

## FREE POSTER SESSIONS

### Oral Session – Preselected Best Posters

#### P-01

### Milrinone relaxes pulmonary veins in precision-cut lung slices from guinea pigs and humans

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**Introduction:** Milrinone acts as a positive inotropic, relaxes pulmonary arteries and reduces right ventricular afterload. Hence, it is used to treat heart failure and pulmonary hypertension (PH). However, its action on pulmonary veins (PVs) is not defined, although PH particularly due to left heart failure affects primarily the pulmonary venous bed. We studied the relaxant effects of milrinone in PVs from guinea pigs (GPs) and humans.

**Methods:** Precision-cut lung slices (PCLS) were prepared from GPs (n = 20). Human lung tissue was received from patients (n = 5) undergoing lobectomy due to cancer. None of the patients showed any sign of PH (echocardiography, histology). After pathological examination, cancer-free tissue was used to prepare human PCLS. Milrinone-induced relaxation was studied by videomicroscopy and baseline luminal vessel area was defined as 100%. Concentration-response curves of milrinone were analysed in naïve and pre-constricted PVs (n ≥ 5). Statistics was performed by the calculation of EC<sub>50</sub> values using the standard logistic regression model.

P-values < 0.05 were considered as significant.

**Results:** In GPs, milrinone relaxed naïve PVs and those pre-constricted with the ETA-receptor agonist BP0104 up to 119% or 121%, respectively. Inhibition of NO-synthesis (L-NAME) did not affect milrinone-induced relaxation, whereas inhibition of protein kinase G (KT 5823), adenylyl cyclase (SQ 22536) and protein kinase A (KT 5720) attenuated the relaxant effect of milrinone. Further, milrinone-induced relaxation was dependent on the activation of K<sub>ATP</sub><sup>+</sup>, BK<sub>Ca</sub><sup>2+</sup>- and K<sub>v</sub>-channels. Human PVs also relaxed to milrinone (121%), however only if pre-constricted.

**Discussion:** In GPs, milrinone-induced relaxation was based on the activation of K<sub>ATP</sub><sup>+</sup>, BK<sub>Ca</sub><sup>2+</sup>- and K<sub>v</sub>-channels and on cAMP/PKA/PKG. The relaxant properties of milrinone on the pulmonary venous bed suggest its usefulness in PH due to left heart disease. They might further contribute to the successful use of milrinone in right and left heart failure, as relaxation of PVs lowers the pulmonary vascular resistance and hydrostatic pressures, alleviating right ventricular afterload and pulmonary oedema. Importantly, milrinone also relaxed human PVs.

**P-02****A meta-analysis of randomised controlled trials on dexmedetomidine in critically ill patients**

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**Introduction:** Comparisons among hypnotics and sedatives used for critical ill patients in the intensive care units have often focused on pharmacokinetics, pharmacodynamics and common adverse effects. Dexmedetomidine is a highly selective  $\alpha_2$ -adrenergic receptor agonist. In contrast to other sedative agents, it also has a potential analgesic effect and may induce a sedative state similar to physiologic sleep without respiratory depression. A meta-analysis of randomised controlled trials (RCTs) reported a significant reduction in length of ICU stay, but not in duration of mechanical ventilation [1]. A large RCT [2] suggested that dexmedetomidine may reduce duration of mechanical ventilation when compared to midazolam. We therefore decided to perform a meta-analysis of all RCTs ever performed on dexmedetomidine versus any comparator in the ICU setting to evaluate the effect on mechanical ventilation, ICU stay and on survival.

**Methods:** Articles were assessed by four trained investigators, with divergences resolved by consensus. BioMedCentral, PubMed, Embase and the Cochrane Central Register of clinical trials were searched for pertinent studies. Inclusion criteria were random allocation to treatment and comparison of dexmedetomidine versus any comparator in the ICU setting. Exclusion criteria were: duplicate publications, non-adult studies and no data on main outcomes. Study endpoints,

main outcomes, study design, population, clinical setting, dexmedetomidine dosage, and treatment duration were extracted.

**Results:** The 28 included manuscripts (29 trials) randomised 3664 patients (1879 to dexmedetomidine and 1785 to control). Overall analysis showed that the use of dexmedetomidine was associated with a significant reduction in length of ICU stay (standardised mean difference (SMD) =  $-0.36$  [ $-0.64$  to  $-0.08$ ] days,  $p$  for effect = 0.01) and with a significant reduction of mechanical ventilation (SMD =  $-0.34$  [ $-0.61$  to  $-0.07$ ] hours,  $p$  for effect = 0.01). Mortality was not different between the two groups (risk ratio (RR) = 1.00 [0.84 to 1.20],  $p$  for effect = 0.9) whereas the use of dexmedetomidine was associated with a significant reduction in delirium rate (RR = 0.69 [0.48 to 0.99],  $p$  for effect = 0.048).

**Discussion:** Dexmedetomidine might reduce time on mechanical ventilation and intensive care unit stay in critically ill patients without differences in mortality rates.

**References**

- [1] Tan JA, Ho KM. Use of dexmedetomidine as a sedative and analgesic agent in critically ill adult patients: a meta-analysis. *Intensive Care Med* 2010; 36: 926-939.
- [2] Jakob SM, Roukonen E, Grounds RM, et al. Dexmedetomidine vs midazolam or propofol for sedation during prolonged mechanical ventilation: two randomised controlled trials. *JAMA* 2012; 307: 1151-1160.

**P-03****Air warming during CABG: simple method to prevent microcirculation disturbances*****Irina Tolstova, Boris Akselrod, Armen Bunatyan****Russian National Centre of Surgery, Moscow, Russia*

**Introduction:** Cardiac surgery is strongly associated with peri-operative hypothermia. The goal of the study was to compare different warming systems and to assess their impact on the microcirculation.

**Methods:** Fifty patients scheduled for CABG with normothermic CPB were randomised into 2 groups. Patients of Group I (n = 30) received an underbody water warming system (HICO-AQUATHERM 660™, Hirtz, Germany); patients of Group II (n = 20) received a forced underbody warm-air blanket (Bair Hugger™, 3M, USA). In both groups active warming was started after admission to the operation room (OR) and continued until the end of surgery. Central temperature (in rectum –  $t_c$ ) and peripheral temperature (of the index finger –  $t_p$ ) were monitored during the surgery. The microcirculation (M) was evaluated by the laser Doppler flowmetry signal from the index finger (LAKK-02, “Lazma”, Russia); total perfusion indices (M) were analysed. We used Student’s t-test and all are presented as mean  $\pm$  standard deviation.

**Results:** After admission to OR and after induction of anaesthesia, temperature did not differ between the groups. Before CPB,  $t_c$  and  $t_p$  were higher in Group II ( $t_c$   $36.2 \pm 0.5$  vs.  $34.7 \pm 0.6$  °C,  $t_p$   $31.1 \pm 0.6$  vs.  $29.5 \pm 0.4$  °C,  $P < 0.05$ ). After 40 min of CPB,  $t_c$  in Group I significantly increased and came up to the  $t_c$  in Group II ( $36.7 \pm 0.2$  and  $36.6 \pm 0.4$  °C). At this stage  $t_p$  was still higher in Group II ( $30.1 \pm 0.5$  vs.  $27.7 \pm 0.6$  °C,  $P < 0.05$ ). At the end of surgery,  $t_c$  and  $t_p$  were higher in Group II ( $t_c$   $36.5 \pm 0.6$  vs.  $35.3 \pm 0.4$  °C,  $t_p$   $31.2 \pm 0.6$  vs.  $27.9 \pm 0.6$  °C,  $P < 0.05$ ). In the postoperative period active warming was required less in Group II (38% vs. 63%,  $P = 0.016$ ).

After admission to OR, M values did not differ between the groups. Before CPB, M was greater in Group II ( $18 \pm 4.5$  vs.  $15 \pm 3.3$ ,  $P < 0.05$ ). After 40 min of CPB, M did not differ between the groups ( $17 \pm 6.2$  and  $16.5 \pm 5.4$ ). At the end of surgery, M was higher in Group II ( $21 \pm 3.7$  vs.  $18 \pm 5.4$ ,  $P < 0.05$ ).

**Discussion:** During CABG a forced warm-air blanket is more effective than a water warming system in prevention of peri-operative hypothermia. Active warming with underbody forced warm-air blanket resulted in better peripheral microcirculation helping to avoid temperature vasoconstriction.

**P-04****A comparison of interindividual variability between thromboelastography (TEG) and rotational thromboelastometry (ROTEM): preliminary data*****Lynne Anderson, Katrina Dick, Robyn Smith, Alistair Macfie, Andrew Grant, Andrew Clark, Myra McAdam, Karim Elkasrawy, Andrew Alistair****Golden Jubilee National Hospital, Glasgow, UK*

**Introduction:** Thromboelastography/ometry has proved useful in decreasing red cell and product use. There are 2 different analysers in use, TEG® and ROTEM®. Many different individuals operate these devices which may be a factor influencing results and may involve clinically relevant discrepancies. Results must be reliable as they guide therapy.

**Methods:** Fourteen adult patients scheduled for elective cardiac surgery were recruited. 36 mL blood was taken and divided into 12 citrated sample tubes. A TEG® kaolin analysis and ROTEM® Intem analysis were subsequently performed. 1 operator performed 6 of each test on each sample to assess intra-operator variability. The other 6 operators performed each test once (inter-operator variability). Results for all ROTEM®/TEG® parameters were noted – CT/r time, CFT/k time

and MCF/MA. The coefficient of variation (CV) was calculated for each measurement and CVs for each comparable parameter were analysed using paired t-tests.

**Results:**

Parameter	Inter-individual CV mean (SD)	Intra-individual CV mean (SD)
TEG R time	13.7 (3.3)	9.89 (4.43)
ROTEM CT	5.18 (2.2) P < 0.01	3.12 (1.59) P < 0.01
TEG K time	16.4 (7.37)	10.9 (5.68)
ROTEM CFT	8.65 (5.79) P < 0.01	6.08 (4.27) P = 0.03
TEG MA	4.23 (1.88)	4.19 (2.1)
ROTEM MCF	2.67 (1.63) P = 0.03	1.82 (1.68) P < 0.01

All CVs for Intem parameters were significantly lower than the kaolin equivalent. CVs for all parameters were lower comparing intra- with inter-individual testing.

**Discussion:** Significantly lower CVs in Intem analysis suggest a more reproducible result compared to TEG® kaolin independent of the user. This may be explained by the automatic pipetting procedure used with ROTEM®.

## P-05

### Tricuspid annular plane systolic excursion (TAPSE) in the modified deep transgastric right ventricle view as an alternative for right ventricular function assessment

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**Introduction:** The aim was to assess the feasibility of TAPSE evaluation in M-mode in deep transgastric right ventricle view (dTGRV) in addition to the standard comprehensive intra-operative TOE examination.

**Methods:** Patients scheduled for elective cardiac surgery underwent standard TOE examination. TAPSE was measured in dTGRV using M-mode with the cursor aligned as good as possible to the free wall of the tricuspid

annulus. TAPSE was also measured using the lateral wall shortening in the mid-oesophageal 4 chamber view (4 Ch). RV function was assessed by means of fractional area change (FAC). Image quality in 4 Ch was evaluated regarding endocardial border definition as good, regular or poor. In dTGRV, degree of cursor alignment to the tricuspid annulus was assessed as good (< 20°), regular (≥ 20-45°) or poor (> 45°). One way ANOVA for repeated measures was performed for both TAPSE measures in each patient. Results are expressed as mean and 95% confidence interval or as percentage (P < 0.05).

**Results:** 40 patients (26 men/14 women) were included. Mean FAC was 40 ± 6, mean TAPSE in dTGRV was 17.4 ± 4 mm vs. 16.8 ± 4 mm in 4CH. We were not able to obtain a dTGRV view in 3 patients (8%).

Image quality	good	regular	poor
dTG RV	81%	11%	0%
4 Ch	73%	27%	0%

No significant difference was found between the two TAPSE measures either when both images were of good quality or when one of them was of regular quality.

Image quality	dTGRV	4Ch	P value
Good in both views (n = 22)	18.1 (16.4-19.9)	17.6 (15.8-19.4)	0.154
Regular in one view (n = 15)	16.1 (13.8-18.4)	15.3 (13.3-17.3)	0.087

**Conclusion:** TAPSE evaluation in M-Mode in dTGRV view is feasible with good quality in most of the cases and it may be used as an additional tool for assessment of RV function when the endocardial borders in 4CH view are poorly defined.

## References

- [1] Kasper J, Bolliger D, Skarvan K, et al. Additional cross-sectional transesophageal echocardiography views improve perioperative right heart assessment. *Anesthesiology* 2012; 117: 726-734.

