materials and Methods:** An artificial Infant/Adult Test Lung (Compliance: 0.1 L/cm H<sub>2</sub>O, 0.01 L/cm H<sub>2</sub>O, 0.003L/cm H<sub>2</sub>O), Metron 5601i, Michigan Instruments

Inc, US) connected with an Infant/Adult Trachea model (ID 4mm, ID 13mm) was ventilated via an adequate Kleinsasser Laryngoscope (CTNS-380-K01, CTNS-330-K01, C. Reiner, Vienna, A) with a TwinStream Jet Ventilator (C. Reiner, Vienna, A). The emission pressure in the low frequency range reached from 0.3-1.2 bar and from 0.2-1.0 bar in the high frequency range depending on the three different model settings. The I:E ratios were 1:1 accordingly 1:2 and breathing rates were 12<sup>-1</sup> respectively 20<sup>-1</sup> in the low frequency range and 600<sup>-1</sup> followed by 1200<sup>-1</sup> in the high frequency range. Wilcoxon signed rank test was applied and measurement data were presented as mean ± SD.

**Results and Discussion:** With augmentation of the emission pressure the tidal volumes generally increased. However, the tidal volume variations in our three setups showed no individual tidal volume shifts in any test series with potential clinical impact.

**Conclusion(s):** Superimposed HFJV is a minimal invasive ventilation technique which offers the surgeon an unimpaired operating field and can be a precondition for endolaryngotracheal surgery.

The boost of the pulsation rate from 600<sup>-1</sup> to 1200<sup>-1</sup> which optimises the operating conditions by minimising undesirable vibrations does not lead to unsafe increase of the tidal volumes.

**Acknowledgements:** Thanks to Mr. Lirsch (C. Reiner, Vienna, A) for his support with the laboratory work.

## 19AP4-5

### Difficult airway management due to symptomless epiglottic cyst: an old tale within new scene

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**Background:** Symptomless epiglottic cysts unexpectedly found on induction of general anesthesia may cause considerable difficulties with airway management.

We report the case of life-threatening airway scenario due to asymptomatic epiglottic cyst, solved with the simple manual maneuvers and aid of gum elastic bougie (GEB).

**Case report:** A 57-year-old female, was scheduled for right mastectomy. Four years previously she had received general anesthesia for cholecystectomy. Her preoperative airway evaluation was unremarkable and there were no symptoms of airway obstruction. Based on those findings it was not considered that intubation would be difficult. Anesthesia was induced with fentanyl and propofol.

Following the easily established face mask ventilation, cisatracurium 10 mg was administered. One minute later, ventilation became tremendously difficult. Despite insertion of an oropharyngeal airway, mask ventilation continued to be difficult and oxygen saturation considerably decreased (SpO<sub>2</sub> < 90%). Direct laryngoscopy with a Macintosh 3 blade exposed a huge cyst arising from the right side of the epiglottis, completely covering the view of the glottis. Considering that hyperextension of the neck simultaneously with BURP maneuver failed to expose the glottis we decided to perform forceful left to the right lateral neck pressure.

With limited view of the laryngeal inlet and by pushing the cyst with GEB aside, intubation was performed with 8.0 cuffed orotracheal tube railroaded over GEB. Anesthesia proceeded uneventfully. Just before extubation the cuff on the ETT was deflated to confirm audible gas leakage.

With a fully awoken and cooperative patient, trachea was extubated. Her postoperative course was unremarkable. Postoperative MSCT revealed 2.8 x 1.5 right epiglottic cyst.

**Discussion:** Aroused life-threatening situation was fortunately overcome with application of simple manual maneuvers as the first line rescue. The successful implementation of manual maneuvers have been already reported in difficult airway management caused by asymptomatic laryngeal cyst<sup>(1)</sup>. Strategies involving aid of GEB also have been reported as successful<sup>(2)</sup>.

#### References:

1. Kariya N et al. J Clin Anesth 2003; 15: 534-6
2. McKiernan EP et al. Anaesthesia 1988; 43: 808-9

**Learning points:** This report helps to highlight the usefulness of simple manual maneuvers and gum elastic bougie as a rescue strategy in management of unanticipated difficult airway due to unexpected epiglottic cyst.

## 19AP4-6

### Temporomandibular joint dysfunction: a classic but still not well known cause for unanticipated difficult airway

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**Background and Goal of Study:** Preoperative assessment of the temporomandibular joint in patients is directed by the American Practice Guidelines for Management of the Difficult Airway [1]. Nevertheless a normal preoperative assessment of the upper airway can turn into an unexpected difficult airway when temporomandibular dysfunction (TMD) causes a limited passive mouth opening after induction of general anesthesia. TMD has a prevalence of around 30% in the normal population; a small percentage of these patients may have a very limited passive mouth opening when anaesthetized [2]. Due to recent cases of TMD resulting in an unanticipated difficult intubation we determined the ready knowledge of TMD amongst our colleagues. We performed a survey to find out if they can correctly recognize and diagnose the condition at the pre-operative visit.

**Material and Methods:** All staff and residents of the anaesthesiology department of our academic hospital were contacted by telephone. They were informed about the purpose of the study and oral permission and consent to participation were obtained, followed by a short questionnaire. Participants were asked to describe the symptoms of TMD [2]. If all symptoms were mentioned this knowledge was scored as "good", if only a few symptoms were mentioned it was scored "intermediate" and no symptoms as "poor". Confidentiality was requested.

**Results and Discussion:** 76.8% of our staff specialists (SS) and anesthesia trainees (AT) were interviewed: 25 SS (83.3%) and 29 AT (71.8%). The knowledge of only a small percentage (22.6%) of the responders was "good", 54.7% was "intermediate" and 22.6% "poor". Although more than 90% had the opinion that TMD might be important for airway management, only 17.1% is examining this at the pre-operative visit and only then, when TMD symptoms are mentioned by patients. There was no significant difference in the results between SS and AT.

**Conclusion:** Although there are many articles and reviews on TMD it is still a condition that is not well known by many anaesthesiologists. TMD is a cause for a potentially preventable unanticipated difficult airway. We hypothesize that this is a common phenomenon. Better understanding of the problem and subsequent better pre-operative upper airway assessment will probably prevent an unexpected difficult airway in these patients.

#### References:

1. Caplan RA et al. Anesthesiology 2003; 98: 1269-77
2. Köhler AA et al. Acta Odontologica Scandinavica; November 2011

## 19AP4-7

### Paratracheal cyst rupture: a differential diagnosis for tracheal rupture

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**Background:** Tracheobronchial rupture (TBR) is a rare but potentially life-threatening complication commonly caused by neck and chest trauma. Iatrogenic TBR can be caused by intubation, tracheostomy, bronchoscopy[1] but also linked to pre-existing primary diseases[2]. Paratracheal air cysts, infrequently described in literature, seem to be associated with obstructive lung disease and weaknesses in right posterior lateral wall of the trachea at thoracic inlet level[3].

**Case report:** A 55-year-old man, ASA II, underwent elective transoral laser microsurgery for Reincke's edema treatment. Chronic smoker with no diagnosis of pulmonary disease. No signs of difficult intubation. Intravenous anesthesia induction, laryngoscopy Cormarck-Lehane's 2, intubated with 5.0-mm Laser-Flex® tracheal tube. No ETCO<sub>2</sub> curve and decreased of SpO<sub>2</sub> justified replacement of tube, although visually there was no doubt of tracheal intubation. Second attempt tried and the same occurred.

Third attempt, performed with same tube and stylet successfully confirmed by capnography. Ten minutes after induction, peak inspiratory pressure increased to 39 cmH<sub>2</sub>O and ETCO<sub>2</sub> to 53mmHg, SpO<sub>2</sub> dropped to 89%. Auscultation revealed audible rhonchi, hydrocortisone and aminophyllin administered. Parameters returned normal.

Extubation performed without complications. On second postoperative day developed severe subcutaneous emphysema without respiratory insufficiency. TC showed posterolateral tracheal focal discontinuity defect with 1mm long, located 2.5cm above the carina which opened in inspiration and with high suspicion of paratracheal cyst rupture, confirmed by cardiothoracic surgeon.

**Discussion:** Iatrogenic post-intubation tracheal rupture have mechanical, anatomical and individual risks factors. A wide presentation can mimic rare conditions like paratracheal cyst rupture.

