Oral Session – Echocardiography

0-1
Feasibility and accuracy of intra-operative assessment of systolic pulmonary artery pressure by transoesophageal echocardiography

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Introduction. The non-invasive Doppler echocardiographic estimation of systolic pulmonary artery pressure (sPAP) based on assessing peak tricuspid regurgitation (TR) velocity and adding central venous pressure is a standard component of the transthoracic echocardiographic examination [1]. However, its feasibility and accuracy in surgical patients studied by transoesophageal echocardiography (TOE) is unknown.

Methods. In 109 consecutive patients undergoing cardiac surgery, we assessed the feasibility for obtaining an adequate Doppler signal with ≤ 20° angle between TR jet and Doppler interrogation beam. In 33 of them who were monitored by a pulmonary artery catheter (PAC), we analysed whether Doppler results were within ± 10% of the value indicated by PAC. TOE studies were performed by two experienced echocardiographers blinded for the sPAP values measured by PAC, on the midoesophageal level between 0-120° before sternotomy. TOE data were electronically stored for off-line analysis by two independent readers.

Results. Doppler signals were found to be adequate for estimation of the peak tricuspid regurgitation velocity in 64 patients (59%) using the modified bicaval view and/or the right ventricular inflow-outflow view. Bias ± 95% limits of agreement between sPAP values measured by PAC and estimated by TOE Doppler were 3.8 ± 15.3 mmHg. Only 16 (40%) of 40 TOE Doppler estimates were within ± 10% of the PAP value simultaneously measured by PAC. α for the rating “feasible Doppler signal” was 0.890, and interclass correlation coefficient for peak tricuspid regurgitation velocity was 0.987 (95% CI 0.975-0.993).

Discussion. The results of this study strongly suggest that estimation of sPAP by TOE using maximal TR velocity is an unreliable method in the peri-operative patient. Reasons are that the feasibility for obtaining adequate Doppler signals was low and, more importantly, that the majority of sPAP values estimated by TOE Doppler were inaccurate, i.e., not within a ± 10% range of the simultaneously measured sPAP value.

References
Prognostic value of pre- and post-operative RV systolic function in patients referred for cardiac surgery

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Introduction. Among patients undergoing cardiac surgery, right ventricular (RV) dysfunction had been proved to be an indicator of peri-operative morbidity and mortality [1]. Our study sought to compare the utility of RV systolic indices in predicting surgical outcomes, and further to clarify, if survey at the different timing of the operation mattered.

Methods. This prospective study enrolled consecutive patients referred for cardiac surgery from June 2012 to June 2013. Exclusion criteria included contraindications to transoesophageal echocardiography (TOE) and non-sinus rhythm. Two-dimensional (2D) and tissue Doppler TOE exam and simultaneous pulmonary catheter haemodynamics were recorded in two stages:
(1) after induction of anaesthesia and before sternotomy;
(2) after sternal closure.
RV systolic measurements performed off-line included RV fractional area change (FAC), RV-to-LV end-diastolic diameter ratio (R/L ratio), peak systolic tricuspid annular velocity (S’), tricuspid annular plane systolic excursion (TAPSE), myocardial performance index (MPI), and RV global longitudinal strain (GLS) by 2D speckle tracking. The outcome of the study was defined as postoperative intra-aortic balloon pump (IABP) placement, duration of mechanical ventilation in the intensive care unit (ICU), length of time of inotropic agents use, and occurrence of arrhythmias.

Results. Of 68 patients with complete data set, the EuroSCORE II averaged 3.27 ± 3.16%. After cardiac surgery, mean duration of ventilator use in the ICU was 22.9 ± 36.4 h and of inotropic agent use was 22.8 ± 32.3 h. IABP was placed in 8 (12%) patients, and arrhythmias were observed in 18 (26%) patients. RV GLS averaged −19.81 ± 5.44% in stage 1 and −17.62 ± 5.19% in stage 2 (p = 0.003), and some other RV variables also became significantly worse post-operatively. In separate-staged regression models toward the individual outcome, serial R² in stage 2 was better than stage 1. In the union-of-two stages model adjusted to EuroSCORE and cardiopulmonary bypass time, RV GLS in stage 2 had the highest partial correlation coefficient (Partial r = 0.486, p = 0.001) toward the duration of postoperative inotropic agent use.

Discussion. RV GLS is reliable for outcome prediction of patients undergoing cardiac surgery. RV systolic measurements with TOE after sternal closure depict better prediction than the pre-operative ones.

References
Oral Session – Kidney

0-3
Erythropoietin and Protection of Renal function In Cardiac Surgery (the EPRICS trial)

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Introduction. To date, there are no known methods for preventing acute kidney injury after cardiac surgery. Increasing evidence suggests that erythropoietin (EPO) has renal anti-apoptotic and tissue-protective effects [1]. However, recent human studies have shown conflicting results. We aimed to study the effect of a single high-dose EPO pre-operatively on renal function after coronary artery bypass grafting (CABG) in patients with pre-operative impaired renal function.

Methods. This single centre, randomized, double blind, placebo-controlled study included 75 patients scheduled for CABG with pre-existing renal impairment (estimated glomerular filtration rate based on p-Cystatin C < 60 ml/min and > 15 ml/min). The patients either received a single high-dose EPO (400 IU/kg) or placebo pre-operatively. The primary endpoint was renal protection evaluated by p-Cystatin C at the third post-operative day compared to the pre-operative values. Incidence of acute kidney injury and other renal biomarker changes were among secondary endpoints.

Results. There was no statistically significant difference on the third postoperative day for relative p-Cystatin C level changes from baseline between the groups, 50% ± 60% (mean ± SD) for the study group and 40% ± 4 for the control group, p = 0.27, 95% CI: −0.10 to 0.37. There were no statistically significant differences in other renal biomarkers or measures between the groups (p-NGAL, p-Creatinine, p-Urea, and estimated glomerular filtration rate). There were no other differences in outcome variables between the groups.

Discussion. Intravenous administration of a single high-dose (400 IU/kg) EPO did not have a renal protective effect in patients with reduced kidney function undergoing coronary artery bypass surgery.

References

0-4
Acute kidney injury may be associated with specific ICAM-1 and TNFα genes variance

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Medical University of Gdańsk, Poland

Introduction. Associations between genome variance and clinical phenotypes of early postoperative morbidity after cardiac surgery with use of cardiopulmonary bypass (CPB) have been revealed in recent years [1].

Table 1

<table>
<thead>
<tr>
<th>Analysed SNV alleles</th>
<th>Average Risk Difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAM-1 rs5498 AA &gt; GG</td>
<td>−7.4%</td>
<td>F-E; 0.0926</td>
</tr>
<tr>
<td>IL6-rs1800796 CG &gt; GG</td>
<td>−2.7%</td>
<td>F-E; 0.4</td>
</tr>
<tr>
<td>LBP1 rs2232582</td>
<td>25.7%</td>
<td>F-E; 0.0351; differ in stratum</td>
</tr>
<tr>
<td>CRP rs1800947 GC &gt; GG</td>
<td>−3.7%</td>
<td>F-E; 0.2699</td>
</tr>
<tr>
<td>NOD2 rs2066844 CC &gt; CT</td>
<td>8.8%</td>
<td>F-E; 0.1338</td>
</tr>
<tr>
<td>MASP2 rs2273346 CT &gt; TT</td>
<td>−7.4%</td>
<td>F-E; 0.4615</td>
</tr>
<tr>
<td>TNF rs1800629 GA &gt; GG</td>
<td>5.1%</td>
<td>F-E; 0.1275</td>
</tr>
<tr>
<td>SEL-E rs1805193 GG &gt; TT</td>
<td>16.5%</td>
<td>nd</td>
</tr>
<tr>
<td>NOS3 rs179983 GG &gt; TT</td>
<td>−5.0%</td>
<td>F-E; 0.2678</td>
</tr>
<tr>
<td>TLR4 rs4986790 AA &gt; GA</td>
<td>4.0%</td>
<td>F-E; 0.3306</td>
</tr>
</tbody>
</table>
Methods. 492 adult patients, referred for open heart surgery with use of CPB, who signed informed consent, were included in a prospective, observational study. It was aimed to assess associations between single nucleotide variants (SNV) of 10 selected genes and acute kidney injury (AKI) defined in the RIFLE classification, after adjusting for CPB-time. Patients with end-stage kidney disease (E; n = 2) and with complicated surgery (n = 43) were excluded. SNV were identified by PCR followed by a SNapShot reaction. Mantel-Haenszel, chi-squared or Fisher-exact tests were considered significant when the \( p \)-value was < 0.05.

Results. No analysed SNV proved to be significantly associated with the AKI-phenotype (RIFL) (Table 1).

However a combination of ICAM-1-rs5498-GG+TNFα-rs1800629-GA SNV revealed a 20% increase of AKI risk when compared with the ICAM-1-rs5498-AA+TNFα-rs1800629-GG allele combination (\( p = 0.0243 \)).

Discussion. It is evidenced that coexistence of two SNV in genes of inflammatory mediators may be associated with increased AKI risk after cardiac surgery with use of CPB.

References
to shortage of disposable components, invasive monitors were reserved for the most critical cases (e.g., restrictive pericarditis). Tank oxygen was the sole carrier gas. Thiopental, halothane, fentanyl, meperidine, succinylcholine and pancuronium were usually available. Rocuronium, vecuronium, morphine and propofol were rarely available. Small supplies of sevoflurane were used when halothane was strongly contraindicated. DLTs were sterilized and re-used. Thoracic epidural use was limited by catheter supply. Cross-matched whole blood was available in exchange for blood donation from family. Blood storage was a significant challenge.

Discussion. Complex cases are routinely managed with very low resources and good outcomes in low-income nations. Strong efforts are needed to incorporate these regions into the global academic community. This project was part of a growing collaboration involving numerous medical and allied health departments.

Method. After ethical approval, 58 patients with spontaneous pneumothorax scheduled for elective VATS using the Arndt® blocker for lung separation were randomly assigned to deflate the operative lung with either disconnecting the endotracheal tube from the ventilator for 60 sec prior to inflation of the bronchial blocker, or attaching −30 cmH₂O suction through a barrel part of a 1-ml insulin syringe attached to the suction port of the Arndt® blocker (n = 29 for each group). Time to total lung collapse, surgeons rating of lung collapse, overall surgeon satisfaction, need for further fibrescopic bronchial suction manoeuvres, and intra-operative hypoxaemia were recorded. ClinicalTrials.gov registration ID: NCT02030795.

Results. Compared with the disconnection group, the bronchial suction technique had a significantly shorter time to total lung collapse (92.5 [95% CI 81.32 to 103.70] vs. 197.2 [95% CI 157.37 to 237.04] s., respectively; p < 0.001). Both groups had comparable excellent surgical rating of lung collapse, overall surgeon satisfaction, and intra-operative hypoxaemia (p > 0.21). No patient in the bronchial suction group needed further manoeuvres to collapse the surgical lung.

Discussion. The use of continuous bronchial suction through the lumen of the Arndt® blocker offers an effective method to accelerate lung collapse.

0-6
Lung deflation with Arndt® blocker during video-assisted thoracoscopy: a comparison of the disconnection technique with a continuous bronchial suction

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Introduction. The use of a wire-guided Arndt® endobronchial blocker does not gain widespread acceptance during video-assisted thoracoscopy (VATS) because it takes a longer time to collapse the operative lung. The use of a disconnection technique could hasten the lung collapse, however with potential risks for contamination of the dependent lung. We hypothesized that the suctioning technique would have a comparable time to optimum lung collapse with the disconnection technique.

0-7
Target-controlled infusion of remifentanil without muscle relaxant allows acceptable surgical conditions during thoracotomy

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Introduction. Muscle relaxation for thoracic procedures is a standard of care, although it could cause postoperative residual curarization (PORC) increasing the total costs. Sugammadex offers new perspectives to re-
duce the incidence of PORC. Unfortunately it is not available in many countries. We hypothesized that the use of target-controlled remifentanil infusion (TCI) with non-muscle relaxant (NMR) would be associated with comparable surgical conditions and reduced total costs compared with the use of neuromuscular blockers during thoracotomy.

Method. After ethical approval, 66 patients scheduled for elective thoracotomy under sevoflurane anaesthesia with TCI remifentanil were randomly assigned to receive cisatracurium or saline (n = 33 for each) throughout the procedure. Laryngoscopy and intubating conditions, intra-operative modified thoracic surgery rating scale, incidence of light anaesthesia defined as an episode with State Entropy values that exceeded 50 and/or mean arterial blood pressure, and heart rate values that exceeded the baseline by 20% and that lasted for more than 3 consecutive min, and use of vasopressors and anaesthetics, clinical recovery, incidence of PORC, and total costs were recorded.

Results. Compared with the cisatracurium group, the NMR group had comparable clinically acceptable laryngoscopy and intubating conditions (93.9% vs. 100%, respectively; p > 0.09), good-to-excellent surgical rating scales (p > 0.32), use of vasopressors, and hospital stay, and fewer episodes of light anaesthesia (p = 0.04), shorter times to clinical recovery, to extubation (7.6 [95%CI 6.82 to 8.39] vs. 19.0 [95%CI 15.76 to 22.23] min respectively; p < 0.001), and to PACU discharge (37.4 [95% CI 35.09 to 39.79] vs. 70.9 [95% CI 56.90 to 84.91] min respectively; p < 0.001), and 47.2% lower total costs (p < 0.001). There was no failed intubation. No patient received cisatracurium in the NMR group. Two patients in the cisatracurium group developed PORC.

Discussion. The use of TCI remifentanil with NMR offers acceptable intubating and surgical conditions and reduced total costs during open thoracotomy.

**0-8**
Effect of benzydamine spraying on postoperative sore throat and hoarseness after tracheal intubation with a double-lumen endobronchial tube

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2 Seoul National University Hospital, Seoul, Republic of Korea

Introduction. Postoperative sore throat and hoarseness are common complaints after tracheal intubation with a double-lumen endobronchial tube (DLT) for one-lung ventilation. The aim of this study was to evaluate the effect of benzydamine hydrochloride (a topical non-steroidal anti-inflammatory drug with analgesic effect) spray on postoperative sore throat and hoarseness following the DLT intubation.

Method. In total, 52 adult patients undergoing thoracic surgery with DLT intubation for one-lung ventilation were randomly allocated to one of two groups. In group S (n = 26), the DLT cuffs and oropharyngeal cavity were both sprayed with 3 puffs of normal saline, and in group BH (n = 26), the DLT cuffs and oropharyngeal cavity were both sprayed with 3 puffs of benzydamine hydrochloride. During tracheal intubation, Cormack-Lehane Grade, resistance to DLT insertion, the number of intubation attempts and the time to achieve intubation were recorded. Throughout the surgery, the number of repositioning, and the duration of one-lung ventilation and tracheal intubation were also recorded. Postoperative sore throat and hoarseness were evaluated at 1, 6, and 24 h after surgery. Sore throat was evaluated using a 0-100 mm visual analogue scale (VAS; 0, no pain, to 100, worst pain imaginable). Hoarseness was defined as a change in voice quality.

Results. In the postoperative period, the incidence and severity of sore throat were lower in group BH compared to group
S (VAS; at 1 h after surgery, 8.4 ± 13.6 vs. 22.4 ± 23.5; p = 0.008, at 6 h after surgery, 8.8 ± 14.3 vs. 24.6 ± 27.9; p = 0.013, at 24 h after surgery, 3.2 ± 4.7 vs. 9.2 ± 10.9; p = 0.034). At 1 h after surgery, the incidence of hoarseness was lower in group BH than in group S (30.8% vs. 7.7%; p = 0.038), but the incidence of hoarseness at 6 and 24 h after surgery was similar between the two groups.

**Discussion.** Prophylactic benzydamine hydrochloride spraying on the DLT cuffs and oropharyngeal cavity reduced the incidence and severity of postoperative sore throat and hoarseness.

0-9
Comparison of the effects of sevoflurane and desflurane on microcirculation in non-cardiac surgery

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**Introduction.** Microcirculation is important for tissue oxygenation. Anaesthetic drugs can alter the microcirculation in cardiac surgery patients [1]. However, to our knowledge, no study has documented effects of sevoflurane and desflurane in non-cardiac surgery. Our aim was to compare the effects of these inhalation agents on the microcirculation in non-cardiac surgery by using side stream dark field (SDF) imaging.

**Methods.** After ethical committee approval and informed consent, ASA I-II patients who underwent ≥ 2 hour surgery were enrolled in this prospective and randomized study. Patients were divided into two groups: Group S (sevoflurane) n = 20; Group D (desflurane) n = 19. Demographic, haemodynamic variables (heart rate, mean arterial pressure) and laboratory parameters (haematocrit, haemoglobin, urea, and creatinine) were recorded. Microcirculation imaging was performed after anaesthesia induction and intra-operative 2nd hour by using SDF technique. SDF images were analysed using AVA 3.1 (Automated vascular analysis programme). The statistical analyses were performed with one-way ANOVA, Mann-Whitney U and Wilcoxon.

**Results.** Thirty-nine patients were enrolled. No statistical differences in demographic, laboratory and haemodynamic parameters were detected between groups. In the sevoflurane group, microvascular flow index (MFI) (5,13%) and proportion of perfused vessel (PPV) (1,87%) of small vessels were increased; total vascular density (TVD) (–4,35%) and perfused vascular density (PVD) (–2,81%) of small vessels were decreased compared to the post-induction period. These differences were not statistically significant except for PPV. In the desflurane group, MFI (2,12%) of small vessels was increased; PPV (–0,75%), TVD (–1,70%) and PVD (–2,37%) were decreased compared to the post-induction period. These differences were not statistically significant. No differences between groups and microcirculation values were seen (Table 1).

**Discussion.** Sevoflurane increased the proportion of perfusion (PPV) of small vessels in non-cardiac surgery in ASA I-II patients (1,87%, p ≤ 0.05).

<table>
<thead>
<tr>
<th>Group</th>
<th>MFI sm (AU)</th>
<th>PPV (%)</th>
<th>PVD sm (mm/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group S</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After induction</td>
<td>2.63 ± 0.23</td>
<td>93.05 ± 4.19</td>
<td>14.90 ± 1.85</td>
</tr>
<tr>
<td>2nd hour p value</td>
<td>2.75 ± 0.31</td>
<td>94.73 ± 3.65</td>
<td>14.38 ± 2.07</td>
</tr>
<tr>
<td></td>
<td>0.092</td>
<td>0.036</td>
<td>0.241</td>
</tr>
<tr>
<td><strong>Group D</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After induction</td>
<td>2.69 ± 0.27</td>
<td>94.24 ± 3.77</td>
<td>15.59 ± 1.91</td>
</tr>
<tr>
<td>2nd hour p value</td>
<td>2.73 ± 0.26</td>
<td>93.50 ± 5.20</td>
<td>15.16 ± 2.24</td>
</tr>
<tr>
<td></td>
<td>0.561</td>
<td>0.358</td>
<td>0.345</td>
</tr>
</tbody>
</table>
References


Oral Session – Myocardial Ischemia

O-10
Intravenous glutamate reduces the need for inotropes in patients with heart failure after CABG for acute coronary syndrome

Bashir Tajik1, Erik Hakanson1, Mårten Vidlund2, Jonas Holm1, Farkas Vanky1, Örjan Friberg2, Rolf Svedjeholm3
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2 Orebro University Hospital, Orebro, Sweden

Introduction. In a double-blind randomized clinical trial (GLUTAMICS-ClinicalTrials.gov Identifier: NCT00489827), intravenous glutamate was associated with a risk reduction exceeding 50% for developing severe circulatory failure after isolated CABG for acute coronary syndrome (ACS) [1]. Here our aim was to investigate whether glutamate also influenced the need or use of inotropes.

Method. Post hoc analysis of 824 patients in the GLUTAMICS-trial operated on isolated coronary artery bypass graft (CABG) for ACS. ICU-records were retrospectively scrutinized including hourly registration of inotropic drug infusion, dosage and total duration during the operation and postoperatively. Student’s t-test and Mann-Whitney U test were used for statistical comparisons.

Results. ICU-records were available for 171 out of 177 patients who received inotropes peri-operatively. Only 26% of the patients treated with inotropes fulfilled study criteria for postoperative heart failure at weaning from cardiopulmonary bypass (CPB) or later in the ICU. Inotropes were mainly given preemptively to facilitate weaning from CPB or to treat postoperative circulatory instability (bleeding, hypovolaemia). With the exception of significantly lower need of epinephrine there were only trends towards lower need of other inotropes overall in favour of glutamate. In patients treated with inotropes (glutamate n = 17; placebo n = 13) who fulfilled criteria for left ventricular failure at weaning from CPB, the average duration of inotropic treatment (34 ± 20 v 80 ± 77 h; p = 0.014) and the number of inotropes used (1.35 ± 0.6 v 1.85 ± 0.7; p = 0.039) were lower in the glutamate group.