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**Poster Round –  
Intensive Care****P-06****Delirium in cardiothoracic critical care: does the use of daily assessment tool and period of education improve recognition***Jing Wang, Alison Bing, Peter Alston  
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**Introduction:** Delirium is the most common neuropsychiatric condition in hospitals with a prevalence ranging from 15-25% on medical wards to 80% on intensive care [1]. It is associated with a high mortality and morbidity rate and additional hospital costs yet it is easily identifiable and treatable [2,3]. The aims of this audit were 1. to quantify the incidence of delirium in cardiothoracic critical care area, 2. to establish how often this diagnosis was being missed and 3. to examine the influence of teaching nursing staff the importance of delirium and to use a daily assessment tool.

**Methods:** The CAM-ICU delirium assessment tool was conducted daily on all patients in cardiothoracic intensive care and high dependency units over a three week period to ascertain a baseline incidence of delirium. These results were compared against outcomes from reviewing patient notes, daily charts and prescriptions of antipsychotic medications as evidence of clinical diagnosis of delirium. A ten-day period of education using laminated handouts ensued, accompanied by introduction of twice-daily CAM-ICU nursing assessments. Subsequently, a re-audit was conducted.

**Results:** Before the introduction of CAM-ICU and teaching, 42 patients were examined. Of these patients, 33% (n = 14) were diagnosed with delirium but 43% (n = 6) of these delirious patients had not been clinically diagnosed. After the ten-day period of education, 40 patients were examined and 38% (n = 15) were diagnosed with delirium but only 20% (n = 3) were not clinically diagnosed.

**Discussion:** CAM-ICU is a validated test to diagnose delirium in the critical care setting. Using this method, we found a high incidence of delirium in patients on our cardiothoracic critical care areas that were often not clinically diagnosed. Introducing CAM-ICU and teaching staff its importance then implementing this daily screening tool, increased the recognition of delirium. One of the limiting factors was the small population studied. Future development includes assessing a larger population sample, formal teaching sessions and targeting all staff working in the critical care areas over a longer period to increase awareness of delirium and its diagnosis. In conclusion, introduction of education and delirium assessment tool improved the recognition of delirium in this population sample.

**References**

- [1] ICU Delirium Home. URL:<http://www.icu-delirium.co.uk/> Accessed 29/11/12.
- [2] Inouye SK. Delirium in older persons. *N Engl J Med* 2006; 354: 1157-1165.
- [3] Pun BT, Ely EW. The importance of diagnosing and managing ICU delirium. *Chest* 2007; 132: 624-636.

## P-07 Esmolol as a treatment of refractory hypoxaemia during veno-venous ECMO: a case series

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**Introduction:** Refractory hypoxaemia despite veno-venous extracorporeal membrane oxygenation (VV ECMO) in patients suffering from severe acute lung failure is uncommon but challenging. A critical degree of hypoxaemia of arterial blood may be observed in such patients, especially if ECMO flow is significantly lower than the patient's cardiac output.

**Methods:** We recently [1] presented a series of three septic patients with refractory hypoxaemia during VV ECMO who had an improvement in arterial oxygenation with the use of esmolol, the strategy of using short half-life beta blockers to reduce the endogenous cardiac output and produced an increase in arterial PaO<sub>2</sub>. We have now expanded our experience and we treated 5 further septic patients with the same strategy.

**Results:** PEEP and ECMO flow did not change before and after esmolol administration ( $10 \pm 3$  vs.  $10 \pm 2$  cm H<sub>2</sub>O, and  $3.0 \pm 1.43$  vs.  $3.0 \pm 1.81$  L · min<sup>-1</sup>, respectively). Mean esmolol dosage over the days of treatment was  $41.7 \pm 20.6$  mcg · kg<sup>-1</sup> · min<sup>-1</sup> (equivalent to a mean rate of esmolol infusion of  $22 \pm 11$  mL · h<sup>-1</sup>). Maximum dose was 75 mcg · kg<sup>-1</sup> · min<sup>-1</sup> for few hours except esmolol infusion was discontinued in one patient on the second day of treatment because of haemodynamic instability. After starting esmolol, heart rate decreased from  $98 \pm 20$  to  $89 \pm 11$  bpm and

mean arterial pressure from  $88 \pm 11$  mmHg to  $85 \pm 9$  mmHg, while arterial oxygenation as measured at the radial blood gas sample site increased from  $9.33 \pm 1.47$  kPa to  $12.26 \pm 4.93$  kPa at 24 h, and to  $12.8 \pm 5.73$  kPa at 48 h.

**Discussion:** This preliminary experience further confirms the feasibility and safety of short-acting beta blockers in refractory hypoxaemia during VV ECMO. The pharmacokinetic profile of esmolol, overcomes the potential limitations of the use of beta-blockers in this context, as its short half life allows a prompt reversal of the effect simply by interrupting the infusion. Due to the consistent use of VV ECMO in acute lung failure [2] and the increased awareness of the risks associated with multiple cannulations or conversion to veno-arterial ECMO in patients suffering from refractory hypoxaemia in VV ECMO, a trial with esmolol is strongly recommended before embracing more invasive manoeuvres.

### References

- [1] Guarracino F, Zangrillo A, Ruggeri L, et al.  $\beta$ -Blockers to optimise peripheral oxygenation during extracorporeal membrane oxygenation: a case series. *J Cardiothorac Vasc Anesth* 2012; 26: 58-63.
- [2] Zangrillo A, Biondi Zoccai G, Landoni G, et al. Extracorporeal membrane oxygenation (ECMO) in patients with H1N1 influenza infection: a systematic review and meta-analysis including 8 studies and 266 patients receiving ECMO. *Crit Care* 2013; (in press).

## P-08 Direct complications of "Avalon" cannula use for adult respiratory ECMO: single centre experience

*Antonio Rubino, Alain Vuylsteke, David Jenkins, Jo-Anne Fowles, Kamen Valchanov*  
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**Introduction:** Single site cannulation with a dual lumen cannula (Avalon™ elite) allows the conduct of veno-venous extracorporeal membrane oxygenation (VV-ECMO). Benefits include decrease in blood recirculation, easier patient mobilisation and lower risk of dislodgment.

**Methods:** We reviewed the records of all patients requiring VV-ECMO in whom an Avalon Cannula was inserted, between November 2009 and October 2012 in a single cardiothoracic centre. Descriptive statistics were used.

**Results:** Fifty-three patients were treated using an Avalon cannula during the study period. All cannulae were inserted under ultrasound guidance for vascular access and fluoroscopy was utilised for Avalon Cannula placement. Complications were recorded and categorised as reported in Table 1. Twenty eight complications were recorded in 23 patients; 6 of these complications required further interventions. Overall 38 patients were weaned from ECMO with 71.7% survival to discharge. In 3 cases there was fatal intracranial bleeding.

Table 1

Complications	n	%	Survival to discharge
At insertion of cannula			
			Pneumothorax
Tamponade	1	1.8	100
Pneumothorax	2	3.7	100
During ECMO treatment			
Cannulation site bleeding	13	24.5	84.6
Cannula displacement	3	5.6	66.6
Clots in cannula	1	1.8	0
Culture-proven cannulation site infection	5	9.4	60

**Discussion:** The Avalon cannula performance was satisfactory with the majority of complications graded as minor.

### References

- [1] Javidfar J, Wang D, Zwischenberger JB, et al. Insertion of bicaval dual lumen extracorporeal membrane oxygenation catheter with image guidance. *ASAIO J* 2011; 57: 203-205.

## P-09 Need for vasoconstrictors after cardiac surgery in patients with reduced preoperative left ventricular function

*Marie Mailleux<sup>1</sup>, Adeline Rosoux<sup>2</sup>, Anne-Sophie Dincq<sup>2</sup>, Sébastien Voisin<sup>2</sup>, Isabelle Michaux<sup>2</sup>*

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**Introduction:** After cardiac surgery, patients with pre-operative poor left ventricular function (LVF) more frequently receive inotropic support than pts with preserved LVF. In the literature, few data are available about the postoperative use of vasoconstrictors in these pts with poor LVF.

**Methods:** From February 2010 to January 2012, 801 patients underwent cardiac surgery in our institution. Pre-operative LVF and the use of vasoconstrictors and inotropes during the first 12 hours after admission in the intensive care unit (ICU) were prospectively recorded in our institutional database. Poor LVF was defined as a left ventricular ejection fraction (LVEF) < 30%, intermediate LVF as 30% to < 50% and normal LVF as LVEF ≥ 50%. ICU infusion of dobutamine < 5 µg · kg<sup>-1</sup> · h<sup>-1</sup> or epinephrine < 0.5 mg · h<sup>-1</sup> was defined as low inotropes; infusion of dobutamine ≥ 5 µg · kg<sup>-1</sup> · h<sup>-1</sup> or epinephrine ≥ 0.5 mg · h<sup>-1</sup> was defined as high inotropes. Data were compared using Chi-squared test.

**Results:** Two patients died in the operating room and for 12 pts pre-operative LVF was

not available; 789 patients' data were analysed. Pre-operative LVF was normal in 659 patients, intermediate in 107 patients and poor in 23 patients.

Table: UCI infusion of inotropes or vasoconstrictors according to LVF.

LVF	Poor	Inter-mediate	Normal	P value
No inotropes	2 (8.7%)	49 (45.8%)	507 (76.9%)	< 0.0001
Low inotropes	8 (34.8%)	35 (32.7%)	101 (15.3%)	
High inotropes	13 (56.5%)	23 (21.5%)	51 (7.8%)	
No Norepi	1 (4.4%)	5 (4.7%)	61 (9.2%)	0.0003
Norepi < 10 µg · min <sup>-1</sup>	13 (56.5%)	73 (68.2%)	492 (74.7%)	
Norepi ≥ 10 µg · min <sup>-1</sup>	9 (39.1%)	29 (27.1%)	106 (16.1%)	
Norepi = Norepinephrine				

**Discussion:** Our single-centre experience confirms that pts with a pre-operative reduced LVF are receiving high dose inotropes as well as high dose vasoconstrictors more frequently than pts with preserved LVF.

## P-10 Relation between organ dysfunction and 30-day mortality after cardiac surgery

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Isabelle Michaux*

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**Introduction:** In cardiac surgery, different severity scores (such as MODS, SOFA-score)

Table 1

	MOF 0 n = 657	MOF 1 n = 100	MOF 2 n = 29	MOF 3 n = 12	MOF 4 n = 3
30-day mortality	3	6	6	6	1
RR of 30-day mortality	1	13.14	45.31	109.50	73.00
95% CI		3.34; 51.7	11.92; 172.2	30.97; 387.14	10.29; 517.48
P value		0.0002	< 0.0001	< 0.0001	< 0.0001

show a relation between organ failure and mortality. In this abstract, we hypothesised that after cardiac surgery the 30-day mortality will be higher in patients with multiple organ failure (MOF) in comparison with patients with no organ dysfunction.

**Methods:** From February 2010 to January 2012, we recorded prospectively all the operated cardiac surgical patients in our institution. Data were entered in our institutional database. We recruited 801 patients. We classified patients in 5 different subgroups according the number of organ failure (MOF 0-1-2-3-4). We defined MOF as need for inotrope support (dobutamine ≥ 5 µg · kg<sup>-1</sup> · min<sup>-1</sup> and/or epinephrine ≥ 0.5 mg · h<sup>-1</sup>), need for mechanical ventilation > 48 h, need for renal replacement therapy or neurologic dysfunction (stroke, TIA or epilepsy). We calculated the relative risk (RR) of 30-day mortality for the different subgroups, considering the MOF 0 as the control group.

**Results:** Twenty-two patients (2.7%) died during the first month after cardiac surgery (Table 1).

**Discussion:** In this single centre experience, we confirm that the occurrence of organ dysfunction after cardiac surgery is associated with higher 30-day mortality. Early detection of patients at high risk of multiple organ failure is mandatory to prevent occurrence of organ dysfunction and to possibly improve the survival.

## Poster Round – Congenital & Paediatrics

### P-11 The efficacy of extubation in operating room flowing TCPC procedure in paediatric patients

**Masakazu Yamaoka, Yuichiro Toda, Tatsuo Iwasaki, Kazuyoshi Shimizu, Tomoyuki Kanazawa, Kenji Kawade, Nahoko Ishii, Kentaro Sugimoto, Hirokazu Kawase, Noriko Ishii, Hiroshi Morimatsu, Kiyoshi Morita**

*Okayama University, Okayama City, Japan*

**Introduction:** Early extubation has been performed after total cavo-pulmonary connection (TCPC). However, the potential benefit of immediate operating room extubation remains controversial.

**Methods:** To evaluate the impact of extubation in the operating room of children undergoing TCPC surgery, retrospective data were obtained from records in our institution. We compared peri-operative variables for patients extubated in operating rooms (OR group) and in the ICU (ICU group). All data were analysed statistically by the Wilcoxon rank-sum test and Fisher's exact test using JMP software.  $P < 0.05$  was considered to indicate statistical significance.