**References:**

1. Miñambres E et al. Tracheal rupture after endotracheal intubation: a literature systematic review. *European Journal of Cardio-thoracic Surgery*, 2009. 35: p. 1056-1062
2. Roh JL et al. Spontaneous Tracheal Rupture after Severe Coughing in a 7-Year-Old Boy. *Pediatrics*, 2006. 118: p.e224-27
3. Goo JM et al. Right paratracheal air cysts in the thoracic inlet: clinical and radiologic significance. *American Journal of Roentgenology*, 1999. 173: p. 65-70

**Learning points:** It's important to clinicians to be aware that paratracheal cyst rupture can be a differential diagnosis for iatrogenic TBR because both have the same clinical manifestation.

## 19AP4-8

### Effect of dexmedetomidine on hemodynamic response to laryngoscopy and tracheal intubation in hypertensive patients: a comparison with esmolol and sufentanyl

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**Background and Goal of Study:** Hypertension and tachycardia caused by tracheal intubation can be detrimental in hypertensive patients. We investigated the effect of dexmedetomidine on hemodynamic response to laryngoscopy and tracheal intubation in hypertensive patients in comparison with esmolol and sufentanyl.

**Material and Methods:** Sixty, ASA II physical status patients with a diagnosis of hypertension were enrolled in the study prospectively. Anticipated difficult airway, electrocardiographic evidence of heart block, congestive heart failure, a history of cerebrovascular disease and myocardial infarction were the exclusion criteria. Patients were randomly assigned to receive one of the three drugs before induction of anesthesia:

- 1) intravenous (iv) esmolol 100mg,
- 2) iv dexmedetomidin 1µg/kg
- 3) iv sufentanyl 0.25µg/kg.

Heart rate (HR) and blood pressures (SAP and DAP) were recorded; before and after the study drug, after induction, after tracheal intubation and 3, 5 and 10 min after intubation. Thiopental dose, onset time of vecuronium and intubation time were also assessed. Statistics were performed by using One-Way ANOVA, Kruskal Wallis test, Pearson Chi-square or Fisher's exact test where appropriate.

**Results:** Demographic and clinical data are presented in Table 1.

	Esmolol Group (n=20)	Dex Group (n=20)	Sufentanyl Group (n=20)	p
Age (y)	56,1±8,3	58,1±8,3	53,2±10,5	NS
Gender (F/M)	17/3	16/4	18/2	NS
Weight (kg)	75,7±9,9	81,1±13,3	78,5±12,4	NS
Height (cm)	160,6±7,3	162,1±11,0	162,3±8,2	NS
Total thiopental dose (mg)	425(325-500)α	325 (250-500)α,β	375 (275-500)β	0,003
Intubation time (s)	15 (7-28)	14,5 (6-25)	10,5 (6-30)	NS
Onset time of vecuronium (s)	245,2±63,0α,δ	193,9±46,6α	205,5±43,5δ	0,007

[Table 1. Patient characteristics (Data are expres)]

According to the mean percentage variation; an increase in HR was observed in the both Esmolol and Sufentanyl groups whereas a reduction was assessed in the Dexmedetomidine group and this reduction was significant compared to the Sufentanyl group (-13.4±17.6% versus 11.0±27.8%,  $p < 0.05$ ). Increase in SAP was significant in the Esmolol group when compared to the Dexmedetomidine [9.8±20.9% vs. -9.2±20.2%, ( $p < 0.05$ )]. Increase in DAP in the Sufentanyl group was significant compared to the Dexmedetomidine group [0.07±19.8 versus 24.5±39.1, ( $p < 0.05$ )].

**Conclusions:** We demonstrated for hypertensive patients that dexmedetomidine is an effective drug for attenuating the hemodynamic response to tracheal intubation while reducing the thiopental dose for induction of anesthesia.

## 19AP4-9

### Tracheal obstruction caused by extravasation of fluid during shoulder arthroscopy in the beach-chair position

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**Background:** Shoulder arthroscopy (SA) is common in orthopaedic surgery and regional anaesthesia is increasingly used<sup>1</sup>. Complications related to this surgery may occur, but respiratory compromise is rare. This report describes a case of tracheal obstruction caused by fluid extravasation in a patient undergoing subacromial arthroscopic rotator cuff repair under combined anaesthesia in beach-chair position.

**Case report:** A 62 yr-old female, 59-kg, ASA II, underwent subacromial arthroscopic rotator cuff repair under combined general anesthesia (GA) with orotracheal intubation (OTI) and US guided interscalene block with the patient in the beach-chair position. An arthroscopy infusion pump at 60mmHg was used to irrigate the joint space, including the subacromial space, with normal saline. Surgery lasted 2 hours and when drapes were removed, we noted a massive swelling across patient's neck and chest. Chest x-ray showed soft-tissue enlargement in the right chest. Patient was kept in head-up position, fluid restriction and diuretics were given. Extubation was delayed and she was admitted to the ICU. 12 hours after, the swelling resolved completely and the patient was extubated after performing a cuff-leak test. She was discharged home on postoperative day 5, and no sequelae were noted.

**Discussion:** This case reports a potential airway problem during SA surgery. To our knowledge, only one case has been reported of severe extravasation of fluid during this type of surgery in beach-chair position.<sup>1</sup> Airway compromise is uncommon, but once it happens, the outcome may be life-threatening. Risk factors for an extended irrigation fluid loss are high pump pressures, obesity, prolonged procedure and subacromial arthroscopy, because the subacromial space is not encapsulated.<sup>1,2,3</sup> A lateral decubitus position may also contribute, and is often used. Close attention should be paid to neck just before extubation if extensive swelling is noted, because airway occlusion after extubation is probable. Airway patency should be confirmed before extubation by having the patient inspire around the endotracheal tube with the cuff deflated and the tube occluded.<sup>2</sup>

**References:**

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2. *Anesth Analg*, 1993; 76: 875-83
3. *Anaesth and Intensive Care*, Vol 39, No 2, March 2011

**Learning points:** OTI is the most reliable method of securing the airway from airway obstruction during SA. Periodic evaluation of the neck and a careful examination before extubation should be performed.

## 19AP4-10

### Indirect laryngoscopy as a predictor of difficult visualization of the larynx

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**Background and Goal of Study:** The anatomic predictors used to predict the difficult airway management have a small accuracy to do it<sup>1,2</sup>. We investigate the power of indirect laryngoscopy(IL) with the rigid laryngoscope of 70 degrees as a predictor of difficult visualization of the larynx(DVL) with the direct laryngoscopy(DL) under general anesthesia in relation with classic predictors.

**Materials and Methods:** We performed an indirect laryngoscopy with the rigid laryngoscope preoperatively to 300 patients. The obtained vision was classified into four grades: 1 (vocal cords visible), 2 (posterior commissure visible), the grades 3 (epiglottis visible) and 4 (no glottic structure visible) were considered predictors of DVL. After, a DL with the Macintosh laryngoscope was practiced to the patients under general anesthesia. Positive value was defined as a Cormack and Lehane III and IV. Other common clinical predictors used in others reports<sup>1,2</sup> were also analysed. We performed a bivariate descriptive analysis to estimate the statistic signification between clinical and demographic predictors and IL, and the DVL under DL. A logistic regression model using the relevant variables of this analysis was elaborated. The data were expressed with mean, median and frequency. We used Student t test for continuous variables and Chi<sub>2</sub> or Fisher test for qualitative variables.  $p < 0,05$  was considered significant.

**Results and Discussion:** We included 324 patients. 23 patients were excluded due to nausea or cough (7%) and one because an epiglottis tumor indicated an awake fiberoptic intubation. 3 patients underwent for fiberoptic

intubation were modified. Table 1 shows the independent clinic predictors of difficult visualization of the larynx with DL.

	B (variable coefficient)	statistic signification	Exp (B):Odds Ratio	95% CI for OR	
				Minimum	Maximum
IL	5,145	0,000	171,555	45,695	644,073
Retrognathia	3,489	0,000	32,743	5,268	203,508
Buccal Aperture <3,5cm	2,548	0,007	12,784	2,036	80,285
TMD <6,5cm	1,911	0,005	6,759	1,792	25,496
Snoring	1,352	0,027	3,863	1,167	12,791
Neck diameter(CM) constante	0,151	0,033	1,163	1,012	1,336
	-10,907	0,000	0,000		

[Table 1]

**Conclusion:** Indirect laryngoscopy was the independent variable with the most predictive power of DVL and it can improve the prediction of DVL and help us to choose the orotracheal intubation technique.