Discussion. Intravenous glutamate had a limited effect on inotrope use overall in patients undergoing CABG for ACS, whereas a substantial and significant effect was observed in patients with left ventricular failure at weaning from CPB.

References


O-11
Hyperoxia reduces regional myocardial oxygenation distal to acute coronary stenosis in swine

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2 Montreal Heart Institute, Philippa & Marvin Carsley CMR Centre, Montreal, QC, Canada

Introduction. Although recent guidelines limit the use of high oxygen concentration after arrest and restoration of circulation, it has
not yet been demonstrated whether hyperoxia can induce relevant regional ischaemia. Oxygenation-sensitive (OS) cardiovascular magnetic resonance can measure changes in myocardial tissue oxygenation.

**Methods.** In 16 swine, a flow probe was placed on the left anterior descending (LAD) coronary artery. In 8, acute significant LAD stenosis was created by proximal hydraulic occlusion. Using OS cine (3T), left ventricular myocardium was imaged at normoxia (PaO$_2$ = 13.3 kPa) and hyperoxia (PaO$_2$ = 39.9 kPa). Myocardial oxygenation changes are presented as %-change in OS signal intensity (SI) between the two levels. Regional differences between LAD territory and remote myocardium were assessed.

**Results.** In both groups, hyperoxia significantly reduced coronary blood flow from normoxia. Global myocardial oxygenation did not differ between healthy or stenosed animals when hyperoxia was induced. However, in healthy animals SI remained consistent across the myocardium, whereas in stenosed animals hyperoxia reduced oxygenation-sensitive SI within the LAD territory significantly more than within remote myocardium.

**Discussion.** Hyperoxia significantly reduces coronary blood flow and may cause regional oxygenation imbalance in myocardium supplied by coronary arteries with significant stenosis.

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**0-12 Mechanical circulatory support with Impella 5.0 assist device in severe cardiogenic shock: 5 years experience**

**Philippe Gaudard, Marc Mourad, Jacob Eliet, Norddine Zeroual, Géraldine Culas, Pascal Colson**

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**Introduction.** Cardiogenic shock (CS) remains an important issue, with high in-hospital mortality rate. The use of mechanical circulatory support is increasing, while inotropes are associated with adverse events, lack of efficacy and increasing myocardial oxygen consumption [1]. We report our single centre experience about MCS with the Impella 5.0 device in CS.

**Methods.** We retrospectively reviewed all the Impella 5.0 implantations indicated for CS from 2008 (first case) to the end of 2013. All clinical parameters, treatments, complications and outcome are described as median [25 and 75 percentile]. Statistical analysis was performed with Wilcoxon test and $p < 0.05$ considered as significant.

**Results.** 40 patients (age: 57yr [49-63]) in severe CS (SOFA: 11 [9-14]) had an Impella 5.0 support device: 25 as a single support strategy (SSS) and 15 as a combined support strategy with VA-ECMO (CSS). CS aetiologies were: postcardiotomy (n = 7), acute myocardial infarction (n = 17), dilated cardiomyopathy (n = 12) and others (n = 2). The duration of support with Impella was 7 days [5-10], and ICU stay was 22 days [9-33]. The cardiothoracic ratio decreased from 0.58 [0.52-0.66] before Impella to 0.54 [0.49-0.59] at day 2 ($p = 0.001$). The inotrope score decreased rapidly from 9.0 [0.6-13.6] before Impella to 1.0 [0.0-8.9] 6 hours after implantation ($p = 0.022$) indicating a fast weaning of inotropes. During support, we observed major device malfunction (n = 4), malposition (n = 8) with successful bedside repositioning, no bleeding requiring surgery, but 32 patients needing transfusion, ischaemic events (n = 3).
and device related infection (n = 7). A cardiac recovery or a bridge to LVAD or heart transplantation was possible for 73% of patients. The survival rates at day 28 and month 6 were respectively 65% and 50% without difference between SSS and CSS.

Discussion. Impella 5.0 in CS offers a cardiac outflow supply with fast weaning of inotropes and may facilitate myocardial recovery and better outcome or bridge to LVAD and heart transplantation.

References

0-13
Intra-aortic balloon pump use does not affect the renal function in patients undergoing off-pump coronary artery bypass surgery

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Introduction. Renal dysfunction is known to occur during cardiac surgery. A few factors such as peri-operative hypotension, use of potential nephrotoxic therapeutic agents, or radio opaque contrast media. In the recent past, intra-aortic balloon pump (IABP) and cardiopulmonary bypass have been blamed as contributing factors to the causation of postoperative renal dysfunction in cardiac surgical patients. At times in patients with renal failure and low cardiac output status, one may face the dilemma whether the use of IABP is safe.

Methods. We undertook this prospective observational study to determine the degree of possible renal injury when IABP is used by measuring serial values of serum creatinine and cystatin C. Elective patients scheduled for off pump coronary artery bypass surgery requiring pre-operative use of IABP were included in this study. Cystatin C and serum creatinine levels were checked at fixed intervals after institution of IABP. Twenty-two patients were eligible for enrolment to the study.

Results. There was no significant change in the values of serum creatinine from the basal value of 1.10 ± 0.233 to 0.98 ± 0.363 mg/dl (p > 0.05). Cystatin C levels significantly decreased from the basal level of 0.98 ± 0.29 (p < 0.05).

Discussion. Contrary to the present belief, cystatin C, the early indicator of renal dysfunction, decreased suggesting absence of renal injury after the use of IABP. Absence of elevation of cystatin C levels in our study suggests the lack of potential of the IABP to cause renal dysfunction in patients who received elective IABP therapy pre-operatively.

0-14
Independent predictive factors of postoperative renal replacement therapy after adult cardiac surgery

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Introduction. Postoperative need for renal replacement therapy (RRT) after cardiac surgery is a serious complication associated with increased morbidity and mortality. Early identification of patients (pts) at high risk of RRT allows applying strategies to reduce acute kidney injury and to improve outcomes. The aim of this study was to identify peri-operative independent risk factors of postoperative RRT after cardiac surgery.

Methods. From February 2010 to June 2013, 1,112 patients (pts) underwent on-pump cardiac surgery in our institution. Peri-operative data were prospectively recorded in our institutional database. Criteria for the initiation of RRT were at least 2 of the follow-
ing: oligo-anuria (urine output < 0.5 ml/kg per 12 h); blood urea > 200 mg/dl; K+ > 6.5 meq/dl; pulmonary oedema unresponsive to diuretics; uncompensated metabolic acidosis. Univariate analysis was performed first to determine factors significantly associated with postoperative RRT. Significant factors ($p < 0.05$) were included in a multivariate logistic regression model.

Results. Two pts died in the operating room, 1,110 were analysed. Five hundred fifty-two pts underwent bypass surgery, 335 pts valve surgery, 172 pts bypass + valve surgery, 28 pts aortic surgery and 7 pts complex surgery. 29 pts (2.6%) required postoperative RRT during intensive care unit (ICU) stay. Median delay between surgery and RRT initiation was 3 days [1.3-4.0]. ICU mortality rate was 41.4% in the RRT group and 2.2% in the non-RRT group ($p < 0.0001$) (Table 1).

Discussion. In our experience, pre-operative creatinine $\geq 1.5$ mg/dL, EuroSCORE > 7, peri-operative use of intra-aortic balloon pump, postoperative low cardiac output, and infection complications during ICU stay are predictive factors of postoperative RRT after cardiac surgery.

<table>
<thead>
<tr>
<th>Table 1. Multivariate logistic regression analysis</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Preop creatinine ≥ 1.5 mg/dL</td>
</tr>
<tr>
<td>EuroSCORE &gt; 7</td>
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<tr>
<td>Intra-aortic balloon pump (IABP)</td>
</tr>
<tr>
<td>Postoperative low cardiac output</td>
</tr>
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<td>Infection during ICU stay</td>
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</tbody>
</table>

Oral Session – Pediatric

0-15
High dose methylprednisolone reduces degradation of endothelial glycocalyx in paediatric open heart surgery

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Introduction. Degradation of glycocalyx occurs in open heart surgery. It regulates leukocyte and platelet adhesion and vascular permeability on the endothelium. Corticosteroids are widely used in paediatric heart surgery. In an ex vivo model of cardiac reperfusion, hydrocortisone has been reported to decrease degradation of endothelial glycocalyx.

Methods. Forty neonates undergoing heart surgery were randomized in a double-blind, placebo-controlled trial to receive 30 mg/kg of methylprednisolone ($n = 20$) or saline ($n = 20$). Plasma syndecan-1 as a marker of glycocalyx degradation was measured pre-operatively, 30 min on cardiopulmonary bypass (CPB), after aortic declamping and 6 h post-CPB.

Results. Plasma syndecan-1 concentration did not differ between the methylprednisolone (35.0 ± 22.4 pg/ml) and the control group (29.8 ± 13.5 pg/ml) at baseline. Due to a wide variation, rise of syndecan-1 is expressed as a fold-increase of the baseline level. After aortic declamping and at 6 h
post-CPB, rise of plasma syndecan-1 was significantly weaker in the methylprednisolone than the control group (Figure 1).

**Discussion.** As glycocalyx is important in regulation of inflammation and vascular permeability, the present data offer a novel mechanism for therapeutic effects of corticosteroids in neonatal heart surgery.

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**0-16**  
Dosage feasibility of urine biomarkers [TIMP-2]/[IGFBP7] in paediatric acute kidney injury after cardiac surgery with cardiopulmonary bypass

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**Introduction.** Urine biomarkers [TIMP-2]/[IGFBP7] (Nephrocheck), are early validated markers of acute kidney injury (AKI) in adults. Acute kidney injury is known to prolong intensive care unit stay, mechanical ventilation and causes higher mortality in children after cardiac surgery. Early AKI detection, and hence setting up peritoneal dialysis, improves these parameters. The objective of the study was to explore the feasibility and accuracy of Nephrocheck to predict AKI in neonates and children after cardiac surgery.

**Methods.** In this prospective, observational cohort study, we included 15 children less than 36 months of age with cardiopulmonary bypass (CPB) longer than 1 h during a 4 months period. We collected demographic, surgery-related and postoperative clinical data, peri-operative NIRS and pNGAL in the paediatric cardiac intensive care unit of a tertiary hospital. Urine samples were collected 1 h before surgery (T0), 1 h (T1), 4 h (T2) and 18 h (T3) after the end of bypass. pNGAL was measured at the same times. AKI stage was defined according to the pRIFLE and AKI Network. We did not use the urine output criteria because of high doses diuretics given. We used thenon-parametric Wilcoxon test.

**Results.** The study included 5 neonates, median age 7 months. The most frequent surgery was correcting VSD (7 cases). Median CPB length was 124 min. All samples were made. Among the 15 patients, 1 required peritoneal dialysis (7%), none died. No correlations were found between AKI and Nephrocheck at any time, Nephrocheck/T2/T1, Nephrocheck/Urinary creatinine,
postoperative creatinine day 1 and 2, pNGAL, clamping time and renal NIRS.

Discussion. As it was possible to sample urine for all the patients, even at T1 in the operating room, we know now it is possible to study Nephrocheck in this patient category. Despite no significant results, Nephrocheck seems interesting in paediatric AKI pathogenesis, as both molecules are involved in the phenomenon of G1 cell cycle arrest. Evolution of Nephrocheck between T1 and T2, so few hours after surgery, seems the most interesting to study.

References

0-17
Analgesia for chest drain removal in children after cardiac surgery: sevoflurane vs. ketamine

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Introduction. Standard postoperative analgesia in the paediatric cardiac intensive care unit comprises paracetamol, ibuprofen and morphine. During painful procedures this may be supplemented with sevoflurane or ketamine (not routinely). This prospective, randomized controlled trial aimed to determine whether standard analgesia is adequate for chest drain removal in awake, non-ventilated children, and whether the addition of sevoflurane or ketamine can enhance comfort and pain relief.

Methods. Following ethics committee approval and informed consent, 51 children under the age of 14 were randomized into 3 groups. Group 1 received the standard analgesia alone, group 2 received standard and sevoflurane (6% start) and group 3 standard and ketamine (1 mg/kg). The primary endpoints were pain and comfort measured by the Comfort B Score and VAS observation scale. Secondary endpoints were changes in blood pressure and heart rate, and potential side effects.

Results. There were no significant differences in the number of drains, consumption of standard analgesics or baseline comfort B score across all groups. In the standard group, there was a significant rise of the Comfort B to a mean of 22 indicating severe discomfort. In the sevoflurane group, it decreased to a mean of 8 indicating oversedation ($p < 0.05$). In the ketamine group, comfort B remained within the limits of comfort. The mean blood pressure rose significantly in the standard and ketamine group (30 and 11% resp; $p < 0.001$), and dropped significantly by 18.9% in the sevoflurane group. The heart rate increased significantly in the standard and ketamine groups (17.8 and 6.3% resp; $p < 0.05$); in the sevoflurane group, there was a non-significant drop (4%).

Discussion. This study suggests that standard postoperative pain relief using a combination of paracetamol, ibuprofen and morphine is inadequate during painful procedures. The use of sevoflurane appears to cause oversedation and haemodynamic instability, whereas the addition of ketamine to the standard pain medication provides sufficient comfort whilst maintaining cardiorespiratory stability.
0-18 Inhalation agents for the treatment of pulmonary hypertension in patients undergoing cardiac surgery: a systematic review and meta-analysis

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2 Hôpital du Sacré-Coeur de Montréal, Montreal, QC, Canada

Introduction. In the context of cardiac surgery, pulmonary hypertension (PH) is an important prognostic factor associated with increased morbidity and mortality, with an impact on survival mainly through its effects on right ventricular function. Optimal perioperative management is therefore essential to ensure the best postoperative results. Intravenous vasodilators play an important role in the management of PH, but their lack of specificity for the pulmonary circulation often limits their use because of their systemic hypotensive effects. The introduction of inhaled nitric oxide (iNO) as a selective pulmonary vasodilator has been a major advance in the treatment of PH, but treatment with iNO is expensive. Consequently, other inhaled pulmonary vasodilators, such as prostacyclin and milrinone, have been investigated as alternatives. In this study, we performed a meta-analysis to determine the effectiveness of inhaled agents compared to intravenously administered agents or a placebo in the treatment of PH during cardiac surgery. Additionally, using subgroup analysis, we explored the efficacy among inhaled agents, divided between iNO and non-iNO alternatives.

Methods. We performed a systematic review and meta-analysis of randomized controlled trials. Studies were identified in MEDLINE, CENTRAL, EMBASE, The Web of Knowledge and ClinicalTrials.gov. databases from inception to February 02, 2013. From 629 studies retrieved, 9 articles comprising a total of 323 patients were included in the meta-analysis. Primary outcome was haemodynamic stability and secondary outcomes were length of stay in-hospital, length of stay in the intensive care unit, and mean dose of inotropes and vasopressor agents.

Results. Overall, inhaled agents were associated with a significant decrease in pulmonary vascular resistance ($p = 0.02$), central venous pressure ($p = 0.04$) and transpulmonary gradient ($p = 0.002$) and a significant increase in cardiac index ($p = 0.03$) and mean arterial pressure ($p = 0.005$). No statistically significant difference was observed regarding other outcomes evaluated. The use of iNO was associated with a significant increase in mean arterial pressure compared with non-iNO inhaled agents ($p = 0.0003$). No other differences were observed between the groups.

Discussion. The administration of inhaled agents for the treatment of PH during cardiac surgery is associated with a greater decrease in pulmonary vascular resistance and fewer systemic haemodynamic side effects compared to intravenously administered agents. Additionally, although non-iNO inhaled vasodilators seem as promising cost effective alternatives, their efficacy compared to iNO requires further study based on randomized controlled clinical trials.

0-19 Specifying indications for chest radiographs after cardiac surgery increase their efficacy and reduce their number

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Introduction. In the intensive care unit (ICU), chest radiographs (CXR) are frequently obtained routinely for postoperative
cardiosurgical patients despite the fact that the diagnostic and therapeutic efficacy of routine CXRs is known to be low. The discussion regarding the safety of abandoning routine CXRs is still ongoing. We investigated the efficacy of CXRs performed after cardiac surgery for specified indications only.

**Methods.** We prospectively included all patients who underwent major cardiac surgery in the year 2012. A routine postoperative CXR was performed at ICU arrival only for certain specified indications like minimally invasive cardiac surgery or difficult central venous catheterization. An on-demand CXR could be obtained during the postoperative period for other specified indications including certain haemodynamic or respiratory problems. A control CXR was performed on the morning of the first postoperative day for all patients who had not undergone a CXR prior to that time. The diagnostic and therapeutic efficacy (the number of abnormalities or interventions divided by the total number of CXRs were calculated for all CXRs.

**Results.** A total of 1,351 patients were included in this study. The diagnostic efficacy of CXRs for major abnormalities was clearly higher for the direct postoperative and on-demand CXRs that were performed for specific indications than for the next morning routine control CXRs (6.7% and 6.9% vs. 2.9%) \( (p = 0.004) \). The therapeutic efficacy was also clearly higher for the direct postoperative and on-demand CXRs (2.9% and 4.1%). The need for intervention after the first postoperative morning control CXRs was minimal (0.6%) \( (p = 0.000) \).

**Discussion.** Specifying clear indications for CXRs following cardiac surgery increases the efficacy of these CXRs and can reduce the total number of CXRs performed.

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**Oral Session – Organ Dysfunction**

**0-20**

**Organ hierarchy during low blood flow on-pump: a randomized experimental positron emission tomography study in pigs**

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² Aalborg University Hospital, Department of Thoracic Surgery, Aalborg, Denmark
³ Aarhus University, Department of Nuclear Medicine and PET-Center, Aarhus, Denmark

**Introduction.** Higher co-morbidity, age and weight of the patients scheduled for today’s cardiac surgery question the precalculation of blood flow during cardiopulmonary bypass (CPB) [1]. Approximately 10-20% of cardiac surgery patients suffer from hyperlactataemia indicating tissue hypoxia [2]. The purpose of this animal study is to investigate the organ hierarchy of brain, liver, kidney and muscle at normal and low blood flows by using dynamic positron tomography (PET-CT) during CPB.

**Methods.** CPB at different blood flows will be investigated in an experimental model of six 70 kg pigs, with normothermic CPB with a blood flow of 2.5 l/min/m² for one h followed by a randomization to a blood flow of either 2.0 l/min/m² (Group I) or 1.5 l/min/m² (Group II) for another h and finally one h with blood flow of 2.5 l/min/m². Regional tissue perfusion of brain, liver, kidney, and muscle will be measured with dynamic PET-CT before CPB and during the different blood flows. Systemic oxygen consumption will be estimated by measurement of mixed venous saturation and lactate, and regional muscle oxygen saturation \( (tSO₂) \) with near-infrared spectroscopy at the lower limb.
Results. Preliminary data of the first four pigs indicate existence of an organ hierarchy with preserved perfusion of the brain but affected muscle tissue perfusion in both groups of suboptimal blood flow. The last two pigs will be studied in May, and the results will be ready for presentation in September. Non-parametric statistical method will be used.

Discussion. To our knowledge this is the first study investigating organ hierarchy with dynamic PET-CT during profound systemic ischaemia due to suboptimal blood flows during normothermic CPB.

References

0-21
Prognosis value of tissue oxygen saturation recovery slope (RS) during a vascular occlusion test (VOT) in cardiogenic shock patients

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Introduction. Cardiogenic shock (CS) results in microcirculatory regulation disorder that may be involved in the development of multiorgan failure and death. Tissue oxygen saturation (StO₂) RS impairment after VOT in septic shock patients is associated with a poor outcome [1]. This study evaluates the prognosis value of dynamic thenar oxygen saturation response using a VOT during severe CS.

Methods. Adult patients treated for severe CS were included within the first 24 h after ICU admission for prospective StO₂ and VOT monitoring during 48 h and for retrospective observational analysis. StO₂, RS after VOT, serum lactate and haemodynamic parameters were compared between ICU survivors and non survivors at 0, 12, 24, and 48 h.

Figure 1
**Results.** Thirty-eight patients suffering from CS (mean ± SD: age 55 ± 14 ys; APACHE score 20.5 ± 11) were treated with inotropes (n = 28) and/or mechanical circulatory support (12 IAPB, 10 ECLS) and vasopressors (n = 33) without significant difference between groups. Mortality in ICU was 47%. The SOFA was more important in non-survivors (12.4 ± 3.3 vs. 9.7 ± 2.1; p < 0.01). The first measurement of RS (% s⁻¹) was low but faster in survivors than non-survivors (2.7 ± 0.9 vs. 1.9 ± 1; p = 0.02). Then, the RS increased early in survivors (to 4.5; p < 0.001) and not in non-survivors (to 2.2; p = 0.59) at H12. We found a cutoff value at 3.5 % s⁻¹ at H12 with 80% sensibility and specificity to predict mortality (Figure 1).

**Discussion.** Our results suggest that in patients treated for CS, the post-VOT StO2 RS within the first 24 h after ICU admission indicates a poor outcome if very low and without an early improvement despite intensive management.