**Results:** Data from an electronic data-base for 127 consecutive patients who underwent TCPC surgery between January 2007 and December 2012 were used in this retrospective study. Although CPB time was longer in the ICU group than in the OR group (median: 94 min, interquartile range (IQR): 108 min, 90-129 vs. 78-111  $P = 0.03$ ), body weight, age, gender and number of patients with fenestration were similar in the two groups. Ninety-two patients (72%) were extubated in the operating room and 35 patients (28%) in the ICU. Length of ICU stay was shorter in the OR group than in the ICU group (median 5 days, IQR: 3-7 vs. 7 days, 4-10;  $P = 0.005$ ). Eight patients required re-intubation because of heart failure or bleeding, but the incidence

of re-intubation did not reach statistical significance (8/92 vs 0/35;  $P = 0.1$ ). Interestingly, systolic arterial blood pressure on ICU admission in the OR group was significantly higher than that in the ICU group (median: 94 mmHg IQR: 84-102 vs. 85 mmHg, 70-102;  $P = 0.02$ ). However, highest lactate levels after ICU admission were similar in the two groups. With regard to respiratory parameters, maximum values of PaCO<sub>2</sub> within 24 hours after ICU admission were similar in the two groups (median: 5.8 kPa, IQR: 5.47-6.47 vs. 6.1: IQR 5.36-6.94;  $P = 0.57$ ).

**Discussion:** According to our results, the operating room extubation seems as safe as ICU extubation. However, there are some risks of early extubation such as risks of hypercapnia, airway obstruction, and bleeding. In conclusion, we suggest very early extubation in the operating theatre following TCPC can be equivalent to late extubation. A limitation of this study is that it was a single centre study, the small number of patients and not a prospective randomised controlled study. A well-designed study to confirm the safety of early extubation is needed.

### P-12 Respiratory change in blood flow profile at the site of anastomosis after bidirectional Glenn operation: can it be used to evaluate whether circulation is well established?

**Satoshi Kurokawa, Kenji Doi, Shihoko Iwata, Minoru Nomura**

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**Introduction:** The aim of this study was to investigate the respiratory change in the pulmonary blood flow (PBF) at the site of a bidirectional Glenn (BDG) anastomosis to evaluate whether the BDG circulation is well established.

**Methods:** Eight consecutive patients (age range: 8 months to 14 years) who under-

went BDG from April 2012 to November 2012 were enrolled in this study. The study was approved by the institutional ethics committee. The CVP and the inferior vena cava (IVC) pressures were taken as proxies for the pulmonary arterial pressure and left atrial pressure, respectively. Hence, the trans-pulmonary gradient (TPG) was calculated by subtracting the IVC pressure from the CVP. The PBF was detected at the site of BDG anastomosis by trans-oesophageal echocardiography (TOE). The peak velocity, mean velocity (mV), and velocity-time integral were measured during both inspiration and expiration to calculate the respective inspiration-versus-expiration ratios of these parameters. Pressure parameters and SpO<sub>2</sub> were measured while the TOE measurements were taken. The haemodynamic and SpO<sub>2</sub> measurements were repeated on arrival at the intensive care unit. The final parameter measured was the duration of postoperative mechanical ventilation (PMV). Correlations among the ratios of the TOE measurements and haemodynamic parameters, the SpO<sub>2</sub> value, and the PMV duration were analysed using Spearman's rank correlation test.  $P < 0.05$  was considered statistically significant.

**Results:** The ratio of mV was inversely correlated with (1) the TPG measured simultaneously with the TOE measurements ( $R^2 = 0.7$ ,  $P = 0.005$ ) and (2) the PMV duration ( $R^2 = 0.7$ ,  $P = 0.037$ ). No correlation was observed in any other relationships among the ratios of TOE measurements and haemodynamic parameters, the SpO<sub>2</sub> value, or the PMV duration.

**Discussion:** A smaller decrease of the mV of the PBF at the site of anastomosis after BDG seems to reliably indicate the establishment of BDG circulation with a lower TPG and a shorter duration of postoperative respiratory support.

### P-13

#### Relationship between serum concentration of tranexamic acid and blood loss in paediatric cardiac surgery

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**Introduction:** The effects of tranexamic acid (TXA) on bleeding in children after cardiac surgery have been published in several articles in the literature. However, results are conflicting and the doses of TXA varied widely in these studies. We previously reported that TXA effectively reduced blood loss after paediatric cardiac surgery [1]. The objective was to investigate the adequacy of our doses by measuring serum TXA concentration and the association between blood loss and TXA concentrations.

**Methods:** 160 children under 18 years of age, who underwent cardiac surgery with the use of cardiopulmonary bypass (CPB) during Jan 2006 to Aug 2007 were included in this study. The participants were randomly assigned to either a TXA group or a placebo group. Neonates born within 1 month were excluded from the study. Written informed consents were obtained from the parents. In the TXA group, 50 mg/kg of TXA was administered as an initial bolus before skin incision followed by a continuous infusion of 15 mg · kg<sup>-1</sup> of TXA. Another 50 mg · kg<sup>-1</sup> of TXA was added to the CPB circuit. Patients in the placebo group received only an equivalent volume of normal saline. Blood samples were obtained for measurement of TXA concentration at pre-bolus, after bolus, 15 min after initiation of CPB, and at the end of CPB. Measurement was made by high performance liquid chromatography. Blood loss was defined as mediastinal and pericardial

drainage measured over 24 hours in the post-operative period.

**Results:** 81 children received TXA. Median age 22 months, body weight 9.4 kg, and male 84/160. TXA concentration was markedly increased immediately after bolus administration, with a rapid reduction in blood concentration after initiation of CPB. The concentration gradually decreased with increased CPB duration. No significant correlation was observed between TXA concentration and the amount of blood loss over 24 h. When patients were divided by a cut-off of  $150 \mu\text{g} \cdot \text{mL}^{-1}$  of TXA concentration at initiation of CPB and  $100 \mu\text{g} \cdot \text{mL}^{-1}$  at the end of CPB, the amount of blood loss was significantly larger in the low TXA group than those in the high TXA group. (low TXA level group vs. high TXA level group,  $22.6 \text{ mL} \cdot \text{kg}^{-1}$  [95%CI; 19.7-25.4] vs.  $17.2 \text{ mL} \cdot \text{kg}^{-1}$  [95%CI; 12.8-21.7],  $P = 0.049$ ).

**Discussion:** TXA concentration was successfully determined in children undergoing cardiac surgery with CPB. The TXA concentrations measured in our study were higher than the previously reported concentration needed to inhibit fibrinolysis.

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## Poster Round – Thoracic & Non-cardiac

### P-14

### Is abdominal aorta aneurism repair possible under regional anaesthesia with spontaneous breathing?

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**Introduction:** Patients with abdominal aorta aneurysm (AAA) are at high risk of peri-operative complications. The anaesthesia of choice in AAA patients is a combination of general and regional anaesthesia together with mechanical ventilation. Regional anaesthesia with spontaneous breathing is used occasionally.

The goal of the study was to identify criteria for the possibility of using regional anaesthesia with spontaneous breathing during AAA repair.

**Methods:** We studied retrospectively 2 groups of pts undergoing AAA repair. Group 1 ( $n = 66$ ) were operated under general anaesthesia with lungs ventilation, group 2 ( $n = 62$ ) were given regional anaesthesia and spontaneous breathing. The choice for anaesthesia technique was made by both anaesthetist and surgeon depending on the pre-operative condition of patient and abdominal aorta. We have compared gender, age, weight, height, BMI, BSA, ASA risk, duration of surgery and aorta cross-clamp time. All data were compared using t-test for numeric data and Fisher's test for non-numeric data.

**Results:** There was no difference between groups in age and ASA risk. No pts of group 2 was converted to general anaesthesia. There were less respiratory complications and ICU stay duration in group 2. We have found that the two groups of pts differed from each other in body weight, height, BMI and BSA. No pts of group 2 were obese or overweight (Table 1).

Table 1: Characteristics of patients ( $M \pm \sigma$ )

Parameter	Group 1 n = 66	Group 2 n = 62
Weight (kg)	88.74 $\pm$ 8.55	66.54 $\pm$ 8.69*
Height (cm)	161.28 $\pm$ 11.32	168.37 $\pm$ 7.89*
BMI	34.12 $\pm$ 4.61	23.47 $\pm$ 6.28*
BSA	1.99 $\pm$ 0.07	1.76 $\pm$ 0.04*
Surgery duration (min)	168.88 $\pm$ 28.03	184.63 $\pm$ 27.88*
Aorta cross-clamp (min)	52.66 $\pm$ 5.72	60.36 $\pm$ 8.52*
* P < 0.05 between groups		

**Discussion:** We consider that regional anaesthesia with spontaneous breathing during abdominal aorta repair can be used in patients with BMI under 28 and BSA under 1.8 m<sup>2</sup>.

## P-15

### Lung transplantation for pulmonary fibrosis: impact on right ventricular function

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**Introduction:** Reduction in right ventricular systolic work index (RVSWI) is an intraoperative improvement in patients with chronic thromboembolic pulmonary hypertension undergoing surgical treatment. Many patients with the diagnosis of pulmonary fibrosis (PF) develop secondary pulmonary hypertension (PHT) at the time of transplantation. The purpose of this study was to determine the immediate impact of lung transplantation (LT) on right ventricular function in patients with PF.

**Methods:** Fifty-four LTs for PF were performed between 1/1996 and 12/2012. The retrospective/prospective analysis included 44 patients with complete pre- and post-transplantation intraoperative haemodynamic data. Thirty eight patients received single

lung transplantation. Student's t-test (paired or unpaired) was used as appropriate.

**Results:** Seventy- three percent of the patients presented with PHT (32/44). Overall, a significant fall of RVSWI was found between pre- (14.6  $\pm$  14.5 gm  $\cdot$  m<sup>-2</sup>) and post-transplantation (6.4  $\pm$  3.8 (gm  $\cdot$  m<sup>-2</sup>), P < 0.001). Preliminary results using propensity score to cancel age and sex variability, indicated that the fall in RVSWI was greater in the group without (12.2  $\pm$  5.7 gm  $\cdot$  m<sup>-2</sup>, n = 10) than in the group with primary graft dysfunction (6.0  $\pm$  6.9 gm  $\cdot$  m<sup>-2</sup>, n = 10, P < 0.05). Using the same groups the post-implant ratio of arterial oxygen partial pressure and fraction of inspired oxygen did not show significant differences.

**Discussion:** In this population, PT generated a significant fall in RVSWI, indicating early improvement of post-implant RVF. According to this analysis, there would be an association between severe primary graft dysfunction and low intraoperative RVSWI variation. More patients are needed to confirm these last results.

## P-16

### CPB in lung transplantation: are there more complications?

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**Introduction:** Lung transplantation is very complex surgery which may be the last therapeutic alternative in patients with end-stage pulmonary disease. Some lung receptors are not capable of handling the haemodynamic changes developed during one-lung ventilation (OLP). This fact makes cardiopulmonary bypass (CPB) necessary. However, CPB is associated with side effects such as higher risk of bleeding, more primary graft failure (PGF) rate and larger mortality.

**Methods:** We made a retrospective observational study in our centre, including our last ten patients having lung transplantations off-pump and our last ten patients with CPB support. All the transplantations with CPB and 50% of non-CPB transplantations were double lung transplantations (DLT). We analysed the CPB impact on the haemodynamic and respiratory postoperative progression, as well as the complications and survival rates.

**Results:** Our two groups were similar in demographics, beside pulmonary hypertension (PH) rate (90% vs. 50%) higher in the CPB group, because PH was one of our indications for going on CPB.

There was more bleeding ( $1,649 \pm 1,130$  vs.  $970 \pm 945$  ml) and higher thrombocytopenia rates (50% vs. 10%) in the first 24 postoperative (PO) hours in patients who underwent CPB. Moreover, transfusion rates (80% vs. 20%) were higher in these patients. Acute kidney injury (AKI) in the first 48 PO h was higher in the CPB group (30% vs. 10%). Bleeding between 24 and 48 first PO h ( $700 \pm 285$  vs.  $690 \pm 535$  ml) and AKI rate between 2<sup>nd</sup> and 7<sup>th</sup> day (10%) were similar in the two groups. In the CPB group there were more neurological complications, pneumothorax and diaphragmatic paralysis. The primary graft failure rate was 80% in the CPB group and 70% in the non-CPB group. Severe PGF rate was higher in the group that did not need CPB (62.7% vs. 42.9%).

Extubation time ( $53.6 \pm 29.3$  vs.  $33.3 \pm 20$  h) and the time until hospital discharge ( $67.3 \pm 56.4$  vs.  $47.2 \pm 28.9$  days) were longer in the group who had CPB during transplantation. The ICU stay time was shorter in this group ( $19.6 \pm 38.8$  vs.  $28.6 \pm 38$ , and 8 days). 30-days mortality was 20% in both groups.

Re-analysing our data, comparing the BLT under CPB and the non-CPB BLT, we observed similar results in complications, postoperative bleeding, extubation time, ICU and hospital stay, but with slight differences. In BLT patients PGF rate and severe PGF rate were similar.

**Discussion:** Despite the fact that the two groups were different populations, we can say that complications were higher in the CPB group in the early PO period. When all the CPB damages were corrected (after 24-48 h) bleeding, AKI and PGF rate were the same in both transplantations groups.

