FREE ORAL SESSIONS

Oral Session –
Technology and Outcome

O-01
Effect of depth of anaesthesia and cerebral oxygenation on postoperative cognitive function in patients undergoing cardiac surgery: rationale and study design

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Introduction: A multi-factorial reduction in cerebral oxygen delivery appears to be a major mechanism in developing postoperative cognitive dysfunction (POCD). High levels of anaesthesia may be associated with poorer long-term outcome in cognition after non-cardiac surgery [1]. We investigate whether optimisation of these factors has an effect on POCD in patients over the age of 65, undergoing coronary artery bypass graft surgery.
Methods: The power analysis, based on vigilance reaction time requires 80 patients to enter this two treatment parallel-design study. Bispectral index (BIS) and cerebral oxygenation (rSO_2) are recorded peri-operatively. The depth of anaesthesia in the intervention group is aimed at a BIS of 50 ± 10 and standardised interventions are delivered if rSO_2 drops below 15% of the baseline or below 50%, whereas the control group are blinded to BIS and rSO_2. Cognitive function tests include global cognitive function, memory, executive function, attention and cognitive processing speed and are undertaken pre-operatively and at 4 days, 6 weeks and 1 year post-operatively.
Results: At the time of submission, 60 patients have already been randomised, and peri-operative data analysed. Commencing bypass and cross-clamping of the aorta resulted in lower levels of cerebral oxygenation compared with surgery as a whole (mean rSO_2 63.29 vs. 69.00 $P \leqq 0.001$ and mean rSO_2 64.2 vs. 69.00 $P < 0.001$, respectively). Mean BIS scores were also reduced during cross-clamp and bypass compared with surgery as a whole (mean BIS value 38 vs. 34 $P = 0.004$ and 38 vs. 34, $P = 0.001$, respectively). 65% ($n = 28$) of patients spent over 15 minutes outside the optimal BIS range 40-60 ± 5 during bypass.
Discussion: This is data collected from an ongoing interventional study to determine whether maintaining BIS and rSO_2 in the optimal range reduces POCD. We do not intend to make a separate analysis of the two groups until the end of the study. However, results of this POCD trial have the potential to demonstrate that optimising depth of anaesthesia and cerebral oxygenation may improve postoperative cognitive function after cardiac surgery.

References

[1] Ballard C, Jones E, Gauge N, et al. Optimised anaesthesia to reduce postoperative cognitive decline (POCD) in older patients undergoing elective surgery, a randomised controlled trial. PLoS One 2012; 7: e37410.

O-02
Peripheral tissue oxygen saturation during cardiac surgery and postoperative outcome

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Introduction: The goal of the study was to evaluate the dynamics of tissue oxygen saturation and oxygen reserve during cardiac surgery and to determine the association of changes in tissue oxygen saturation with postoperative outcome in cardiac surgery patients.
Methods: Ninety two patients scheduled for cardiac surgery were analysed. A tissue oximeter sensor (FORE-SIGHT, CASMED, USA) was placed on the upper third of the forearm; peripheral tissue oxygen saturation (StO_2) was monitored. An arterial occlusion test (AOT: 3 min., 240 mmHg) was carried out to investigate oxygen reserve (StO_2min). Retrospectively patients were divided into 3 groups. Patients of Group I (n = 19) had StO_2 after admission to the operation room (base level) below 70%; in Group II (n = 49) base level of StO_2 was ≥ 70%, but became lower than 70% before CPB; in Group III (n = 24) patients had a normal level of StO_2 throughout the surgery. Student's t-test and Fisher's exact test were used for statistical analysis.
Results: Demographic parameters were equal in the three groups. The two groups, I and II, were comparable. Patients of Group I had the lowest StO_2min before the surgery and at the end. In Group II StO_2min decreased before CPB and during CPB came up to Group I values. In Group III StO_2min was higher than in Group I and Group II throughout the surgery. In all the groups StO_2min significantly decreased at the end of surgery in comparison with base level. All the patients had a normal lactate level, but in Group I the lactate values were higher than in the other groups. Patients of Group I and Group II had lower venous saturation in comparison with Group III during surgery except at the base level. Also patients of Group I and Group II had significantly longer duration of mechanical ventilation (9.6 ± 2.8 and 9.7 ± 3.3 vs. 7.9 ± 2.4 h, $P < 0.05$), duration of ICU stay (1.6 ± 0.4 and 1.5 ± 0.3 vs. 1.2 ± 0.5 days, $P < 0.05$) and postoperative length of stay in hospital (10.7 ± 2.1 and 12.9 ± 3.5 vs. 9.1 ± 1.4, days, $P < 0.05$).
Discussion: During cardiac surgery decrease of tissue oxygen saturation and oxygen reserve occurs. The decrease of tissue oxygen saturation below 70% before CPB can be used as predictor of poor postoperative outcome.

O-03
Incidence, causes and outcome of emergency cardiac surgery and emergency cardiopulmonary bypass in 994 patients for transcatheter aortic valve implantation (TAVI)

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Introduction: The aim of the study was to evaluate whether the route of valve implantation or type of transcatheter valve was associated with differences in the emergency adverse events and to determine pre-operative risk factors.
Methods: 994 patients who underwent TAVI between 2006 and 2010 were included in the study. The clinical information systems as well as the anaesthetic protocol were reviewed retrospectively for incidence of conversion either to emergency cardiac surgery (ECS) and/or emergency cardiopulmonary bypass (E-CPB). Incidences and mortality were analysed by Chi-squared tests and Fisher's exact test. Length of stay (LOS) in hospital was compared by t-test.

Results: The overall rate of ECS/emergency CBP was 5.1% (n = 51). Sternotomy was performed during TAVI in 41.2% (n = 21) and post-TAVI due to delayed complications in 35.3% (n = 18). 23.5% (n = 12) patients underwent E-CBP but no sternotomy was required as they stabilised after a short recovery time of E-CPB. The incidence of these events was not significantly different between the transfemoral and transapical approach (4.4% vs. 6%, P = 0.253). The complication rate was lowest in valves implanted frequently (Medtronic Corevalve n = 463, Edwards Sapien Valve n = 499) compared to those valves which were infrequently implanted (e.g: Ventor Embracer: n = 19 and Jena Valve n = 13). Overall in-hospital mortality was approximately 7-fold increased in patients who required ECS and/or E-CBP (52.9% vs. 7.2%, P < 0.001) compared to non-ECS or E-CPB groups. The majority of deaths following ECS and E-CBP occurred in patients who underwent transfemoral TAVI compared to a transapical approach (Mortality 68% vs. 38.5%, P = 0.05). For patients in the ECS and E-CPB groups who survived, mean duration of hospitalisation increased to 32.2 (SD 19.3) days compared to 23.5 (SD 12.5) days in non-ECS or E-CPB group, presenting significant difference (P = 0.038).