**References**


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**Oral Session – Thoracic Anaesthesia**

**0-22**

**Continuous control of double-lumen endotracheal tube cuff pressure vs. standard management for the prevention of intra-operative pulmonary aspiration**

*Vanessa Díaz-Ravetllat¹, Gianluigi Li Bassi², Francisco Campos³, María Mayoral³, Ignacio Navales³, Ricard Navarro³, María José Jimenez³, Carmen Gomar³, María José Arguis³, Elisabet Aguilera³, Joan-Daniel Martí³, Neus Fabregas³, Francisco Lomeña³, Laureano Molins¹, Antoni Torres²*

¹ Hospital Clinic, Thoracic Surgery  
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³ Hospital Clinic, Nuclear Medicine  
⁴ Hospital Clinic, Anesthesiology, Barcelona, Spain

**Introduction.** Leakage of colonized oropharyngeal secretions across the double-lumen endotracheal tube cuff frequently occurs, particularly when the cuff is under-inflated. This potentially leads to postoperative pneumonia. We evaluated whether continuous control of the tracheal cuff pressure (PTCuff), in comparison with standard cuff management could avoid pulmonary aspiration.

**Methods.** Twenty-seven patients (64.7 ± 10.8 yr) undergoing elective lobectomy for lung cancer were enrolled into the study. Tracheal diameter was computed through CT scan. Tracheal cuff diameter was measured with a caliper. A 20-G epidural catheter was attached to the double-lumen tube to allow installation into the subglottic region. Following intubation, patients were randomized to receive continuous control of PTCuff (treatment group, 12 patients) through an electronic controller (Mallinckrodt pressure control, Covidiens, Boulder, USA) or standard care of PTCuff (control group, 15 patients). In the treatment group, PTCuff was maintained at 28 cmH₂O. In the control group, following intubation, the PTCuff was set at 28 cmH₂O.
with a manometer, and adjusted in cases of consistent signs of air leakage. Throughout the surgical procedure, nitrous oxide was never administered. Following placement of the patient into the lateral position for thoracotomy, 4-ml of a solution of methylene blue and 3.7 megabecquerels of $^{99m}$Tc-DTPA were slowly installed into the subglottic region. The half-life of the isotope is 6 h and is not orally absorbable. 1, 2 and 3 h after installation, we collected oropharyngeal and tracheal secretions to assess macro-aspiration through presence of methylene blue. Radioisotopic counting was performed using a gamma counter to evaluate micro-aspiration. Scintigraphic results were corrected for background activity, decay, and expressed as log10 of the counts per minute (cpm) per gr. Data were analysed through student’s t-test, Wilcoxon-Mann Whitney test, Chi-squared test and Friedman test. A two-sided $p < 0.05$ was considered statistically significant.

**Results.** The median double-lumen tube diameter was 39 Fr (range 35-41). The ratio between cuff and tracheal diameter was 1.71 ± 0.2 without difference between groups ($p = 0.990$). Macro-aspiration was detected in 20.0 and 23.3% of the samples in the treatment and control groups, respectively ($p = 0.736$). Mean oropharyngeal radioactivity was 5.5 ± 1.5 log10 cpm/gr. Tracheal secretion’s radioactivity was 2.4 ± 1.6 log10 cpm/gr in the treatment group and 2.8 ± 1.8 in the control group ($p = 0.213$). Additionally, tracheal secretion’s radioactivity was consistent at 1 h (2.8 ± 1.8), 2 h (2.4 ± 1.6) and 3 h (2.8 ± 1.8) after installation ($p = 0.437$).

**Discussion.** Our findings demonstrate that pulmonary aspiration across the double-lumen tracheal cuff is common during thoracic surgery, irrespective of continuous control of internal cuff pressure.

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**0-23**

**Effect of increasing age on the haemodynamic response to thoracic epidural anaesthesia**

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2 University Hospitals Ghent, Ghent, Belgium

**Introduction.** Sympathetic blockade with thoracic epidural anaesthesia (TEA) results in circulatory changes and may directly alter cardiac function. Aging is associated with an impairment of autonomic nervous system control and a deterioration of diastolic performance. We postulated that haemodynamic changes induced by TEA could vary with age.

**Methods.** Thirty-five patients scheduled for lung surgery and TEA, were stratified into three age groups (G1: < 45 y; G2: 45-65 y; G3: > 65 y). Cardiac performance was evaluated in awake patients immediately before and 45 minutes after institution of TEA using transthoracic echocardiography (TTE). Tissue Doppler imaging (TDI) and other echo-derived indices were used to quantify biventricular systolic and diastolic function. Cardiac Index was calculated using the LV outflow velocity time integral. For statistical analysis, we used the paired student’s t-test and linear regression analysis.

**Results.** After exclusion of five patients, 10 patients per age group were analysed. Baseline systolic and diastolic LV function and RV diastolic function decreased with age. After TEA, mean arterial pressure decreased (91.2 versus 79.2 mmHg, $p < 0.001$) and Cardiac Index increased (2.7 versus 3.0 l/min/m$^2$, $p = 0.005$), while heart rate and Doppler-derived indices of LV contractility remained unchanged. RV ejection indices increased, and TDI-derived measures of diastolic performance increased for the LV as well as the RV. Except for TAPSE that increased with increasing age ($R = 0.53$, $p$
Discussion. When preload is preserved with volume loading, TEA predominantly causes systemic vasodilatation and increases global haemodynamic performance. Indices of LV systolic function do not change while LV and RV diastolic function appear to improve. TEA effects on RV systolic function are inconclusive. While increasing age causes a consistent decline of baseline diastolic function, the cardiovascular response to TEA is not impaired in the elderly.

O-24
Acute permissive hypercapnia during one lung ventilation: impact on right ventricular function during lung resection

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Introduction. Mechanical ventilation with low tidal volume has been shown to attenuate lung injuries in critically ill patients. This study assesses the impact of acute permissive hypercapnia on haemodynamics, gas exchange and right ventricular function during one-lung ventilation (OLV) for pulmonary resection.

Methods. We studied 15 patients scheduled for pulmonary resection through a thoracotomy. Patients with pulmonary hypertension (systolic > 50 mmHg), intracranial hypertension or previous intracranial haemorrhage, pre-existing hypercapnia, co-existing metabolic acidosis, ischaemic heart disease, predicted postoperative FEV1 < 800 ml or < 40% of the expected in pneumonectomy were excluded. Patients had a standardized management for thoracotomies. Initial VT 10 ml/kg was reduced to 8 ml/kg after OLV and the rate adjusted to maintain PaCO2 4-4.7 kPa. Haemodynamic, respiratory variables and echocardiographic data were obtained at: T1, 15 min after establishing OLV with normocapnia, T2, 15 min after establishing OLV with hypercapnia (PaCO2 8 kPa (60 mmHg) and 9.3 kPa (70 mmHg) and pH > 7.1), and T3, 15 min after resuming OLV with normocapnia. One-way repeated measures ANOVA with post hoc Dunnet’s test were used for analysis. p < 0.05 is considered statistically significant.

Results. Values as mean (SD).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(T1)</th>
<th>(T2)</th>
<th>(T3)</th>
<th>p value</th>
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<tbody>
<tr>
<td>CO (l·min)</td>
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<td>RVSP (mmHg)</td>
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<td>TAPSE (cm)</td>
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<td>RVMPI</td>
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<td>0.33 (0.01)</td>
<td>0.33 (0.015)</td>
<td>&lt; 0.001</td>
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</tbody>
</table>

Discussion. OLV with permissive hypercapnia is likely to be tolerated in the short-term and beneficial in terms of attenuating lung injury.

O-25
Comparison between dopamine and phenylephrine in maintaining cerebral oxygen saturation in thoracic surgery

Ji Won Choi, Hyun Joo Ahn, Mi Kyung Yang, Jie Ae Kim, Eun Kyung Lee, Sangmin M Lee
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Introduction. Fluid restriction is recommended to prevent acute lung injury in thoracic surgery. In case of intra-operative hypotension, we therefore often administer vasoactive agents or inotropes. One lung ventilation (OLV) decreases arterial oxygenation, so that oxygen delivery to the brain can also be decreased. In this study, we compared dopamine and phenylephrine in maintaining cerebral oxygen saturation during OLV in major thoracic surgery.

Methods. Fifty patients aged 65 and more undergoing lobectomy were randomly
assigned to a dopamine (group D) or phenylephrine (group P) group. Mean blood pressure (MBP) was maintained within 20% of baseline by dopamine or phenylephrine continuous infusion. Desflurane 1 minimum alveolar concentration (MAC) and remifentanil were administered under bispectral index guidance. Cerebral tissue oxygen saturation (SctO2) by near infrared spectroscopy and haemodynamic parameters, including oesophageal cardiac Doppler measurement, were recorded at baseline, 15 min after induction, 30 and 60 min after OLV and 15 min after restart of two lung ventilation. T-test, Mann-Whitney test, Chi-squared test or Fisher’s exact test were conducted for the comparison between the two groups. Relationship between various factors and SctO2 was analysed by Pearson’s correlation.

**Results.** Dopamine was better in maintaining SctO2 during OLV than phenylephrine (72 vs. 66%, p = 0.011). The number of patients whose SctO2 < 60% during operation was higher in the group P (4 vs. 12 p = 0.016). Group D showed a higher cardiac index (CI) and lower MBP than group P (2.9 vs. 2.4 l/min/m², 77 vs. 84 mmHg, p = 0.029, 0.017). Age and CI were correlated with SctO2. There were no differences in the incidence of postoperative delirium, atrial fibrillation, mechanical ventilation or intensive care unit hours between the two groups.

**Discussion.** Dopamine was superior to phenylephrine in maintaining SctO2 during OLV. Dopamine showed a higher CI than phenylephrine and CI was correlated with SctO2.

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**O-26 Double-lumen tube vs. video-assisted Cohen blocker for mini-invasive mitral valve surgery**

**Vincenzo Pota, Vincenzo Schiavone, Giuseppe Pescatore, Silvio Allocca, Agostino Cantiello, Cleamaria De Bonis, Salvatore Di Maio, Alfonso Di Lorenzo, Ottavia Ferrone, Salvatore Giordano, Tito Passannanti, Paolo Pepino, Vincenzo Sferragatta, Viviana Ventriglia, Paola Vosa, Sara Schiavone**

**Pinetagrande Private Hospital, Castelvolturno, Italy**

**Introduction.** Mini-invasive mitral valve surgery is one of heart surgical procedures requiring single lung ventilation. The most commonly used devices are the double-lumen tube (DLT) and different models of endobronchial blockers. The aim of this randomized controlled study was to compare the efficacy and the safety of Cohen endobronchial Blocker (CB) placed with Et-view vs. DLT in mini-invasive mitral valve surgery.

**Methods.** After Ethics Committee approval and informed written consent, 30 patients undergoing elective mini-invasive mitral valve surgery via right mini-thoracotomy were included. Exclusion criteria were age < 18, ASA IV or patients with a suspected difficult airway. Patients were randomly allocated into two groups: DLT and CB. The DLT group was intubated with a left-side DLT using conventional laryngoscopy. The CB group was intubated with an Et-view tube, and then the Cohen endobronchial blocker was placed into the right bronchus under continuous bronchial vision. Efficacy parameters were: time to initial tube placement (TIP); the incidence of displacement; the time to correct replacement; the grade of satisfaction of surgeons on lung collapse and the grade of difficulty in using the devices.

**Results.** The placement of DLTs was faster than CBs (TIP: 85 sec ± 35 vs. 130 ± 95 sec). After posturing patients into the correct surgical position there were 2 cases of dis-
placement of the DLT with the necessity of fibreoptic broncoscopy (mean time 185 sec) vs. 1 in the CB group which was immediately resolved with the Et-view (mean time 40 sec). There was no difference in the grade of satisfaction of surgeons. The degree of difficulty (DLT vs. CB) for anaesthesiologists was very easy in 50% vs. 66%; easy 15% vs. 33%; medium 2% vs 10%; worse 13% vs 5%. All patients were then transferred to UTI, but in the DLT group, it was necessary to change to a single tracheal tube for the DLT to facilitate respiratory weaning.

Discussion. Although time for intubation was longer in the CB group, there was a minor incidence of displacement and more rapid replacement of CB thanks to Et-view. The efficacy of single lung ventilation was the same. There were also advantages of Et-view CB in cases of unsuspected difficult airway. Moreover after heart surgery with the necessity of progressive awakening and weaning in the UTI, the DLT has to be changed to a normal single lumen tube. So, Et-view CB can be considered a valid alternative device for mini-invasive mitral valve surgery.

Oral Session – Electrophysiology

0-27
Implementation of a modified WHO checklist for the cardiac catheterization laboratory – a complete audit cycle

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Introduction. In 2007, the World Health Organization (WHO) trialled a surgical checklist and demonstrated a significant reduction in both major complications and 30-day mortality [1]. In the UK, this checklist is mandatory for all surgical procedures. Uptake for medical procedures has been variable. Our quaternionary referral cardiac catheterization laboratory (Cath Lab) frequently performs complex invasive procedures. Following a patient safety incident, we suspected that we were not utilising the WHO checklist to its fullest extent and proposed changes to the form aimed at providing specialty-specific safety checks and improving its use in this environment. We conducted audits before and after the introduction of this modified checklist.

Methods. We conducted a Trust-registered audit, during which we observed whether each of the three sections (sign-in, time-in, time-out) was carried out for 20 Cath Lab cases, and if these sections were documented as completed. Feedback was then sought from the Cath Lab team, and the WHO checklist was modified to make it more appropriate for use in this area. After staff training, our audit was repeated for 34 further cases.

Results.

<table>
<thead>
<tr>
<th>Section</th>
<th>Initial Audit n = 20 (%)</th>
<th>Re-audit n = 34 (%)</th>
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<tr>
<td>Time-out</td>
<td>2 (10)</td>
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Two patient safety incidents were reported during the initial audit; none were reported in the subsequent re-audit.

Discussion. Initial audit results were poor. Sections of the checklist were documented as completed, despite never being carried out, suggesting it was treated as a ‘tick-box’ exercise rather than a patient safety tool. Following staff engagement and the development of an area-specific checklist, we demonstrated improvement in both completion and documentation in all sections of the checklist.

References
Introduction. In our cardiac catheterization laboratory (CCL), several procedures are performed with the aid of transoesophageal echocardiography (TOE). In this setting, we use general anaesthesia (GA) [1]. Use of laryngeal mask airways is technically difficult due to space constraints. We designed an observational study about the feasibility to perform total intravenous anaesthesia (TIVA) and volume support mechanical ventilation (VMV) through the new laryngeal mask airway (LMA) Baska mask (BM) and the simultaneous use of TOE monitoring.

Methods. Ten patients ASA III-IV scheduled for percutaneous cardiac techniques in the CCL were included (Table 1). The anaesthetic technique chosen was TIVA propofol (bolus 1.5-2.5 mg/kg plus continuous iv. infusion 5 mg/kg/h) and remifentanil (0.15 µg/kg/h). The BM was inserted, and the ease of success and technical features were recorded. VMV was set at VT of 8 ml/kg and RR of 10/min to obtain normocapnia and SaO₂ > 96%.

Results. Insertion rate success was 100%. Two BM were changed after insertion because the size first selected was deemed not correct. The management of the TOE probe was feasible in all patients. In one patient, severe laryngospasm occurred during TOE probe insertion, which was resolved successfully.

Discussion. Percutaneous interventional cardiology is an expanding area. TIVA is used because it provides safety and a rapid recovery. The BM supraglottic device is a new LMA with special characteristics: A bite block over the full length of the airway; a self-sealing membranous variable-pressure cuff; a large sump cavity with two aspiratable gastric drain tubes. The cuff is not an inflatable balloon but increases laryngeal pressure seal with every mechanical breath when VCV [2]. Our preliminary study highlighted the feasibility to technically insert and perform TOE monitoring during VMV with the BM.

References

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Remote ischaemic preconditioning for elective abdominal aortic aneurysm (AAA) repair: a randomized controlled trial to assess feasibility

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Introduction. Remote ischaemic preconditioning (RIC) is a brief episode of ischaemia-reperfusion with a limb tourniquet that protects against a subsequent longer ischaemic insult. Small clinical trials demonstrated it can protect organs during cardiovascular surgery. This study investigated the feasibility of RIC in elective AAA surgery, a specialty that is undergoing significant organizational change, to inform the design of a large RCT.

Methods. Consecutive patients presenting for elective AAA repair (using the open or EVAR approach) were assessed for eligibility. Consented patients were randomized to receive either RIC (three cycles of 5 min ischaemia and 5 min reperfusion in the upper arm immediately before surgery) or a sham procedure. Blood samples to measure serum creatinine and troponin levels were taken after surgery and on the first 2 postoperative days. Patients were followed-up for 6 months. We assessed the practicability and acceptability of the intervention, and success of blinding through interviews with patients and staff. A study in 60 participants (30 Open and 30 EVAR procedures), was considered sufficient to provide recruitment estimates with adequate precision to inform a larger definitive trial; e.g., 50% eligible patients recruited (worse-case scenario) would be estimated with a 95% confidence interval of ±13%. The study was not powered to compare outcomes between the RIC and sham groups.

Results. Ninety-eight patients underwent surgery during the study period, 93 were screened for the trial, and 84 were eligible to take part. Of these 70 were approached and 69 patients consented to participate. Thirty-four participants were randomized to RIC and 35 to a sham procedure. By chance, the complexity of EVAR surgery was higher in the RIC group. Overall, 28/69 participants (41%) had acute kidney injury (AKI) following surgery. In the majority of cases the injury was graded as AKIN 1 (16 participants, 23%). AKI occurred more frequently in the RIC group (47% vs. 34%). Cardiac events were also more common in the RIC group (MI 15% vs. 6%; new arrhythmias 21% vs. 14%; Troponin T > 14 ng/l 47% vs. 29%). There were 3 deaths, one in the RIC group and 2 in the sham group. Post procedure interviews indicated that patients and staff remained blinded to the allocation and that the procedure was acceptable. There were no adverse events secondary to the intervention.

Discussion. This study provides essential information for the planning and design of a multi-centre RCT to assess the effectiveness of RIC for improving clinical outcomes for patients having elective AAA surgery. Consent was high and the RIC intervention can be carried out with minimal disruption to clinical care and the time taken for anaesthetic or surgical procedures.
Adherence to ACC/AHA guidelines does not decrease the incidence of MI in post-PCI patients undergoing non-cardiac surgery

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Introduction. It is estimated that 5-16% of patients (pts) previously treated with Percutaneous Coronary Intervention with stents (PCI) will present for elective non-cardiac surgery (NCS) within the year. The ACC/AHA guidelines for management of these pts suggest a combination of delaying NCS and the continuation of anti-platelet therapy (APT) with aspirin (ASA) and/or clopidogrel for up to 1 year. Despite these recommendations, the incidence of peri-operative myocardial infarction (MI) in these patients (pts) remains very high. The objective of this multi-centre prospective, cohort study was to determine if the guidelines and specifically APT decreased the incidence of MI in this population. The secondary objective was to determine the mechanism of MI in post-PCI pts undergoing NCS.

Methods. After REB approval, pts after previous PCI scheduled for elective NCS were recruited for this prospective study. The primary outcome was MI. The incidence of MI was blindly adjudicated in duplicate using the 3rd Universal Definition of MI. Troponin levels were measured every 8 h for the first two days postoperatively, then once daily until discharge in addition to ECG measurements. All pts were followed up for any clinical symptoms of MI. The location of MI was judged according to its location (area of stent or not). The platelet inhibition by ASA and clopidogrel was measured using Platelet Mapping Assay (PMA). PMA was performed pre- and post-operatively and at 24 h after surgery. Pts’ demographics and pre-operative characteristics were summarized using descriptive statistics. We used restricted cubic spline plots to evaluate the nature of the association of platelet inhibition (continuous variable) and the risk of MACE (logit transformation). Univariate analyses applied chi-squared or Fisher’s exact test for categorical data, and t-test and Mann-Whitney U test for continuous data.

Results. A total of 190 pts were recruited. Thirty pts were excluded from analysis (day case surgery or lack of third PMA). The incidence of MI was 19%. Pts operated within 60 days of PCI had an increased risk of MI > 60%. Pts exposed to ASA within 5 days of surgery had better PMA than non-exposed pts. The area of the MI occurred most frequently in the location of the stent placement (71%). Percentage of inhibition was analysed as a continuous variable. There was no difference in the PMA between pts suffering from MI and those who did not. Factors that were associated with increased MI included higher Revised Cardiac Risk Index, specifically elevated creatinine, and a history of diabetes. Pre- and post-operative anaemias were independent predictors of MI.