## P-17

### Different cardiac output monitoring during lung transplantation: comparison of FloTrac/Vigileo versus CCOmbo/Vigilance monitors

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**Introduction:** Currently, the pulmonary artery catheter represents the most commonly used haemodynamic tool during lung transplantations. Alternative strategies of cardiac output determination have become increasingly accepted in clinical practice. The FloTrac/Vigileo device offers a continuous uncalibrated left heart cardiac output measurement by arterial waveform analysis. The aim of this study was to validate the arterial waveform analysis at specified time points during lung transplantations against a simultaneous measurement of the gold standard pulmonary artery catheter.

**Methods:** After ethical approval (nr 326-11) we analysed in this prospective study, data from 13 patients undergoing single or double lung transplantation. Cardiac index measured with the FloTrac/Vigileo monitor and cardiac index measured with the continuous cardiac output pulmonary artery catheter/Vigilance device were determined in all patients up to six different measurement points.

**Results:** The correlation before 'incision' showed a Pearson correlation coefficient

between Clvigilance and Clvigileo of 0.748 ( $P = 0.008$ ), before 'chest opening' of 0.751 ( $P = 0.003$ ) and after 'one lung ventilation' of 0.869 ( $P = 0.00$ ). The Bland-Altman analysis showed respectively limits of agreement of  $-1.41$  to  $1.06 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$  (percentage error: 43%),  $-1.24$  to  $1.34 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$  (percentage error: 41%) and  $-1.65$  to  $0.95 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$  (percentage error: 38%). The correlation during the measurement points 'clamping of the pulmonary artery' and 'reperfusion' was not any longer significant. The correlation at the end of the operation returned significant ( $P = 0.05$ ) with limits of agreement of  $-2.21$  to  $0.67 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$  and a percentage error of 42%.

**Discussion:** This pilot study shows, that arterial waveform cardiac index is comparable, even if it slightly underestimated the pulmonary artery cardiac index in patients undergoing lung transplantation before pulmonary clamping. Therefore, it might be a useful haemodynamic trend monitoring in patients undergoing lung surgery with one-lung ventilation.

## Poster Round – Blood Management

### P-18 Acute mesenteric ischaemia after cardiopulmonary bypass: a retrospective case series study

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**Introduction:** Acute mesenteric ischaemia after cardiac surgery is a rare life-threatening surgical emergency [1]. The clinical presentation is often subtle and difficult to diagnose and treat, resulting in high mortality [2]. Several risk factors have been linked to the condition including low cardiac output, using vasopressors, increased age and atherosclerosis.

**Methods:** 4,089 cardiac operations were performed in our centre over 3 years. We retrospectively identified and studied cases complicated by postoperative acute mesenteric ischaemia.

**Results:** 38 cases were identified with a mortality rate of 73%.

	Non-survivors	Survivors
EuroSCORE (mean)	15.8	7.9
Ejection fraction > 50%	75%	40%
Smoking	17.8%	40%
Claudication	8%	40%
Diabetes	21%	30%
ICU Mechanical ventilation (mean)	7.4 days	7.7 days
Postoperative AF	60%	40%
Re-thoracotomy	21%	0%
Use of noradrenaline	35%	70%
Use of noradrenaline + vasopressin	50%	0%
Laparotomy	29%	100%

**Discussion:** Our study outlined some risk factors for developing acute mesenteric ischaemia after cardiopulmonary bypass surgery. All surviving patients required laparotomy. Early intervention is advisable.

## References

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- [2] Schütz A, Eichinger W, Breuer M, et al. Acute mesenteric ischemia after open heart surgery. *Angiology* 1998; 49: 267-273.

**P-19****The association of lowest haematocrit and intra-operative transfusion during cardiopulmonary bypass with acute kidney injury****Sophia Chew<sup>1</sup>, Roderica Ng<sup>2</sup>, Lian Ti<sup>3</sup>**<sup>1</sup> Singapore General Hospital, <sup>2</sup> National University of Singapore, <sup>3</sup> National University Hospital Health System, Singapore, Singapore

**Introduction:** Cardiopulmonary bypass (CPB)-induced haemodilution during coronary artery bypass graft (CABG) surgery reduces blood viscosity and improves regional blood flow. However, recent studies suggest an association of CPB-haemodilution with increased postoperative acute kidney injury (AKI) risk [1]. As Asians are smaller in body size, the use of CPB circuits designed for the Western population can result in greater haemodilution. It is the current practice to maintain a haematocrit of  $\geq 22\%$  during CPB with blood transfusion as needed. However, blood transfusion has been shown to increase AKI risk [2]. We hypothesise that lowest haematocrit during CPB and intra-operative transfusions are independently associated with post-operative AKI in our prospective cohort of multi-ethnic Asians.

**Methods:** Data from 1744 patients who underwent CPB between December 2008 and December 2010 were obtained. Perioperative risk factors were studied via univariate and multivariate analyses for their associations with post-operative AKI.

**Results:** The incidence of AKI was 27% and the mean lowest haematocrit during CPB was 24.5%. Lowest haematocrit during CPB and intra-operative transfusion were independently associated with AKI. For every 1% reduction of haematocrit during CPB, there was a 5% increase of risk of AKI (RR = 0.954, C.I. 0.919-0.990). For every one pack of red blood cells transfused, there was an 8% increase risk of AKI (RR = 1.077, C.I. 1.013-1.145)

**Discussion:** This is the first report of a step-wise correlation of haematocrit and intra-operative transfusion with postoperative AKI in an Asian population undergoing cardiac surgery.

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**P-20****Fondaparinux management for heparin-induced thrombocytopenia in postoperative cardiac surgery patients****Virginia Cegarra, Raúl González, Pilar Paniagua, M Luisa Cuevas, Josefa Galan, M Victoria Moral***Hospital de la Santa Creu i Sant Pau, Barcelona, Spain*

**Introduction:** Heparin-induced thrombocytopenia (HIT) occurs in approximately 1 to 3% [1] of cardiothoracic surgical patients. Once HIT is suspected, heparin must be stopped and an alternative anticoagulant, such as lepirudin or argatroban should be started. However, they are not exempt from bleeding risk and they are not always available at hospital centres. The aim of our study was to describe our experience in postoperative cardiac surgery patients diagnosed with HIT, who were treated with fondaparinux.

**Methods:** A retrospective observational study was carried out from October 2009 to June 2012 at our cardiac surgery intensive care unit. Routinely, anticoagulation is

managed with unfractionated heparin. The aPTT target is a ratio between 2-2.5 in aortic valve replacements and between 2.5-3.0 in mitral valve replacements. We included patients with a moderate or high score in the 4Ts test. Detection of PF4/H antibodies was performed with the enzyme immunoassay. Once HIT was diagnosed, heparin was stopped and fondaparinux started. Initial dose of fondaparinux was 1.25 mg or 2.50 mg per day depending whether a prophylactic or therapeutic range was required. Platelet count and anti-Xa levels ( $\text{IU} \cdot \text{mL}^{-1}$ ) were determined daily. Although recommendations remain controversial, the generally accepted therapeutic range for anti-Xa is  $0.4\text{-}1.0 \text{ IU} \cdot \text{mL}^{-1}$  and for prophylactic range is  $0.2\text{-}0.4 \text{ IU} \cdot \text{mL}^{-1}$ . If an invasive technique was necessary during fondaparinux treatment, the drug was discontinued 36 h before, and re-started 8-12 h after the procedure.

**Results:** We included 15 patients (1.1%); 46% (7/15) were men. The mean patient age was 64 years. The type of surgery performed was aortic valve replacement 33% (5/15), mitral valve replacement or annuloplasty 26% (4/15), heart transplant in 26.6% (4/15), coronary artery bypass graft 13.3% (2/15). Two patients presented thrombus at the moment of diagnosis. During fondaparinux treatment, a handling manoeuvre was performed in 9 patients, thoracocentesis being the most common. Two were complicated by major bleeding. No new thrombotic events occurred. 86% of patients were discharged successfully.

**Discussion:** Fondaparinux in postoperative cardiac surgery patients is an alternative for heparin when HIT is suspected. Monitoring anti-Xa activity and platelet count offer an estimation of the coagulation state. Prospective studies evaluating the efficacy and safety of fondaparinux are required.

## References

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bidities and mortality. *Eur J Cardiothorac Surg.* 2010; 37: 1391-1395.

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## Poster Round – Intensive Care

### P-21

#### A meta-analysis of randomised trials on percutaneous tracheostomy techniques in critically ill adults

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**Introduction:** Single dilator technique (SDT) and guide wire dilating forceps (GWDF) are the two most common percutaneous tracheostomy techniques. So far, their peculiar associated risks and benefits have not been evaluated by a meta-analytical approach. No indication on when SDT should be preferred to GWDF and vice-versa is available. We performed a meta-analysis of randomised controlled trials comparing intra-operative and long term complications of SDT and GWDF in critically ill adult patients.

**Methods:** Pertinent studies were independently searched in BioMedCentral, PubMed, Embase, and the Cochrane Central Register of clinical trials. The methodology and reporting conform to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.

**Results:** Among 1021 retrieved studies, 3 eligible studies randomising 233 patients (116 to GWDF, 117 to SDT) were finally identified.

The incidence of difficult cannula insertion (9.5% versus 1.7%,  $P = 0.029$ ) and of failure rate (4.3% versus no failure,  $P = 0.004$ ) was higher with GWDF technique. Haemodynamic complications were more common with the SDT technique (10.3% versus 1.7%). No difference in mid-term or long term complications was observed.

**Discussion:** The SDT and GWDF techniques showed a different pattern of peri-procedural complications. The SDT technique caused more episodes of haemodynamic instability while the GWDF technique was associated with more failures or technical insertion difficulties. No differences were identified in mid-term and long-term complications. The choice between the two techniques should be determined by the risk-profile of the single patient. ICU staff should be fully trained in both techniques.

## P-22

### Mortality in high risk septic patients treated with drotrecogin alfa or placebo

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**Introduction:** Drotrecogin alfa (recombinant human activated protein C) was approved in 2001 for severe sepsis, as defined by the development of acute organ dysfunction. Later subgroup analyses and further studies proposed that the beneficial effect of drotrecogin alfa could be limited to high risk population, while being counterbalanced by the bleeding risk in other populations. Recently the drug was voluntarily withdrawn from

the market by the pharmaceutical company, after newer data [1] questioned its efficacy even in high risk populations of patients with septic shock.

**Methods:** Four investigators independently searched BioMedCentral, PubMed, Scopus, and the Cochrane Central Register of clinical trials for all randomised controlled trials (RCT) that confronted drotrecogin alfa with controls in adult patients with severe sepsis, expressing mortality by number of organs involved. Only subgroups of patient at higher risk of death (as defined by multiple organ dysfunction and a mortality rate in controls  $> 40\%$ ) were selected for inclusion in analysis. Binary outcomes from individual studies were analysed.

**Results:** Among the four RCTs identified that compared drotrecogin alfa versus placebo in adult patients with sepsis, two fulfilled all the described inclusion criteria and were included in the analysis [1,2]. Data collected refer to surgical and non-surgical patients and the most frequent sites of infections were lung, abdomen, urinary tract and skin. When data were pooled together in the analyses, drotrecogin alfa demonstrated a reduction in mortality when confronted with placebo 99/263 (37.6%) for drotrecogin alfa vs. 115/244 (47.1%) for placebo, RR 0.80 [95% CI 0.65 vs. 0.98],  $P$  for effect = 0.03,  $P$  for heterogeneity = 0.77,  $I^2 = 0\%$ , with 507 patients included.

**Discussion:** Drotrecogin alfa was marketed for a decade before its recent withdrawal. While published data consistently show that drotrecogin alfa has no effect on mortality in the overall population of adult septic patients, this study provides new insight that, in this subgroup of extremely high risk patients it may still be beneficial. The Ranieri et al [1] paper, recently published in the NEJM shows the same trend on mortality in this high risk subpopulation of patients, (RR 0.83 [95% CI 0.6-1.14]), but is underpowered to reach statistical significance. Given that no new large RCT will probably be conducted on Xigris after its withdrawal, an individual patient

meta-analysis including all randomised controlled trial on sepsis is warranted.

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### P-23

#### Lower levels of glycosylated haemoglobin can assess increased postoperative renal complication risk in coronary bypass patients

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**Introduction:** There is an understanding to redefine the relation between glucose levels and cardiovascular disease that may extend below the threshold currently defined as diabetes. We hypothesised that the relation between HbA1c levels and renal complications could be redefined in lower threshold values. In this study, we analysed the perioperative outcomes of coronary artery bypass grafting (CABG) operations in order to evaluate the association of HbA1c levels and renal complications.

**Methods:** In this retrospective study, we analysed the prospectively collected data of 510 coronary bypass patients with documented HbA1c levels. The relationship of HbA1c with postoperative renal morbidity was evaluated with logistic regression analysis with lower threshold value (5.9%) for elevated levels.