Discussion: ECS/E-CBP is associated with considerably increased in-hospital mortality rates as well as prolonged hospitalisation in patients undergoing TAVI. Mortality was higher in the transfemoral compared to the transapical group. Progression in the learning curve specific to the use and management of certain valve-types may play an important part in reduction of intra-operative complications.

Oral Session – Transfusion and Haemostasis

O-04
Effect of colloids Gelatin and HES 130/0.4 on blood coagulation in cardiac surgery patients: a randomised controlled trial

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Introduction: The choice of the prime solution for cardiopulmonary bypass (CPB) can play an important role in limiting the effect on blood coagulation, but it is still unclear what the effect of colloids on blood coagulation is. The aim of this study was to investigate the effect of synthetic colloids on blood coagulation in patients who underwent a CABG (coronary artery bypass craft) procedure.

Methods: Based on sample size estimation (α = 0.05, power = 0.80) each treatment arm required 30 patients. Sixty elective CABG patients who underwent CPB were randomly assigned to receive the prime solutions lactated Ringer's solution combined with Hydroxyethyl Starch 130/0.4 (HES, 6% Volulyte, Fresenius Kabi Nederland BV, The Netherlands) (HES group) or gelatin (Gelofusin®, Braun Melsungen AG, Germany) (Gelo group). Blood loss was assessed using chest tube drainage; secondary endpoints were amount of blood component transfusion, routine coagulation tests values and rotation thromboelastometry values (Rotem®).

Results: There was no significant difference in chest tube drainage between the groups (total chest tube drainage: HES group, 500 ± 420 ml vs. Gelo group, 465 ± 390 ml, P = 0.482). No significant differences were observed in any of the routine coagulation tests, thromboelastometry parameters (table 1) and blood component transfusion

Table 1: Rotem® variables (mean ± SD)

	Pre-op		Post-op 1 hour		
	HES group	Gelo group	HES group	Gelo group	P value
MCF InTEM®	65 ± 5	65 ± 10	61 ± 4	60 ± 5	0.47
MCF HepTEM®	62 ± 4	62 ± 5	58 ± 5	57 ± 6	0.57
MCF ExTEM®	66 ± 4	65 ± 4	61 ± 5	61 ± 6	0.93
MCF FibTEM®	19 ± 5	17 ± 4	12 ± 5	11 ± 3	0.90
CT InTEM®	187 ± 38	162 ± 34	185 ± 25	192 ± 26	0.28
CT HepTEM®	192 ± 44	185 ± 48	193 ± 27	199 ± 36	0.50

between the groups. Independent samples T-test; HES group vs. Gelo group. CT = clotting time; MCF = maximum clot firmness

Discussion: In this randomised controlled trial of adults undergoing CABG procedure, there was no significant difference in blood loss or blood coagulation between HES 130/0.4 and gelatin combined with lactated Ringer's solution.

O-05
ACT measurement: the biased gold standard of measuring heparin anticoagulation in cardiac surgery

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Introduction: In cardiac surgery anticoagulation is usually achieved by administration of heparin. For nearly 50 years the activated clotting time (ACT) has been known as a practicable method to measure this effect [1]. Despite its widespread use, a degree of uncertainty remains concerning its validity and repeatability. Furthermore, ACT measurements can vary based on the measurement method [2]. A smaller trial suggests that there is no statistically significant difference in ACT measurement using the same system [3]. Takeing two samples from the same patient at the same time and measuring with the same Hemochron Response® machine, we compared repeatability of ACT measurements.

Methods: In this retrospective observational study, we compared duplicate ACT values in patients undergoing cardiac surgery in our institution between January 2010 and May 2012. We used Bland-Altman analysis to look for differences between the two measurements.

Results: 11569 pairs of duplicate ACT measurements were analysed. Mean bias was –19.5 s ($P < 0.05$), 95% confidence interval was –20.6 s to 18.3 s. 2,540 pairs (22.0%) varied by more than 10%, 1,831 (15.8%) by more than 20%.

Discussion: In our institution, a substantial proportion of ACT measurements taken at the same moment from the same patient vary significantly. This disagreement should be considered when defining target areas for anticoagulation to ensure patient safety.

References

[1] Hattersley PG. Activated coagulation time of whole blood. JAMA 1966; 196: 436-440.
[2] Thenappan T, Swamy R, Shah A, et al. Interchangeability of activated clotting time values across different point-of-care systems. Am J Cardiol 2012; 109: 1379-1382.
[3] Bosch YP, Ganushchak YM, de Yong DS. Comparison of ACT point-of-care measurements: repeatability and agreement. Perfusion 2006; 21: 27-31.

O-06
Postoperative bleeding after cardiac surgery is associated with increased need for organ support and higher 30-day mortality

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Introduction: Postoperative excessive bleeding in cardiac surgery increases mortality and the rate of postoperative complications. We tested the hypothesis that patients (pts) with increased postoperative bleeding have a higher rate of postoperative organ support and of 30-day mortality.

Methods: From February 2010 to July 2011, 600 pts underwent cardiac surgery in our institution. Peri-operative data were prospectively recorded in our institutional database. We defined postoperative haemorrhage as a mean chest tube drainage ≥ 1 ml $\cdot$ kg^{-1} $\cdot$ h^{-1} during the first 12 hours (h) after ICU admission. Need for at least 1 organ support in the ICU was the need for inotropes support (dobutamine ≥ 5 µg $\cdot$ min^{-1} or epinephrine ≥ 0.5 mg $\cdot$ h^{-1} or balloon pumping), or for mechanical ventilation ≥ 3 days, or for renal replacement therapy. Data were analysed with Mann-Whitney U test or Chi-squared test as appropriate.

Results: 106 patients bleed ≥ 1 ml $\cdot$ kg^{-1} $\cdot$ h^{-1} in the first postoperative 12 hours.

Patients with a bleeding $\geq$ 1ml kg^{-1} $\cdot$ h^{-1} had a relative risk of 2.3 (95% CI: 1.6-3.4; P < 0.0001) for ICU organ support and of 4.6 (95% CI: 1.7-12.9; P < 0.0034) for 30-day mortality (see Table).

Discussion: In this single centre experience, pts with postoperative increased bleeding had a higher rate of ICU organ support and 30-day mortality.