Discussion. In this prospective study, PMA adequately indicated platelet inhibition when ASA was stopped prior to surgery. However, the use of ASA or its withdrawal were not associated with MI. This increased risk of MI was associated with chronic renal failure, diabetes and anaemia. Future interventional trials should incorporate these findings.
0-31
Identification of the guidewire in the brachiocephalic vein to confirm guidewire placement during internal jugular central venous catheter placement

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Introduction. Ultrasound (US) visualization of the guidewire in the internal jugular vein (IJV) during central venous catheterization (CVC) is often used to verify proper guidewire placement and to aid in prevention of inadvertent arterial cannulation. However, inadvertent arterial cannulation can occur despite visualization of the guidewire in the IJV. Visualizing the guidewire in the brachiocephalic vein (BCV) might be a more reliable method of confirming proper guidewire placement.

Methods. This prospective feasibility study included 76 adult patients undergoing cardiothoracic procedures. The aim of the study was to assess the likelihood of obtaining US imaging of the guidewire in the BCV during CVC placement. All of the images were acquired by anaesthesiology trainees under direct supervision of one of the investigators. The guidewire was imaged in the IJV in short axis view and the transducer was then angled caudally under the clavicle, following the guidewire until the BCV appeared in the view.

Results. The BCV was imaged in all patients. There were 4 out 76 (5%) failures to visualize the guidewire in the BCV. In 2 patients, the guidewire was not clearly visualized in the BCV due to presence of multiple pacemaker/defibrillator wires and a pre-existing CVC. In another 2 patients, the guidewire was not visualized in the BCV because it coiled in the IJV (confirmed by a long axis view of the IJV). The guidewire was then visualized in the BCV on the second attempt after it was repositioned. There was a single arterial puncture, but no arterial cannulations.

Discussion. Visualizing the guidewire in the BCV assures that the guidewire is not curled in the IJV, mispositioned in the subclavian vein, or inadvertently placed in an artery. Imaging the guidewire in the IJV alone does not rule out arterial placement because the wire may continue through the far wall of the IJV and into an adjacent artery. Our preliminary data suggests that the BCV can be imaged routinely, although interference from pre-existing wires or catheters may obscure the guidewire.

0-32
Treatment of gram-positive cardiovascular infections with daptomycin or vancomycin: a retrospective analysis of efficacy and nephrotoxicity

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2 Pharmacy Lapeyronie hospital, Montpellier, France

Introduction. Gram-positive organisms are a leading cause of infection for patients undergoing cardiovascular surgery as a reason or a complication of surgery. Furthermore, these patients are at high risk for postoperative renal impairment. Some antibiotic drugs are known to further impair renal function [1], which can necessitate renal replacement therapy (RRT). The aim of our study was to evaluate whether the use of a less nephrotoxic drug such as daptomycin (DAP) for high-risk patients (rate of RRT about 5%) leads to improved efficacy, outcomes and reduced cost of medical care in comparison with vancomycin (VAN).

Methods. All patients who received either DAP or VAN in the ICU prior to or after cardiovascular surgery from January 2010 to June 2012 were included in this retrospective cohort study. We excluded patients with end stage renal disease and length of treatment less than 48 h. The main purpose was
to compare the incidence of a 20% decrease in creatinine clearance measured by MDRD formula for the two drugs. Secondary objectives were the incidence and duration of RRT in ICU, mortality and clinical success rates.

Results. Seventy-five patients were included. Infections were: endocarditis (n = 18), vascular graft infections (n = 14), ventricular assist device infections (n = 7), catheter-related infections (n = 8), operative site infections (n = 13) and miscellaneous (n = 15). A decrease in creatinine clearance > 20% or need for RRT during treatment occurred more frequently with VAN 74% vs. 48% with DAP, \( p = 0.024 \). The maximum decrease in MDRD was significantly higher with VAN (–32%) versus DAP (–14%), \( p = 0.032 \). RRT was required at the beginning or during antibiotic therapy for 9 DAP patients (31%) and 19 VAN patients (41%), \( p = 0.465 \). The incidence of RRT for more than 5 days was 10% with DAP vs. 35% with VAN, \( p = 0.028 \). When RRT was started before antibiotic therapy (n = 18), duration of RRT was significantly reduced with DAP (3 days) versus VAN (22 days), \( p = 0.019 \). Treatment discontinuation (n = 35/61) and clinical failure (n = 14/48) of initial antibiotic therapy occurred more likely with VAN (71% and 42%) than with DAP (35%, \( p = 0.021 \) and 14%, \( p = 0.024 \)).

Discussion. Nephrotoxicity is a clinically relevant issue in ICU that leads to discontinuation of VAN therapy with a negative impact on treatment efficacy. DAP appears to be safer than VAN with regard to renal function in a high risk population and may reduce duration of RRT, with a potential economic impact.

References

0-33
Randomized trial of fish oil infusion to prevent atrial fibrillation after cardiac surgery: data from implantable continuous cardiac monitor

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Introduction. The effectiveness of ω-3 polyunsaturated fatty acids (PUFA) for the prevention of postoperative atrial fibrillation (POAF) in cardiac patients is questionable. We hypothesized that peri-operative ω-3 PUFA infusion would reduce the incidence of POAF as assessed by performing subcutaneous continuous cardiac monitoring (CCM).

Methods. In a single-centre, prospective, double-blind, placebo-controlled trial a sample size of 148 patients was calculated to provide 80% power to detect a reduction in the event rate from 30% to 15%. The study was suspended when the first interim analysis showed a higher incidence of event in the intervention group at 10 days of follow-up and terminated due to futility when this trend was supported at the 2-year follow-up. Thus, 39 patients undergoing coronary artery bypass graft surgery (CABG) under cardiopulmonary bypass (CPB) were randomly assigned to receive either ω-3 PUFA infusion (200 mg/kg/day starting before anaesthesia induction for 24 h followed by 100 mg/kg/day from postoperative day [POD] 2 to POD 7) or placebo. A continuous cardiac monitor (Reveal XT®, Medtronic Inc., USA) was implanted intra-operatively after the CABG in the parasternal area of the chest of all patients. The primary outcome was freedom from atrial fibrillation (AF) at 2-year follow-up. AF was defined as AF burden > 0.5%. Data from CCM was collected on POD 10 and 3, 6, 12, and 24 months after surgery.

Results. POAF developed in 4 (19%) patients in the control group and in 5 (27.8%)
patients in the ω-3PUFA group at 10-days follow-up \( (p = 0.88) \). At 2-years follow-up, 5 (27.8\%) patients in the control group and 6 (35.3\%) patients in the ω-3PUFA group had AF \( (p = 0.9) \). AF duration predicted risk of cardiovascular hospitalization at the 2-year follow-up (regression coefficient estimate = 0.24, standard error 0.02, \( p < 0.0001; R^2 = 0.74 \)).

Discussion. Infusion of ω-3PUFA failed to prevent the occurrence of new-onset AF immediately after the operation or AF burden in 2 years after CABG surgery. The AF burden registered on performing CCM at the 2-year follow-up was a significant predictor of adverse outcome.

Oral Session – Best Orals

O-34
Effect of anti-platelet drugs on platelet microparticles during on-pump cardiac surgery

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Introduction. Platelet microparticles (PMP), sub-micron sized vesicles released from activated platelets, are involved in haemostasis, but little is known about the effect of anti-platelet drugs on PMP populations. Patients receiving aspirin and clopidogrel in the week before their cardiac surgery are at an increased risk of postoperative bleeding.

Methods. This prospective observational study gathered data from 137 patients undergoing on-pump cardiac surgery, of which 65 received aspirin and/or clopidogrel in the 7 days before their operation while 62 did not. Pre-anaesthetic, intra-operative (pre- and post-heparin, pre- and post-crossclamp, after crossclamp removal, and post-protamine) and both 1 and 5 days postoperative blood samples were analysed by flow cytometry for microparticle counts and expression of platelet-specific antigens (CD41, CD42, CD61 and CD62P). Blood-product transfusions and postoperative blood-loss were recorded. Platelet inhibition was analysed using Multiplate® to identify non-responders.

Results. PMP numbers decreased by 54\% at the onset of CPB in both groups, even when accounting for haemodilution. There was no significant difference in PMP numbers or antigen expression between the two groups, even when platelet inhibition was accounted for. Despite this, patients who exhibited platelet inhibition from aspirin and/or clopidogrel had a relative risk of intra-operative blood-product transfusion of 6.0 \( (p = 0.01) \) and of blood-product transfusion in the 24 h following surgery of 2.6 \( (p = 0.02) \). There was no significant difference in mean blood loss in the 12 h following surgery between patients in the anti-platelet drug group and those in the control group (382 ml, 95\% CI 326-444 ml, vs. 354 ml, 95\% CI 295-422 ml, \( p = 0.62 \)).

Discussion. Pre-operative aspirin and/or clopidogrel do not affect the numbers of PMP produced during cardiac surgery. The increased risk of transfusion in the anti-platelet group could be a result of proactive steps to infuse coagulation products more readily in patients receiving pre-operative anti-platelet drugs in order to minimise blood-loss in this group.

O-35
Systemic and pulmonary phenotypes in relation to postoperative hypoxaemia

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Introduction. The association between exposure to major surgery and impaired oxygenation is well known, but the mechanisms that drive this effect remain unclear. We have previously shown that exposure to coronary
artery bypass grafting (CABG) severely affects human metabolome. The purpose of this study is to further characterize the systemic (pulmonary artery, PA) and pulmonary (left atrium, LA) phenotypes first morning postoperatively and to identify events that contribute to the development of hypoxaemia.

**Methods.** Fifty patients undergoing CABG were included in this study. Blood gases, C-reactive protein (CRP), lactate dehydrogenase (LDH), and 70 metabolites measured by nuclear magnetic resonance spectroscopy were analysed by paired t-test, Pearson correlation, and regression analysis. A p-value below 0.05 was considered significant.

**Results.** Thirty-four patients showed decreased oxygenation on the third day postoperatively. In order to characterize systemic and pulmonary microvasculature responses to surgery, LA and PA samples were compared. Elevated levels of LDH, metabolites involved in mitochondrial respiration, energy supply, reactive oxygen species (ROS) formation, oxidative stress, inflammation, fatty acids, together with lower levels of CRP, lipoproteins, antioxidants, and ketone bodies were found in LA compared to PA samples of patients developing hypoxaemia. Interestingly, more similar phenotypes were observed in patients with normal oxygenation, indicating more protected mechanisms. In addition, metabolites involved in mitochondrial respiration, ROS formation, and inflammation were found both correlating \((r > 0.4-0.51, p < 0.009)\) and showing high predictive power \((r = 0.9, p < 0.0001)\) to the indices of hypoxaemia measured on the third day postoperatively.

**Discussion.** We report different systemic and pulmonary phenotypes in patients developing hypoxaemia postoperatively. Further, metabolites involved in mitochondrial respiration, ROS production and inflammation were identified as cornerstones contributing to the triggering mechanisms involved in the progression of postoperative hypoxaemia.

**0-36**

**Goal-directed crystalloid fluid resuscitation does not increase extravascular lung water content in cardiac surgery patients: a randomized pilot study**

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**Introduction.** The ‘right’ fluid for hypovolaemia treatment without evoking pulmonary oedema is still unclear, particularly in cardiac surgery patients. The aim of the study was to investigate the effect of crystalloid as compared to colloids on extravascular lung water index (EVLWI) in patients who underwent on-pump coronary artery bypass surgery (CABG).

**Methods.** Based on sample size estimation \((\alpha = 0.05, \text{power } = 0.8)\) each intervention arm required 15 patients. Patients were randomized to receive either balanced crystalloid (group I) or balanced 6% hydroxyethyl starch 130/0.42 (group II) or 4% gelatin (group III). Fluids were administered to maintain global end-diastolic volume index (GEDVI) determined by trans-pulmonary thermodilution (PiCCO plus) within 680–850 ml/m². Primary (EVLWI) and secondary (fluid balance, lactate, SvO₂, haemodynamics) outcome measures were assessed at baseline (T1), 5 min before CPB (T2), 5 min after CPB (T3), at the end of surgery (T4), 2 h (T5), 4 h (T6), 6 h (T7), 12 h (T8), and 24 h after surgery (T9). For statistical analysis, Kruskal-Wallis test and post-hoc analysis with Mann-Whitney U test with Bonferroni correction were used.

**Results.** There were no differences in EVLWI among the groups (Figure 1). Values of GEDVI were similar among the groups. It was provided by significantly higher fluid balance in group I \([1,570 \text{ ml (750-1,920)}]\) compared with group III \([0 \text{ ml (–515-380)}]\) and group II \([–300 \text{ ml (–663-165)}]; p
< 0.017] at 24 h after surgery, but fluid balance was comparable at the end of surgery. No significant differences were observed in SvO2, lactate, and haemodynamics values among the groups.

**Discussion.** The study showed that within the goal-directed haemodynamic algorithm to optimize preload in CABG patients, balanced crystalloid does not increase extravascular lung water content when compared with colloids. However, the algorithm was reached by about 200% more fluid balance in the crystalloid group, as compared to colloids, at 24 h after surgery.

**0-37**

*In vitro endothelial cell barrier disruption after exposure to plasma from patients subjected to cardiopulmonary bypass*

**Christa Boer, Martijn Overmars, Nick Koning, Charissa Van Den Brom, Geerten Van Nieuw Amerongen**

*Vu University Medical Center, Amsterdam, The Netherlands*

**Introduction.** Cardiopulmonary bypass (CPB) for cardiac surgery is suggested to be associated with postoperative vascular leakage. We investigated the effects of non-pulsatile or pulsatile CPB-induced plasma changes on *in vitro* endothelial barrier function and evaluated whether these changes could be ascribed to haemodilution.

**Methods.** Plasma samples of patients undergoing elective coronary artery bypass graft surgery randomized for non-pulsatile (n = 20) or pulsatile (n = 20) CPB were obtained after anaesthesia induction (pre-CPB), after
protamine administration (post-CPB; ≈ 30% haemodilution) and upon intensive care unit (ICU) arrival. Using Electric Cell-substrate Impedance Sensing (ECIS) with human umbilical vein endothelial cells exposed to 10% plasma, the effects of CPB on in vitro endothelial barrier function were assessed. We further obtained a dose-response relation of different dilutions (3x, 5x and 10x) of plasma drawn before CPB with barrier function. Between group differences were analysed by repeated measures ANOVA. \( p < 0.05 \) was considered as statistically significant.

**Results.** In vitro endothelial barrier function after exposure to post-CPB and ICU plasma was 21% (Resistance 784 ± 91 \( \Omega \); \( p < 0.001 \)) and 20% (Resistance 792 ± 106 \( \Omega \); \( p < 0.001 \)) lower compared to pre-CPB samples (Resistance 993 ± 153 \( \Omega \)). No beneficial effect was found of pulsatile CPB-flow: post-CPB (Resistance 778 ± 130 \( \Omega \)) and ICU plasma samples (Resistance 802 ± 150 \( \Omega \)). During CPB, haematocrit decreased by 31% from 0.39 ± 0.04 to 0.27 ± 0.04 L/L (\( p < 0.001 \)). Steady-state barrier function with 3x diluted post-CPB plasma (Resistance 1,142 \( \Omega \)) was still lower when compared to 10x diluted pre-CPB plasma (Resistance 1,183 \( \Omega \)), suggesting that reduced post-CPB endothelial resistance could not overtly be explained by haemodilution.

**Discussion.** Cardiopulmonary bypass-related changes in the constitution of human plasma have a profound negative effect on in vitro endothelial barrier function. The human plasma-induced alterations in in vitro endothelial barrier function could not be prevented by pulsatile flow during CPB.

**0-38 Acute myocardial and skeletal muscle injury after serial transthoracic shocks as detected by cardiovascular magnetic resonance in swine**

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**Introduction.** It is controversial to what extent cardioversion or defibrillation damage the myocardium. Features of acute myocardial injury are oedema and hyperaemia, which can be visualized by T2 mapping and early gadolinium enhancement (EGE), respectively.

**Methods.** Sixteen swines were anaesthetized; ten were treated with R-triggered synchronized 5x200J transthoracic shocks; six served as control. T2 maps in 3 short-axis (SAX) slices at 3T, and SAX function cines were obtained hourly during a 5 h observation period. Regions of interests (ROI) were visually defined in T2 maps. Early (EGE) and Late Gadolinium Enhancement (LGE) images were acquired at the end of the protocol. EGE was normalized to healthy skeletal muscle and expressed as an EGE-Ratio.

**Results.** T2 increased in the affected ROI at 1 h, 3 h and 5 h post defibrillation, which differed from remote myocardium of the same animals (\( p < 0.05 \)) and from control animals. T2 changes corresponded to the defibrillation pad locations and were most pronounced in the basal slices. In the basal images EGE-Ratios of the shocked pigs were significantly higher in the left ventricle (3.1 ± 0.4 vs. 2.1 ± 0.2; \( p = 0.02 \)) and the pectoral muscle (2.7-fold, \( p = 0.03 \)) than in controls. T2 of the left pectoral muscle was also increased at all time points compared to baseline and to contralateral muscle (\( p \)
There was a decrease in end-diastolic volume at 3-5 h post-shock (nadir, –13%; \( p < 0.05 \)), while cardiac output was depressed after 3 h (–10 ± 4%) and 5 h (–18 ± 7%; \( p < 0.05 \)). There was no change in systolic volume or ejection fraction.

Discussion. Serial cardioversion/defibrillation consistently results in myocardial injury. This can be visualized by T2 mapping (oedema) and early gadolinium enhancement (hyperaemia), and is associated with signs of diastolic dysfunction.

Oral Session – Lung

0-39
Adverse pulmonary changes following cardiopulmonary bypass: separate assessment of bronchoconstriction and lung peripheral derecruitment

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\(^2\) Department of Medical Physics and Informatics, Szeged University, Szeged, Hungary

Introduction. Cardiopulmonary bypass (CPB) induces adverse alterations in the pulmonary system. However, the effects of CPB on the airway and lung tissue mechanical changes have not been related to those indices reflecting ventilation heterogeneities and anatomical and functional dead spaces.

Methods. We enrolled anaesthetized, mechanically ventilated patients (n = 46) undergoing elective cardiac surgery under open-chest condition. Forced oscillation technique was applied to measure the airway resistance (\( R_{aw} \)), inertance (\( I_{aw} \)), lung tissue damping (G) and elastance (H). Mainstream capnography was used to assess the third phase slope of the expired CO\(_2\) concentration (\( S_{III} \)) and the respiratory dead space parameters. Fowler’s dead space (\( V_{D_f} \)) reflecting the volume of the conductive airways, Bohr’s dead space (\( V_{D_B} \)) including also the unperfused alveolar volume, and Enghoff’s dead space (\( V_{D_E} \)) comprising additionally the volume of the perfused, but not ventilated alveoli were assessed. Accordingly, the intrapulmonary shunt was estimated by calculating the \( V_{D_E}-V_{D_B} \) difference. All mechanical and ventilation variables were assessed before CPB and 5 min after weaning from CPB. The measurements were preceded by a recruitment maneuver to minimize the extent of atelectasis and to standardize the volume history. Paired t-tests were used for the statistical analyses.

Results. Following CPB, significant increases in \( R_{aw} \) (143 ± 15 [SE]%), decreases in \( I_{aw} \) (–178 ± 25%) and \( V_{D_F} \) (–10 ± 0.1%) were observed. \( S_{III} \) (38 ± 17%), G (130 ± 6%) and H (7 ± 0.5%, \( p = 0.024 \)) were elevated post-CPB. The CPB-induced decreases in \( V_{D_B} \) (–12 ± 0.1%) were associated with significant rises in \( V_{D_E}-V_{D_B} \) (38 ± 0.6%) (\( p < 0.001 \) for all).

Discussion. The development of airway narrowing along with their shortening can be anticipated from the rise of \( R_{aw} \) with concomitant drops of law and \( V_{D_f} \) after CPB. Enhancement of ventilation heterogeneities is suggested by the CPB-induced increases in \( S_{III} \), G and H. These adverse lung peripheral changes led to increased \( V_{D_E}-V_{D_B} \) indicating augmented intrapulmonary shunting subsequent to CPB. In conclusion, combination of forced oscillatory and bedside capnography measurements revealed that constriction of the central conducting airways are associated with loss of alveoli and increased ventilation/perfusion mismatch following CPB.
Scavenging of volatile anaesthetics during long-term sedation of critical care patients

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Toronto General Hospital, Toronto, Canada

Introduction. Volatile anaesthetics are theoretically ideal sedative agents for long-term ICU sedation. However, the administration of volatile-based sedation within ICUs has been partly limited by concerns regarding staff exposure and atmospheric pollution. Previously, our group developed a simple scavenging system to be used with the Anaesthesia Conserving Device (AnaConDa®, Sedana Medical, Sweden) and demonstrated atmospheric volatile concentration levels were below current Canadian limits for occupational exposure (< 2 ppm) during short-term sedation study [1, 2]. We are currently running the ‘Volatile Anesthetics for Long-term Sedation in Critically Ill Patients (VALTS)’ study. This sub-study reports our initial data on atmospheric isoflurane levels during this long-term ICU sedation study.