**Results:** Two hundred and ninety-three patients (57.5%) had elevated HbA1c values. Patients with a raised HbA1c level had a higher incidence of atherosclerotic vascular diseases. Renal complications occurred at a significantly higher rate in the raised HbA1c group (1.8% vs. 11.9%;  $P = 0.0001$ ). The High HbA1c group had a greater incidence of renal morbidity (odds ratio = 4.608) and every 1% over 5.9% increased the risk of renal complications by 23.6%. The other factors associated with renal morbidity were known history of diabetes, chronic renal failure and the addition of any concomitant procedure.

**Discussion:** Pre-operative evaluation of HbA1c is an important tool in pre-operative risk assessment of coronary bypass patients. An elevated level of HbA1c is associated with increased renal complications and the cut-off values of HbA1c could be lowered to the upper range of normal.

### P-24

#### Impact of the preceding time of coronary angiography on acute kidney injury after elective off-pump coronary artery bypass surgery

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**Introduction:** Previous studies have suggested that early surgery after coronary angiography may be associated with the risk of acute kidney injury (AKI) in cardiac surgery with cardiopulmonary bypass. However, the effect of coronary angiography on the risk of AKI after off-pump coronary artery bypass surgery (OPCAB) remains uncertain.

**Methods:** We assessed pre-operative and peri-operative data in 1,364 consecutive adult patients who underwent elective OPCAB surgery after coronary angiography. AKI was defined by Acute Kidney Injury Network

criteria based on changes in serum creatinine within the first 48 hours after OPCAB. Multi-variable logistic regression was performed to evaluate the association of the time interval between coronary angiography and OPCAB with postoperative AKI.

**Results:** AKI developed in 391 patients (28.7%). The unadjusted and adjusted rates of AKI according to the length of time between coronary angiogram and OPCAB did not show any increasing or decreasing trend ( $P = 0.86$  and  $0.33$  for trends of unadjusted and adjusted AKI rates, respectively), and early OPCAB after coronary angiography was not related to postoperative AKI. Results were the same in high-risk patients with pre-operative renal insufficiency, low ejection fraction, or who received an ionic contrast agent or a high-dose of contrast agent.

**Discussion:** The risk of postoperative AKI was not related to the time between coronary angiography and OPCAB. These findings suggest that delaying elective OPCAB after coronary angiography due to the sole concern for renal function may be unnecessary.

## P-25 Association of the ACE D allele with acute kidney injury in non-Chinese patients after cardiac surgery

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**Introduction:** Acute kidney injury (AKI) after cardiac surgery is a frequent, serious, multifactorial complication with interpatient variability predicted poorly by pre-operative clinical and procedural markers [1]. Our study showed that ethnicity was independently associated with the risk of AKI, with Indians and Malays having a higher risk of developing AKI after cardiac surgery [2]. The ACE D allele has been implicated in kidney

injury in African Americans and we postulate that the D allele is associated with the increased incidence of AKI in the non-Chinese after cardiac surgery.

**Methods:** 991 consenting patients who underwent cardiac surgery were studied. Clinical covariates were recorded. The primary outcome was AKI, defined as a 25% or greater increase in pre-operative to maximum postoperative serum creatinine level within 3 days after surgery. DNA was isolated from pre-operative blood and PCR was used to detect the deletion (D) allele and insertion (I) allele of the ACE gene.

**Results:** 49.5% patients had a creatinine rise of 25% post cardiac surgery. Out of 491 patients who developed AKI, 60.9% carry the D allele, Indians and Malays having a higher risk of developing AKI compared to Chinese ( $P \leq 0.002$ ). However, non-Chinese with ACE D allele are not at higher risk of developing AKI compared to Chinese (OR 1.037, CI 0.949-1.134).

**Discussion:** Indians and Malays who have the D allele do not have a higher risk of developing AKI compared to Chinese. The ACE D allele is linked to increased renal vasoconstriction but the lack of association suggests that the ACE D allele may not play a role in the racial susceptibility to AKI in our multi-ethnic population [3].

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**P-26**  
**Furosemide bolus in acute kidney injury: the effect on survival in critically ill adult patients**

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**Introduction:** Furosemide is commonly administered in critically ill patients with acute kidney injury (AKI) to increase urinary output, but its effect on clinically relevant outcomes remains uncertain. Furosemide also has immunosuppressive effects [1] on peripheral blood mononuclear cells similar to equimolar concentrations, hence equivalent doses, of hydrocortisone. We performed a meta-analysis of randomised controlled trials to investigate whether furosemide bolus has beneficial or detrimental effects on survival in AKI patients.

**Methods:** Pubmed, Embase and the Cochrane Central Register of clinical trials were searched (updated on March 2012) for pertinent studies by two trained investigators. Inclusion criteria were random allocation of critically ill patients with AKI to treatment with furosemide intermittent bolus injection versus continuous infusion or versus placebo. The primary endpoint was mortality at the longest follow-up.

**Results:** Ten studies enrolling 790 patients were included in this meta-analysis. We observed an overall trend towards an increase in mortality in patients treated with furosemide bolus injections versus any comparator [OR = 1.32; 95% CI 0.96-1.83, P = 0.09] and more specifically if compared with furosemide continuous infusion [OR = 1.98; 95% CI 0.98-4.00, P = 0.056].

**Discussion:** Furosemide use in AKI is not supported by evidence-base medicine and might be detrimental. The non-statistically significant trend towards an increase in mortality in AKI patients receiving furosemide should be further investigated by large randomised controlled studies.

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**P-27**  
**Fast track cardiac anaesthesia decreases ICU length of stay without compromising outcome: a single centre experience**

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**Introduction:** Fast track (FT) cardiac surgery is a multidisciplinary clinical pathway to facilitate early discharge after cardiac surgery and to reduce costs. Early extubation is a key step. We recently implemented a FT protocol with transfer of the patients to the regular postoperative care unit (PACU) using nurse-driven extubation and management protocols.

**Methods:** From June 2011, our cardiac surgical patients were screened for FT treatment using strict inclusion criteria (age below 80 yrs, absence of pulmonary or renal disease, BMI < 40 kg/m<sup>2</sup>, no redo or multiple valve surgery, LV ejection fraction [EF] > 30%). Between June 2011 and December 2012, 104 patients were initially treated as FT, but 10 were excluded peri-operatively due to organisational problems or intra-operative events. Anaesthesia was adapted from previously reported FT regimens. Postoperatively, FT

patients were admitted to the PACU instead of ICU. A nurse-driven extubation and management protocol was used. 90 patients (66 single valve surgery, 12 OPCAB, 2 combined valve/CABG, 10 others) finished the fast track protocol. We compared the FT patients to a comparable group from our cardiac surgery-database, matched for procedure, sex, age, weight, BMI, EF, Euro-SCORE II, CPB time and other variables of pre-operative morbidity. Main outcome variables were length of hospital and ICU/PACU stay and time to extubation. Statistical analysis was performed using Student's t-test and Fisher's exact test where appropriate. Financial data were obtained from the hospital financial department.

**Results:** Groups did not differ with respect to patient characteristics, comorbidities and peri-operative surgical data. 4 patients were admitted to the ICU due to respiratory or haemodynamic complications. Length of stay (LOS) and in-hospital mortality did not differ between groups ( $9 \pm 2$  vs.  $9 \pm 3$  days and 0 vs. 1). The FT approach reduced ventilation times (4 vs. 10 h,  $P < 0.01$ ) and PACU/ICU LOS ( $23 \pm 2$  vs.  $48 \pm 26$  h,  $P < 0.01$ ). Other outcome and safety parameters were unaffected. The reduced PACU/ICU LOS was associated with a cost-reduction of 74.61 euro for these 90 patients.

**Discussion:** These data confirm previous reports that nurse-driven, protocol-based FT cardiac anaesthesia decreases ventilation time, ICU/PACU LOS and costs without compromising patient outcome.

## Poster Round – Cardiac Protection

### P-28

#### Comparison between the effects of retrograde and antegrade cold-blood cardioplegia on right ventricular function assessed by transoesophageal echocardiography

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**Introduction:** The protective effect of retrograde vs. antegrade blood cardioplegia on right ventricular function is questionable. We studied the effect of both myocardial preservation techniques on right ventricle (RV) systolic and diastolic functions.

**Methods:** Forty adults scheduled for elective single-valve surgery were randomly divided into 2 groups by random numbers table, receiving either antegrade (A/G) or retrograde (R/G) cold-blood cardioplegia. Patient characteristics, haemodynamic parameters, serum lactate and troponin I, and intra-operative right ventricular systolic and diastolic functions by TOE (fractional area change [FAC] and tricuspid annular plane systolic excursion [TAPSE]) were assessed at 3 time points; (1) after induction of anaesthesia, (2) after weaning off cardiopulmonary bypass (CPB), and (3) at the end of surgery. Data were analysed using Student's t-test, Mann-Whitney U-test,  $\chi^2$ , Fisher's exact test, and analysis of variance (ANOVA) test with post-hoc multiple comparisons as appropriate. The results are presented as mean (SD), median (IQR), or number of patients as appropriate. A probability value (P value) less than 0.05 was considered significant.

**Results:** The groups were statistically comparable regarding demographic data, pre-operative comorbidities, type of valvular surgery, TOE findings, and laboratory findings (troponin I and lactate). The mean (SD) heart

Table 1

Timepoint	RV-FAC			TAPSE		
	A/G	R/G	P value	A/G	R/G	P value
1	50 (10.2)	50.6 (7.6)	0.83	22.3 (2.9)	20.7 (2.8)	0.88
2	54.3 (6.3)	53.7 (5.7)	0.77	23.7 (3.4)	21.9 (3.1)	0.13
3	49.8 (8.7)	50.2 (8.4)	0.90	22.9 (3.1)	21.8 (2.9)	0.29

recovery time (time to restore satisfactory rhythm and rate of 90-110 bpm for weaning off CPB) in the retrograde cardioplegia group was significantly shorter than that for the antegrade group [6 min (1.07) vs. 7 min (0.92),  $P = 0.003$ ] and fewer patients needed inotropic support [3/17 vs. 9/11,  $P = 0.002$ ] (see Table 1).

**Discussion:** Both preservation techniques protected the myocardium during elective valve surgery. Retrograde cardioplegia provided earlier post-bypass recovery of the heart and less need of inotropes.

## P-29

### The effect of pre-operative beta-blocker treatment in cardiac surgery patients with or without COPD on postoperative extubation time and ICU length of stay

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**Introduction:** In this study, we compared patients with COPD and without COPD, both taking pre-operative beta blockers, undergoing elective coronary artery by-pass grafting surgery, in terms of postoperative extubation time and intensive care unit length.

**Methods:** Our cross-sectional study was conducted on retrospectively reviewed com-

puter and file data of a total 2423 patients undergoing coronary artery bypass grafting surgery between 01.05.2005 and 31.05.2012. In our study we excluded those without pre-operative beta blocker therapy, emergency cases, morbidly obese, those having left ventricular aneurysm repair, carotid endarterectomy, and in addition, valve repair or replacement, re-operation, cardiopulmonary bypass time more than three hours, inability to access pre-operative arterial blood gas values and those who died before extubation in the intensive care unit.

Patients had been diagnosed with COPD by pre-operative physical examination and/or respiratory function tests that had hospitalised them (and followed by diseases of chest with COPD) were considered to be the COPD group. The remaining patients formed the control group.

**Results:** 687 patients were included in the study. The mean age of the patients was  $59.9 \pm 10.8$  yr. 75.3% of patients were male. The mean age of males was  $58.5 \pm 10.6$  and for females  $64.4 \pm 10.2$  yr. The average age of patients with and without COPD was  $63.8 \pm 9.8$  and  $59.5 \pm 0.9$  yr respectively. The mean age of patients with a diagnosis of COPD, was found to be significantly higher than without COPD. The mean extubation time of patients with and without COPD were  $1,093 \pm 2,217$  min and  $835 \pm 572$  min respectively. There was no statistically difference between the two groups. The mean intensive care unit length of stay of patients with and without COPD was  $3.6 \pm 2.7$  days and  $2.9 \pm 1.5$  days respectively. It had been found that the intensive care unit length of stay of patients with COPD was more than without.

**Discussion:** We found that using beta blockers on the patients with or without COPD

in the pre-operative period does not make a difference in extubation time in the post-operative period but it extends the intensive care unit length of stay significantly in patient with COPD. We think this situation could be due to postoperative complications in patients with COPD.

### P-30

#### **A Bayesian network meta-analysis of randomised trials on anaesthetic drugs and survival in cardiac surgery**

**Alberto Zangrillo<sup>1</sup>, Claudia Cariello<sup>2</sup>, Roberto Dossi<sup>1</sup>, Peitro Bertini<sup>2</sup>, Marta Eugenia Sassone<sup>1</sup>, Rubia Baldassarri<sup>2</sup>, Ambra Licia Di Prima<sup>1</sup>, Daiana Taddeo<sup>1</sup>, Valentina Tarzia<sup>1</sup>, Laura Pasin<sup>1</sup>**

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**Introduction:** We performed direct and indirect comparisons among desflurane, isoflurane, sevoflurane and total intravenous anaesthesia (TIVA) to assess how anaesthetics influence patients' survival after cardiac surgery.