	Bleeding < 1 ml $\cdot$ h^{-1} n = 492	Bleeding $\geq$ 1 ml $\cdot$ h^{-1} n = 106	P value
Need for ICU organ support	64 (13.0%)	32 (30.2%)	< 0.0001
Re-thoracotomy	9 (1.9%)	17 (16.0%)	< 0.0001
Total red cells transfusions	1.0 [0.0;3.0]	4.0 [2.0;7.0]	< 0.0001
Total fresh frozen plasma transfusions	0.0 [0.0;0.5]	4.0 [1.0;6.0]	< 0.0001
ICU length of stay	3.0 [2.0;5.0]	3.0 [3.0;6.0]	0.0066
30-day mortality	7 (1.4%)	7 (6.6%)	0.0053

Oral Session – Vascular Anaesthesia and Postoperative

O-07
Assessment of myocardial damage among vascular and thoracic surgery patients by late enhancement cardiac magnetic resonance imaging after postoperative troponin elevation

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Introduction: In non-cardiac surgery, a postoperative troponin elevation is associated with an increase of short and long term cardiac morbidity and mortality. Cardiac mortality is proportional to the peak of biomarker. Cardiac magnetic resonance (CMR) allows the assessment of myocardial microcirculation and the characterisation of the injuries related to the biomarker's elevation.

Methods: All the patients programmed for elective vascular or thoracic surgery between March 31st 2010 and December 31st 2011, who had postoperative troponin elevation on 2 consecutives measures have had a late enhancement CMR if there were no contraindications.

Results: On the 249 patients who had a postoperative elevation of troponin during the study period, only 24 underwent a CMR. Troponin elevations occurred mostly during the first 48 hours (79%). The median time to CMR was 81.5 days. For 14 patients, CMR identified myocardial damage related to an alteration of myocardial microvascularisation. These alterations were independent of the coronary stenosis identified in the preoperative period.
Discussion: The median time to CMR of 81 days could explain negative MRI, because of the healing potential of the alterations concerning less than 25% of myocardial wall. Due to the cost and the constraints, late enhancement CMR can only be realised for a clinical study. In conclusion, postoperative troponin elevations in vascular and thoracic surgery are associated with myocardial damages related to alterations of microvascularisation of myocardial wall, which can be visualised on cardiac magnetic resonance. Microcirculation studies with CMR assess the reality of myocardial damages after non-cardiac surgery. Elevated mortality of these patients implies the creation of early medical strategies.

O-08
Cardiac complications following lower limb arterial bypass surgery in West of Scotland

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Introduction: Population studies have shown that about 20% of people aged over 60 years have some degree of peripheral arterial disease and this group of patients has a higher peri-operative risk of major adverse cardiac events (MACE). The incidence of coronary heart disease (CHD) in the West of Scotland is amongst the highest in Western Europe (estimated 3% of the population) [1]. The Lee's revised cardiac risk index (RCRI) is used to predict MACE following non-cardiac surgery [2]. We compared the predictive value of the RCRI with the incidence of MACE following lower limb arterial bypass surgery in our patient population and also looked at the prevalence of CHD in our cohort based on the RCRI criteria [2].
Methods: We conducted a prospective observational study on 51 patients undergoing lower limb arterial bypass surgery. Patients were given an RCRI score and grouped into 4 classes (A, B, C, and D) according to the RCRI of 0, 1, 2 and ≥ 3 respectively. 90-day patient outcome was obtained from the electronic patient records. The occurrence of MACE (primary cardiac arrest, complete heart block, acute myocardial infarction, pulmonary oedema, cardiac death during admission) was compared to the predicted MACE using the RCRI.
Results: The mean patient age was 66.3 years. Seven patients (13.7%) died in the observed study period but none from a primary cardiac event. Four patients developed MACE in the postoperative period, the incidence in the risk groups A, B, C and D was 8%, 7.7%, 9.1% and 0% respectively. The prevalence of CHD was 37.2%, much higher than the prevalence in the general population (4.3% for ages 45-64 years; 13.7% for ages 65-74 and 17.3% for > 75 years) [2].
Discussion: Although our study showed no correlation between the observed and the RCRI-predicted incidences of MACE (0.4%, 0.9%, 6.6% and > 11% in the corresponding groups), the cardiac morbidity and all cause mortality remained high. This suggests that infra-inguinal arterial surgery carries a higher peri-operative cardiac risk than that predicted by the RCRI. However due to the small sample size, we cannot confidently make that conclusion. The study also confirms that the prevalence of CHD is much higher in this patients group compared to the general population. A much larger prospective study is needed to truly evaluate the RCRI in this patient population.

References

[1] The Information services division of National services Scotland, NHS Scotland. 2012. http://www.isdscotland.org/Health-Topics/Heart-Disease/Topic-Areas/Prevalence/

[2] Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. Circulation 1999; 100: 1043-1049.

O-09
Haemodynamic and cerebral oxygenation changes during carotid endarterectomy under local anaesthesia

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Introduction: Carotid endarterectomy (CEA) is a major surgical procedure performed on patients who often have major co-existing cardiovascular disease. It is commonly performed under local anaesthesia (LA) to minimise the haemodynamic changes associated with general anaesthesia and to use the "awake" brain as a cerebral function monitor. Carotid artery clamping to enable endarterectomy causes haemodynamic changes and decreases cerebral oxygenation which can lead to alteration in cerebral function ranging from mild confusion to loss of consciousness and stroke. The aim was to study the haemodynamic and cerebral oxygenation changes during CEA under LA.

Methods: Local ethical approval was obtained. 69 patients underwent awake carotid endarterectomy during this study. Cerebral Oximetry was assessed with INVOS™ (Covidien inc, Co, USA) and haemodynamics with the LiDCO*rapid*™ or LiDCO*plus*™ (LIDCO plc, Cambridge, UK). Monitoring was commenced pre-operatively and continued until the end of the procedure. Shunting was only performed if there was deterioration in the conscious state.

Results:

	Baseline Mean(SD)	Post clamp Mean (SD)	P value
Cardiac output	8.1 ± 2.6	8.9 ± 2.8	0.07
Mean arterial pressure	100 ± 19	110 ± 18	0.0032
Heart rate	73 ± 14	81 ± 17	0.0016
Cerebral oximetry (rSO_2)	68 ± 9	61 ± 9	0.001
Shunted patients (4 patients)			
Cardiac output	6.7 ± 2.0	7.2 ± 2.8	0.28
Mean arterial pressure	75 ± 20	100 ± 25	0.27
Heart rate	69 ± 21	77 ± 16	0.6
rSO_2	66 ± 11	46 ± 11	0.0012

Discussion: Patients requiring a shunt did not mount a significant haemodynamic response to clamping and had a greater drop in rSO_2 values. Haemodynamic manipulation may decrease the requirement of a shunt. Haemodynamic monitoring alongside rSO_2 is useful to both predict and prevent the occurrence of adverse events.

References

[1] Samra SK, Dy EA, Welch K, et al. Evaluation of a cerebral oximeter as a monitor of cerebral ischemia during carotid endarterectomy. Anesthesiology 2000; 93: 964-970.