Methods. VALTS is a prospective, multi-centre RCT recruiting 60 ICU patients requiring mechanical ventilation > 48 h. With REB approval, 60 patients will be randomized to receive either isoflurane via AnaConDa® (40 patients) or intravenous propofol and/or midazolam (20 patients). Sedation is titrated to a sedation agitation scale (SAS) score of 3-4 (unless medically indicated otherwise) using an explicit sedation-analgesia protocol until extubation or tracheostomy. Isoflurane is infused at low rates of 0.5-5 ml/hour. Atmospheric pollution is minimized using a combination of ICU room air exchanges and our previously developed active scavenging system. This system comprises 2 Deltasorb® canisters (Bluezone, ON, Canada) arranged in-series from the expiratory port of the ICU ventilator to wall outlet suction. Isoflurane concentrations were measured daily using the InfraRan Specific Vapour Analyzer (Wilkins Enterprise Inc.) at 4 points along the system – (1) Expiratory port, (2) Post 1st Deltasorb, (3) Post 2nd Deltasorb, (4) Patient’s head.

Results. Twelve patients received isoflurane for a mean (standard deviation) 4.5 (3.2) days. There were no technical difficulties pertaining to the scavenging system or AnaConDa®. The mean (SD) isoflurane levels at the expiratory port, post 1st Deltasorb, post 2nd Deltasorb and around the patient’s head were 5.4 (3.3) ppm, 3.3 (1.6) ppm, 1.9 (1.4) ppm, and 0.5 (0.6) ppm respectively.

Discussion. This sub-study shows volatile anaesthetics can be safely administered, with atmospheric levels well below current Canadian occupational exposure guidelines for long-term sedation in critical care environments.

References
Oral Session – Renal

O-41
Risk factors of acute kidney injury in adult cardiac surgical patients operated with use of cardiopulmonary bypass

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Introduction. Accurate risk prediction of acute kidney injury (AKI) morbidity after open heart surgery with cardiopulmonary bypass (CPB) is vital for the appliance of preventive measures and avoidance of additional risk factors.

Methods. A prospective observational cohort of 492 adult patients referred to open heart surgery with use of CPB who signed a written consent were studied. Pre-operative EuroSCORE-II variables, intra-operative data, and levels of two cytokines measured in serum with flow cytometry bead array 3 h after the operation were adjusted in simple and logistic regression against capability to predict early postoperative AKI according to RIFLE classification. Three patients with low output/end stage renal disease were excluded. For normally distributed data, means and standard deviation (SD) were compared with ANOVA test. Non-homogeneous distributed data were compared by medians and interquartile ranges (IQR) with Kruskal-Wallis test. Bartlett’s test was used to analyse inequality of population variances. Univariate and multiple logistic regression was used to test significant associations between risk variables and AKI with p-value considered significant when ≤ 0.05.

Results. The characteristics of 100/489 (20.4%) AKI-cases (s. Table 1).

A logistic regression model consisting of EuroSCORE (aOR-2.1), intra-operative complications (aOR-4.1), intra-operative base excess (aOR-1.9), postoperative ICAM-1 (aOR-1.8) and IL-6 (aOR-1.9) proved significant risk factors with sensitivity-95.5%, specificity-100%, negative predictive value-93.1%, precision-100%.

Discussion. Previously identified risk factors of AKI were confirmed as reliable risk-predictors. However, intra-operative complications were related to the highest risk of AKI after cardiac surgery with CPB. Our study confirmed the value of an early increase of IL-6 and ICAM-1 concentrations as AKI predictors in cardiac surgical patients.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>no-AKI</th>
<th>Risk</th>
<th>Injury</th>
<th>Failure</th>
<th>p-value</th>
<th>OR for AKI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. (%)</td>
<td>389 79.4%</td>
<td>74 (15.1%)</td>
<td>17 (3.5%)</td>
<td>9 (1.8%)</td>
<td>0.0001</td>
<td>2.2; 4×10-4</td>
</tr>
<tr>
<td>EuroSCORE-II</td>
<td>4.3; 2.3-7.0</td>
<td>5.9; 4.1-8.4</td>
<td>5.2; 4.4-9.2</td>
<td>10.6; 3.7-19.1</td>
<td>0.0001</td>
<td>2.2; 4×10-4</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>5.9; 4.1-8.4</td>
<td>5.2; 4.4-9.2</td>
<td>10.6; 3.7-19.1</td>
<td>0.0001</td>
<td>2.2; 4×10-4</td>
<td></td>
</tr>
<tr>
<td>CBP-time [Min.]</td>
<td>123; 98-152</td>
<td>144; 112-173</td>
<td>171; 156-195</td>
<td>198; 180-202</td>
<td>0.0000</td>
<td>2.6; 3×10-5</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>144; 112-173</td>
<td>171; 156-195</td>
<td>198; 180-202</td>
<td>0.0000</td>
<td>2.6; 3×10-5</td>
<td></td>
</tr>
<tr>
<td>Intraop. compl.</td>
<td>5.1; 3.2-7.9</td>
<td>17.6; 9.7-28.2</td>
<td>23.5; 6.8-49.9</td>
<td>66.7; 29.9-92.5</td>
<td>0.0000</td>
<td>5.4; 3×10-7</td>
</tr>
<tr>
<td>[%; 95% CI]</td>
<td>17.6; 9.7-28.2</td>
<td>23.5; 6.8-49.9</td>
<td>66.7; 29.9-92.5</td>
<td>0.0000</td>
<td>5.4; 3×10-7</td>
<td></td>
</tr>
<tr>
<td>Lactates [mmol/l]</td>
<td>1.7; 1.4-2.1</td>
<td>1.9; 1.5-2.6</td>
<td>2.1; 1.3-2.9</td>
<td>2.4; 2.0-2.8</td>
<td>0.0303</td>
<td>1.8; 0.004</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>1.9; 1.5-2.6</td>
<td>2.1; 1.3-2.9</td>
<td>2.4; 2.0-2.8</td>
<td>0.0303</td>
<td>1.8; 0.004</td>
<td></td>
</tr>
<tr>
<td>Base deficit [mmol/l]</td>
<td>3.8; 5.0-2.5</td>
<td>4.7; 5.8-3.1</td>
<td>4.4; 5.3-2.7</td>
<td>5.5; 10.1-5</td>
<td>0.0006</td>
<td>2.2; 3×10-4</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>4.7; 5.8-3.1</td>
<td>4.4; 5.3-2.7</td>
<td>5.5; 10.1-5</td>
<td>0.0006</td>
<td>2.2; 3×10-4</td>
<td></td>
</tr>
<tr>
<td>ICAM-1 [ng/ml]</td>
<td>34; 26-44</td>
<td>40; 31-54</td>
<td>44; 27-50</td>
<td>48; 42-55</td>
<td>0.0020</td>
<td>2.2; 3×10-4</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>40; 31-54</td>
<td>44; 27-50</td>
<td>48; 42-55</td>
<td>0.0020</td>
<td>2.2; 3×10-4</td>
<td></td>
</tr>
<tr>
<td>IL-6 [ng/ml]</td>
<td>0.2; 0.1-0.3</td>
<td>0.3; 0.1-0.5</td>
<td>0.2; 0.1-0.4</td>
<td>0.3; 0.8-1.6</td>
<td>0.0130</td>
<td>1.9; 0.003</td>
</tr>
<tr>
<td>(median; IQR)</td>
<td>0.3; 0.1-0.5</td>
<td>0.2; 0.1-0.4</td>
<td>0.3; 0.8-1.6</td>
<td>0.0130</td>
<td>1.9; 0.003</td>
<td></td>
</tr>
</tbody>
</table>
Does dexmedetomidine affect renal outcome in patients with renal impairment undergoing CABG?

Maged Salah, Tarek Eltawil, Sherif Nasr, Tarek Nisser
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Introduction. Dexmedetomidine has been used as adjunct to anaesthesia and sedation for its efficient sympatholytic, analgesic and anxiolytic properties. Coronary artery bypass grafting (CABG) with cardiopulmonary bypass (CPB) is associated with a high incidence of peri-operative renal dysfunction which is believed to be caused partly by the increased sympathetic nervous system activity leading to compromised haemodynamics and attenuated renal function. We aimed to test the hypothesis that dexmedetomidine would prevent the development of AKI in patients undergoing elective CABG with mild to moderate renal dysfunction during the early postoperative days.

Methods. A double-blind randomized placebo controlled study. Eighty adult patients with mild to moderate renal impairment (serum creatinine between 132-177 µmol/l) and scheduled for elective CABG with CPB were randomly allocated into either dexmedetomidine infusion or placebo infusion groups. Infusion was started after anaesthesia induction and continued until end of surgery. The primary outcome measured variables for assessing renal functions included serum creatinine, creatinine clearance and urinary output in the 72 h postoperatively.

Statistical Analysis: Forty patients per treatment group were needed to get a 80% power to detect a 36% difference between the treatment groups with a 5% type I error rate and assuming a standardized effect size (expected effect size divided by SD of the outcome variable) of 0.63. Results of urine output, serum creatinine, creatinine clearance and urinary output in the 72 h postoperatively.

Results. No significant difference was detected for any indicators of renal function of both groups, except for an increase in urinary output in the dexmedetomidine infusion group. In between both groups, there was no statistically significant difference in the first 24 h after surgery ($p = 0.007$) in creatinine clearance at any time of comparison (baseline, 24, 48, and 72 hours postoperatively). However a significant increase in creatinine clearance at 24 h postoperatively was noted in both groups as compared to their own baseline values.

Discussion. Use of dexmedetomidine infusion did not alter renal function in terms of serum creatinine or creatinine clearance, but was associated with an increase in urinary output in the first 24 h postoperatively.

Heparin management during cardiopulmonary bypass: a comparison between traditional method and new technologies

Andrea Farinaccio, Paolo Prati, Valentina Ajello, Nicola Iasevoli, Chiara Buonomo, Pasquale De Vico, Dionisio Colella
Policlinico tor Vergata, Rome, Italy

Introduction. Peri-operative blood loss and transfusions during cardiopulmonary bypass (CPB) could be due to total dose of heparin and protamine administered. Strategies to optimize administration of heparin and protamine are evolving. In a randomized prospective study, we compared the traditional weight-based method with two heparin and protamine-concentration level techniques.

Methods. We enrolled 54 patients undergoing elective normothermic cardiac surgery and randomized them to three different methods using computer programme G*Power 3 for Windows. (Franz Faul, Universität Kiel, Germany).

Results. No significant difference was detected for any indicators of renal function of both groups, except for an increase in urinary output in the dexmedetomidine infusion group. In between both groups, there was no statistically significant difference in the first 24 h after surgery ($p = 0.007$) in creatinine clearance at any time of comparison (baseline, 24, 48, and 72 hours postoperatively). However a significant increase in creatinine clearance at 24 h postoperatively was noted in both groups as compared to their own baseline values.

Discussion. Use of dexmedetomidine infusion did not alter renal function in terms of serum creatinine or creatinine clearance, but was associated with an increase in urinary output in the first 24 h postoperatively.
groups: 18 in the Control group (heparin bolus UI 300/kg and protamine reversal 1:100), 18 in the Hepcon® HMS™ group and 18 in the Hemochron® group. The ACT target was 480 seconds for all the patients.

Two-way analysis of variance (ANOVA) and Chi squared tests were used to study demographic variables. Two-ways ANOVA test was used to compare the parameters. A p-value of < 0.05 was considered to be significant.

**Results.** Total heparin administered and its plasma level during cardiopulmonary bypass were higher in the control group than in the others (319 ± 27.5, 291 ± 31.6, 263 ± 43.1, p 1-2 < 0.05, p 1-3 < 0.05, p 2-3 NS). The ACT target was reached more precisely using the heparin concentration-level techniques (32.4 ± 8.5, 8.1 ± 2.4, 18.3 ± 6.2, p 1-2 < 0.05, p 1-3 < 0.05, p 2-3 NS). Patients treated with heparin concentration-level management protocols had less bleeding at 12 h in ICU (486 ± 89, 357 ± 116, 315 ± 57, p < 0.05) and fewer blood transfusions (3.28 ± 2.13, 1.79 ± 0.97, 1.94 ± 1.24, p < 0.05).

**Discussion.** Compared with the traditional weight-based method of anticoagulation during CPB, the use of new technologies based on the heparin concentration-level show a reduction of the total heparin and protamine administered, a higher precision in obtaining the ACT desired and a significant reduction in bleeding and in the use of blood and platelets transfusions.

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**O-44 Thromboelastography (TEG) and post cardiopulmonary bypass bleeding**

*Marc Mourad, Norddine Zeroual, Jacob Eliet, Géraldine Culas, Philippe Gaudard, Rémy Coves, Pascal Colson*

Hôpital Arnaud de Villeneuve, Montpellier, France

**Introduction.** Circulating Heparin (CH) due to incomplete heparin reversal or heparin rebound is common after cardiopulmonary bypass (CPB) [1] and can contribute to excessive bleeding. An extra protamine dose for all patients has been suggested [2], but excessive heparin/protamine reversal could alter coagulation. TEG analysis can detect CH [1] and help to assess its contribution to other coagulation disorders.

**Methods.** In a six month period, 40 mg of protamine was administrated to 36 consecutive patients presenting with post-CPB bleeding (chest tube loss > 2 ml kg/h). TEG (Haemoscope, TEG-5000) was measured before protamine injection (without and with heparinase: TEG k and TEG kh) and 30 minutes after (TEG k2). No haemostatic factors transfusions were given before TEG 2 analysis. CH was defined as a difference > 2 min in TEG Reaction time (R) without and with heparinase.

**Results.** CH was found in 27 (75%) of these 36 patients.

<table>
<thead>
<tr>
<th>TEG results of patients with CH</th>
<th>TEG k</th>
<th>TEG kh</th>
<th>TEG k2</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-time increased, n (%)</td>
<td>25 (93)</td>
<td>4 (15)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>K and/or angle abnormalities, n (%)</td>
<td>22 (82)</td>
<td>12 (44)</td>
<td>3 (11)</td>
</tr>
<tr>
<td>MA decreased, n (%)</td>
<td>15 (55)</td>
<td>8 (29)</td>
<td>4 (15)</td>
</tr>
</tbody>
</table>

Heparin neutralization improved R-time, but also coagulation time and clot amplitude in case of CH. The in-vivo effect of 40 mg protamine was stronger than in-vitro heparinase. 9 patients (25%) had no CH at the time of bleeding. All patients presenting coagulation...
time and/or clot amplitude TEG abnormalities without CH or after full neutralization by protamine had fibrinogen level < 2 g/l and platelet count < 100 10^9/l–1 respectively.

**Discussion.** TEG can avoid inappropriate heparin reversal. Because of incomplete heparin reversal by heparinase, TEG-guided haemostatic factors transfusion should be given if there is no CH or after full reversal by protamine to avoid excessive transfusion.

**References**


**O-45**

**Von Willebrand Factor assay in patients with aortic valve stenosis: impedance aggregometry vs. laboratory tests**

*Chiara Buonomo, Valentina Ajello, Andrea Farinaccio, Pasquale De Vico, Dionisio Fernando Colella*

Division of Cardio-Vascular Anesthesia and Intensive Care, Tor Vergata University, Rome, Italy

**Introduction.** Acquired von Willebrand syndrome (AvWS) is a rare bleeding disorder (0.04-0.013%) that can lead to unforeseen bleeding in surgical patients. The diagnosis is made on expensive laboratory tests (vWF:Ag, vWF:RCO/vWF:Ag, VIIIIF), not feasible in all centres. Whether vWF can be quantified by impedance aggregometry is still unclear. The aim of this study was to evaluate whether AvWS can be diagnosed by aggregometric response.

**Methods.** This was a prospective observational study, enrolling 25 patients with severe aortic valve stenosis undergoing aortic valve replacement (AVR). vWF:Ag, vWF:RCO/vWF:Ag, VIIIIF and the aggregometric response by RistoTestHigh/RistoTestLow were quantified by collecting two blood samples at: T0 (before anaesthesia induction), T1 (after AVR) and T2 (24 h after surgery).

**Results.** No bleeding or deaths were observed. At T0, both laboratory tests and aggregometry results were normal in all 25 patients. Instead, at T1 and T2, the increase of vWF detected with the laboratory tests was not confirmed by the aggregometric response, whose result was lower than normal values.

**Discussion.** We can confirm that vWF levels increased after AVR and remained high. Aggregometry, on the contrary, has proved to be reliable at T0 agreeing with laboratory results, but at T1 and T2, had high sensitivity and low specificity proving to be unhelpful in patients’ follow-up. The altered aggregometric response at T1 and T2 should be attributed to cardiopulmonary by-pass, which represents a massive stress for platelets. Finally, aggregometry is certainly reliable in diagnosis of vWD, but more studies are required to assess its value in follow-up.

**O-46**

**Dalteparin does not increase post-operative bleeding and has no effect on selected in-hospital morbidity parameters and 30-day mortality**

*Jacob Greisen, Mariann Tang, Michael Kremke, Carl-Johan Jakobsen*

Aarhus University Hospital, Aarhus, Denmark

**Introduction.** To discontinue antiplatelet therapy or in patients with acute coronary syndrome, patients may in the immediate pre-operative period be treated with Dalteparin for pre-operative thromboprophylaxis.
The aim of this study was to analyse the association between Dalteparin treatment and postoperative bleeding and selected outcomes. The hypothesis was that Dalteparin is associated with more transfusions and complications.

**Methods.** We made a cohort study of 7,583 patients undergoing CABG ± AVR at three university hospitals (2006-2012) based on data from the common heart registry. Groups were established based on pre-operative exposure to Dalteparin or control. To adjust for possible patient differences and continued antiplatelet therapy the groups were balanced using propensity scores on 24 parameters, resulting in 2x 735 patients for analysis. The primary outcome was re-exploration surgery and postoperative drainage together with 30- day mortality, postoperative new dialysis and thromboembolic event.

**Results.** We found no difference in bleeding, but Dalteparin patients were more often transfused. No difference was seen in the frequency of re-exploration. We found no statistically significant differences between Dalteparin and the control group in 30-day mortality (4.76% vs. 3.13%; \( p = 0.141 \)). Conditional regression analysis of in-hospital new dialysis, stroke, myocardial infarction and CAG, PCI or CABG within 6 month is given in Table 1.

**Conclusion.** Dalteparin has no impact on postoperative bleeding. The data raise question regarding protection against postoperative thromboembolic event but further studies and analysis are needed.

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>Dalteparin</th>
<th>Control</th>
<th>Odds-ratio (95% CI)</th>
<th>Adjusted* Odds-ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRT (new dialysis)</td>
<td>27</td>
<td>27</td>
<td>1.00 (0.58-1.72)</td>
<td>0.50 (0.18-1.33)</td>
</tr>
<tr>
<td>Stroke</td>
<td>13</td>
<td>15</td>
<td>0.85 (0.39-1.85)</td>
<td>1.48 (0.48-4.57)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>56</td>
<td>46</td>
<td>1.23 (0.82-1.84)</td>
<td>1.17 (0.75-1.83)</td>
</tr>
<tr>
<td>In-hospital event</td>
<td>106</td>
<td>92</td>
<td>1.17 (0.87-1.58)</td>
<td>1.08 (0.78-1.51)</td>
</tr>
<tr>
<td>CAG and/or PCI</td>
<td>110</td>
<td>75</td>
<td>1.56 (1.13-2.13)</td>
<td>1.58 (1.12-2.21)</td>
</tr>
<tr>
<td>Event within 6 month</td>
<td>191</td>
<td>156</td>
<td>1.29 (1.01-1.64)</td>
<td>1.23 (0.96-1.59)</td>
</tr>
</tbody>
</table>

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**O-47**

The effects of red blood cell transfusion during cardiac surgery: a matched cohort study in Jehovah Witnesses

*Esther Hogervorst1, Anske van der Bom2, Nardo van der Meer3, Anneke Brand4, Leo van de Watering5, Mohamed Bentala5, Peter Rosseel5*

1 Sanquin Research, Leiden, The Netherlands
2 LUMC, Leiden, The Netherlands
3 Amphia Hospital, Breda & Oosterhout, The Netherlands

**Introduction.** Anaemia as well as red blood cell (RBC) transfusion is associated with (severe) side effects during cardiac surgery. The independent effect of each is hard to analyse because they often occur simultaneously. Jehovah’s Witnesses (JW) refuse blood products based upon their religious beliefs, making it possible to investigate the adverse effects of anaemia. The primary objective of this study is to analyse the effect of RBCs administered according to current transfusion guidelines proposing a transfusion trigger of 7-8 g/dl during cardiac surgery.

**Methods.** In this single centre cohort study, data were collected from consecutive patients undergoing cardiac surgery from 1997 until 2012. JWs with an intra-operative haemoglobin (Hb) < 8 g/dl and/or Hb decrease of 50% or more were compared with propensity matched patients who received 1 RBC unit. Propensity scores were calcu-
lated based on pre-operative patient characteristics and type of surgery.