**References:**

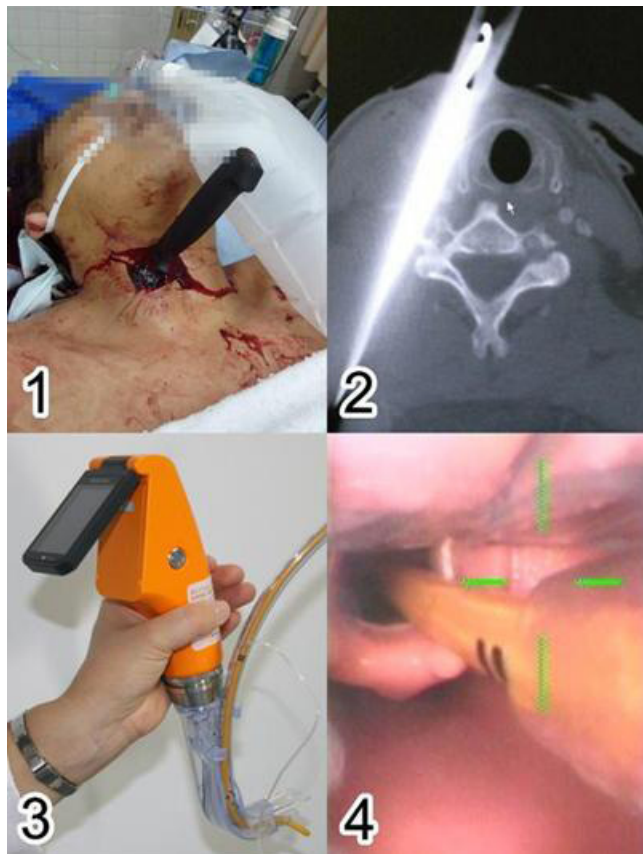
1. Canadian Journal of Anesthesia. 2005; 52:291-296.
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**19AP5-1**

**Combined usage of an Airway Scope and gum elastic bougie for emergency airway management in a patient with neck stab wound**

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**Case report:** A-30-year old male with schizophrenic disorder attempted to commit suicide with a kitchen knife (Fig. 1). Knife removal and tissue repair under general anesthesia was planned. The knife did not damage the vital organs. However, the hemorrhage surrounding the knife suggested anatomical changes in the neck (Fig. 2). Further movement of the knife could have caused vital organ damage, enlarged the neck hemorrhage and led to life threatening events.



[Figures]

Rapid sequence tracheal intubation was selected because of poor patient cooperation. An endotracheal tube (ETT) was mounted on the Airway Scope (AWS; Hoya-Pentax, Tokyo, Japan) blade and a gum elastic bougie (GEB) was inserted into the ETT (Fig. 3). The AWS was inserted into the mouth leftward considering the anatomical changes in the neck. The trachea was located on the left edge of the AWS monitor screen. Instead of moving the AWS, the curved tip of the GEB was rotated leftward and inserted into the glottis opening to minimize neck movement. The ETT was inserted into the trachea over the GEB (Fig. 4: Simulated figure on the mannequin). No hemorrhage growth and vital organ damage was observed during intubation.

**Discussion:** The AWS has an ETT guide function. The direction of advancing the ETT is fixed and the approximate location when the ETT is advanced is indicated by the target symbol on the monitor screen. Thus the ETT is easily inserted into the trachea when the target symbol is aligned with the glottis opening. Even when the target symbol is not aligned with the glottis opening, using GEB as an aid enables tracheal intubation without moving the AWS. This contributed to minimal neck movement in the current case.

**Learning points:** The combined use of AWS and GEB contributed to successful airway management in a patient with a neck stab wound. This method is a potent option for the management of such a critical case.

**19AP5-2**

**The use of “Internal Laryngeal Pressure” to improve laryngeal view in a patient with difficult airway**

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**Background:** External laryngeal pressure is used to improve laryngeal view during intubation. We report the use of “internal laryngeal pressure”.

**Case:** A sailor caught in a flash fire sustained 48% burns to his face, neck, torso and limbs. He presented to hospital 1 week later and underwent wound desloughing and skin grafting.

His initial Cormack and Lehane grade was 2a, which improved to 1 after external laryngeal pressure was applied. He was kept intubated after operations as airway edema was expected.

On postoperative day 1, he self extubated and attempts to reintubate him resulted in esophageal intubation. Cormack and Lehane grade was 3. Gastric content was suctioned via the tube. The esophageal tube was left in situ and the airway team was called.

Sophisticated difficult airway equipments were not immediately available. Decision was made by the airway team to attempt intubation, with a bougie, while maintaining spontaneous ventilation.

Direct laryngoscopy with Macintosh showed the same laryngeal view as before. As the bougie was being inserted into the pharynx, the operator’s right hand, which was directing the bougie, rested on the esophageal tube. This inadvertent downward displacement of the esophageal tube displaced the larynx downwards, improving the glottic view to grade 2b. The bougie was inserted into the trachea under direct vision. The endotracheal tube was railroaded into the trachea uneventfully.

Ventilation via the new endotracheal tube was commenced. Chest auscultation was difficult as the patient’s entire thorax was bandaged. Patient’s venous saturation remained at 100% after a period of observation. The new endotracheal tube was secured and the original endotracheal tube removed from the esophagus.

**Discussion:** This case describes a new maneuver to improve glottic view. Similar to external laryngeal pressure where the glottic opening is manually displaced downwards, this maneuver brings the glottic opening into view by inferior displacement of the glottis by “internal laryngeal pressure” via the endotracheal tube placed in the esophagus.

**Learning Point:** Improvement of laryngeal view allows us to see the passage of the endotracheal tube through the vocal cords. This confirmation of tube placement was invaluable as end tidal carbon dioxide monitoring was not available. Chest auscultation was impossible. This maneuver should be kept in mind when dealing with difficult airways in austere locations.

### 19AP5-3

#### Comparison of Gum-Elastic Bougie and introducer tool as aids, in positioning of PLMA, in patients with simulated restricted neck mobility

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**Background and Goal of Study:** The ProSeal laryngeal mask airway (PLMA) is a unique laryngeal mask device with a modified cuff to improve seal and a channel to facilitate gastric tube placement and drainage of regurgitated fluid. This is a better device in difficult airway situations compared to classic LMA. This prompted us to study the ease of insertion and positioning PLMA in patients with simulated restricted neck mobility while using gum elastic bougie (group GEB) or introducer tool (group IT) to aid insertion.

**Materials and Methods:** Sixty ASA 1 or 2 patients, aged between 18 to 60 years, undergoing minor non-head and neck surgery in supine position were studied. A rigid neck collar was used to simulate restricted neck mobility in all the patients. After anaesthetising the patients with a standard protocol, the PLMA was inserted using either of the technique using tongue depressor to open the mouth. The ease of insertion, positioning, haemodynamic responses to insertion and other complications related to the procedure were noted.

**Results and Discussion:** The time taken for insertion of PLMA in group GEB was  $67.80 \pm 17.55$  sec compared to group IT  $46.79 \pm 13.46$  sec ( $p < 0.05$ ). Patients of group GEB had better positioning assessed by FOB grading. Systolic and diastolic blood pressures and end-tidal carbon dioxide (ETCO<sub>2</sub>) showed significantly higher values in IT group. The incidence of sore throat, dysphagia and dysphonia were higher in IT group in the twelve hours

**Conclusion(s):** Guided insertion technique with GEB took a longer time but had a better positioning and lower ETCO<sub>2</sub> values when compared to introducer tool technique. The patients of Group GEB had better haemodynamics as we have used the tongue depressor instead of laryngoscope as in previous studies.