**Oral Session –
Transcatheter aortic valve replacement, TAVI**

O-10
Transcatheter aortic valve replacement (TAVI) in patients aged 90 years or more: procedural outcome

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Introduction: Transcatheter Aortic Valve Implantation (TAVI) was designed as a therapy for patients with severe aortic stenosis and high peri-operative risk. With growing experience and the increasing aged population in Europe, cardiac anaesthesiologists will face more patients aged 90 years or more. With these patients, there was a rising concern whether specific precautions for nonagenarians (NONA) are necessary.
Methods: We compared patients undergoing a transfemoral TAVI aged 90 years or more with patients aged 80-89 years (OCTO). Group comparisons were performed by the Mann-Whitney *U* test.
Results: Between June 2007 and June 2012 841 TAVI procedures (all methods of access) were performed in our University hospital. Transfemoral access and a age of at least 80 yr was found in 299 of these patients (35.6%).

	OCTO n = 270	NONA n = 29	P value
Male : female ratio	1:1.8	1:1.1	
Body mass index (kg · m^{-2})	25.8 ± 3.9	24.5 ± 3.8	0.097
Left ventricular ejection fraction (%)	51 ± 12	50 ± 12	0.764
dPmax (mmHg)	74 ± 27	84 ± 33	0.115
Aortic valve area (cm^2)	0.6 ± 0.2	0.6 ± 0.2	0.651
Propofol (mg · kg^{-1})	5.2 ± 7.6	3.7 ± 3.4	0.201
Remifentanil (µg · kg^{-1})	0.28 ± 0.23	0.20 ± 0.15	0.083
Norepinephrine (µg · kg^{-1})	4.2 ± 6.8	3.9 ± 3.6	0.763
Crystalloid infusion (ml · kg^{-1})	15.0 ± 6.3	13.8 ± 4.3	0.249
Procedure time (min)	191 ± 73	187 ± 36	0.659

62% of octogenarians and 52% of nonagenarians were transferred to ICU without inotropic or vasopressor support. Peri-operative CPR was needed in 2.9% (n = 8) of NONA and 3.4% (n = 1) of OCTO patients.
Discussion: The population of nonagenaric TAVI patients will most likely be growing. Our data suggest, that no specific precautions for these patients seem to be necessary.

O-11
Incidence and outcome of atrioventricular block after transcatheter aortic valve implantation (TAVI): analysis in 994 patients

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Introduction: Atrioventricular block (AV) with postoperative permanent pacemaker dependency after TAVI, is a known complication. The aim of this study was to evaluate whether the method and type of valve were associated with differences in the incidence of AV block.
Methods: All patients scheduled for TAVI from 2006 to 2010 were included. Based on the clinical information system, we retrospectively looked for the incidence of AV-block, including pre-operative use of pacemaker in these patients. Incidences were analysed by chi-squared tests and Fisher's exact test, where appropriate. Length of stay in hospital for AV block categories was tested by ANOVA.

Results: 184 of the 994 patients (18.5%) sustained AV block as a result of TAVI from either approach (Table 1).

Total number of patients n = 994	Grade III block	Grade II block	Grade I block
Number of patients with AV Block n = 184 (18.5%)	153 (15.4%)	13 (1.3%)	18 (1.8%)
Long term pacemaker	153 (15.4%)	None	None

Grade III AV block was associated with significant difference in length of stay in hospital compared to patients without AV block (median 24, interquartile range [16.5, 31] vs. 20 [15, 27, P = 0.012]). No change in mortalitiy (9.8% vs. 9.4%, P = 0.870) was observed.

Discussion: TAVI by trans-femoral approach is associated with two fold increase in atrioventricular block and permanent pacemaker dependency. As a result, length of hospitalisation in these patients was significantly longer. However, in-hospital mortality was not affected by this complication.

O-12
Copeptin as a marker for stress in surgical (SAVR) and transcatheter aortic valve replacement (TAVI)

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Introduction: Transcatheter aortic valve replacement (TAVI) is commonly used in Europe as an alternative for patients with high peri-operative risk. To date the patient's individual stress level during TAVI compared to patients undergoing a surgical aortic valve replacement (SAVR) has not been shown. Copeptin is an easy to measure stable 39-amino-acid glycopeptide at the C-terminal portion of provasopressin, reflecting the release of arginine-vasopressin and has previously been shown to be a stress marker in different clinical settings.

Methods: This pilot-study was designed to gain information about the course of copeptin in patients undergoing SAVR or TAVI. Plasma samples from 50 patients (25 SAVR, 25 TAVI) were used. Copeptin levels were determined: 1. Before induction; 2. End of operation; 3. 2 h post operation; 4. 4 h post operation. Descriptive statistics of quantitative data are given by median and interquartile range (IQR; 5% percentile – 95% percentile) due to deviations from the normal distribu-

Table 2. Incidence of Grade III AV block showed a two fold increase in the transfemoral approach P < 0.001).

Type of Valve	Corevale	Edwards Sapien	Ventor Embracer	Jena Valve	Symetis Acurate
Grade III block (Transfemoral)	94/462 (20.3%)	19/102 (18.6%)			
Grade III block (Transaortic)		37/378 (9.8%)	1/19, (5.3%)	1/13 (7.7%)	1/20 (5.0%)

tion. Group comparisons were performed by Mann-Whitney-*U* test. All statistical tests were two-sided and conducted in an explorative manner on a 5% significance level.

Results: 25 samples from SAVR and 24 samples from TAVI patients were analysed. 15 TAVI procedures were done during general anaesthesia (TAVI-GA) and 9 during sedation (TAVI-CS). All TAVI-GA patients were extubated at procedure's end. Volume and vasopressor therapy did not differ in TAVI-GA and TAVI-CS patients. Pre-operative copeptin levels were significantly lower in intramuscular SAVR than in oral premedicated TAVI patients (median: 5 pmol · L^{-1}, 5^{th}-95^{th} percentile: 2-21 pmol · L^{-1} vs. 9 pmol · L^{-1}, 3-51 pmol · L^{-1}, P = 0.003). Even still anaesthetised SAVR patients did not show the lowest level of copeptin (41 pmol · L^{-1}, 4-202 pmol · L^{-1}) at operation's end compared with those found in TAVI-GA patients shortly after their extubation (19 pmol · L^{-1}, 4-94 pmol · L^{-1}). A statistical significance between these groups could not been seen (P-value SAVR vs. TAVI-GA = 0.120; P-value TAVI-GA vs. TAVI-CS = 0.193). 4 h after operation's end SAVR patients were still sedated and ventilated. Copeptin levels were significantly higher in SAVR patients compared to those of the awake TAVI patients (SAVR: 124 pmol · L^{-1}, 18-790 pmol · L^{-1}, TAVI: 61 pmol · L^{-1}, 14-199 pmol · L^{-1}, P = 0.011).