**Results.** Data of 23,590 non-JWs and 270 JWs were collected. 60 JWs had an intra-operative Hb < 8 g/dl and/or a Hb decrease of 50% or more. Results are shown in Table 1. JWs had a similar postoperative outcome than matched non-JWs who received RBC’s.

**Discussion.** JWs who according to the guidelines should receive RBC’s were compared to non-JWs who did receive RBC’s. JWs had a similar postoperative outcome. These results could imply that the current guidelines propagate a too liberal transfusion strategy in cardiac surgery patients.

**Oral Session – Fluids**

**O-48**

**Effects of acute plasma volume expansion on renal perfusion, filtration and oxygenation after cardiac surgery: crystalloid vs. colloid**

**Jenny Skytte Larsson, Gudrun Bragadottir, Bengt Redfors, Vitus Krumbholz, Sven-Erik Ricksten**

Anaesthesiology and Intensive Care Medicine, Sahlgrenska University Hospital, Gothenburg, Sweden

**Introduction.** Acute kidney injury may occur in patients undergoing cardiac surgery because of hypovolaemia and renal hypoperfusion. Hypovolaemia is commonly treated with artificial solutions. In a recent experimental study, haemodilution with crystalloids, in contrast to colloids, showed to induce intrarenal hypoxia [1].

**Methods.** The study was approved by the Institutional Ethics Committee. Twenty-eight patients where studied in the ICU early after surgery. Patients were randomized to receive a bolus of either a balanced crystalloid (Ringers-Acetate, 20 ml/kg, n = 14) or a colloid solution (HES 6%, 130/0.4, 10 ml/kg, n = 14). Systemic haemodynamics and renal variables were measured before and 20, 40 and 60 minutes after volume expansion. Renal blood flow (RBF) and glomerular filtration rate (GFR) were measured by the
renal vein retrograde thermodilution technique and by renal extraction of Cr-EDTA, respectively. Blood samples were taken for measurements of arterial (CaO₂) and renal vein (CrvO₂) oxygen contents. Renal oxygen consumption \( RVO₂ = RBF \times (CaO₂ - CrvO₂) \), delivery \( RDO₂ = RBF \times CaO₂ \) and extraction \( RO₂Ex = (CaO₂ - CrvO₂)/CaO₂ \) were calculated. \( RO₂Ex \) is a direct measure of renal \( O₂ \)-demand/supply. ANOVA was used for intragroup statistical analysis, followed by Greenhouse-Geiser post-hoc test. Intergroup comparisons were made by t-tests on area under the curve.

**Results.** Plasma volume expansion was greater in the colloid group, indicated by significantly lower haematocrit and \( CaO₂ \) and higher filling pressures. Urine flow increased significantly only in the crystalloid group. Cardiac index, RBF and GFR increased to a similar extent in both groups. \( RDO₂ \) did not change in any of the groups. \( RVO₂ \) increased significantly only in the crystalloid group, with no significant between-groups difference. \( RO₂Ex \) increased by 19% in the crystalloid group, compared to 5% in the colloid group \( (p = 0.034) \) (Figure 1).

**Discussion.** The crystalloid and colloid solutions both increase GFR, but none of the solutions improve renal oxygen delivery as the increase in RBF is offset by haemodilution. Crystalloids, in contrast to colloids, impair the renal oxygen demand/supply relationship.

**References**


**0-49**

**A randomized controlled trial of the effect of concentrating residual cardiopulmonary bypass blood using Hemosep on patient haematocrit after cardiac surgery**

*Maurice Hogan¹, Amy Needham¹, Erik Ortmann², Fiona Bottrill¹, Martin Besser¹, Andrew Klein¹*

¹ Papworth Hospital, Cambridge, UK
² Kerckhoff Klinik, Bad Nauheim, Germany

**Introduction.** Re-transfusion of residual pump blood at the end of cardiopulmonary bypass (CPB) is currently recommended as a blood conservation strategy after cardiac surgery [1]. Hemosep is a cell salvage device, designed to ultra-filter residual CPB blood. The blood is introduced into the device, concentrated using the membrane controlled superabsorber process, and transfused back to the patient. The aim of this study was to determine if concentration of residual CPB blood using Hemosep was associated with
raised patient haematocrit compared with standard re-transfusion of CPB blood.

**Methods.** After formal ethical approval and written consent, 47 adult patients undergoing primary coronary bypass graft, valve, or combined graft and valve surgery using CPB were randomized to have residual CPB blood treated with Hemosep or not, before it was re-transfused. Data are reported as mean (standard deviation), and analysed for significance using student’s t-test.

**Results.** The quantity of residual CPB blood collected was not different between groups (768 [189] ml and 797 [245] ml, \( p = 0.66 \)). Treatment with Hemosep for a fixed 20 minute period significantly reduced the volume of blood from 797 (245) ml to 624 (257) ml (\( p = 0.04 \)), and effectively raised the haematocrit of the residual CPB blood (26 [4]% to 31 [5]%, \( p = 0.002, n = 20 \)). Patient haematocrit after re-transfusion was however not significantly different between either standard (30 [3]%, \( n = 27 \)), or Hemosep (31 [4]%, \( n = 20 \)), treated groups.

**Discussion.** Hemosep reduced the volume of residual CPB blood, leading to a concentration effect of around 20%. However, this was not associated with increased patient haematocrit compared with current standard practice of simply re-transfusing the residual blood. The concentration effect is insufficient to result in raised patient haematocrit after cardiac surgery with CPB.

**References**

between the MCPB and CCPB groups. These were not associated with AKI in either group.

Discussion. Despite a better preserved haematocrit in the MCPB group, the initial haematocrit that occurs on initiation of bypass is significantly associated with AKI. We postulate that the absence of a venous reservoir in the MCPB circuit may expose patients to reduced cardiac index at this stage, which then may render the haematocrit that is acceptable on the CCPB flow rates to be insufficient for adequate oxygen delivery to the renal vasculature, thereby predisposing MCPB patients to AKI. There was significantly higher bleeding in the CCPB group which may have predisposed patients to AKI in that group.

O-51 Central venous oxygen saturation as trigger for blood transfusion in cardiovascular surgery patients: an observational study

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Introduction. The blood transfusion rate in patients undergoing cardiovascular surgery is around 50% [1]. The decision to transfuse is taken according to haemoglobin levels (Hb), where Hb less than 7 g/dl is considered a reasonable trigger [2]. There is some suggestion that central venous oxygen saturation (Svo2) could be a complementary and accurate parameter to trigger blood transfusion [2]. We carried out a retrospective study in patients who received blood transfusion during or immediately after cardiovascular surgery.

Methods. Patients undergoing coronary artery bypass, valve replacement or combined operations, as well as major vascular surgery were included in the study. Exclusion criteria were active bleeding due to coagulation instability and emergency surgery. At the time the decision to transfuse blood was made, as a standard procedure, samples were collected through peripheral arterial and central venous catheters to measure respectively Hb and Svo2 (co-oximetry). A trend between the two has been shown. Moreover, the retrospective character of the study did not allow us to collect SvO2, because we do not use Swan Ganz probes systematically. Statistical analysis was performed with Mann-Whitney test, median (25 and 75 percentile), p < 0.05 was considered as statistically significant.

Results. Sixty-eight consecutive patients were included in the study. The Hb at the time of transfusion was 7.4 g/dl (6.9; 8.2), while Svo2 was 70% [60; 77]. There was no correlation between Hb and Svo2. Svo2 of patients transfused with Hb < 7 g/dl (n = 44) was not significantly different from Svo2 in patients transfused with Hb > 7 g/dl (n = 23) (69, 59-79 vs. 71, 61-77 respectively; p = 0.90). Svo2 levels in patients transfused during controlled ventilation (n = 45) were significantly higher compared to patients in support/spontaneous ventilation (n = 22) (72; 64-81 vs. 63; 56-71 respectively; p = 0.01), while Hb among the two groups were similar (7.5; 6.9-8.2 vs. 7.15; 6.8-8.1 respectively p = 0.73).

Conclusions. In this study, Hb level at the time of transfusion does not correlate to Svo2. Patients undergoing respiratory weaning or during spontaneous ventilation have significantly reduced Svo2 compared to patients who still benefit from controlled ventilation, in the absence of a significant difference in Hb.

References

0-52
The impact of routine noradrenaline infusion on haemodilution and blood transfusion in cardiac surgery

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Introduction. Haemodilution and blood transfusion are associated with poor outcome after cardiac surgery, and routine prevention of haemodilutional anaemia intra-operatively is recommended [1]. We hypothesised that routine noradrenaline infusion (NA) commenced prior to and during anaesthesia to treat vasodilation would reduce red blood cell (RBC) transfusion for on-pump cardiac surgery.

Methods. The Control group (n = 94) included consecutive patients from a single surgeon 12 month experience where patients received selective noradrenaline infusion post cardiopulmonary bypass for persistent hypotension and vasodilation, in 2005. The NA group (n = 72) included consecutive patients form the same surgeon, but all received low dose noradrenaline commenced at 3-5 μg/min⁻¹ prior to anaesthetic induction which continued into the postoperative period, in 2010. In the absence of blood loss, haemodynamic stability was achieved using vasopressors and inotropes rather than fluid administration, in an attempt to reduce haemodilutional anaemia and trigger for RBC transfusion. Retrospective data extraction of perioperative Hb, creatinine concentrations and units of RBCs transfused was performed. The surgeon, perfusion management and transfusion trigger (haemoglobin < 70 g/l) were the same in both groups. Aprotinin was not used in 2010.

Results. Intraoperatively, haemoglobin concentrations were higher in group NA compared with controls (p < 0.0001), despite lower baseline values (p = 0.03), more extensive surgery (p = 0.042), longer clamp-time (p = 0.009) and less aprotinin use. Three-fold fewer units of RBCs were transfused in the NA group compared with controls. Maximum postoperative rise in serum creatinine concentration was not different (NA 26 ± 32, controls 30 ± 57, p = 0.49 μmol/l) (Table 1).

Table 1: Intraoperative RBC transfusion and surgical data; mean ± SD or n(%)
Discussion. This study shows proof of concept that during on-bypass cardiac surgery, routine low dose noradrenaline infusion used to treat vasodilation is associated with reduced haemodilution and intra-operative red cell transfusion, without increasing postoperative serum creatinine.

References

Oral Session – Aorta

O-53
Multiorgan protection for arch surgery with Frozen Elephant Trunk: antegrade perfusion instead of long circulatory arrest

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Humanitas Gavazzeni, Bergamo, Lombardia, Italy

Introduction. Appropriate management of arch surgery with Frozen Elephant Trunk technique (FET) is a critical factor for achieving satisfactory organ protection. We report our experience with additive thoracoabdominal aorta perfusion in addition to epiaortic vessels to attenuate multiorgan ischaemia after mild hypothermic circulatory arrest.

Methods. Twelve patients underwent ascending aorta and arch replacement with Vascutek Lupiae™ prosthesis plus antegrade delivery of endograft E-vitaOpen Plus-Jotec. After FET deployment in mild hypothermic circulatory arrest, antegrade perfusion through a Pruitt Catheter (LeMaitre-Paris) was immediately provided to achieve MAP 30-40 mmHg in the femoral artery. We evaluated mortality, ICU Length Of Stay, neurological and visceral damage.

Results. We observed in-hospital mortality 0%. There was no stroke or spinal cord injury, no renal, bowel, hepatic, significant or permanent dysfunction. There was an uncommonly rapid decrease of serum lactate. Median ICU LOS was 4 ± 2 days.

Discussion. Our results suggest that this type of modified perfusion strategy attenuates the lower body and visceral ischaemia providing a better systemic multiorgan protection.

References

O-54
Prolonged ICU stay following cardiac surgery: is there any room for new scores?

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Introduction. Although several pre-operative scoring systems have been developed, ICU mortality after cardiac surgery (CS) may not be so easy to predict [1]. Peri-operative
events also play an important role in affecting patients’ (pts) early outcome. The aim of our study was to evaluate the role of early ICU support requirement in predicting postoperative mortality in adult pts undergoing CS.

Methods. We prospectively analysed 3,735 pts who were admitted to our ICU over a period of 49 months (January 2010-January 2014). 667 pts who stayed at least 72 h in ICU were selected. 525 of them underwent conventional CS (group 1) and 142 received left ventricular assist device (LVAD) implantation or heart transplant (group 2). We developed a home-made score, in which every pt was daily weighted by giving a value, ranging from 0 to 6, to 13 supports, when utilized. Ventilation, IABP, ECMO, cardiac rhythm control, coagulation control, inotropes, vasoconstrictors, pulmonary vasodilators, systemic vasodilators, targeted insulin infusion, renal function control, thermal control and sedation were considered. Their sum was used to create a daily overall support dependency score (SDS) assigned to each pt from the first postoperative day (Adm score), to pt’s discharge or death.

Results. Group 1: mortality (5.9%) was significantly related to the Adm score (9 ± 5 vs. 15 ± 5 p < 0.001), cardiopulmonary bypass (CPB) time (173 ± 79 min vs. 223 ± 111 min p = 0.022), ICU length of stay (LOS) (9 ± 10 days vs. 20 ± 15 days p = 0.001). Mean area under ROC curve (AUC) for Adm score was 0.77 (95%-CI 0.7-0.83), which increased in 2nd (AUC 0.807 95%-CI 0.75-0.86) and 3rd (AUC 0.84 95%-CI 0.79-0.88) postoperative day. Group 2: mortality (9.8%) was not significantly related to the Adm score (16.2 ± 5.8 vs. 20.7 ± 11.9), but significantly related to the 2nd postoperative day SDS (13.9 ± 5.9 vs. 24.4 ± 7.1 p < 0.001) and ICU LOS (10.4 ± 6.7 vs. 27.6 ± 27.2 p = 0.03). AUC for 2nd and 3rd postoperative day SDS was 0.86 (95%-CI 0.77-0.96) and 0.88 (95%-CI 0.79-0.96) respectively. In both groups, non-survivors showed difficulties in dismissing supports.

Discussion. Early and daily assessment of SDS were shown to be reliable in predicting death in pts requiring more than 72 h of ICU stay after conventional CS. Pts undergoing LVAD implantation or heart transplantation need higher early ICU support; but fast weaning from 2nd postoperative day predicts successful intensive care treatment. Pts who need prolonged high postoperative assistance are at high risk of death.

References

Oral Session – Cardiac Anaesthesia

0-55
Anaesthesiologic regimen for transcatheter aortic valve implantation (TAVI): sedation vs. general anaesthesia: a prospective randomised comparison

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2 Institut für Medizinische Statistik und Epidemiologie, Klinikum Rechts der Isar
3 Klinik und Poliklinik für Psychiatrie und Psychotherapie, Klinikum Rechts der Isar, Technische Universität München, Munich, Germany
4 Department of Anesthesiology and Intensive Therapy, University of Szeged, Szeged, Hungary

Introduction. TAVI has become an established treatment strategy for patients having a high peri-operative risk. Different methods of anaesthesia care (general anaesthesia [TAVI-
GA] and sedation [TAVI-S]) have previously been described. The proposed benefits of sedation have not been investigated in a randomised trial.

**Methods.** Sixty-six patients were enrolled in a controlled parallel-group study with balanced block randomisation. The same haemodynamic monitoring and anaesthetic drugs (remifentanil, propofol) were used in both groups. We chose cerebral oximetry (rSO$_2$) as a robust noninvasive parameter for assessing peri-operative outcome. We assumed that TAVI-S would exhibit a higher peri-operative cumulative decline below the desaturation threshold (> 20% below room-air baseline or 50% absolute). Patients underwent pre- and postoperative neurocognitive testing examining age-adjusted cognitive dysfunction, perceptual speed and formal-lexical stream of speech. Peri-operative arterial blood gas (ABG) samples were also analysed.

**Results.** After secondary exclusion, 62 patients were analysed. Pre-operative clinical data, procedure-time and room-air rSO$_2$ were comparable. rSO$_2$ values decreased in all the patients during valvuloplasty. In six TAVI-GA and five TAVI-S patients, rSO$_2$ dropped below the desaturation threshold (TAVI-GA (median [IQR]) (108 [48-204] sec% vs. TAVI-S (66 [48-138] sec%); $p = 0.792$). During valve implantation, six TAVI-GA and five TAVI-S presented an rSO$_2$ decrease below desaturation threshold (TAVI-GA (median [IQR]) (315 [138-798] sec% vs. TAVI-S (1674 [1632-3468] sec%); $p = 0.052$). Overall, 24 (39%) patients showed a decrease in rSO$_2$ below the desaturation threshold (TAVI-GA: n = 13, TAVI-S: n = 11; $p = 0.602$). Cumulative peri-operative cerebral desaturation was comparable (TAVI-GA (0 [0-1308] sec%) vs. TAVI-S (0 [0-276] sec%); $p = 0.505$). Eight patients (TAVI-GA: n = 5, TAVI-S: n = 3; $p = 0.707$) presented a cumulative desaturation of more than 3000 sec%. Baseline ABG analysis was comparable. Peri-operative TAVI-S patients showed significantly higher values of PaCO$_2$ and lower pH. Pre-/postoperative differences in neurocognitive testing were comparable. Adverse events in TAVI-S patients were mainly restlessness/pain (61%), bradypnoea (52%), and respiratory disruption, with 6 patients (19%) requiring bag-valve mask ventilation.

**Discussion.** A decrease of rSO$_2$ below desaturation threshold was common (39% 24/62). There was no difference between the anaesthesia regimens. Secondary outcome parameters revealed significantly better arterial blood gas values in TAVI-GA while TAVI-S presented more frequent adverse events. Neurocognitive testing revealed no advantage of a specific regimen. Based on these findings, we do not see a favour for sedation and believe that general anaesthesia should be the favoured regimen for TAVI.

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**0-56**

A comparison of three strategies for levosimendan administration in cardiac surgery patients with severe myocardial dysfunction

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$^2$ Petrovsky National Research Center of Surgery, Moscow, Russia

**Introduction.** Levosimendan was associated with reduced mortality and other adverse outcomes in patients undergoing cardiac surgery. We compared three different modalities of levosimendan administration.

**Methods.** After approval by Ethical Committee, sixty consecutive patients with a pre-operative ejection fraction $\leq 35\%$ scheduled for elective cardiac surgery with cardiopulmonary bypass (CPB), were randomly allocated to 3 different groups. In Group A (n = 20), infusion of levosimendan (0.1 µg/kg/min) was started 24 h before surgery. In
Group B (n = 20), infusion of levosimendan (0.1 µg/kg/min) started just after the induction of anaesthesia. In Groups A and B the loading dose of levosimendan (6 µg/kg, for 10 min) was used. In Group C (n = 20), patients received a bolus of levosimendan (24 µg/kg) 15 min before aortic cross-clamping. Haemodynamic data and blood samples for troponin T were obtained initially (24 h before surgery) (T in), 30 min after separation from CPB (post-CPB), on arrival in the ICU (T0), and 6 (T6), 12 (T12), 24 (T24), and 48 (T48) h later.

Results. Parameters of central haemodynamics were comparable in the three groups but PCWP was significantly higher in Group C at the stages of T0, T6 and T12. (p = 0.010, p = 0.001, p = 0.005 respectively). The number of patients who needed pharmacological and mechanical cardiac support was higher in Group B and C. There was a significant difference in troponin T levels between groups and reached a critical level of significance at several points: T0 (p = 0.037), T6 (p = 0.004), T12 (p = 0.001), T24 (p = 0.004), and T48 (p = 0.011). The ICU length of stay was much shorter in Group A than in Group C (p = 0.002).

Discussion. Thus, the “full dose” of levosimendan was much more effective than single bolus 24 µg/kg in reducing the extent of postoperative troponin T release and ICU LOS, whereas initiation of therapy for 24 h prior to surgery allowed further reduction of the frequency of administration and the total dose of sympathomimetics.

Table 1: Postoperative complications and costs

<table>
<thead>
<tr>
<th></th>
<th>No re-sternotomy (n = 1,034)</th>
<th>Re-sternotomy (n = 94)</th>
<th>Pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative course</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inotrope support</td>
<td>50.2</td>
<td>72.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>IABP support</td>
<td>1.1</td>
<td>6.4</td>
<td>0.002</td>
</tr>
<tr>
<td>Ventilation &gt; 48 h</td>
<td>3.2</td>
<td>24.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>6.2</td>
<td>24.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Surgical wound infection</td>
<td>0.8</td>
<td>6.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.4</td>
<td>3.2</td>
<td>0.16</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>0.0</td>
<td>1.1</td>
<td>0.08</td>
</tr>
<tr>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU LOS (days)</td>
<td>1 (1-3)</td>
<td>3 (2-8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Postoperative LOS (days)</td>
<td>7 (6-12)</td>
<td>11.5 (7-23.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>1.7</td>
<td>13.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Overall Costs (£)</td>
<td>14,358 (£11,207-11,942)</td>
<td>20,725 (£14,580-39,697)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
comparison with those without this event. To account for differences in case-mix we developed a propensity score for pre-operative re-sternotomy group membership, based on twenty-one variables using multivariable logistic regression analysis. The financial and clinical outcomes between the propensity matched groups were compared. \( p < 0.05 \) was significant.