**Methods:** We performed standard pair-wise and Bayesian network meta-analyses. Pertinent studies were independently searched in BioMedCentral, MEDLINE/PubMed, Embase, and the Cochrane Library (last updated in June 2012).

**Results:** We identified 38 randomised trials with survival data published between 1991 and 2012, with most studies (63%) performed on coronary artery bypass grafting patients (CABG) with standard cardiopulmonary bypass. The standard meta-analysis showed that the use of a volatile agent was associated with a reduction in mortality when compared to TIVA at the longest follow-up available (25/1994 [1.3%] in the volatile group

versus 43/1648 [2.6%] in the TIVA arm, odds ratio = 0.51, 95% confident interval 0.33 to 0.81, P for effect = 0.004, number needed to treat = 74,  $I_2 = 0\%$ ) with results confirmed in trials with low risk of bias, in large trials and when including only CABG studies. Bayesian network meta-analysis showed that sevoflurane (odds ratio = 0.31, 95% credible interval 0.14 to 0.64) and desflurane (odds ratio = 0.43, 95% credible interval 0.21 to 0.82) were individually associated with a reduction in mortality when compared to TIVA (the results with isoflurane went in the same direction but did not reach statistical significance).

**Discussion:** Anaesthesia with volatile agents appears to reduce mortality after cardiac surgery when compared to TIVA, especially when sevoflurane or desflurane is used. A large, multicentre trial to confirm that long term survival is significantly influenced by the choice of the anaesthetic is highly warranted.

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### Poster Round – Technology & Outcome

### P-31

#### **Anaesthetic management for off-pump implantation of partial mechanical support systems: first experiences**

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**Introduction:** Mechanical circulatory support is a growing alternative for treatment of end-stage congestive heart failure. For patients in NYHA class IIIb and IVa partial mechanical support systems were developed (CircuLite®), a miniaturised mechanical support device that allow flows of 3.5 L · min<sup>-1</sup>. We describe our first experiences with anaesthetic management for the implantation of these systems.

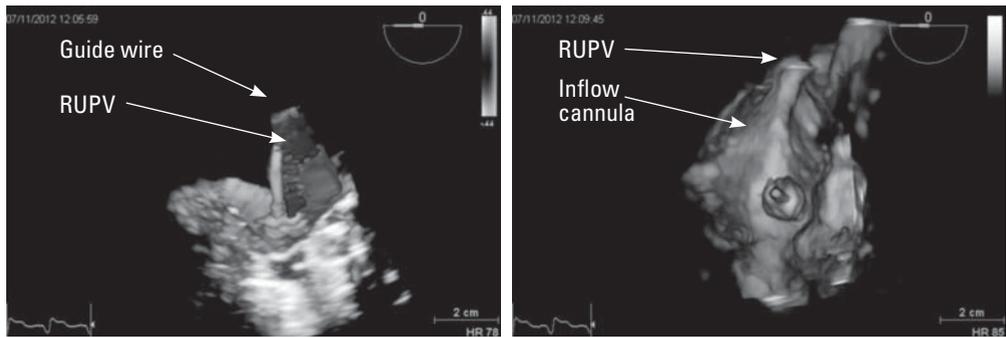


Figure 1

**Methods:** In contrast to other systems, the outflow cannula is placed in the left atrium in between the right upper (RUPV) and lower (LUPV) pulmonary veins and the inflow cannula into the right subclavian artery. The procedure is performed without the use of cardiopulmonary bypass. Anaesthetic management includes insertion of a double lumen tube to optimise surgical exposure. The inflow into the right subclavian artery can produce hyperperfusion of the right arm therefore invasive blood pressure measurement is established in right and left radial arteries. In addition to the comprehensive TOE examination, a complementary rt 3D TOE is performed for the implantation of the inflow cannula due to limited surgical exposure. To guide implantation of the left atrium the visualisation of both right pulmonary veins in the RT 3D x-plane mode as well as in the RT 3D zoom mode is crucial. The outflow cannula should be placed right between the right upper and lower pulmonary vein.

**Results:** So far the partial support system was implanted in 3 patients. Two patients were transferred to ICU, the third patient was extubated in the operating room and was delivered to the post anaesthetic care unit.

Figure 1 shows the rt 3D TOE guided placement of the guide wire adjacent to the right upper pulmonary vein (RUPV) and the position of the outflow cannula, respectively.

**Discussion:** Implantation of partial mechanical support systems is feasible with the minimally invasive surgical approach under TOE guided placement of the inflow cannula.

### P-32 Extracorporeal life support: experience from a single cardiac surgery centre

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**Introduction:** Extracorporeal life support (ECLS) is a system for mechanical cardio-circulatory (and pulmonary) assistance in patients with cardiogenic shock of different origins. The use of such a device, has gained wider application in clinical practice. The present study is aimed at presenting the experience, in ECLS implantation, of a cardiac surgery unit of a teaching University hospital.

**Methods:** Data was collected from January 2012 to January 2013. 10 patients underwent mechanical assistance for cardiogenic shock.

**Results:** The mean age was 66.7 (8.3 SD) years, the mean log. EuroSCORE was 40.68 (28.35 SD)%. ECLS was implanted for weaning failure from CPB in 8/10 patients (80%). In 1 patient (10%) the ECLS was placed in the Cath. Lab. for refractory cardiac arrest occurring during a PCI, and 1 patient (10%)

received the ECLS in the Emergency Department for an out-of-hospital cardiac arrest. Hospital survival rate was 3/10 (30%), ECLS-related complication rate was 3/10 (30%), and re-sternotomy was necessary in 3/10 (30%) patients. Median time of ECLS was 6.5 days (3-9; 25<sup>th</sup>-75<sup>th</sup> interquartile), range 1-23 days. Two of the three survived patients were from the CBP weaning failure group and the last one received the ECLS in the Cath Lab after a PCI.

**Discussion:** Our early experience, although in a very limited number of patients, with this type of mechanical support suggests that: 1) ECLS is a feasible technique to support patients with cardiogenic shock originating from different causes; 2) complications related to the ECLS implantation after CS are not rare and mainly related to bleeding; 3) since our experience has just begun, Extracorporeal Life Support Organisation (ELSO) demonstrated to be of a great help in managing these patients [1]. The mortality and complication rates in our small cohort of patients is similar to those reported from other, more experienced, centres; 4) the primary disease may influence the outcome; 5) peripheral cannulation seems to be as safe as central cannulation when an appropriate management of "Harlequin Syndrome" or leg ischaemia is performed; 6) bleeding complications with ECLS or post-cardiotomy requiring re-sternotomy can occur.

### References

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### P-33

#### Robotic assisted mitral valve surgery experiences

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**Introduction:** Robotic assisted mitral valve surgery has the advantages of minimally invasive cardiac surgery having three dimensional image and manoeuvrability without tremor. The aim of this single centre study was to present our experiences with robotic assisted mitral valve surgery and anaesthetic management.

**Methods:** We retrospectively reviewed the data from 23 patients who underwent mitral valve procedures in our hospital from March 2010 to December 2012. We analysed the demographic data, type of surgery, anaesthetic management, complications and discharge times.

**Results:** Twelve patients underwent robotic mitral valve replacement, six of whom had additional cardiac procedures (tricuspid valve replacement/ tricuspid valve repair/ left atrial radiofrequency ablation). Eleven of the patients underwent robotic mitral repair and ring replacement. Mean age and EuroSCORE of the patients were  $51 \pm 11.9$  and  $53.3 \pm 2.1$  years, respectively. Standard ASA monitoring and anaesthesia induction were used, with double lumen endobronchial intubation. The TOE probe was inserted and external defibrillator pads were placed on the chest wall. Standard CPB protocol was applied with 17F venous cannula from the internal jugular vein performed by the anaesthesiologist. 21F venous and 17F arterial cannulas were inserted via the femoral route. Mean cross-clamp and cardiopulmonary bypass times were  $130.4 \pm 42.5$  and  $191.7 \pm 56.7$

min, respectively. Only 2 patients required red blood cell transfusion intra-operatively. Mean extubation time and intensive care unit stay were  $16.5 \pm 31.4$  and  $42 \pm 47.1$  h, respectively. During the intensive care unit stay, one patient required femoral embolectomy and one other required revision for bleeding via minimal thoracotomy. Two patients required prolonged ventilatory support and one patient required prolonged inotropic support. There were no re-operations for mitral valve and no complication of anaesthetic management. Twenty patients (87%) were discharged from the hospital within 10 days. There was no mortality.

**Discussion:** Robotic assisted mitral valve surgery is a promising alternative with knowledge of basic cardiovascular and one lung ventilation principles, alternative cannulation strategies along with strong TOE skills are keys to ensure successful anaesthetic management.

### P-34

#### Left ventricular outflow tract obstruction after cardiopulmonary bypass: the six-year singlecentre experience

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**Introduction:** Left ventricular outflow tract (LVOT) obstruction with mitral valve systolic anterior motion (SAM) is a well known complication of cardiac surgery [1]. Our aim was to analyse our 6-year experience of management of this haemodynamic disturbance.

**Methods:** In 2006-2012 years (yrs) 8 patients (pts; 6 males, 2 females) with LVOT obstruction after cardiopulmonary bypass (CPB), detected by transoesophageal echocardiography (TOE), were included. Data are given as mean  $\pm$  standard deviation.

**Results:** These pts were 0.21% of the total number of CPB pts ( $n = 3,655$ ) and 1.7% of the number of perioperative TOE-examinations ( $n = 474$ ) in the same period. Seven pts had coronary artery bypass grafting (CABG) and one, aortic stenosis correction. The LVOT obstruction was diagnosed by anaesthesiologists with 6-74 ( $35 \pm 26$ ) months' experience of TOE: in 6 pts just after CPB, in 2 pts, in the intensive care unit. The indications for TOE were arterial hypotension and low cardiac index ( $CI < 2 \text{ L} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$ ) despite dopamine ( $6 \pm 1.1 \text{ mcg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) or epinephrine ( $57 \pm 36 \text{ ng} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) infusions. TOE was used routinely only after aortic valve replacement. Stopping the inotropic support was enough for haemodynamics restoration in 2 pts, esmolol ( $1.8 \pm 1 \text{ mg} \cdot \text{kg}^{-1}$ ) as a bolus and fluid infusion ( $17 \pm 9 \text{ ml} \cdot \text{kg}^{-1}$ ) were additionally required in other cases. In 2 pts a phenylephrine infusion was used too. One pt (84 yr old woman) died in the 3rd day after CABG because of persistent LVOT obstruction.

**Discussion:** A distinctive feature of this study was the prevalence of CABG patients. Routine intraoperative TOE is reasonable for the timely detection and treatment of LVOT obstruction.

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## Poster Round – Cardiac Anaesthesia

### P-35 Clinical evaluation of an endotracheal impedance cardiography cardiac output monitoring method versus continuous thermodilution

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**Introduction:** Endotracheal cardiac output measurement system (ECOM) measures cardiac output (CO) continuously based on impedance changes caused by pulsatile flow in the nearby ascending aorta via a special endotracheal tube. Earlier results showed poor correlation between ECOM and non-continuous pulmonary artery thermodilution (TD) measurement [1]. We therefore compared ECOM with continuous TD (cTD) in coronary artery bypass grafting (CABG) patients.

**Methods:** Simultaneous CO data points were collected in 10 patients every 2-3 minutes

during 2 h periods peri-operatively. Trending data analysis was performed as described by Critchley et al. [2]. Trending capability was considered acceptable when  $\Delta\text{meanCO}$  change in time was  $\geq 0.25 \text{ L} \cdot \text{min}^{-1}$  and within  $30^\circ$  trending line of each other.