Discussion: Copeptin levels seem to correlate well with the clinical setting in these patients. Intramuscular premedication seem to reduce the patient's pre-operative stress. A randomised trial seems to be necessary to determine patient stress comparing TAVI-GA and TAVI-CS procedures.

Oral session – Cardiac Anaesthesia and Postoperative

O-13
Sevoflurane optimal dosage for myocardium pharmacological post-conditioning: experimental study

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Introduction: Recently there have been literary discussions regarding myocardial protection by volatile anaesthetics against reperfusion injury (pharmacological post-conditioning, PPC). The aim was to assess the role of sevoflurane PPC for myocardium protection against reperfusion injury and find the optimal dosage of volatile anaesthetics.

Methods: Twenty five pigs were divided into five groups. In each group, 20 min before the left coronary artery (LCA) cross-clamp was taken off and for the first 20 minutes of reperfusion, sevoflurane was directly fed into the CPB machine with doses: PPC1.0 group, 1.0 vol%; PPC1.5 group, 1.5 vol%; PPC2.0 group, 2.0 vol%; PPC2.5 group, 2.5 vol%. The CON group was the control and PPC was not used. The CPB and LCA cross-clamp period was 120 min and reperfusion period 60 min. After reperfusion CPB was stopped, the heart taken out and a histological examination by TTC-staining made, to determine the myocardial infarction area (IA). To measure the reperfusion injury malondialdeghide (MDA) was used from blood taken from the coronary sinus. To indicate ischaemic myocardium injury we used lactate and glucose from coronary sinus blood. All blood samples are taken in 2 steps; T1 – at start; T2 – after cross-clamp was taken off (15 min of reperfusion).

Results: The average data in all groups at T2 stage was: lactate 2.3 ± 0.35 mmol · L^{-1}; glucose 8.7 ± 1.25 mmol · L^{-1}. But the reperfu-

sion injury was dose-dependent of the PPC. The infarct area on histological sections was: CON 28 ± 2.4%; PPC 1.0 25 ± 2.4%; PPC 1.5 20 ± 3.0%; PPC 2.0 14 ± 2.6%; PPC 2.5 12 ± 2.0%. The average BP in the PPC period was: CON 93 ± 10.3 mmHg; PPC 1.0 88 ± 7.9 mmHg; PPC1.5 83 ± 9.5 mmHg; PPC 2.0 72 ± 13.4 mmHg; PPC 2.5 57 ± 15.3 mmHg.
Discussion: The cardioprotective effect of sevoflurane PPC is dose-dependent. The maximum effect is found at doses of 2 and 2.5 vol%, but at dose 2.5 vol% vasoplegia is manifested. Thus the optimal sevoflurane dose for PPC is 2.0 vol%.

O-14
Association of perioperative troponin and atrial fibrillation after coronary artery bypass grafting

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Introduction: Atrial fibrillation (AF) is frequently seen in patients undergoing coronary artery bypass grafting (CABG), leading to increased morbidity, prolonged hospital stay, and unfavourable outcomes. Prediction of AF after CABG may lead to preventive or early treatment and improved outcome. The extent of myocardial damage, reflected by the degree of postoperative myocardial enzyme elevation, may be associated with the development of AF. More extensive surgery might lead to oedema and myocardial cell decay, further interrupting electrical impulses and increasing the risk of developing an irregular rhythm. Therefore we investigated the association of serial peri-operative cardiac Troponin T (cTNT) measurements with postoperative AF in patients undergoing CABG.
Methods: In a retrospective analysis of prospectively collected data, 3148 patients undergoing elective CABG were evaluated. cTNT values were routinely determined before start of surgery (cTNT0), at arrival on the Intensive Care Unit (ICU) (cTNT1), and 8-12 hours later (cTNT2). Measurement of cTNT was continued until the peak value was reached. The development of AF during hospital stay was scored. The association between cTNT (cTNT0, cTNT1, cTNT2, and cTNTmax in the first 48 h) and AF was calculated in univariate and multivariate analysis, adjusting for potentially confounding factors as known from the literature.
Results: AF occurred in 1080 (34%) patients. cTNT0, cTNT2, and cTNTmax were significantly and positively associated with postoperative AF ($P < 0.001$) in a univariate analysis, whereas a trend was seen for cTNT1 ($P = 0.051$). Advanced age, inotropic support, and postoperative infection were independently associated with postoperative AF after logistic regression analysis, but cTNT was not. Categorising patients by inotropic support into categories of support duration (none, < 48 h, > 48 h), the mean cTNT values were significantly higher among patients with AF in each category (all $P < 0.001$). Peri-operative cTNT was significantly higher in patients with postoperative complications, longer hospital stay, and reduced in-hospital survival.
Discussion: Peri-operative cTNT is univariably associated with postoperative AF after CABG, but not independently. Further, no clinically useful cut-off point for preventive or early treatment could be identified. Both peri-operative cTNT and postoperative AF are associated with negative outcome and prolonged hospital stay.

O-15
Intraoperative intraaortic balloon pump versus levosimendan in high risk cardiac patients: a pilot study

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Introduction: Recent studies showed that levosimendan has several advantages over pre-operative intra-aortic balloon pump (IABP) in patients with reduced (< 35%) left ventricular ejection fraction [1, 2]. The purpose of this pilot, prospective, randomised study was to compare the efficiency of intra-operative IABP use and levosimendan infusion in high-risk cardiac patients operated under cardio-pulmonary bypass (CPB).
Methods: Patients with coronary artery disease were randomly assigned into two groups. In 10 patients, an IABP was inserted intra-operatively after anaesthesia induction (IABP-group). 10 patients (LEVO-group) received a levosimendan infusion at a dose of 0.1 μg · kg^{-1} · min^{-1}, with a loading dose of 12 μg · kg^{-1} for 10 min after anaesthesia induction. Mann-Whitney U test and exact Fisher's test were used to analyse peri-operative complication rates, haemodynamics and markers of cardiac damage in the groups. $P < 0.05$ was considered significant.
Results: Pre-operative status, CPB time and number of grafts were comparable in both groups. Mean arterial pressure, pulmonary artery pressure and systemic vascular resistance index were significantly lower in the LEVO-group. Both intensive care unit (ICU) and hospital stay were significantly shorter in the LEVO-group. Blood loss during ICU stay was significantly lower in the LEVO-group, median (IQR) 9.7 (6.2-12.3) vs.14.6 (12.8-20) ml/kg. There were no significant differences in the rate of complications and levels of troponin I between the two groups.
Discussion: Our preliminary results indicate that the use of levosimendan in high risk cardiac surgery patients is as safe and effective as intra-operative IABP. The longer duration of ICU stay in the IABP-group might be partly due to the adherence to the strict protocol of IABP withdrawn. Our study is underpowered, however. Further investigation will provide more conclusive data.