### 19AP5-4

#### Flexible fiberoptic versus Parker Flex-It and hockey stick formed stylet as an intubation guide with the videolaryngoscope McGRATH Series 5

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**Background and Goal of Study:** Fiberoptic intubation is still the gold standard in the management of the difficult airway. A good alternative for difficult intubation is the videolaryngoscope with indirect laryngoscopy. Visualisation of the glottis is often easy with these devices but entering the trachea with the endotracheal tube may be a problem because intubation must be performed in a curved way. Therefore special stylets were designed and different methods were described. Aim of the study was to compare a fiberoptic bronchoscope as a flexible guide wire versus Parker Flex-It and a hockey stick formed stylet in patients with the McGRATH Series 5-videolaryngoscope to time and success of insertion.

**Materials and Methods:** After ethic vote approval 120 patients without expected difficult airway were randomly assigned for videolaryngoscopy with the fiberoptic (FO), the Parker Flex-It (PF) or a hockey stick formed stylet (HS) as introduction aid. One in videolaryngoscopy experienced anaesthetist performed all intubations. Every step of the intubation was noted by time and success. Data are mean  $\pm$  standard deviation.

**Results:** Success rate was 100% in all groups. Time from introducing the camera stick of the McGRATH in the mouth to the first ventilation was 10.1s significantly slower in the FO-group vs. PF-group but 11.1s significantly faster than in the HS-group (FO:  $48s \pm 13s$  vs. PF:  $37.9s \pm 6.4s$  vs. HS:  $59.1s \pm 33.3s$ ). No complications like injuries of mouth or lips were noted in all groups. Also no postoperative complications like hoarseness or sore throat were noted 1 h after the operation or on the first postoperative day. The subjective sensation of the experienced anaesthetist using the FO as intubation aid was more comfortable, flexible and much more atraumatic than using PF or HO.

**Conclusion:** Combination of McGRATH Series 5 with a flexible fiberoptic as a guide for intubation may be an alternative for the Parker Flex-It or a hockey stick formed stylet.

### 19AP5-5

#### Suctioning endotracheal tubes induces more silent aspiration if no high flow CPAP is used. An in vitro comparison of suctioning catheters/ETT with or without a Boussignac CPAP

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**Background and Goal of Study:** Silent aspiration during anesthesia happens when oral fluids run along the cuff into the trachea. Gel and certainly special cuff design can prevent this leak. However during suctioning the ETT, the pressure in the trachea might drop below zero and cause the cuff to leak fluids into the trachea.

**Materials and Methods:** An invitro setup is used. Taperguard endotracheal tubes with a size 6, 6.5, 7, 7.5, 8 and 8.5 are inserted in a plexiglass cylinder with internal diameter of 19 mm connected to an airbag of 2 liter. The cuff pressure is kept constant at 25 cmH<sub>2</sub>O. Water added with methylene blue is injected above the cuff. Suction catheters with size 8, 10, 12, 14 and 16 ch are connected with a suction line to a negative pressure source set at - 500 mbar. Suctioning is performed in an open ETT or through a Boussignac CPAP system connected to the ETT while giving 10 cm H<sub>2</sub>O CPAP

If water leaks along the cuff within 30 seconds the test is positive.

**Results and Discussion:** The flow measured through the suction system was 4, 13, 21, 25 and 27 L/min for the 8, 10, 12, 14 and 16 Ch suction catheters.

Table 1 gives the negative pressures in the open tube during aspiration in cmH<sub>2</sub>O

ETT / suction cath	6 mm	6,5 mm	7 mm	7,5 mm	8 mm	8,5 mm
8 Fr	-1	-0,5	0	0	0	0
10 Fr	-4	-3	-2	-1	-0,5	-0,5
12 Fr	-24 *	-11 *	-6 *	-4	-3	-2
14 Fr	-94 *	-32 *	-17 *	-11 *	-6 *	-4
16 Fr	-300 *	-90 *	-38 *	-23 *	-11 *	-8 *

[Fig 1 open ETT]

and table 2 gives the negative pressures in the CPAP setup. With an asterisk is indicated when a leak occurred.

ETT / suction cath	6 mm	6,5 mm	7 mm	7,5 mm	8 mm	8,5 mm
8 Fr	8	9	10	10	10	10
10 Fr	4	6	7	8	9	9
12 Fr	-16 *	-2	2	4	6	7
14 Fr	-86 *	-26 *	-10 *	-2	2	4
16 Fr	-300 *	-90 *	-30 *	-14 *	-3	1

[Fig 2 with CPAP]

Negative pressures below -5 cmH<sub>2</sub>O induces silent aspiration. Such low negative pressures might also induce lung atelectasis, something not analyzed in this set up.

**Conclusion(s):** A 16 Ch suction catheter could never be used in an open ETT up to a size of 8.5. Cpap with a continuous high flow allows to use a thicker suction catheters without silent aspiration safe ETT.

### 19AP5-6

#### Adequate minute volume ventilation through a 100 cm long, 3 mm inner diameter airway exchange catheter by expiratory ventilation assistance (EVA)

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**Background and Goal of Study:** In the management of a difficult airway the use of an airway exchange catheter (AEC) is often suggested for facilitating intubation or oxygenation in critical situations (1). Data on how to achieve safe and efficient oxygenation and ventilation through an AEC are still sparse. Recently, a jet-flow driven ventilation device, Ventrain (Dolphys Medical, Eindhoven, The Netherlands), applying expiratory ventilation assistance (EVA) by suction became available. A prototype of this ventilation ejector has been able to achieve a minute volume of approximately 7 liters through a 7.5 cm long, 2 mm inner diameter (ID) transtracheal cannula (2). The goal of this study was to evaluate the efficacy of Ventrain in combination with a long small-lumen AEC.

**Material and Methods:** A Ventrain was connected to an air flowmeter (Digi-flow; Dräger, Lübeck, Germany) set at a flow of 15 l/min and an 100 cm long, 3 mm ID AEC (Cook Medical, Bloomington, IN, USA). On a ASL 5000 lung simulator (Ingmar Medical, Pittsburgh, PA, USA) inspiratory and expiratory

times were measured during EVA and passive expiration (Ventrain disconnected) with tidal volumes of 600 ml at variable compliances (100, 50, 30, 10 ml/mbar) and resistances (5, 8, 32 mbar/l/s). Based on the means of five consecutive breaths the minute volume (MV) and inspiratory/expiratory ratio (I/E ratio) were calculated for each pulmonary setting.

#### Results:

Compliance (ml/mbar)	100	50	30	30	30	10
Resistance (mbar/L/s)	5	5	5	8	32	32
Inspiratory Time (s) -EVA	2.39	2.40	2.39	2.39	2.40	2.41
Expiratory Time (s) - EVA	2.50	2.47	2.41	2.42	2.48	2.29
Inspiratory Time (s) - Passive Expiration	2.42	2.47	2.48	2.44	2.47	2.48
Expiratory Time (s) - Passive Expiration	18.80	10.96	7.77	7.32	8.45	4.27
MV (L/min) - EVA	7.36	7.39	7.49	7.48	7.38	7.66
I/E ratio - EVA	1/1.04	1/1.03	1/1.01	1/1.01	1/1.03	1/0.95
MV (L/min) - Passive Expiration	1.70	2.69	3.52	3.69	3.30	5.33
I/E ratio - Passive Expiration	1/7.79	1/4.45	1/3.14	1/2.99	1/3.42	1/1.72

[Table 1]

**Conclusion:** Our *in vitro* data show that Ventrain is capable of achieving adequate minute volume ventilation through a 100 cm long, 3 mm ID AEC by applying EVA in a simulated completely obstructed airway. The I:E ratio of 1:1 facilitates clinical application of the Ventrain with this AEC.

#### Literature:

1. Anesthesiology 98 (2003): 1269-77
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## 19AP5-7

### Efficacy of adhesive facemask on the air leak during mask ventilation

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**Background and Goal of Study:** Bag-mask ventilation is an important and basic skill for anesthesia and resuscitation. Prevention of gas leakage from the gap between face and mask is essential for effective ventilation, though is not always sufficient. Especially, for those with small hands, it is difficult to provide tight contact on entire surface of facemask to eliminate air leakage. We devised an adhesive facemask to improve tight contact. We aimed to ascertain whether the new facemask is more effective to reduce air leakage during bag-mask ventilation.