**Results:** Ten male patients were included ( $63 \pm 11$  years) providing 942 paired data points. Median CO for cTD was 5.7 (2.0-10.8) and for ECOM 5.4 (1.7-9.1)  $\text{L} \cdot \text{min}^{-1}$ . Bias (95% limits of agreement) was 0.3 (-2.2-2.7)  $\text{L} \cdot \text{min}^{-1}$ . Only 37% of the changes of ECOM were in line with TD. **Discussion:** ECOM correlated poorly in CABG patients for all grouped data for both absolute values as well as trending capability (Figure 1)

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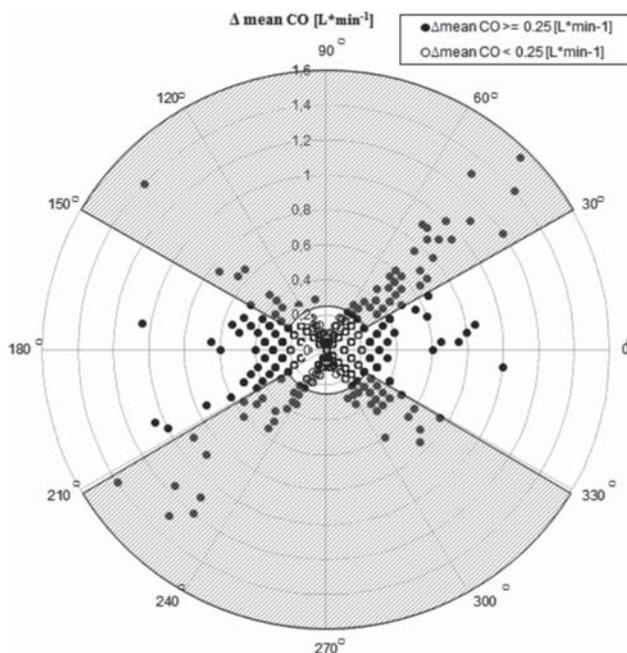


Figure 1: Polar plot.  $\Delta\text{meanCO} = (\text{DECOM} + \text{DcTD})/2$

**P-36****Haemodynamic monitoring with hTOE?  
A case series report**

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**Introduction:** Low cardiac output (CO) is one of the major determinates of insufficient oxygen delivery [1]. Today, in case of severe haemodynamic instability a multiplane transoesophageal echocardiography (TOE) is recommended to determine underlying pathophysiological causes, e.g. hypovolaemia, reduced myocardial contractility, etc. [2]. However, performing a monoplane, continuous, haemodynamic focused, transoesophageal examination (hTOE) using the ImaCor® ClariTEE® probe might be a useful alternative and we want to present our first experiences.

**Methods:** Residents of our ICU, not previously familiar with echocardiography, received an approximately 6-hours training session to obtain the three most important 2D views to determine haemodynamics: a) transgastric short axis view of the left ventricle, b) mid-oesophageal four chamber view and c) mid-oesophageal superior vena cava view. For continuous examination the probe was designed to remain in situ for up to 72 hours.

**Results:** Up to date, we performed 10 hTOE's in mainly cardiac surgery patients experiencing sustained haemodynamic instability post-operatively. In all cases residents achieved at least moderate image quality which was sufficient for haemodynamic guidance. Results of the hTOE exams changed the current therapy in nearly all cases, e.g. a) further volume administration in patients with severely reduced left ventricular function, b) re-operation due to pericardial tamponade, c) supporting right ventricular function due to

new postoperative failure, etc. In three cases hTOE changed clinical management despite measurements with PAC and/or PICCO.

**Discussion:** Performing hTOE in haemodynamically unstable patients was feasible without extensive cardiologic echocardiographic knowledge. Current haemodynamic management was immediately and persistently influenced by hTOE, occasionally despite an extended haemodynamic monitoring [3]. Nevertheless, prospective, randomised, clinical trials investigating a possible benefit of hTOE are lacking so far.

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**P-37****Haemodynamic effects of low versus moderate dose opioid anaesthesia: a randomised study of apical-TAVI versus standard surgical AVR replacement**

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**Introduction:** Our standard anaesthesia for surgical aortic valve replacement (SAVR) is based on moderate to high dose sufentanil

combined with low to moderate propofol infusion, which mostly results in modest changes in haemodynamics. For trans-catheter aortic valve implantation (TAVI) in the elderly, we use a different approach based on low dose sufentanil supplemented with moderate sevoflurane inhalation. In order to maintain afterload, low dose noradrenaline is used in almost all patients. Due to a randomised study (STACCATO) [1], we have a unique opportunity to evaluate the two methods in comparable patients. Although there were differences in both surgical and anaesthetic approach, a comparison of the haemodynamics could be of value for continuous improvement of anaesthetic handling of cardiac surgery patients.

**Methods:** Fifty-nine patients included in our centre age  $\geq 75$  yr. and a EuroSCORE  $\geq 8$  scheduled for aortic valve replacement were randomised to SAVR or apical TAVI. The SAVR patients received sufentanil 4-5  $\mu\text{g}/\text{kg}$  and propofol infusion 100-200 mg/h, while TAVI patients received sufentanil 0.3  $\mu\text{g}/\text{kg}$ , midazolam 0-2.5 mg, and S-ketamine 0.5 mg/kg, continued with sevoflurane 1-1.5%. All patients were followed with full invasive monitoring during anaesthesia and recovery.

**Results:** One TAVI patient was peroperatively converted to SAVR and excluded for analysis. The observations were divided into 3 periods; SAVR group: pre- and post-CPB and recovery; TAVI group: pre- and post- the valve placement and recovery. Changes over time were found in almost all parameters in all three periods with moderate decline in pre- period, moderate increase in post-period followed by a slow increase to pre-operative or higher values during recovery. SVI and CI were significantly higher in the TAVI group in all periods while SvO<sub>2</sub> was marginally lower. HR, MAP and CVP were significant higher during surgery and significantly lower during recovery. ( $P < 0.005$ ; 2-way ANOVA). According to our protocol all TAVI patients were extubated in the OR while SAVR patients was extubated following a standard procedure 2-5 hours after surgery.

**Discussion:** The data demonstrates the huge impact of the surgical approach on anaesthetic options. The TAVI protocol resulted in more stable haemodynamics than the SAVR protocol, and especially in the period before CPB. The difference can be attributed to the anaesthetic protocol, while the post-bypass period primarily is dominated by the surgical approach. As the impact of stress and pain is higher in SAVR, the TAVI protocol would hardly be sufficient.

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### P-38

#### The effect of milrinone on mortality in cardiac surgery: a meta-analysis of randomised trials

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**Introduction:** Milrinone is associated with increased mortality in long-term use in chronic heart failure. A recent meta-analysis suggested that it might increase mortality in patients undergoing cardiac surgery [1]. The authors conducted an updated meta-analysis of randomised trials in patients undergoing

cardiac surgery to determine if milrinone impacts survival.

**Method:** BioMedCentral, PubMed, EMBASE, the Cochrane central register of clinical trials, and conference proceedings were searched for randomised trials that compared milrinone versus placebo or any other control in adult and paediatric patients undergoing cardiac surgery. Authors of trials that did not include mortality data were contacted. Only trials for which mortality was available were included.

**Results:** Overall analysis showed no difference in mortality between patients receiving milrinone vs. control, (12/554 [2.2%] in the milrinone group vs. 10/483 [2.1%] in the control arm, RR = 1.15, 95% CI [0.55 to 2.43], P = 0.7) or in analysis restricted to adults, (11/364 [3%] in the milrinone group vs. 9/371 [2.4%] in the control arm, RR = 1.17, 95% CI [0.54 to 2.53], P = 0.7).

Sensitivity analyses performed in trials with low risk of bias showed a trend towards an increase in mortality when using milrinone versus any control, (8/153 [5.2%] in the milrinone arm versus 2/152 [1.3%] in the control arm, RR = 2.71, 95% CI [0.82 to 9], P for effect = 0.10 with 7 studies included).

**Discussion:** Despite theoretical concerns for increased mortality with intravenous milrinone in patients undergoing cardiac surgery, we were unable to confirm an adverse effect on survival. However, we noted a trend towards an increased mortality in trials with low risk of bias.

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## P-39

### Impact of intra-aortic balloon pump on cerebral oxygenation in patients undergoing CABG

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**Introduction:** Even lower decrease in cerebral saturation in patients undergoing cardiac surgery was recently associated with adverse outcomes [1]. We aimed to evaluate the impact of prophylactic IABP on cerebral oxygenation in high risk CABG patients.

**Methods:** This was a single-centre retrospective study. Data of operated patients in a 20 month period and monitored with Invos cerebral oximetry were reviewed. Patients were divided into two groups – high risk (LVEF < 30% or LVEF < 40% with any one of the following: left main stem disease, unstable angina or redo surgery) and control. For high risk patients an IABP was placed before surgery in the OR. During CPB, IABP was set on automatic 80 beats/min rate to induce pulsatile flow. Patients who needed IABP treatment in the pre-operative period were excluded from the analysis. Regional cerebral oxygen saturation (rSO<sub>2</sub>) was monitored bilaterally in all patients.

**Results:** Data of 134 pts were analysed. 44 pts were high risk. They had lower baseline oxygenation (left 65.7 ± 7.6% vs. 70.3 ± 7.4%, P = 0.001, right 64.5 ± 8.5% vs. 69.0 ± 7.4%, P = 0.002) than control group pts. Desaturation (absolute rSO<sub>2</sub> less than 50% or 20% lower than baseline) occurred in 21 (48%) high risk pts and in 44 (48%) pts in the control group. However, at the majority of stages during surgery the decline from baseline was lower in IABP treated patient group: incision L -1.5 ± 10.4% vs. -6.5 ± 9.5%, P = 0.07, R -1.6 ± 11.2% vs. -5.7 ± 10.4%, P = 0.038; start of CPB L 1.8 ± 12.6% vs. -6.4

$\pm 10.5\%$ ,  $P < 0.001$ ,  $R -0.3 \pm 15.5\%$  vs.  $-7.2 \pm 10.6\%$ ,  $P = 0.003$ ; closing sternum L  $3.2 \pm 15.5$  vs.  $-6.2 \pm 9.5$ ,  $P < 0.001$ ,  $R 3.8 \pm 18.4\%$  vs.  $-4.7 \pm 9.5$ ,  $P = 0.001$ .

**Discussion:** Prophylactic use of IABP was associated with less decline of oxygen saturation during on-pump CABG surgery. A large prospective randomised study in this regard is needed.

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## P-40

### Transcatheter aortic valve implantation

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**Introduction:** Patients with severe aortic stenosis (SAS) excluded from surgery due to their high risk condition may benefit from transcatheter aortic valve implantation (TAVI).

**Methods:** This study describes observational TAVI results in patients with SAS. From March 2009 to November 2012, pre-operative, intra-operative and postoperative variables in 73 patients with SAS undergoing TAVI were prospectively analysed. General anaesthesia was performed in 70 patients and sedation/analgesia in 3 patients. Arterial pressure, vasopressors and preload were optimised to obtain mean arterial pressure  $> 75$  mmHg before and during the implant. Angiography/fluoroscopy was used for valve implantation guidance, and transoesophageal echocardiography except in one patient

with previous oesophageal stenosis. Corevalve (Medtronic) implantation was done by a retrograde approach (72 transfemoral and 1 subclavian), 62 of which were primary TAVI (without predilation).

**Results:** Mean age was  $79.8 \pm 7.6$  years (61-93), 41.1% were women, 19.2% had diabetes, 72.6% dyslipidaemia, 91.8% hypertension, 8.2% history of heart failure, 9.6% chronic renal failure, 17.8% previous myocardial revascularisation surgery and Logistic EuroSCORE was  $21.2 \pm 14.8\%$ . 18.1% of patients presented with angina, 97% dyspnoea, and 78.1% were in NYHA functional class (FC) III-IV and 21.9% in FC II, 12.1% presented with syncope and 8.2% atrial fibrillation. Pre-operative Doppler evaluation showed  $80.9 \pm 20.5$  mmHg peak gradient and  $54.9 \pm 11.8\%$  left ventricular ejection fraction. Thirty per cent of patients had pacemaker implantation and 30-day mortality was 2.7% (2 patients, intra-procedure, one due to mechanical dissociation and another to ventricular perforation). Only 4 patients required postoperative assisted mechanical ventilation ( $11 \pm 10.9$  hours, range 1-24) and mean intra-hospital stay was  $5.7 \pm 6.6$  days.

**Discussion:** TAVI was feasible and safe in this high risk population. All patients tolerated anaesthesia well while blood pressure control presented the greatest difficulty.

## Poster Round – Thoracic & Non-cardiac

### P-41 Incidence and perioperative risk factors of acute kidney injury after oesophageal surgery for cancer

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**Introduction:** Postoperative acute kidney injury (AKI) is associated with increased short-term and long-term morbidity and mortality. The aim of this study was to evaluate the incidence and risk factors of AKI in patients undergoing oesophageal surgery.

**Methods:** A retrospective, observational study of 595 consecutive adult patients who underwent elective oesophageal surgery for cancer between January 2005 and April 2012 was performed. AKI was defined by the Acute Kidney Injury Network criteria based on serum creatinine changes within the first 48 hours after oesophageal surgery. Multi-variable logistic regression was performed to evaluate the association between peri-operative variables and postoperative AKI. The association between postoperative AKI and patient outcome was evaluated.

**Results:** Two hundred and ten patients (35.3%) developed postoperative AKI (180 patients [30.3%] with an AKIN classification of stage 1, 16 [2.7%] with stage 2, and 14 [2.3%] with stage 3), and 11 patients (1.9%) required renal replacement therapy. Multi-variate analysis identified five risk factors for AKI: body mass index (odds ratio [OR] 1.07; 95% confidence interval [CI] 1.01 to 1.14;  $P = 0.047$ ), pre-operative serum albumin level (OR 0.52; 95% CI 0.33 to 0.84;  $P = 0.008$ ), use of angiotensin-converting enzyme inhibitors or angiotensin-receptor blockers (OR 1.35; 95% CI 1.05 to 1.75;  $P = 0.019$ ), colloid infusion during surgery (OR 1.11; 95% CI 1.06 to 1.18;  $P < 0.001$ ), and postoperative 2

day C-reactive protein (OR 1.05; 95% CI 1.01 to 1.09;  $P = 0.009$ ). Postoperative AKI was associated with prolonged hospital length of stay. There was no significant difference in duration of stay in the ICU and mortality between patients with and without AKI.