References

[1] Severi L, Lappa A, Landoni G, et al. Levosimendan versus intra-aortic balloon pump in high-risk cardiac surgery patients. J Cardiothorac Vasc Anesth 2011; 25: 632-636.
[2] Lomivorotov VV, Boboshko VA, Efremov SM, et al. Levosimendan versus an intra-aortic balloon pump in high-risk cardiac patients. J Cardiothorac Vasc Anesth 2012; 26: 596-603.

O-16
Postoperative cerebral oxygenation after CABG: is it relevant?

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Introduction: Postoperative cognitive dysfunction (POCD) after cardiac surgery is a common problem with implications for prolonging intensive care and hospital stay. We hypothesise that by optimising cerebral oxygenation (rSO_2) the incidence of this phenomenon can be decreased. To date rSO_2 has been studied intra-operatively but there are very few studies measuring it postoperatively [1].

The aim of this study was to evaluate if cerebral oxygenation was optimal postoperatively prior to extubation.
Methods: This is the preliminary report from all the patients involved in a prospective randomised control study looking at optimising BIS and rSO_2 conducted after obtaining institutional ethical approval. Clinical trials identifier NCT01743456 Patients over 65 years

undergoing isolated coronary artery bypass grafting (CABG) were recruited. Data of rSO_2 was collected continuously from before induction of anaesthesia until extubation postoperatively in the high dependency unit. The rSO_2 was optimised by the anaesthetist intraoperatively only in the intervention group.

Results:

	Surgery	High dependency unit	P value
Patients with > 15% drop in rSO_2 (n)	30	24	
Patients with no drop in rSO_2 (n)	12	11	
No data available	0	7	
Total (n)	42	42	
Average duration of drop (min)	34	119	< 0.008
Average duration of surgery (min)	289	426	< 0.006
Average% time of > 15% rSO_2 fall	11	31	< 0.02
Area under the curve (min x% decline)	3.72	4.44	< 0.02

Discussion: Postoperative cerebral oxygen desaturation is significant in terms of severity and duration. This might have an impact on POCD and other complications related to low cerebral oxygen delivery. We propose this parameter should be recorded and optimised postoperatively.

References

[1] Greenberg SB, Murphy G, Alexander J, et al. Cerebral desaturation events in the intensive care unit following cardiac surgery. J Crit Care. Nov 2012, Epub ahead of print.

O-17
Relationship between cardiac output, bispectral index and cerebral oxygen saturations in cardiac surgery

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Introduction: In cardiac surgery, postoperative outcome has been associated with a cumulative duration of low bispectral index (BIS) [1] and also with reduced cerebral oxygen saturations. The aim of our study was to assess the relationship between cardiac output (CO), BIS and cerebral oxygenation (rSO_2) in patients undergoing coronary artery bypass graft (CABG) surgery. Possible correlations could help to explain the association between low BIS or rSO_2 and postoperative outcome.

Methods: After ethical approval, patients undergoing CABG surgery were recruited. Induction of anaesthesia included hypnosis with propofol and maintenance continued with 1-1.25 MAC (minimum alveolar concentration) end-tidal isoflurane. Data was collected every 5 seconds using ASYS from the BIS, LiDCO*Rapid* and Somanetics INVOS monitors. Data up to 60 minutes after the first reading of BIS below 60 and before cardiopulmonary bypass was considered. Collected data was averaged with a 20 seconds window and subsequently analysed with *MATLAB*. Data is presented as mean (standard deviation). Correlation analysis was used for CO, BIS and rSO_2. Significant differences were defined as $P < 0.05$.

Results: Thirteen patients were included, age 72.3 (5.7) years, weight 88.1 (25.7) kg and height 160.6 (26.0) cm. There was a significantly positive correlation between CO and BIS with r = 0.45 (0.22) in 11 patients (85%). Correlations between CO and rSO_2 were significantly positive in only 7 patients, r = 0.41 (0.18).

Discussion: The results of this pilot trial suggest a positive correlation of BIS and CO in

the majority of patients undergoing CABG surgery. These findings, if confirmed in a larger number of patients, provide pathophysiological support for the previously described association of low BIS with postoperative outcome.

References

[1] Kertai MD, Pal N, Palanca BJ, et al. Association of perioperative risk factors and cumulative duration of low bispectral index with intermediate-term mortality after cardiac surgery in the B-Unaware Trial. Anesthesiology 2010; 112: 1116-1127.

O-18
Early extubation after cardiac surgery is associated with better postoperative cognitive function

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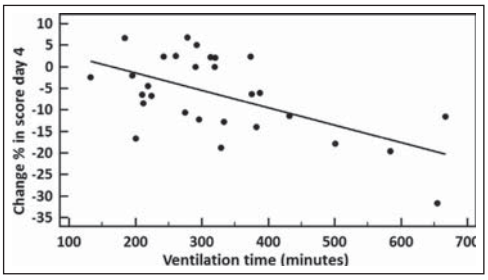
Introduction: Postoperative cognitive dysfunction (POCD) is a well known complication after cardiac surgery. It may affect as much as 80% of patients and cause permanent disabilities with severe consequences for quality of life. Even though POCD is well known after major surgery, discharge from the ICU is mainly based on physiological parameters such as cardiac function, respiratory parameters and level of sedation, unless an abnormal psychological state is prominent.

The objective *was* to estimate the frequency of POCD after on-pump cardiac surgery and to evaluate the associations between POCD and quality of recovery and peri-operative haemodynamics respectively.
Methods: An on-going study of sixty patients scheduled for elective coronary artery bypass grafting ± aortic valve replacement randomised to remifentanil or sufentanil combined with propofol anaesthesia, after written informed consent. Cognitive function is evaluated pre-operatively and day 1, 4 and 30 after surgery with the 50 question Palo Alto Veterans Affairs Hospital questionnaire. An objective score is used to evaluate quality of recovery and eligible time to ICU discharge.
Results: Interim analysis (30 patients) showed that cognitive function had deteriorated on 1st (9.6%; $P < 0.0001$) and 4th (6.6%; $P = 0.0007$) postoperative days. No difference in mean values was detected on day 30, though 2 patients (7%) were still 15% below pre-operative values. Higher age was correlated to lower pre-operative cognitive score, but had no impact on postoperative changes. Remifentanil and sufentanil were fully comparable in ventilation time, ICU stay and postoperative cognitive function. Early extubation ($r -0.59$; $P = 0.001$) and early eligible ICU discharge time ($r -0.45$; $P = 0.014$) were associated with POCD on day 4. No patients showed severe peri-operative organ dysfunction or haemodynamic problems.



Discussion: The study showed that decline in cognitive function and longer ventilation times are associated. A causal relation is yet to be analysed, but interventions improving the postoperative cognitive function may be valuable both to patients and hospital economics.