**Results.** Postoperative complications and costs (s. Table 1).

The re-sternotomy group had an increased incidence of renal failure, wound infections and mortality \( (p < 0.001) \). The additional cost of re-sternotomy was £ 6,367 \( (p < 0.001) \) per case. The increased costs were mainly due to longer critical care time and higher blood product requirement.

**Conclusion.** This financial and outcome data should be used to support the cost effectiveness of investment in near-patient coagulation testing, targeted pharmacological interventions such as tranexamic acid and Factor \( rVIIa \) which have been shown to reduce re-sternotomy rate.

**0-58**

**Effects of remote ischaemic preconditioning on cognitive function and neurologic injury in cardiac surgery**

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**Introduction.** Remote ischaemic preconditioning (RIPC) is a strategy thought to confer organ protection against prolonged ischaemia achieved via brief preceding ischaemia of a remote organ or tissue. We hypothesized that RIPC could affect cognitive function and neurological injury in patients operated under cardiopulmonary bypass (CPB).

**Methods.** 83 patients scheduled for coronary artery bypass grafting (CABG) were randomly assigned to RIPC (42) or control (41). RIPC was induced by three 5-min cycles of upper limb ischaemia and reperfusion using a blood pressure cuff immediately after induction. The groups were well-matched by baseline characteristics. Neuron specific enolase (NSE), troponin I, haemodynamics, and complication rates were assessed perioperatively. Neurological examination, neuropsychological and psychophysiological assessment were conducted the day before and 10-14 days after surgery. Repeated-measures ANOVA, Mann-Whitney, and chi-squared tests were used for the analysis.

**Results.** No neurologic events occurred in the study. No statistically significant between-group differences in neurocognitive parameters, levels of biochemical markers, haemodynamics, or clinical outcome were observed. There was a considerable improvement in cognitive function after surgery regardless of group allocation. Peri-operative NSE data are presented in Table 1.

**Discussion.** No evidence of an effect of RIPC on NSE release and cognitive function after CABG surgery was found. An observed improvement of the latter may be attributed to ameliorated haemodynamics after surgery. A study powered for neurological outcome is needed to conclude on clinical benefits of RIPC.

**Table 1: Perioperative NSE results, \( \mu \text{mol/l}. \) Data are median (25-75).**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>30 min post-bypass</th>
<th>6 h post-bypass</th>
<th>1 POD</th>
<th>2 POD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIPC</td>
<td>2.03 (1.47-4.30)</td>
<td>9.11 (5.06-11.20)</td>
<td>9.15 (7.04-11.65)</td>
<td>7.69 (3.83-10.05)</td>
<td>3.95 (3.38-5.02)</td>
</tr>
<tr>
<td>Control</td>
<td>3.33 (1.50-5.00)</td>
<td>7.57 (5.53-12.80)</td>
<td>11.55 (6.46-17.25)</td>
<td>6.68 (4.32-9.94)</td>
<td>2.95 (2.04-4.60)</td>
</tr>
</tbody>
</table>

POD = postoperative day
Intra-operative methadone for the prevention of postoperative pain: a randomized, double-blinded clinical trial in cardiac surgical patients

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² Northwestern University, Chicago, IL, USA

Introduction. The intensity of pain after cardiac surgery is often underestimated, and inadequate pain control may be associated with poorer quality of recovery. An alternative strategy to short-acting opioids in the operating room is the administration of a single intra-operative dose of methadone, which has an elimination half-life of up to 35 h. The aim of this randomized, double-blinded study was to examine the effect of intra-operative methadone on postoperative analgesic requirements, pain scores, patient satisfaction, and clinical recovery.

Methods. Patients undergoing cardiac surgery with cardiopulmonary bypass (n = 164) were randomized to receive methadone (0.3 mg/kg) or fentanyl (12 µg/kg) at anaesthetic induction. All anaesthetic and surgical management was standardized. Postoperative analgesic requirements were recorded. At 15 minutes and 2, 4, 8, 12, 24, 48, and 72 h after tracheal extubation, patients were assessed for pain at rest and with coughing and movement. At these same assessment periods, patients were evaluated for level of sedation, nausea, vomiting, itching, hypoventilation, and hypoxia. Ordinal data and non-normally distributed continuous data were compared between groups using the Mann-Whitney U-test and within groups across time with the Friedman test. Normally distributed continuous data were compared using the unpaired t-test. The criterion for rejection of the null hypothesis was a two-tailed p < 0.01.

Results. The time to first morphine rescue was longer in the methadone group (6.5 [0.05-72] h) compared to the fentanyl group (3.75 [0.25-21.75] h, p < 0.0001). The requirements for morphine during the first 24 h were reduced in methadone group compared to the fentanyl group (6 [0-34] mg vs. 10 [2-106] mg, p < 0.0001). The number of patients requiring high-dose morphine (≥ 20 mg) during the first 24 h was lower in the methadone group (2.6%) compared to the fentanyl group (29.1%, p < 0.0001). Total morphine use over the first 72 h was less in the methadone group (8 [0-44] mg) compared to the fentanyl group (14 [2-146] mg, p < 0.0001). Verbal pain scores (scale of 0 to 10, with 0 = no pain, 10 = worst pain imaginable) at rest were significantly less in the methadone group (2-3) compared to the fentanyl group (3-5, all p < 0.0001). Pain scores with coughing (4-5 methadone group, 5 to 7 fentanyl group, all p < 0.0001) and with movement (3-5 methadone group, 5-7 fentanyl group, all p < 0.0001) were reduced in the methadone group throughout the first three postoperative days. Overall satisfaction with pain management, measured on a 100-point VAS scale, was higher in the methadone group (90-100) compared to the fentanyl group (70-90, p < 0.0001). The incidence of opioid-related adverse events was not increased in the methadone group. The durations to tracheal extubation (6.5 versus 6.0 h) and ICU admission (30.5 versus 47.1 h) were not different between the methadone group and the fentanyl group.

Discussion. The administration of intra-operative methadone resulted in reductions in analgesic requirements, improvements in pain scores, and enhanced patient-perceived quality of pain management.
**O-60**

**TOE-guidance for transcatheter paravalvular aortic, mitral or tricuspid leakage repair**

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**Introduction.** Paravalvular leakage (PVL) is a potential complication of valve replacement surgery. Incidence is reported to be 2-17%. Percutaneous transcatheter closure of PVLs, using various devices, has been reported with variable procedural success rates.

**Methods.** Between Nov 2006 and Dec 2013, 145 procedures were performed in 137 patients (mitral = 85, aortic = 50, tricuspid = 2), age (16-75 yr), all under general anaesthesia and visualization of defects by TOE and fluoroscopy without using contrast media. Type of valves was mechanical (bileaflet, single leaflet, single disc, ball and cage) in 135 patients and bioprosthesis in 2 patients. A variety of devices were used including ASD Amplatzer, perimembranous and muscular VSD Amplatzer, PDA occluder and vascular plug. Time from replacement surgery resulting in a paravalvular leakage was 1 week to 32 yr before the percutaneous procedure.

**Results.** Time of procedure was 25-180 (98 ± 33) minutes. The procedure was technically successful in 137 of 145 patients (94.4%). A successful second attempt was carried out in 3 patients as the result of ventricular fibrillation and resuscitation or difficulties during first attempt. In one patient was contrast induced nephropathy found. In two patients residual peridevice leak occurred. One of them had transient severe haemolysis, which resolved after 1 week. Two patients died In-hospital, one as a result of vascular access complications and one unknown. One later death occurred as a result of intracranial haemorrhage at 3 yr follow up. Three patients required surgery for tamponade or unsuccessful procedure. Clinical improvement in NYHA class occurred in 135/137 patients (98.5%). None of patients (0.0%) developed contrast induced nephropathy (CIN) because no contrast media was injected.

**Discussion.** Percutaneous closure of PVLs is feasible in selected referral centres with experienced operators. Intra-procedual TOE has an impact on confirming previous diagnosis and co-existing abnormalities, evaluation of endocarditis as well as determination of size, shape and location of leak, proper positioning of device, evaluation of complications of device before release and residual leak assessment. As we improved our experiences, we carried out this time-consuming procedure straightforwardly and faster. TOE reduces the need for contrast media injection and the incidence of contrast induced nephropathy.

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**O-61**

**MPR and i-scan planimetry in real time 3D transoesophageal echocardiographic (3DTOE) measurement of tricuspid valve annulus area change and its correlation with right ventricle function parameters in patients with rheumatic mitral stenosis**

*Prabhat Tewari, Shantanu Pande, Surendra Kumar Agarwal*  
*Sgpgims, Lucknow, Uttar Pradesh, India*

**Introduction.** Tricuspid valve annulus (TVA) shows conformational change during the cardiac cycle [1]. In patients with mitral stenosis and tricuspid regurgitation (TR) the TVA dilates and becomes more circular. 3DTOE helps in delineating the complete TVA, thus making area measurement more reliable [1]. We evaluated the indexed TVA area change and correlated it with RV systolic pressure (RVSP), tricuspid annular plane systolic excursion (TAPSE), RV S’ (at lateral annulus tissue Doppler), RV myocardial performance index (MPI), and RV area change.

**Methods.** After institutional approval, prospectively, 25 patients having mitral ste-
nnosis with no AF underwent TOE on ie33 system (Phillips) after induction of GA in the operation room. RV function parameters RVSP, TAPSE, RV MPI and RV S’ were measured in standard 2D views. 3DTOE data set was acquired in full volume mode in mid-oesophageal position with centred TV and then analysed on Q Lab software (Phillips Medical Systems, Andover, MA) for TVA area measurement in end systole and diastole by planimetry. Data was presented as mean with SD and analysed with correlations and scatterplots using SPSS software ver. 15.00.

**Results.** Complete echo dataset for the evaluation of the parameters was acquired in 14 female and 8 male patients. TVA area increased with TR (diastole male 15.41 ± 1.69 female 8.62 ± 1.32; systole male 9.38 ± 0.15 female 5.16 ± 0.28). The indexed change in TVA area (icTVAa) correlated strongly with MPI in a negative way (males: r –1.00, p < 0.01; females: r –0.754, p < 0.01). icTVAa correlated well, only in males, with RVSP (r –1.00, p < 0.01), with s’ and s’ duration (r 1.00, p < 0.01; r -1.00, p < 0.01) and TAPSE (r 1.00, p < 0.01).

**Discussion.** icTVAa significantly diminishes as RV MPI increases in both male and female patients and seems to be a better index of RV function as compared to RV MPI because it is measured in a single cardiac cycle. 3DTOE based i-scan MPR planimetry seems to be an accurate method for its evaluation.

**References**


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**Oral Session – Transplant**

**0-62**

Association between peri-operative factors and in-hospital and long term mortality of patients undergoing orthotopic heart transplantation

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**Introduction.** Pre-operative organ dysfunction and many procedural factors are among well-known risks of cardiac transplantation. Blood transfusion is a significant risk factor in cardiac surgery, but there is not much known about the influence of the cumulative amount of transfused blood products on the postoperative outcome after heart transplantation.

**Methods.** Sixty-nine patients in one centre were studied (age: 13-66 yr, median 53 yr), who underwent cardiac transplantation in 2012-2013. Peri-operative data were collected and analysed retrospectively. The patients spent an average of 16.5 (median 9) days on the intensive care unit (ICU). 13 of 69 patients died during hospital stay. Mann-Whitney and chi-squared tests have been performed, multivariable Cox-regression model was adjusted for the logarithmic transformation of age, pre-operative red cell distribution width, high dose epinephrine (EPI) use (> 0.07 µg/kg/min), high dose norepinephrine (NOREPI) use (> 0.7 µg/kg/min), need for mechanical circulatory support (MCS), cumulative amount of blood products, cardiopulmonary bypass time.

**Results.** Univariate analysis showed an association between in-hospital mortality and use of packed red cell, fresh frozen plasma (FFP), thrombocytes, prothrombin complex concentrate, terlipressin, bleeding on the day of surgery, pre-operative MCS use,
postoperative left ventricular ejection fraction < 40%, length of stay on ICU, hypotension, need for MCS, high NOREPI or EPI dose after transplantation, primary graft failure, respectively \((p < 0.05)\). Multivariable analysis showed that cumulative FFP use \((p = 0.015; \text{adjusted odds ratio (AOR): } 1.46; 95\% \text{ confidence interval [95\% CI]: } 1.08-1.98\) and perioperative terlipressin use \((p = 0.009; \text{AOR: } 3.24; 95\% \text{ CI: } 1.34-7.79)\) were independently associated with long-term mortality.

**Discussion.** Cumulative amount of blood products given and indicators of unstable haemodynamics, i.e., need of high catecholamine, terlipressin and MCS, are significant risk factors of in-hospital mortality. The use of FFP and terlipressin seem to be independent risk factors of long-term mortality.

**O-63**

**AMiLiE-Survey: current practice of anesthesia in patients undergoing lung transplantation in Europe**

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**Introduction.** More than 1,750 lung transplantations were performed throughout Europe in 2012 [1]. Nevertheless, just a few single centre reports concerning the intra-operative management of patients undergoing lung transplantation have been published. With the objective of reducing a crucial lack of information, an online-survey was performed to collect data about the way intra-operative management is actually performed in European transplant centres.

**Methods.** The survey consisted of 31 questions covering six major subjects: structural data, haemodynamic management, fluid therapy, vasopressor/inotropic support, treatment of intra-operative pulmonary hypertension and general anaesthesiological considerations. The survey was sent to 72 transplant centres currently performing lung transplantations in 17 countries in Europe.

**Results.** 42 questionnaires were completed representing an overall response-rate of 58.3%. Standard haemodynamic monitoring such as ECG, etCO\textsubscript{2}, body temperature, CVP, SPO\textsubscript{2} and invasive blood pressure was used in every transplant centre. The standard use of advanced haemodynamic monitoring included pulmonary arterial catheter (78.6%) and transoesophageal echocardiography (71.4%). VV-ECMO (92.9%), VA-ECMO (97.6%) and CBP (95.2%) were available in almost all transplant centres and were commonly used in case of pulmonary arterial hypertension with right heart failure (88.1%), severe hypoxaemia (85.7%), and therapy-refractory hypercapnia with respiratory acidosis (73.8%), haemodynamic instability (76.2%) and pulmonary oedema (64.3%). Crystalloids (95.2%) were used for fluid replacement. Volume replacement therapy consisted of crystalloids (38.1%) as well as colloids (38.1%) and blood products (i.e., FFP) (23.8%). 64.3% of the transplant centres established transfusion management protocols or algorithms to control procoagulatory therapy. Most commonly used first choice inotropic therapy was dobutamine (45.2%) and epinephrine (23.8%), first choice vasopressor therapy was norepinephrine (95.2%). When facing intra-operative pulmonary hypertension, most centres used either inhaled NO (73.8%) or inhaled prostanoids (11.9%) as first choice medication. Postoperative ventilation was usually managed by using pressure controlled ventilation (61.9%), a tidal volume of 6–8 ml/kg BW (97.6%) and a maximum PIP of 25–30 cmH\textsubscript{2}O (71.4%).
Conclusion. In some fields, we see overall consensus, i.e., regarding intra-operative basic and advanced technical equipment. However, there is a great variability of intra-operative management strategies, especially with respect to recent controversial issues (i.e., volume replacement therapy) and new technologies (i.e., POC-devices). Therefore establishing a consensus recommendation seems helpful to improve intra-operative standards in lung transplantation, to give guidance to low volume centres and thus possibly to improve patients’ outcome.

References

O-64
Low cardiac output states in LVAD patients: an overview of cases in a cardiac centre in the United Kingdom

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Introduction. Left ventricular assist devices (LVAD) are an increasingly common in emergency departments and non-cardiac intensive care units worldwide. While the devices are very safe, patients can still present in low cardiac output states needing urgent medical management. We examined the cases of low cardiac output diagnosed in the over 100 LVAD patients known to our institution. We excluded LVAD patients presenting in cardiac arrest.

Methods. We reviewed the patients whose LVADs had been implanted at our institution.

Results. Of the 130 HeartWare LVADs implanted, 43 patients died before transplantation. 6 had pump-related complications (5 pump thrombus and 1 bleed from driveline entry), 10 died of a cardiac cause (7 RV failure, 1 calcified LV and 2 arrhythmias), and 27 died of non-pump non-cardiac causes (13 sepsis, 13 intracerebral bleed and one withdrawal by the local hospital).

Discussion. Low cardiac output states in LVAD patients are a recognised entity. Low device preload due to right ventricular failure or inflow cannula obstruction are the most common, while LVAD failure is a vanishingly rare entity. The degree of flow decrease tolerated by the patient is dependent on the underlying left ventricular function and/or recovery, right ventricular function and the individual’s physiological reserve. Clinical management is similar to that of any acute heart failure patient – ventilatory support, inotropes, mechanical circulatory support including extracorporeal life support, urgent transplantation, and targeted end-organ support therapy. LVAD patients with primary or secondary device failure must be heparinised as they are at high risk of device thrombosis and subsequent high mortality. New generation non-occlusive LVADs also allow free regurgitation of blood back into the left atrium and pulmonary circulation, thus worsening the degree of heart failure.

References
O-65
Percutaneous trans-femoral trans-septal left atrium drainage for left heart decompression of heart transplant candidates with peripheral veno-arterial extracorporeal membrane oxygenation

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Introduction. The purpose of this study was the evaluation of efficiency of the left heart by trans-femoral trans-septal decompression of the left atrium (LA) of heart transplant candidates with peripheral veno-arterial extracorporeal membrane oxygenation (VA ECMO).

Methods. This study included 46 heart transplant candidates (35/11M/F, age 16-66 [42.1 ± 4.1 yr]) with peripheral VA ECMO. Diagnoses were DCM (n = 31; 67.4%), CAD (n = 8; 17.4%), chronic cardiac allograft dysfunction (n = 4; 8.7%) and valvular diseases (n = 3; 6.5%). In all cases, we used a peripheral surgical cannulation technique via femoral arterial cannula 15-19 Fr, venous cannula 21-25 Fr and arterial cannula or vascular catheter 8-10 Fr for anterograde legs perfusion. For LV unloading, we used a supplement drainage cannula (venous cannula 17-19 F) percutaneously introduced to the LA through the femoral vein of the contralateral leg and connected to the venous line of the ECMO circuit. For installation of transcutaneous trans-septal LA cannula we used a long trans-septal needle, long introducer and long dilator, and standard venous ECMO cannula. All manipulations were controlled by transoesophageal echocardiography and radioscopy. We tried to make the trans-septal puncture of LA in the region of the fossa ovalis.

Results. VA ECMO support was a blood flow 4.8 ± 0.6 L/min or 2.65 ± 0.06 l/min/m², gas flow 4.8 ± 0.6 L/min, FiO₂ 0.81 ± 0.02. 28 (60.8%) of 46 patients receiving VA ECMO, despite right atrium unloading (CVP 3.2 ± 0.4 mmHg), still had a high (> 25 mmHg) pulmonary artery wedge pressure (PAWP) that demanded active left heart decompression. In 17 (61%) of 28 patients, trans-septal LA cannulation was made immediately after VA ECMO initiation, and 11 (39%) on 3.4 ± 0.5 day. Mean blood flow of the LA cannula was 1.84 ± 0.04 L/min. After beginning LV drainage, we noted a significant (p < 0.05) decrease of PAWP from 29 ± 2 to 18 ± 3 mmHg. Duration of pre-transplant VA ECMO in surviving patients receiving OHTx/reOHTx was 1-34 (8.6 ± 1.7) days. The mortality of heart transplant candidates with active LA/LV unloading (n = 2, 7.1%) was less (p < 0.05) than patients without left heart decompression (n = 6, 33.3%). Just before heart transplantation, the LA cannula was removed into the vena cava inferior.

Discussion. More than 50% heart transplant candidates with peripheral VA ECMO needed active left heart decompression. Active percutaneous trans-femoral trans-septal LA drainage following VA ECMO is an effective tool of left ventricle unloading and protection against pulmonary congestion.

O-66
Vasoplegia after implantation of a non-pulsatile left ventricular assist device: incidence, risk factors and outcome

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Introduction. Vasoplegia occurs in 5-25% of regular cardiac surgery patients and is associated with increased morbidity and mortality. The exact incidence of vasoplegia after non-pulsatile left ventricular assist device (LVAD) implantation as a treatment of heart
failure is unknown. The aim of this study was to evaluate the incidence, potential risk factors and the outcome of vasoplegia after LVAD implantation.