**Discussion:** Postoperative AKI is common in patients undergoing oesophageal surgery for cancer. In the present cohort, variables independently related to AKI after oesophageal surgery were elevated BMI, low pre-operative serum albumin level, pre-operative treatment with ACEI or ARB, colloid infusion during surgery, and high postoperative 2 day CRP. Early postoperative AKI is related to prolonged hospitalisation.

### P-42 Randomised control trial comparing the GlideScope and Macintosh laryngoscope for double lumen endotracheal tube intubation

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**Introduction:** Double lumen tubes (DLT) are most commonly used to achieve lung isolation. In this study we compared the clinical performance of the GlideScope and Macintosh laryngoscopes for the insertion of left sided DLTs.

**Methods:** Eighty patients with predicted normal airways were randomised to either GlideScope or Macintosh laryngoscope assisted DLT intubation. The primary outcome was time to achieve intubation and secondary outcomes were duration of lung isolation, intubation success, difficulties and patient complications.

**Results:** Seventy patients completed the study with a longer first attempt duration using the GlideScope, 77 seconds (44) compared to the Macintosh laryngoscope, 51 (61)

( $P = 0.047$ ). There were no statistical differences in the success of the first intubation attempt (74% vs. 88%), the total intubation duration or the total lung isolation duration. On a numerical rating scale (NRS) from 0-10, anaesthetists rated the overall intubation difficulty higher using the GlideScope 3 (2-6 [0-10]) vs. 2 (1-3 [0-8]) ( $P = 0.003$ ). Postoperative voice changes were more common in the GlideScope patients, 17 vs. 8 ( $P = 0.045$ ).

**Discussion:** Anaesthetists found the GlideScope more difficult to use compared to the Macintosh with longer first intubation attempts and increased incidence of patient voice changes postoperatively.

### P-43

#### Pressure and volume controlled ventilation during OLV: evaluation of the effect of the lipid peroxidation

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**Introduction:** During single lung ventilation (SLV), we compared the effects of pressure or volume controlled ventilation (PCV, VPC) modes on blood gas measurement, respiratory dynamics and haemodynamic parameters. Free oxygen radical effect was evaluated by measurement of melondialdehyde (MDA) which is the final product of lipid peroxidation, during the ventilation.

**Methods:** Patients were divided into two groups randomly as pressure control group

(group P) and volume controlled group (group V) using two ventilation protocol. Induction of anaesthesia was provided by fentanyl, thiopental and vecuronium. Fentanyl, vecuronium, sevoflurane 1 MAC (minimum alveolar concentration) were used with a mixture of air and oxygen for continued anaesthesia. After induction of anaesthesia, endobronchial intubation was achieved with a double-lumen tube. During operation, haemodynamic values and respiratory parameters were recorded.

Before induction of anesthesia, before SLV, at the end of SLV and six hours after operation blood samples were taken from an arterial catheter to measure MDA.

**Results:** There were no differences between groups and demographic data. Peak and trial volumes were lower in group P than group V. Haemodynamic data were similar in the two groups. When we compared measurement of MDA between groups, MDA in group P was lower than group V at the beginning of the SLV (see Table 1).

**Discussion:** There was an increase in MDA level in both groups. There is no difference between the effects of PCV or VCV modes on lipid peroxidation during SLV.

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Table 1

MDA	Group P n = 15	Group V n = 17	P value
Pre-operative	109.9 ± 35.0	97.1 ± 17.4	0.20
Before SLV	50.4 ± 27.1	86.5 ± 52.7	0.026
After SLV	107.5 ± 33.8	112.4 ± 40.0	0.80
Postop 6 hour	116.3 ± 45.9	119.8 ± 50.9	0.70

#### **P-44** **Paravertebral levobupivacaine and ropivacaine differences in pain relief after thoracotomy**

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**Introduction:** This research aimed to demonstrate whether pain relief and analgesia satisfaction perceived by patients is better in one of two homogeneous groups who underwent unilateral thoracotomy with a paravertebral catheter, using ropivacaine 0.2% or levobupivacaine 0.125%, by the need for more analgesia rescues.

**Methods:** This is descriptive, prospective and observational research. Between June 2011 and July 2012, 42 patients underwent unilateral open thoracotomy by the same surgeon. The same anaesthesiologist prescribed randomly ropivacaine 0.2% or levobupivacaine 0.125% by continuous infusion at  $0.1 \text{ ml kg}^{-1} \text{ hr}^{-1}$  for the postoperative (PO) and adjuvant rescue analgesia. Each patient answered a questionnaire about Verbal Analgesic Scale (VAS) at rest, coughing or moving during the first 48 h, intensity of nausea and vomiting (PONV), mood and satisfaction with analgesia received. We recorded the number of analgesic rescues administered. Five patients were excluded from the study. Thirty seven patients were included in the analysis into two groups, 19 with ropivacaine 0.2% (R group) and 18 with levobupivacaine 0.125% (L group). The data were analysed using a statistical programme SPSS v.18.0 (SPSS Inc., Chicago, IL, USA); qualitative variables were presented as percentage and the quantitative variables as mean and standard deviation (SD). The Student's t-test was used to evaluate the quantitative variables. A P-value of  $< 0.05$  was accepted to be statistically significant.

**Results:** 12 patients (63%) in the R Group and 11 (61%) in the L Group required rescues, in R group with a mean of 1.42 (SD 1.50), while in L group 1.16 (1.38). No significant difference found ( $P = 0.59$ ). The mean VAS in the first 24 h PO in R group was 4.36 (SD 3.18), while in L group 4.22 (3.15) without significant difference ( $P = 0.88$ ). On the second day, mean PO VAS in R group was 2.7 (2.42) and in L group 3.22 (2.41), with no significant difference ( $P = 0.54$ ). PONV in R group reach a mean of 0.31 (1.00) and in L group of 1.55 (2.70) with the difference close to significance:  $P = 0.07$ . Mean satisfaction with analgesia in R group was 8.26 (1.93), while in L group 8.16 (1.68) without significant difference ( $P = 0.84$ ). The mean mood in R group was 7.47 (2.34) and L group 8.05 (1.92), ( $P = 0.41$ ).

**Discussion:** Pain control and analgesia satisfaction were similar in the two groups, with means and SD very similar and no statistically significant difference between them. There were no significant differences found in the number of analgesic rescues. The use of levobupivacaine could be associated with increased intensity of PONV with respect to ropivacaine, where the difference was close to significance. This should be clarified in future studies, as this may be due to increased hypotension or an intrinsic effect of it per se.

## Poster Round – Patient Blood Management

### P-45 Evaluation of the coagulation profiles of preserved autologous whole blood using rotation thromboelastometry

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**Introduction:** Pre-operative autologous whole blood (AWB) donation is performed as a method to avoid peri-operative allogeneic blood transfusion. In general, the aim of autologous blood donation is to preserve and replace red blood cells. The coagulation profile of stored whole blood is unknown. We therefore evaluated the coagulation profiles of stored AWB using rotation thromboelastometry (ROTEM).

**Methods:** Sixty-two AWB samples were obtained from 23 consented patients who underwent elective cardiac surgery. The collected AWB was stored in a refrigerator and re-infused to the patient according to our institute's protocol. Blood sample for ROTEM analysis was collected from the remaining blood in the storage bag immediately after reinfusion. INTEM (ellagic acid-activated coagulation profile), EXTEM (tissue factor-activated coagulation profile) and FIBTEM (EXTEM with platelet deactivation) tests were performed. The standard ROTEM parameters; clotting time (CT), clot formation time (CFT) and maximum clot firmness (MCF) were recorded.

**Results:** Sixty-two AWB samples were obtained. Fifty-six samples were analysed and 6 samples were excluded due to technical failures. The average duration for storage was  $17 \pm 7.0$  days (mean  $\pm$  S.D., range: 6-31 days). INTEM-, EXTEM- and FIBTEM-CT were significantly prolonged ( $302.2 \pm 107.6$  sec,  $78.5 \pm 28.2$  sec and  $75.4 \pm 37.2$  sec, respectively).

CFT were immeasurable in almost all traces. On the other hand, INTEM-, EXTEM- and FIBTEM- MCF were  $17.0 \pm 7.6$  mm,  $16.5 \pm 7.3$  mm and  $13.6 \pm 4.4$  mm, respectively.

**Discussion:** In our pilot study, ROTEM demonstrated clinically significant fibrin polymerization activity in stored AWB. Prolonged clotting time was considered to be due to platelet dysfunction. Our results suggest that the activities of coagulation factors in the AWB are still preserved after storage.

### P-46 Activated factor V11a increases postoperative cerebrovascular events in patients undergoing aortic surgery with deep hypothermic circulatory arrest

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**Introduction:** Concerns have been raised over the increased risk of stroke in cardiac surgical patients treated with activated factor VIIa, (rAFVIIa) [1]. In an audit of rAFVIIa use in cardiac surgery in our unit all new postoperative strokes were noted in patients undergoing aortic surgery with hypothermic circulatory arrest. We wished to determine the increased risk of stroke with rAFVIIa administration in this population.

**Methods:** A retrospective cohort study comparing 25 patients who received rAFVIIa for control of postoperative haemorrhage and 107 patients not exposed to rAFVIIa after aortic surgery with DHCA. All patients were treated in our institution from 2004-2011. Demographic data, operative data, bleeding and transfusion data and stroke, renal failure and 30 day mortality were compared between the 2 groups. Data was analysed using paired t test and Fisher's exact test.

**Results:** All patients in the treated group received 90 mcg/kg of rAFVIIa. The rAFVIIa group had higher additive EuroSCORE ( $P < 0.005$ ), lower starting haemoglobin levels ( $P < 0.02$ ), longer cardiopulmonary bypass

times ( $P < 0.001$ ), and incidence of postoperative stroke ( $P < 0.01$ ). There was no difference in age, sex ratio, rate of emergency or redo surgery, use of antiplatelets, blood loss, DHCA time, postoperative renal failure, or 30 day mortality between the 2 groups. Aprotinin was used in 12/25 rAFVIIa patients and 49/107 controls. The relative risk of new CVA in the rAFVIIa treated group was 2.75 (95% CI 1.35-5.62).

**Discussion:** Our findings support the evidence that rAFVIIa, dosed at 90 mcg/kg, increases stroke risk after high risk aortic surgery. There is evidence that lower dosing regimes of 30 mcg/kg do not increase this risk in aortic operations [2]. We suggest that when considering the use of rAFVIIa, the lowest clinically effective dose should be used to minimise the risk of stroke.

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## P-47

### The effect of 6% hydroxyethyl starch and 3% modified fluid gelatin on thromboelastography parameters in patients undergoing coronary surgery

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**Introduction:** Colloids are often used peri-operatively for normovolaemic haemodilution and volume replacement therapy but

can impair haemostasis. Medium molecular weight starches have a greater plasma expanding effect than modified fluid gelatin (GEL) and have similar untoward effects to HES 130/0.4 on coagulation [1, 2]. In this study, we compared the effects on coagulation of HES 200 and gelatin solutions in CABG patients.

**Methods:** In this controlled, double blind trial, 40 patients scheduled for coronary surgery were randomised into two groups: 20 patients were allocated to receive 6% HES 200/0.4 and 20 patients received 3% gelatin solution for acute normovolaemic haemodilution.

Thromboelastography parameters (R, K, maximum amplitude, alpha angle, lysis 30) were measured before (T0) and after acute normovolaemic haemodilution (T1), and two (T2), four (T3), and 24 h (T4) after separation from CPB.

**Results:** Thromboelastography variables were not significantly different (ANOVA) between the two groups. R time was significantly longer at the end of the colloid infusion than at the beginning in group GEL. At this stage, the median (25<sup>th</sup>-75<sup>th</sup> percentiles) R time was 12.8 min (11.0-15.7) and 8 min (7.2-11.6), respectively. R time was also significantly longer at T2 [14.5 min (12.1-15.5)] than at T0 [9.3 min (5.0-11.7)] in group HES. The total mean dose of the study solution used was 15 ml kg<sup>-1</sup>. Peri-operative blood product transfusion requirements, volume of mediastinal drainage, organ failure scores, and length of hospital stay were similar in both groups.

**Discussion:** Niemi [3] found similar results to ours using the ROTEM method of monitoring coagulation parameters when HES and GEL were given in the immediate post-CABG period [2]. In our study, we performed acute normovolaemic haemodilution, thus patients received back fresh autologous blood, which is rich in coagulation factors and platelets. This may have partially improved the patients' hypocoagulable state after cardiac surgery and diminished the need for transfusion. In conclusion, clot strength and firm-

ness after CABG were impaired in patients undergoing acute normovolaemic haemodilution with both 6% HES 200/0.5 and 3% gelatin solutions. At these doses, regarding thromboelastography parameters, either solution can safely be used for perioperative volume replacement therapy.

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