**Materials and Methods:** This is a randomized crossover study. A facemask (Premium Plus™, Smiths Medical) was modified by attaching an adhesive gel (Vitrode J™, NIHON KOHDEN) on entire circumference cuff, was evaluated with normal facemask. A manikin (Laerdal™ Airway Management Trainer) was used to evaluate static and dynamic air leakage.

First, anesthesiologists (n=12) were asked to fit manikin with the facemask connected to valve-closed anesthesia circuit with 6L/min of fresh gas flow from anesthesia machine (Fabius™, Dräger) until the emergence of air leakage (=air leak pressure).

Next, the participants were asked to hold the facemask during ventilation (500ml by 10 times) given mechanically by anesthesia machine or manually by each participant. Tidal volume in inspiratory (VTi) and expiratory (VTe) and its ratio (VTe/VTi) were measured as an average of 10 times using anesthesia monitor (Datex-Ohmeda S/5™, GE). Data are means ± SD. Gas-leaking pressure and ventilation volume were analyzed using paired *t*-test. A *p* value less than 0.05 was considered significant.

**Results and Discussion:** Air leak pressure was higher in adhesive than in conventional mask (15.4 ± 10 vs 32.3 ± 14.0 cm H<sub>2</sub>O, *p* < 0.05). With mechanical ventilation, adhesive facemask held up higher amount in VTi (390.8 ± 69.4 ml vs 426.2 ± 47.8 ml, *p* < 0.05), in VTe (207.6 ± 59.0 ml vs 383.2 ± 81.1 ml, *p* < 0.05), and showed larger ratio (37.1 ± 11.6% vs 76.0 ± 16.3%, *p* < 0.05).

With manual ventilation, no significant difference was seen in VTe (262.7 ± 108.3 ml vs 380.3 ± 76.4 ml), while adhesive facemask showed lower amount in VTi (510.2 ± 137.8 ml vs 450.2 ± 120.4 ml, *p* < 0.05) and larger ratio (40.2 ± 23.1% vs 78.9 ± 16.0%, *p* < 0.05).

**Conclusion(s):** Adhesive facemask was effective to improve mask-face sealing by reducing the gas leakage during bag-mask ventilation.

## 19AP5-8

### Prospective evaluation of the LMA-Supreme™ as an airway intubation conduit in patients with a predicted difficult airway

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**Background and Goal of Study:** Two guidelines for management of the difficult airway<sup>1,2</sup> recommend the use of a laryngeal mask to secure ventilation and oxygenation after failed optimized laryngoscopy attempts.

In contrast to other devices, the LMA-Supreme™ (LMA-S, The Laryngeal Mask Company, UK) does not allow the passage of a tracheal tube (TT). Different approaches to place a TT with an LMA-S in situ were tried, often leading to the airway exchange catheter to be advanced dorsally into the oesophagus.<sup>3</sup> We aimed to test whether the LMA-S is a successful fiberoptic-guided intubation conduit in patients with predicted difficult airways.

**Materials and Methods:** After IRB approval and written informed consent 23 patients (Table 1), with one or a combination of preoperative difficult airway metrics, underwent a variety of elective surgery under general anesthesia in which first the LMA-S device was used, followed by fiberoptic endoscopy loaded with a nasogastric tube, which was inserted into the trachea, and exchanged for a TT.

**Results and Discussion:** The fibroscope first entered the left (N=15) or right (N=8) channel of the LMA-S, depending which direction the scope took during insertion, resulting in full visualization of the vocal cords in 14 patients, whereas in 9 patients the other channel had to be used to get full access to the glottis inlet. Tracheal insertion of the fibroscope loaded with a nasogastric tube and correct placement of the TT was obtained in all patients. The mean effective airway time was 63 ± 17 s (range 44-116 s). None of the patients needed to be intubated using direct or indirect laryngoscopy as the fiberoptic-guided intubation via the LMA-S was successful in all patients. No untoward effects were detected.

Male:female ratio, n	9:14	Denture: double:single:none, n	17:1:5
Age; yrs	47.9 ± 14.4	Adequate neck movement; yes/no, n	16:7
Height; cm	170 ± 8 (155-185)	Cormack Lehane grade III:IV, n	15:8
Weight; kg	108 ± 26 (61-155)	LMA-Supreme™ size; 4:5, n	4:19
ASA class I:II:III, n	3:16:4	Choice of ventilation channel; left/right, n	15:8
Mallampati score III:IV, n	3:16:4	Attempts to intubate; 1:2, n	14:9
Thyromental distance; mm	56 ± 4 (47-61)	Effective airway time, s	63 ± 17 (44-116)
Interincisor distance; mm	31 ± 2 (27-34)	Correct placement of TT, n	23

[Patients and Anaesthesia characteristics]

**Conclusion(s):** This study shows that the LMA-S can be used successfully as an airway intubation conduit for fiberoptic-guided tracheal intubation in patients with predicted difficult airways.

#### References:

1. Anesthesiology 2003;98:1269-1277.
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3. J. Clin. Anesth. 2008;20:322-323.

## 19AP5-9

### Airway exchange devices: evaluation of airway trauma potential using porcine lungs

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**Background and Goal of Study:** Airway exchange devices (AED) are designed as a means of achieving safe tracheal tube exchange and in the extubation of potentially difficult airways [1].

A number of cases reports described life threatening airway trauma associated with use of the AED [2]. This study aims to determine the force required to induce airway trauma and the speed of barotrauma when an AED is used to insufflate oxygen

**Materials and Methods:** *Perforation potential:* porcine lungs were attached to a sliding table that was aligned with the disc of a force transducer. The force required to cause perforation was recorded three times for each device. *Barotrauma potential:* time to visible barotraumata (air under visceral pleura) was measured by insufflating oxygen at 2 l/min and 4 l/min through the airway exchange device that is lodged into the porcine lung airway. Each device was

tested three times at each flow rate. Ten samples of the Sheridan (Teleflex Medical, UK) and Cook (Cook UK) AEDs were studied.

**Results and Discussion:** Our findings are presented in the table.

	Sheridan	Cook	Difference [95%CI]	p value
Perforation force (N)	11.3 (1.6)	20.1 (2.6)	8.8 [6.7 - 10.9]	< 0.001
Time to perforation (s)				
O2 flow 2 l/min	12 (1.3)	20 (4.7)	8 [5 - 11]	< 0.001
O2 flow 4 l/min	5 (1.1)	10 (1.5)	5 [4 - 7]	< 0.001

[Table of results. Values are mean (SD)]

This study found that the Cook AED needed significantly more force to cause airway perforation than the Sheridan AED. This would suggest that Cook AED may be less likely to be associated with airway trauma. When these devices are used to insufflate O<sub>2</sub>, barotrauma was caused within a few seconds when the AED is lodged into the airway. The speed of barotrauma was significantly faster with the Sheridan than with the Cook AED at both flow rates. Although AEDs are not to be advanced more than 26 cm into the airway, a number of airway trauma reports were due to the AED being advanced too far during airway exchange.

**Conclusion(s):** Two studied AEDs have significant potential to cause airway trauma and should be used with caution. Our findings suggest that these devices should not be used to insufflate oxygen due to the rapid onset of barotrauma if they are advanced to far.

#### References:

1. Mort TC. *Anesth&Analg* 2007; **105**:1357-62.
2. Benumof JI. *Anesthesiology* 1999; **91**:342-3.

**Acknowledgements:** Devices tested in this study were donated free of charge from the Cook UK and Teleflex Medical.

## 19AP5-10

### Flexible fiberoptic versus Parker Flex-It, Truflex and hockey stick formed stylet as an intubation guide with the videolaryngoscope McGRATH Series 5 in a simulated airway

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**Background:** The unexpected difficult airway is always a challenge for experts as well as for trainees. Fiberoptic intubation is still the gold standard in the management of the difficult airway. A good alternative for difficult intubation is the videolaryngoscope with indirect laryngoscopy. Visualisation of the glottis is often easy with these devices but entering the trachea with the endotracheal tube may be a problem because intubation must be performed in a curved way.

Therefore special stylets were designed and different methods were described. Aim of the study was to compare a fiberoptic bronchoscope as a flexible guide wire versus Parker Flex-It, the Truflex™ and a hockey stick formed stylet in a simulated airway with the McGRATH Series 5 videolaryngoscope to time and success of insertion.