Oral Session –
Safety & Anaesthesia

O-19
Haemodynamic changes after single dose remifentanil or sufentanil; a randomised study in cardiac surgery patients

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Introduction: Remifentanil has received considerable attention in fast-track cardiac surgery. However, the haemodynamic effects of remifentanil in this population remains poorly described. This study aimed to evaluate the haemodynamic effects of remifentanil compared to sufentanil in ischaemic cardiac surgery patients.

Methods: Patients scheduled for elective CABG with or without AVR were randomised to anaesthetic induction with either remifentanil (0.5-0.6 $\mu g \cdot kg^{-1} \cdot min^{-1}$) or sufentanil (1-2 $\mu g \cdot kg^{-1}$). Prior to induction a pulmonary artery catheter was inserted and transthoracic echocardiography was performed immediately before and two minutes after induction. No other drugs were administered.

Results: Thirty patients were included in the study. Three were excluded (two changed surgery type, one developed severe stiffness after medication) leaving twenty-seven for analysis. Both opioids caused a 13 mmHg decrease in mean arterial pressure (MAP). After remifentanil a 4 mmHg increase in mean pulmonary artery pressure (mPAP) was seen, while sufentanil administration was followed by a 3 mmHg increase in central venous pressure (CVP). All other invasive parameters and echocardiographic measures of systolic, global longitudinal peak systolic strain (GLPS) and diastolic heart function, (E/E' and E'/A' ratio) remained unchanged (statistics: paired samples t-test). No differences were seen between the groups either before or after medication (see Table).

Discussion: The haemodynamic effects of remifentanil are comparable to those of sufentanil in ischaemic cardiac surgery patients. The compared haemodynamic effects of single drug administration of moderate to high dose remifentanil or sufentanil do not discourage the use of remifentanil in cardiac surgery.

Parameter	Remifentanil			Sufentanil		
	Before	After	P value	Before	After	P value
CI ($L \cdot m^{-2} \cdot min^{-1}$)	3.48 ± 0.83	3.14 ± 0.63	0.137	3.16 ± 0.82	3.18 ± 0.79	0.900
MAP (mmHg)	104 ± 14	91 ± 15	0.001	107 ± 21	94 ± 24	0.003
CVP (mmHg)	6.0 ± 6.7	7.6 ± 6.5	0.366	7.4 ± 7.1	10.2 ± 6.4	0.022
mPAP (mmHg)	17.2 ± 4.7	21.0 ± 7.2	0.020	19.2 ± 8.6	23.2 ± 8.8	0.036
GLPS (%)	–14.3 ± 4.0	–16.3 ± 4.6	0.059	–14.5 ± 2.8	–15.1 ± 2.3	0.469
E/E' ratio	9.1 ± 2.5	7.9 ± 2.3	0.244	9.5 ± 6.1	9.8 ± 5.3	0.728
E'/A' ratio	0.82 ± 0.26	0.85 ± 0.22	0.604	0.85 ± 0.15	0.88 ± 0.32	0.760

O-20
Single bolus of propofol in patients with Brugada syndrome: a retrospective analysis

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Introduction: Brugada syndrome is an autosomal dominant disorder with variable penetrance. Typical electrocardiographic changes are seen in the right precordial leads from V_1 to V_3 [1]. Currently in the literature there is conflicting evidence about the safety of propofol in patients with Brugada Syndrome [2]. The purpose of our study was to investigate if a single bolus of propofol, for induction of anaesthesia, is safe in patients with this syndrome.
Methods: This study is a single centre retrospective database analysis.
Results: In our university hospital, 1043 patients have been screened upon suspicion for Brugada syndrome in the past fifteen years. We present a database analysis of patients with Brugada syndrome who have been stratified as being high risk, requiring implantation of an automated cardioverter defibrillator (AICD). It consists of patients with syncope, pre-syncope or aborted sudden death and asymptomatic family members. Diagnosis of Brugada syndrome was made in 117 of them and needed an AICD. Fifty four of them where treated in our centre under general anaesthesia. Induction of anaesthesia was performed with propofol in 45 patients. None of those patients developed a malignant arrhythmic event, and none of them needed to be defibrillated or resuscitated in any way during the peri-operative period.
Discussion: In our study, general anaesthesia was induced safely with a single dose of propofol. Further investigation should be performed to confirm these findings. In the meantime, close monitoring during anaesthesia is recommended in patients with Brugada syndrome.

References

[1] Brugada P, Brugada J. Right bundle branch block, persistent ST segment elevation and sudden cardiac death: A distinct clinical and electrocardiographic syndrome: A multicenter report. J Am Coll Cardiol 1992; 20: 1391-1396.
[2] Postema PG, Wolpert C, Amin AS, et al. Drugs and Brugada syndrome patients: review of the literature, recommendations and an up-to-date website (www.brugadadrugs.org) Heart Rhythm. 2009; 6 (9): 1335-1341.

O-21
Advantages of on-pump beating-heart CABG in patients with a low ejection fraction

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Introduction: The purpose of the present study was to compare different modes to maintain the haemodynamics during CABG in patients with a low ejection fraction (EF).
Methods: After approval by the Ethics Committee, we analysed 60 cases of CABG performed by one operating team in patients with EF ≤ 40%. Patients were divided into 3 groups by the method of sealed envelopes: in the first (n = 20) the surgery was performed on-pump; in the second (n = 20), off-pump; in the third (n = 20), on-pump beating-heart. Initially, the groups were comparable in all respects. We studied the haemodynamic parameters, oxygen transport, and the levels of CPK, CPK-MB, and Troponin-T. The data obtained were statistically processed.
Results: Cardioversion to restore sinus rhythm was required in 8 patients in Group 1 and one patient in Group 2 and Group 3. Inotropes were needed in 7 pts in Group 1,

in 14 patients in Group 2 and in 8 patients in Group 3. After surgery, an increase in CI, SI, LVSWI and decreased SVR were observed in all patients. Increased CI in Group 3 (+ 43.1%, P < 0.001) was mainly due to increase in SI (+ 40.8%, P < 0.001). At the same time, in Group 1 and in Group 2 increased CI was due not only to increase in SI (+ 28.5%, P = 0.006 and + 16.7%, P = 0.224, respectively), but also increase in HR (+ 17.1%, P = 0.013 and + 14.5%, P = 0.038). We also observed increasing LVSWI by 53.8% (P < 0.001) in Group 3, 43.8% (P < 0.001) in Group 1, and 17.4% (P = 0.124) in Group 2. Analysis of ECG and the levels of CPK, CPK-MB, and Troponin-T after surgery showed no myocardial injury in any patients.
Discussion: The analysis of the postoperative period did not reveal significant differences between the groups in duration of MV and LOS in the ICU. The LOS in hospital was in Group 3 10.5 (5.9, 11); in Group 2, 11.5 (11, 14); in Group 1, 12 (11, 13) days. The data we obtained demonstrated the advantages of CABG on-pump beating-heart in patients with low EF.