Methods. All patients scheduled for LVAD implantation between 2006 and 2013 were included. Vasoplegia was considered present if a patient had at least three out of the following conditions in the first 48 h after ICU admittance: mean arterial pressure < 50 mmHg, systemic vascular resistance < 800 dyn/s/cm², cardiac index > 2.5 l/min/m², or use of norepinephrine > 100 ng/kg/min. The analysis included independent student’s t-test and logistic regression analysis.

Results. One hundred forty-seven patients underwent 176 procedures. Vasoplegia occurred in 76 procedures (43%). Pre-operatively, patients with vasoplegia were older (p = 0.006, OR 1.03, 95% CI 1.01-1.06), used more loop-diuretics (p = 0.020, OR 2.40, 95% CI 1.13-5.07) and less low-molecular-weight-heparins (p = 0.023, OR 0.41, 95% CI 0.19-0.90), had lower neutrophil volumes (p = 0.007, OR 0.96, 95% CI 0.93-0.99), higher bilirubin levels (p = 0.036, OR 1.02, 95% CI 1.00-1.04) and higher creatinine levels (p = 0.029, OR 1.01, 95% CI 1.00-1.01). Intra-operatively, they received more epinephrine (p = 0.003, OR 6.06, 95% CI 1.65-22.32). Immediately post-operative, haemoglobin (Hb) levels were lower (p = 0.007, OR 0.68, 95% CI 0.51-0.90). They underwent more often a re-thoracotomy (p = 0.014, OR 2.19, 95% CI 1.16-4.11), developed more often renal failure (p < 0.001, OR 3.90, 95% CI 1.91-7.98), and showed increased ICU mortality (p = 0.040, OR 2.49, 95% CI 1.02-6.04). Using multivariable regression analysis, neutrophil volumes, the use of loop-diuretics and epinephrine, and post-op Hb remained significantly associated with vasoplegia. However, the areas under the ROC-curves were < 0.64.

Discussion. Vasoplegia after LVAD-implantation affects almost half of the LVAD patients. Prediction of this condition remains difficult.

Oral Session – Safety

0-67
Is osteopontin a new biomarker of systemic inflammatory response in high risk coronary artery bypass grafting patients?

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Introduction. A systemic inflammatory response (SIRS) following cardiac surgery is common, and resultant impairment of multiple organ function is exacerbated in patients with co-existing morbidity and minimal cardiac reserve. TNF-α is one of the earliest cytokines detected in the blood after activation of macrophages and pro-inflammatory cells. Osteopontin (OPN) is a multicellular protein that mediates diverse biological functions, promotes cell mediated immune responses and plays a role in chronic inflammatory diseases. However, its role in cardiopulmonary bypass (CPB) related inflammation is currently not known. The objectives were to assess the relation of OPN and TNF-α level in high risk patients who underwent coronary artery bypass grafting (CABG), and to examine if there exists any association between serum OPN level and SIRS in this group of patients.

Methods. The study comprised 50 adults (EuroSCORE of > 6 [8-13]) undergoing elective CABG using CPB. Plasma OPN and TNF-α levels were determined at base line (T1), 24 (T2), 48 (T3) and 72 (T4) h postoperatively. The clinical evidence of SIRS and postoperative outcome was recorded. Data are presented as mean ± SD/number%. Continuous variables between groups were estimated using student’s t test. Categorical variables were compared using chi-squared test. The association between OPN and TNF-α, TNF-α and SIRS was analysed by using Kruskal-Wallis test. The correlation between OPN and SIRS was tested by using General-
ized Estimating Equation. \( p < 0.05 \) was considered to be statistically significant.

**Results.** Post CPB, SIRS developed in 9 (18%) patients. At T1, the OPN and TNF-\( \alpha \) levels were comparable in all patients (\( p = 0.23 \) and 0.65 respectively). A positive correlation was observed between OPN and TNF-\( \alpha \) at different time points (T1; \( r = 0.33, p = 0.01 \), T2; \( r = 0.84, p = 0.00 \), T3; \( r = 0.88, p = 0.00 \) and T4; \( r = 0.92, p = 0.00 \) respectively). Significantly high levels of OPN and TNF-\( \alpha \) were found at T2 (50.1 ± 11.3 vs 77.9 ± 16.6 pg/ml, \( p = 0.01 \) and 132.8 ± 13.9 vs. 191.9 ± 35.7 pg/ml, \( p = 0.001 \) respectively), T3 (38.9 ± 12.8 vs. 154.1 ± 35.5 pg/ml, \( p = 0.001 \) and 130.5 ± 8.2 vs. 290.5 ± 18.8 pg/ml, \( p = 0.0001 \) respectively) and T4 (28.7 ± 14 vs. 261.6 ± 40.2 pg/ml, \( p = 0.000 \) and 119.4 ± 22.5 vs. 335.5 ± 26.5 pg/ml, \( p = 0.002 \) respectively) in SIRS patients. The overall complication rate, inotropic support, duration of intensive care unit stay and hospital stay was significantly higher in patients with a high OPN level.

**Discussion.** High serum levels of OPN were associated with poor clinical outcome in patient suffering from post CPB SIRS. There exists a direct potential link between OPN and SIRS related to cardiopulmonary bypass. Advances in our understanding of the interaction of OPN with other inflammatory marker of cellular and humoral responses to CPB will enable more effective intervention to reduce the deleterious effects and improve outlook for patients undergoing cardiac operations in future.

**O-68**

Association between rs5498 single nucleotide variation of ICAM-1 gene and EuroSCORE-II in adult cardiac surgical patients operated with use of cardiopulmonary bypass.

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**Introduction.** Association between specific genome variants of inflammatory mediator genes and risk of complications after cardiac surgery was proposed [1]. The rs5498 single nucleotide variation (SNV) of the intracellular adhesion molecule 1 (ICAM-1) gene was previously reported to be associated with post-operative myocardial infarction and acute kidney injury after cardiac surgery [2].

**Methods.** 492 adult patients referred for open heart surgery with use of cardiopulmonary bypass were recruited and signed informed consent to participate in a prospective observational cohort study (NCT01020409). ICAM-1 SNV rs5498 was identified with polymerase chain reaction and SNaPshot tests. Relevant pre-operative data were collected at the pre-operative visit, and EuroSCORE-II was calculated. Score and variables were compared between GG and AA alleles.

**Results.** 152 (30.9%) patients were identified with the AA allele and 91 (18.5%) with the GG allele of rs5498. Patients with the AA-allele compared with patients having the GG-allele presented, respectively: EuroSCORE-II 6.57/4.80 (K-W \( p = 0.029 \)), female/male ratio 0.92/0.49 (OR –1.87; 95% CI: 1.09-3.25; \( p = 0.011 \)), arterial hypertension ratio 5.33/2.79 (OR –1.91; 95% CI: 1.00-3.63; \( p = 0.025 \)) and NYHA I/II/III/IV class ratios 0.90/1.28/2.37/7.00 (\( p = 0.036 \)), while other EuroSCORE variables proved insignificant.
Discussion. The wild ICAM-1-rs5498-AA allele seems be related to higher risk of cardiac surgery, as estimated with EuroSCORE-II, due to its connection with pre-operative risk factors such as arterial hypertension and more advanced heart failure. The observed association with female gender could not be explained by this study and required further analysis. Pre-operative tests of specific genome variants might prove useful in calculating peri-operative risk in adult cardiac surgical patients.

References

Oral Session – Cerebral Oximetry

0-69 Optimization of intra-operative depth of anaesthesia and cerebral oxygenation significantly reduces postoperative delirium after coronary artery bypass graft surgery

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Introduction. Postoperative delirium after cardiac surgery is a common problem with significant implications for patient morbidity and mortality.

Methods. After ethical approval, patients older than 64 yr undergoing coronary artery bypass graft surgery were enrolled in a randomized controlled trial. The depth of anaesthesia in the intervention group was aimed at a BiSpectral Index (BIS) of 50 ± 10 and standardized interventions were delivered if cerebral oxygenation (rSO2) dropped below 15% of the baseline or below 50%. The control group was blinded to BIS and rSO2. We hypothesized that optimisation of intra-operative depth of anaesthesia and cerebral oxygenation significantly reduces postoperative delirium, which was the primary outcome. The trial was powered as a pilot study. We projected a 40% incidence of post-operative delirium and a 70% relative risk reduction with BIS and rSO2 monitoring. A total sample size of 76 gave an 80% power to detect a significant difference at the 95% confidence level. Postoperative delirium was assessed at 3 ± 1 days following surgery using the Confusion Assessment Method (CAM).

Results. Eighty-one patients (86% male) with a mean age of 71.9 yr were randomized. Baseline mini-mental state examination (MMSE) ranged from 24-30. At 3 days postoperatively 26% of the control group were CAM positive compared to 0% of the intervention group (p = 0.001 (Fisher’s exact test). The percentage of time spent outside the target BIS range was significantly higher in the control group (median 38% vs 21% IQR 18%-55% vs 9%-26%). The number of minutes spent with rSO2 less than 15% of baseline was significantly higher in the control group 9.5 vs 0, (IQR 0-47 vs 0-3). Patients with postoperative delirium spent significantly longer with an rSO2 less than 15% of baseline than those without (IQR 36-49 vs 0-31 min, p = 0.048).

Discussion. Intra-operative monitoring of depth of anaesthesia and cerebral oxygenation significantly reduced postoperative delirium in elderly patients undergoing cardiac surgery. BIS and rSO2 optimization may be associated with a reduction in postoperative delirium.
Cerebral oximetry monitoring during transcatheter aortic valve implantation (TAVI) procedure

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Introduction. For 12 years, TAVI has become an alternative solution for patients not eligible for surgical aortic valve replacement. However, TAVI procedures are not without risk, especially regarding the neurological events [1]. The aim of the study was to assess whether cerebral oximetry monitoring is predictable for neurologic outcome.

Methods. This is a prospective study including 100 consecutive patients eligible for TAVI (femoral access most of the time) in a single centre. The cerebral oxygen saturation (rScO₂) was monitored (INVOS® device Covidien®). Desaturation was defined as a 20% decrease of the basal value and early neurologic event as a stroke within 2 days after the procedure.

Analysis of variance, parametric or non-parametric statistic tests were used to assess statistical significance (p < 0.05)

Results. Forty-six percent of the patients experienced at least one episode of rScO₂ decrease, but early neurological events were observed in 3.75% patients only. Three pre-operative characteristics were associated with desaturation occurrence:
- Low pre-operative haemoglobin level: 11.53 vs 12.32 g/dl (p = 0.026).
- Sex: 61% women vs 39% men (p = 0.028).
- Right basal rScO₂: 57.6 vs 61.1% (p = 0.042).

There was no significant correlation between desaturation occurrence and neurological events. There was no difference between the types of valve implanted (Corevalve®, Edwards Sapiens®)

Discussion. The TAVI technique is associated with impaired cerebral oxygenation in almost half of the cases. Cerebral desaturation is not predictive of early neurologic event, but its association with cognitive dysfunction remains unclear and deserves further studies.

References

Oral Session – Haemodynamics

Comparison of single and recalibrated measurements of cardiac index obtained by ProAQT-Pulsioflex™ with those of FloTrac/Vigileo™

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Introduction. The ProAQT-Pulsioflex™ is a minimally invasive method to obtain cardiac index (CI) using pulse contour analysis. According to the manufacturer, the device has to be calibrated at the start of every procedure and should be able to measure CI accurately without further calibration. However, recalibration of CI is possible, e.g., after major changes in vascular tone or volume. We compared these single calibrated measurements (CIPAsc) and recalibrated ones (CIPAcal) with our clinical standard, i.e., CI measured by FloTrac/Vigileo (CIFTV).

Methods. This prospective, observational single centre study includes seventy patients undergoing off-pump coronary artery bypass surgery. The moments at which CI was documented were randomly chosen during surgery to resemble clinical practice. Values were compared by Bland-Altman analysis for repeated measures.
polar plot methodology were used to evaluate CI trending ability for each Method.

**Results.** CIPAsc overestimated CIFTV with an average of 23%. This overestimation increased over time, doubling in four hours from 15% to 30%. In contrast, CIPAcal consistently overestimated CIFTV by 13%. Agreement analysis of CIPAsc and CIPAcal versus CIFTV revealed a bias of −0.76 and −0.23 l/min/m² and 95% limits of agreement of ±1.37 and 0.95 l/min/m², respectively. The percentage error was 112% for CIPAsc and 79% for CIPAcal. Polar plot analysis showed moderate concordance to track CI changes in both methods (69% and 84% within 30º limits of agreement).

**Discussion.** The ProAQT-Pulsioflex™ should be recalibrated at certain intervals to increase its accuracy and precision of measuring and tracking CI. Both CIPAsc and CIPAcal are not interchangeable with CIFTV.

**0-72**

**Tissue rSO₂ during on-pump CABG can predict post-op renal dysfunction**

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**Introduction.** Near-infrared spectroscopy is a non-invasive continuous monitoring method for measuring the oxyhaemoglobin saturation. Cerebral rSO₂ is the parameter being most commonly monitored during CPB, especially in aortic surgery. But it was shown in several publications that rSO₂ of skeletal muscles can also reflect the hypovolaemic disorders in human traumatic and septic shock [1, 2]. It is also clear that during CPB, the cerebral blood flow is not the same as other regions. The aim of our work was to monitor skeletal muscle rSO₂ during on-pump CABG and to estimate its predictive value for post-op renal dysfunction.

**Methods.** Twenty-two men and women (mean age 56.8 ± 4.1 yr) underwent CABG with normothermic CPB. The INVOS method was used during the whole period of operation before and after CPB. The two NIRS sensors were positioned at the dorsum muscles at the Th 10-L2 levels. Also for cerebral rSO₂ measurement, two other NIRS sensors were used in the standard frontal cerebral position. rSO₂ values were recorded every 3 seconds. To assess renal dysfunction, the RIFLE score was used. For statistical analysis, the nonparametric methods were used in IBM SPSS Statistic 19.0. To assess the predictive value, ROC-analysis was used.

**Results.** In all patients rSO₂ levels decreased after sternotomy and were significantly lower during the whole period of CPB than before the operation levels (70.3% vs. 87%; p < 0.01). In patients with acute kidney injury, the rSO₂ levels during CPB were significantly lower than in the patient with normal renal function (65.1% vs. 78%; p < 0.01). The area under the ROC-curve for rSO₂ was calculated as 0.773 (p < 0.0001) and the mean rSO₂ value less than 69% during the CPB has a sensitivity 53.5 and specificity 97.1 for post-op acute kidney injury prediction. Cerebral and tissue rSO₂ trends of those patients were compared.

**Discussion.** Regional tissue rSO₂ can possibly be routinely monitored during on-pump CABG to assess the safety of the procedure.

**References**


Propofol anaesthesia for surgery with cardiopulmonary bypass is related to decreased tissue saturation during vascular occlusion test in comparison to sevoflurane

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Introduction. The purpose of this study was to compare the effects of propofol and sevoflurane on tissue saturation during a vascular occlusion test (VOT) in various phases of heart surgery with CPB.

Methods. Data from 60 patients, randomized to group P (Propofol) and S (Sevoflurane) were analysed. VOT was performed using the INVOS oximeter placed over the thenar muscle, by inflating a sphygmomanometer cuff to exceed the systolic pressure value by 30 mmHg, and maintain this induced ischaemia for 3 minutes at the following stages:
1) 30 min after anaesthesia induction;
2) directly after sternotomy;
3) 20 min after aortic X-clamp;
4) 40 min after aortic X-clamp;
5) 20 min after release of aortic X-clamp;
6) 45 min after weaning of CBP. Group and time effects on oximetric parameters were analysed with RM-ANOVA and post hoc Tukey test.

Results. During the hypoxic phase, a trend towards a lower rate of desaturation was observed in group S compared to group P ($p = 0.08$). Patients given propofol showed lower measurements of the lowest tissue saturation ($p = 0.018$). No difference between propofol and sevoflurane was observed in the speed of tissue saturation recovery and the highest saturation on reperfusion. Post hoc analysis demonstrated that in both groups, the lowest

![Figure 1](image-url)
tissue saturation during CPB was lower than before (s. Figure 1.

**Discussion.** The rate of desaturation during VOT was proposed to reflect the local metabolic rate and the speed of tissue saturation recovery on reperfusion is thought to express microcirculatory flow [1]. Differences observed in the hypoxic phase might be caused by attenuation of mitochondrial respiration by sevoflurane. We conclude that sevoflurane anaesthesia may ameliorate hypoxia resulting from tissue ischaemia in comparison to propofol.

**References**


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**O-74**

**Troponin T and brain natriuretic peptide after on-pump cardiac surgery: impact on 1-year mortality and major cardiac events after adjustment for postoperative complications**

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**Introduction.** The independent predictive value of troponin T (TNT) after on-pump cardiac surgery was established in several studies. However, adjustment was limited to pre-operative risk factors without considering peri-operative complications. Data on post-operative B-type natriuretic peptide (BNP) after on-pump cardiac surgery are scarce. Our aim was to assess the independent value of TNT and BNP to predict 1-year outcome after adjustment using the EuroSCORE and postoperative complications and to report risk stratification gains.

**Methods.** This prospective cohort study included consecutive patients undergoing on-pump cardiac surgery between 2007 and 2010 in a tertiary centre. We evaluated postoperative peak TNT and BNP, the EuroSCORE, and postoperative complications, i.e., sepsis, sternal infection (without sepsis), respiratory infections and acute kidney injury as predictors of adverse events using Cox regression. The primary endpoint was death or major adverse cardiac events (MACE) within 1 year after surgery. We calculated the net reclassification improvement of TNT and BNP in addition to the EuroSCORE.

**Results.** We enrolled 1559 patients. Follow-up was completed in 1545 patients (99.1%). Within the first year after surgery, 176 patients (11.3%) suffered an event. Eighty-three events (5.3%) occurred within 30 days of surgery, of which there were 58 deaths (3.7%). The adjusted hazard ratio (HR) of peak TNT > 0.8 μg/l was 2.13 (95% CI 1.47-3.15), of peak BNP > 790 ng/l 2.44 (95% CI 1.65-3.62). The net reclassification improvement of the addition of TNT and BNP to the EuroSCORE was 0.276 (95% CI 0.195-0.348). A model fitted to predict 30-day events showed similar results.

**Discussion.** Postoperative TNT and BNP are strong predictors of 1-year events after on-pump cardiac surgery independent of pre-operative risk factors and postoperative complications. Updating the pre-operative EuroSCORE risk with postoperative TNT and BNP after surgery allows improved prediction of 1-year death or MACE.
**0-75**  
**In a FAST-TRACK protocol remifentanil is not superior to standard sufentanil regime**

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**Introduction.** Progressive cost containment care has resulted in a growing interest of fast-track cardiac surgery and length of stay (LOS) in the ICU. A recent, though not randomized, study showed that remifentanil anaesthesia resulted in shorter postoperative ventilation time and LOS. Additionally, a major issue is that LOS in ICU is not a fully objective measure, as patient discharge, besides medical factors, may also be guided by logistics and policies. We hypothesized that remifentanil compared to sufentanil would reduce ventilation time and LOS in ICU and that remifentanil would have beneficial effects on the overall quality of recovery.

**Methods.** Sixty patients, planned for elective coronary artery bypass grafting ± aortic valve replacement were randomized to remifentanil or sufentanil combined with propofol. Patients with ejection fraction < 0.3, myocardial infarction within the last 4 weeks, diabetes and severe pulmonary or arterial hypertension were excluded. The primary outcome was eligible LOS in the ICU. Secondary parameters were ventilation time, actual LOS in ICU, time in hospital, quality of recovery and peri-operative complications.

Groups were, assuming non-normal distribution, compared with Mann-Whitney tests. *p < 0.05* was considered significant.

**Results.** The groups were fully comparable in selected demographic and peroperative parameters. There were no differences in ventilation time, eligible or actual ICU discharge time and in-hospital stay between remifentanil and sufentanil patients (table). Remifentanil patients received more morphine during recovery (20 mg vs. 10 mg; *p = 0.040*). No difference was found in medical support or use of pacemaker (s. Table 1).

**Discussion.** In a fast-track protocol remifentanil does not seem superior to standard moderate to high dose sufentanil regime.

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**Table 1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sufentanil</th>
<th>Remifentanil</th>
<th><em>p</em> value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation time (min)</td>
<td>268 (224-375)</td>
<td>298 (242-333)</td>
<td>0.69</td>
</tr>
<tr>
<td>Eligible discharge ICU (h)</td>
<td>11.4 (8.2-13.3)</td>
<td>10.6 (7.8-15.5)</td>
<td>0.79</td>
</tr>
<tr>
<td>Actual discharge ICU (h)</td>
<td>21.2 (19.7-23.2)</td>
<td>20.2 (18.7-22.2)</td>
<td>0.17</td>
</tr>
<tr>
<td>Hospital time (days)</td>
<td>5.5 (4.4-8.4)</td>
<td>5.4 (4.5-7.2)</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Statistics: Mann-Whitney test