**Materials and Methods:** After ethic vote approval 20 anesthesiologists in the first or second year of practise without any experience in videolaryngoscopy maintained a 5 minute lasting instruction and performed a standardized intubation with an airway simulator SimManMark II of Laerdal with the videolaryngoscope McGrath with the fiberoptic (FO), the Parker Flex-It (PF), the Truflex™ (TF) or a hockey stick formed stylet (HS) as introduction aid. In a randomized sequence 8 different kinds of airway were managed. All steps of the intubation were documented and compared. Data are mean ± SD.

**Results and Discussion:** Intubation with the TF was significant faster in the simple airway (Sniffing Position) as intubation with PF, HS or FO (TF: 26.4s ± 5.5s vs PF: 35.3s ± 9.8s HS: 41.2s ± 18.3s vs FO: 45.8s ± 10.2s, p < 0.05). In the difficult airway (swollen tongue) the intubation with the Truflex™ was significant faster compared with FO, HS, PF (TF: 30.6s ± 9.2s vs FO: 41.7s ± 9.6s vs HS 42.7s ± 18.4s vs PF: 45.4s ± 21.3s). Success rate of intubation was in Sniffing Position: TF 100%, PF 100%, FO 95%, HS 90% and for the difficult airway: TF 100%, FO 100%, PF 80%, HS 60%.

**Conclusion(s):** For the untrained anaesthesiologist the combination of McGRATH Series 5 videolaryngoscope and Truflex™ is a fast and efficient alternative to secure the airway. The subjective sensation of the unexperienced anaesthetist using the FO as intubation aid was more comfortable, flexible and much more atraumatic than using TF, PF or HS.

## 19AP6-1

### Extubation after anaesthesia: a randomised comparison of three extubation strategies

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**Background and Goal of Study:** The Fourth National Audit Project identified a disproportionate incidence of adverse events occurring during emergence from anaesthesia<sup>1</sup>. To our knowledge no study has evaluated the effect of ventilatory modality used during the extubation process on the incidence of adverse airway events. We therefore proposed to compare three strategies for awake extubation: spontaneous respiration (Spont), intermittent positive pressure ventilation (IPPV) and pressure support ventilation (PSV). We hypothesised that extubation using PSV would result in a reduced incidence and severity of adverse airway events.

**Materials and Methods:** Following Local Research Ethics Committee approval, 42 ASA 1-3 patients undergoing elective non-oral surgery were randomised to one of the three extubation strategies following cessation of anaesthesia. We recorded time to extubation, incidence and severity of cough (scale adapted from Minogue et al<sup>2</sup>), incidence of adverse airway events (breath-holding, tube-biting, laryngospasm, apnoea, aspiration, hypoxaemia) and cardiovascular parameters. Statistical analysis with SPSS v18 used ANOVA, Kruskal-Wallis and Chi-squared tests.

**Results and Discussion:** Our findings are presented in the table. Data are expressed as mean (SD) or number (proportion). Three patients were excluded due to unanticipated grade 3 laryngeal view. In two cases cough grade was not recorded.

	Spont (n = 13)	IPPV (n=13)	PSV (n=13)	p value
Time to extubation (min)	17.0 (7.3)	14.2 (7.2)	14.9 (4.9)	0.54
Cough incidence	13 (100%)	11 (85%)	11 (85%)	0.34
Cough grade (None / Mild / Moderate / Severe)	0 / 1 / 6 / 5	2 / 1 / 5 / 5	2 / 4 / 5 / 1	0.049
Adverse airway events	6 (46%)	3 (23%)	2 (15%)	0.20
Mean arterial pressure at extubation (mmHg)	103 (19)	86 (16)	106 (11)	0.007

[Table of results]

Our study demonstrates that severity of peri-extubation cough is significantly affected by mode of ventilation used at extubation. By supporting patient-triggered breaths PSV may reduce airway irritation through more favourable flow and pressure dynamics than spontaneous respiration or IPPV. In this study mean arterial pressure at extubation was lowest in the IPPV group. This probably reflects higher mean intrathoracic pressures generated during this mode of ventilation.

**Conclusions:** Use of pressure support ventilation for awake extubation may offer an advantage over spontaneous and IPPV extubation strategies. Validation through larger studies is recommended.

#### References:

1. Cook TM et al. *BJA* 2011; **106**: 617-31
2. Minogue SC et al. *Anesth Analg* 2004; **99**(4):1253-7

## 19AP6-2

### Contents of difficult airway trolleys in emergency departments throughout West Yorkshire, UK

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**Background and Goal of Study:** Rapid sequence induction in the emergency department (ED) carries significant risk of major airway events [1]. The Royal College of Anaesthetists recommends that the same equipment is available as in theatre. ED space is limited and huge departmental variations have previously been shown [2]. By comparing the contents of difficult airway trolleys (DATs), we aim to identify/address regional differences.

**Materials and Methods:** During unannounced visits, data was collected regarding DAT contents in EDs, using a standardised proforma based on the Difficult Airway Society (DAS) guidelines [3].

**Results and Discussion:** Of nine EDs (with resuscitation bays) surveyed:

- eight had a dedicated DAT; seven an equipment checklist.
- one lacked a DAT due to disagreement regarding responsibility for upkeep.
- one had DAS algorithms visible.



- all had capnography, a bougie, appropriate ranges of facemasks, oro-/nasopharyngeal airways readily available.
- one lacked the minimum of two working laryngoscope handles; one no Magill's forceps.
- all had alternative blades; five a McCoy, the remaining either long/straight.
- three had an intubating LMA; three a Proseal LMA..
- none had a flexible fiberoptic bronchoscope.
- two stocked a Glidescope.
- eight stocked a kink resistant cannula for cricothyroid puncture with high pressure jet ventilation.
- six had a surgical airway kit.
- other equipment stocked included: the Airtraq; Aintree catheter and lGels.

As highlighted in NAP4; major airway events in the ED were due to inadequacies in planning and provision of airway equipment [1]. Although no guidelines exist regarding required equipment in the ED, the DAS provide a suggested list [3]. Our data demonstrates significant variations (in some cases a complete absence) in essential equipment across EDs.

**Conclusion(s):** For those involved in advanced airway manoeuvres, provision of essential equipment and adequate training is vital. The introduction of a standardised DAT across a training region, which is regularly audited and included as a core component of anaesthesia and EM training, would be a step closer to improving patient safety.

**References:**

1. Cook TM, Woodall N, Harper J et al. *BJA* 2011; 106 (5): 632-42.
2. Morton T, Brady S, Clancy M. *Anaesthesia* 2000; 55: 585-8.
3. Difficult Airway Society equipment list. Difficult Airway Society guidelines 2005. www.das.uk.com.

**Acknowledgments:** None.

**Conflict of Interests:** None declared.

**19AP6-3**

**The ascendancy of the videolaryngoscope: findings from an audit of recent experience in airway management techniques**

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**Background and Goal of Study:** When managing the difficult airway, factors contributing to adverse outcomes include lack of training and unfamiliarity with equipment.<sup>1</sup> We surveyed members of our anaesthetic department to determine recent experience with airway equipment and techniques, with a view to improving training.

**Materials and Methods:** A questionnaire was distributed to all members (19 trainees and 23 consultants) of our anaesthetic department. Respondents were asked to indicate recency of training in or use of 12 pieces of equipment or techniques. We expected 100% of anaesthetists, within the last year, to have used/had training in the use of at least one alternative laryngoscope blade, a videolaryngoscope, one alternative intubation technique (intubating laryngeal mask airway (ILMA) or fiberoptic bronchoscope) and one cricothyrotomy technique.

**Results and Discussion:** The response rate was 71% (30/42). A videolaryngoscope had been used by 76% of respondents within the last year, while 67% had used an alternative laryngoscope blade.

This difference was more marked for consultants: 90% versus 50% respectively. 85% of respondents had used the fiberoptic bronchoscope or ILMA within the last year. Only 65% met the standard for training in at least one cricothyrotomy technique. Trainees were more likely than consultants to meet this standard but three respondents (all trainees) had never had training in any cricothyrotomy technique.

In this UK District General Hospital anaesthetic department we have found greater utilisation of videolaryngoscopes than traditional alternative laryngoscope blades, particularly among consultants. This could indicate their perceived superiority, or reflect increased usage in an effort to improve familiarity. Either way, the result represents a major change in contemporary anaesthetic practice. We have also demonstrated a lack of recent training in cricothyrotomy, which could be addressed by in-house training.

**Conclusion(s):** Videolaryngoscopes are becoming more popular and in our department are used more often than alternative laryngoscope blades. It is nonetheless important to maintain skills in less technologically advanced techniques, including cricothyrotomy.

**References:**

1. Cook TM, Woodall N, Frerk C. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society. Part 1: anaesthesia. *Br J Anaesth* 2011;106:617-31

**19AP6-4**

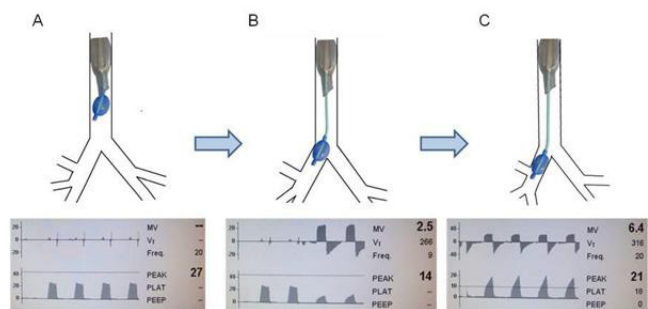
**A novel maneuver to blindly position an endobronchial blocker**

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**Background:** The use of a fiberoptic bronchoscope (FOB) is fundamental to adjust position of the endobronchial blocker. However, occasionally a small caliber FOB is unavailable or inapplicable. We thus tried to devise a blind method to locate the blocker without FOB.

**Methods:** A Uniblocker® was inserted into the endotracheal tube (ETT). Peak inspiratory pressure (PIP) abruptly increased and expiratory V<sub>T</sub> disappeared with inflation of the balloon (Fig. 1A). The blocker was advanced with its tip rotated to non-thoracotomy side until abrupt drop in PIP and reappearance of expiratory V<sub>T</sub> (Fig. 1B). Thereafter, blocker was advanced 3 cm further with the cuff deflated (Fig. 1C). Using a FOB, position of the blocker was checked after inflation of the cuff. Results were graded as follows: 1, the blocker cuff positioned just below the carina without herniation; 2, below the tracheal carina, but not too deep; 3, acceptable herniation of the blocker; 4, one lung ventilation appeared impossible. The whole procedure was repeated to the thoracotomy side.



[Figure 1]

**Results:** With the enrolled 56 patients, 112 blocker placements were tried. The number of suitable placements (Grade 1-3) was 85 of 112 (75.9%) (Table 1). In right, 52 of 56 (92.8%) attempts were suitable, 3 could not obstruct the right upper bronchus, and 1 could not visualize the left main bronchus. In left, 33 of 56 (58.9%) attempts were suitable, 18 cases failed to be located at left bronchus, 3 cases were too deep, and 2 cases were too shallow.

Grade	Right bronchus, n = 56	Left bronchus, n = 56	Overall, n = 112
1	43 (76.7%)	24 (42.8%)	67 (59.8%)
2	7 (12.5%)	7 (12.5%)	14 (12.5%)
3	2 (3.6%)	2 (3.6%)	4 (3.6%)
4	4 (7.2%)	23 (41.1%)	27 (24.1%)

[Table 1]

**Conclusions:** This blind technique to position a Uniblocker® could be employed almost successfully in case of isolation of right lung. However, in case of isolation of left lung, a FOB is required to direct the blocker into targeted direction.

**19AP6-5**

**Need some help? Dealing with difficult airway**

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**Background and Goal of Study:** The availability of help should be considered in case of difficult airway (DA) scenarios. It's our purpose to identify who verifies the availability of help when managing a predictable DA, who has called for help for DA management and to point out factors that might relate with these behaviors.

**Materials and Methods:** A questionnaire was delivered to all the anesthesiologists in our department and returned anonymously. Data collected was analysed by application of the Pearson test (p < 0.05) with the SPSS statistical analysis software, version 18.0.

**Results and Discussion:** All the 100 questionnaires were returned. 69% of the inquiries verify the availability of help before managing a DA. This correlates positively with: female gender (r=0,497; p < 0,001); searching for difficult ventilation predictors (r=0,222; p < 0,05); direct access to a Laryngeal Mask Airway (LMA) (r=0,230; p < 0,05); and calling for help when managing a DA

( $r=0,203$ ;  $p < 0,05$ ). We found a negative correlation between verification of the availability of help before DA management and fiberoptic guided intubation of awake patients ( $r=-0,205$ ;  $p < 0,05$ ). 88% of the inquiries asked for help sometimes per year for DA management. Positive correlations were found between calling for help when managing a DA and: verification of the availability of help before DA management ( $r=0,203$ ;  $p < 0,05$ ); changing the airway management operator due to DA ( $r=0,399$ ;  $p < 0,001$ ); and changing the anesthetic plan to a local/regional technique due to DA ( $r=0,360$ ;  $p < 0,001$ ). We have also found negative correlations between calling for help when managing a DA and: years of practice in anesthesiology ( $r=-0,249$ ;  $p < 0,05$ ); use of LMA ( $r=-0,384$ ;  $p < 0,001$ ); use of Proseal LMA ( $r=-0,246$ ;  $p < 0,05$ ); use of Fastrach LMA ( $r=-0,252$ ;  $p < 0,05$ ); and intubation of awake patients ( $r=-0,216$ ;  $p < 0,05$ ). 99% of the subjects claim to often or always assess the airway before the anaesthetic procedure. The ASA-DA Algorithm is used by 70% of respondents and 11% used the DAS.

**Conclusion(s):** Not verifying the availability of help in DA seems to be related with the ability to perform fiberoptic intubation. The need to call for help was less likely for those who perform awake intubation techniques and with the use of laryngeal masks, supporting their roles in DA. The vast majority of the respondents claim to follow a DA algorithm but only about two thirds do always verify the availability of help in this setting.

## 19AP6-6

### “No touch” extubation technique and respiratory complications in nasal surgery: one technique, two anesthetic methods

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**Background and Goal of Study:** “No touch” extubation technique has been described that absolutely no stimulation was allowed until patients spontaneously woke up (1). It has been reported that no laryngospasm, severe coughing or desaturation occurred in patients when was used this technique. We aimed to compare the effect of two anesthetic methods on “no touch” extubation technique and respiratory complications.

**Materials and Methods:** In this prospective study, ASA I-II sixty adult patients were randomly assigned to receive anesthesia with remifentanyl-propofol (REM-PRO) or remifentanyl-sevoflurane (REM-SEVO) for nasal surgery. All patients were administered standard anesthesia induction with remifentanyl, propofol, rocuronium. At the end of the surgery anesthetic agents were discontinued while positive pressure ventilation was continued with 100% oxygen until spontaneous ventilation returned. Absolutely no stimulation was allowed until patients spontaneously woke up. Tracheal extubation was performed when patients were able to open their eyes. Duration of anesthesia and tracheal extubation time were measured. Respiratory complications and recovery characteristics were also recorded.

**Results and Discussion:** Demographic characteristics and numbers of smoking were not statistically different. The duration of anesthesia and tracheal extubation time in REM-PRO group were  $125.83 \pm 31.90$  min,  $581.07 \pm 225.95$  sec and in REM-SEVO group were  $118.97 \pm 32.53$  min,  $562.63 \pm 202.32$  sec, respectively. Respiratory complications and recovery characteristics were also statistically similar in both groups (Table).

Variable	Tracheal extubation		Recovery room	
	REM-PRO (n=30)	REM-SEVO (n=30)	REM-PRO (n=30)	REM-SEVO (n=30)
Coughing	7 (23.3%)	7 (23.3%)	2 (6.7%)	2 (6.7%)
Breath holding	0	0	0	0
Laryngospasm	0	0	0	0
Desaturation	0	0	0	0
Agitation	0	3 (10%)	0	2 (6.7%)
Shivering	0	4 (13.3%)	1 (3.3%)	6 (20%)
Nausea-Vomiting	1 (3.3%)	0	0	1 (3.3%)
Sore-throat	-	-	14 (46.7%)	7 (23.3%)

[Table]

**Conclusion(s):** Although it may seem like a more comfortable period in REM-PRO group, respiratory complications, recovery characteristics and tracheal extubation times are statistically similar between the groups. “No touch” extubation technique with these types of anesthesia may be safe method for nasal surgeries.

#### References:

1. Anesth Analg 2004;98:327-9.

## 19AP6-7

### Anesthesiologist gender influences the airway management?

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**Background and Goal of Study:** The practice of airway management has become more complex with time, as evidenced by the introduction of a number of new airway devices, several of which have been included in the ASA Difficult Airway (DA) Management Algorithm.

The process in which health care professionals who practice airway management are educated in the use of these devices is variable, as there is no standard method of instruction. Difficulty can be encountered at any of airway approach, potentially resulting in significant complications. Thorough preoperative assessment, as well as careful planning and preparation, can reduce the potential for complications.

The aim of our survey was to identify different pattern tendencies of the airway management related to gender.

**Materials and Methods:** A questionnaire containing 33 questions was delivered to all practising anaesthetists in our department. Questionnaires were returned anonymously and were analysed using the Pearson test ( $P < 0.05$ ) with the SPSS version 18.0 statistical software program.

**Results and Discussion:** All of the 100 surveyed responded. 62% were female. Of the respondents, 99% claim often or always to assess the airway before the anaesthetic procedure. The ASA-DA Algorithm is used by 70% of respondents and 11% used the Difficult Airway Society Algorithm.

We found positive correlation between female gender and: verify the availability of help before DA management ( $r = 0,497$ ;  $p < 0,001$ ), the frequency to use a McCoy blade ( $r = 0,319$ ;  $p < 0,001$ ) or a tracheal tube introducer ( $r = 0,228$ ;  $p < 0,05$ ) and the CICV (cannot intubate, cannot intubate) LMA@ rescue ventilation ( $r=0,257$ ;  $p < 0,05$ ).

We didn't find any correlation between gender and morbimortality.

**Conclusion(s):** Women verify the availability of help when facing a predictable DA more than men, we must try to implement the same pattern of action. We didn't find correlation between gender and incidence of CICV clinical situations, although women are more prone to use laryngeal mask rescue ventilation in that scenario.

## 19AP6-8

### Evaluation of the Naguib model and a new modification for prediction of difficult airway in obstetric patients: preliminary data

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**Background and Goal of Study:** The purpose of this study is to give preliminary data of the Naguib model in the prediction of difficult obstetric laryngoscopy and intubation.

For the first time in the current literature a modification of this model is suggested.

**Materials and Methods:** Out of 35 parturients scheduled to receive general anesthesia for elective caesarian section the number of difficult laryngoscopies and intubations were recorded.

The modified Cormack-Lehane's classification for difficult intubation was used. The Naguib formula was applied. Naguib suggested a multivariate difficult tracheal intubation model which incorporates thyromental distance, mouth opening, height, and MMT grade in a binary form (0 for grade 1,2 and 1 for grade 3,4).

The final equation is  $I=0,2262 - (0,4621 \times \text{thyromental distance in centimeters}) + (2,5516 \times \text{MMT}) - (1,1461 \times \text{intercisor gap in centimeters}) + (0,0433 \times \text{height in centimeters})$ .

Difficult intubation correlates with I value  $> 0$  while I value  $< 0$  indicates easy intubation. The replacement of the MMT variable with the ULBT variable also in binary form is suggested by us (ULBT grade 1-2 value 0, and ULBT grade 3 value 1).

**Results and Discussion:** Difficult laryngoscopy (Grade 2b-3-4) occurred in 7 patients (20%). Difficult intubation occurred in 3 cases (8,5%).

Data are presented in table 1

	TMD (cm)	HEIGHT (cm)	RHTMD	MMT	MOUTH OPENING	ULBT	Cormack Lehane grade	Original L	Modified L
1	7	172	24,5	2	4	3	3 (gum elastic bougie)	L>0	L>0
2	6	164,5	27,4	2	6	3	2b burp→2a	L<0	L>0
3	4,5	151	33	2	4	1	2b burp→2a	L<0	L<0
4	7	164,5	23,5	2	5,5	3	3 (gum elastic bougie)	L<0	L>0
5	7	161	23	3	6	3	2b burp→2a	L<0	L<0
6	7,1	167	23,2	1	6	1	2b burp→2a	L<0	L<0
7	6	160	26,6	2	3	3	3 (gum elastic bougie)	L>0	L>0

[Table 1]

TMD=thyromental distance, RHTMD=ratio TMD to height , MMT=Modified Mallampati test , ULBT=upper lip bite test.

The results indicate that the original Naguib formula predicts 2/7 (28%) difficult laryngoscopies. The modified formula predicts 3/7 (42,8%). The original Naguib formula predicts 2/3 (66%) difficult intubations. The modified Naguib model predicts 3/3 (100%).

**Conclusion(s):** A multivariable model such as the Naguib model has not been tested in an obstetric population. The modification suggested promises greater sensitivity than the original model. These are only the preliminary data and a larger sample is needed to confirm the results.

### 19AP6-10

#### Effective use of an algorithm for extubation in a morbid obese patient with obstructive sleep apnea

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**Background:** Claims for difficult airway management have decreased since the introduction of the difficult airway algorithm in 1993. There has been no decrease in adverse events during other phases of airway management. Problems during emergence represent 20% of serious complications. Development of strategies during emergence may improve patient safety. Although criteria for extubation exist, the continued incidence of morbidity and mortality indicate that these criteria are not entirely successful. Textbooks and articles describe long lists of extubation criteria that are hard to teach, clinically impractical. Factors listed are often mechanical measurements or subjective criteria. For example, measurements such as negative inspiratory force are not easy to perform on the modern anesthesia machine. Poorly controlled emergence is often tolerated, expected and remains undocumented.

**Case Report:** A 42 year old woman with Obstructive Sleep Apnea (OSA) presents for Laparoscopic Cholecystectomy. Upon examination the patient

has a history of breast cancer, obesity and OSA. She has diet controlled diabetes. She normally takes Amlodipine to control hypertension and took her medication the morning of surgery. She weighs 100 kg and is 157cm tall. BMI equals 40.6. She sleeps with a BiPAP machine at home.

Based on the mnemonic VSS + 4-S + 2-S, we perform emergence and extubation:

**Discussion:** This technique facilitates controlled extubation. The checklist format is easily taught to residents and has been applied to OSA patients. We believe that our algorithm should be integrated into general practice to increase the safety and improve the art of anesthesiology.

The implementation of universal extubation criteria has yet to be tested in a large study.

**References:**

1. Anesthesiology 1993;78(3): 597-602.
2. Anesthesiology 2005;103(1): 33-9.
3. Anesthesiol 2011: 114: 236

**Learning Points:** The consideration of an Extubation Algorithm can facilitate smooth, reliable and safe in OSA patients.

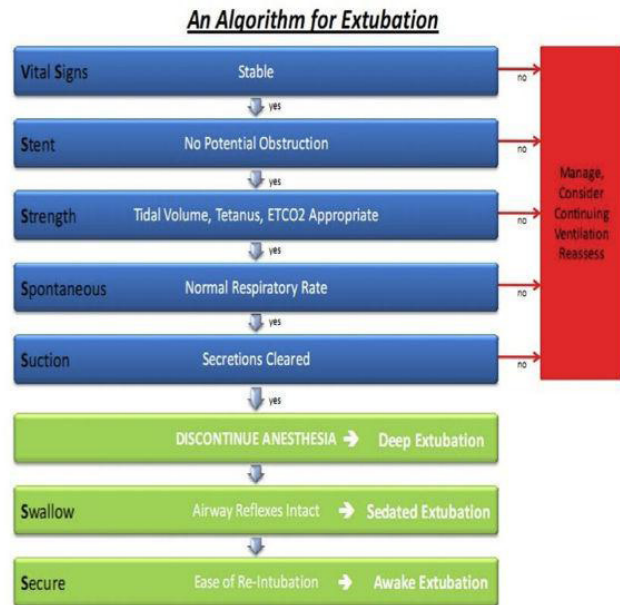


Figure 1. Extubation Criteria VSS + 4S + 2S

[Extubation Algorithm]

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