References

[1] Mizutani S, Matsuura A, Miyahara K, et al. On-pump beating-heart coronary artery bypass: a propensity matched analysis. Ann Thorac Surg 2007; 83: 1368-1373.

O-21
Effects of the cardiac output on sevoflurane pharmacodynamics

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Introduction: This study was carried out to investigate the influence of cardiac output reduction on the volatile agent concentration required for maintenance of the targeted anaesthesia depth.
Methods: Thirty six patients who had been scheduled for CABG with cardiopulmonary bypass (CPB) were included in the prospective non-controlled study. All patients underwent general anaesthesia based onf sevoflurane and fentanyl. Anaesthetic concentration (from 0.75 to 2.5 vol%) was adjusted to ensure the target anaesthesia depth, corresponding to Entropy index not exceeding 40. Analgesia was provided by fentanyl infusion 5 mcg · kg^{-1} · h^{-1}. To assess the influence of cardiac output on sevoflurane pharmacodynamics we measured cardiac index (CI) simultaneously with end-tidal sevoflurane concentration (ETsev) and anaesthesia depth based on Entropy monitor data. Studied variables were measured at three time points: 5 minutes after sternotomy, during internal mammary artery harvesting and during pericardiotomy. 95 sets of variables (Entropy index, ETsev, CI) were obtained. Since we proposed that maintenance of the target level of anaesthesia in patients with reduced cardiac output may be accomplished with lower ETsev, further analysis included 65 sets of variables measured in patients with target Entropy index (≤ 40). Univariate analysis of variance (ANOVA) was performed to compare the characteristics of the two groups.
Results: Mean Entropy index was 31.2 ± 5.7. We did not find a linear correlation between ETsev and CI in patients with target Entropy index (r = 0.18, P = 0.14). It was assumed

an existence of a non-linear correlation between CI and ETsev variables with potential rise in anaesthetic efficacy of the sevoflurane in patients with reduced CI. To test this hypothesis we divided all the data on ETsev obtained at the target anaesthesia level into 2 groups depending on the measured CI: CI ≤ 2.2 L $min^{-1} \cdot m^{-2}$, n = 19 (Group I) and CI > 2.2 L $min^{-1} \cdot m^{-2}$, n = 46 (Group II). ETsev in Group I was 1.15 ± 0.28% vs. 1.37 ± 0.31% in Group II, P = 0.01.

Discussion: The relationship between CI and ETsev required for maintenance of the target level of anaesthesia is non-linear. Patients with CI ≤ 2.2 L $\cdot min^{-1} \cdot m^{-2}$ are characterised by lowering of the ETsev required for maintenance of the target level of anaesthesia.

Oral Session – Myocardial Protection

O-23
Effects of remote ischaemic preconditioning on oxidative stress in cardiac surgery: a singleblind randomised study

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Introduction: Remote ischaemic preconditioning (RIPC) is a strategy to confer organ protection against prolonged ischaemia achieved via brief preceding ischaemia of remote tissue. We hypothesised that RIPC could modulate oxidative stress in patients operated under cardiopulmonary bypass (CPB) and improve clinical course.

Methods: Eighty coronary artery bypass grafting (CABG) patients (EF > 50%) were randomly assigned to RIPC (40) or controls (40). RIPC was induced after induction by three 5-min cycles of upper limb ischaemia and reperfusion using a blood pressure cuff. Haemodynamics, plasma levels of oxidative stress markers, troponin I, and complication rates were assessed peri-operatively. The

Table 1: Dynamics (median [IQR]) of oxidative stress markers, μmol · L^{-1}

	Total peroxide concentration		Advanced oxidation protein products	
	RICP	Control	RICP	Control
Baseline	319.0 (238.8-426.0)	395.5 (274.9-569.1)	42.6 (33.9-53.6)	36.4 (32.7-40.6)
30 minutes post-CPB	132.9 (91.3-193.2)	184.8 (134.6-253.6)	44.6 (37.8-52.7)	41.7 (35.8-48.7)
6 hours post-CPB	241.9 (178.4-328.0)	273.5 (201.1-372.0)	28.2 (25.2-31.4)	32.1 (26.7-38.5)
1 POD	327.1 (251.4-425.7)	435.5 (321.3-590.2)	27.9 (24.6-31.6)	26.7 (24.1-29.7)
2 POD	453.2 (329.1-624.2)	466.7 (331.9-656.1)	27.1 (24.5-29.8)	27.0 (23.6-30.8)

Mann-Whitney *U* test with Holm correction was used for comparisons of the two groups. A two-sided $P < 0.05$ was considered significant.

Results: No statistically significant differences were found between the two groups in levels of biochemical markers, complication rates or haemodynamics. Oxidative stress data are shown in Table 1.

Discussion: To our knowledge, we are the first to investigate effects of RIPC on oxidative stress in cardiac surgery setting. We conclude that RIPC has no effect on oxidative stress nor does it result in reduced myocardial damage or improved clinical course after CABG surgery.

O-24
Effects of the remote ischaemic preconditioning on the myocardial injury in the patients undergoing aortic valve replacement

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Introduction: Our study was carried out to estimate whether remote ischaemic preconditioning (RIPC) reduces myocardial injury in patients undergoing aortic valve replacement under cardiopulmonary bypass (CPB).

Methods: Twentyseven patients, who had signed informed consent, were included in the prospective, randomised study. Thirteen patients received RIPC (Group I) and 14 patients formed the control group (Group II). Anaesthesia was maintained either by propofol and fentanyl (8 patients in Group I, 7 patients in Group II) or by sevoflurane and fentanyl (5 patients in the Group I, 7 patients in the Group II). RIPC was induced by three 5-min cycles of lower limb ischaemia and reperfusion. Troponin I (cTnI) was analysed at baseline, 30 min, 12, 24, 48 h after CPB completion. Quantitative data are presented as median (25th–75th percentile). According to nonparametric distribution, data were assessed by the Mann-Whitney U-test.

Results: We found significant elevation in cTnI levels above baseline in both groups with maximal values at 12 h for Group I and at 24 h for Group II. There were no statistical differences in cTnI levels between groups at any time point as well as the area under the curve (AUC). Significant differences in the cTnI levels between the RIPC patients and the control patients were found only when sevoflurane anaesthesia cases were selected for analysis (table). There were no statistical differences in the cTnI levels and the cTnI AUC between the RIPC patients and the control ones in the propofol anaesthesia cases.

Variable	Sevoflurane		P value
	Group I n = 5	Group II n = 7	
cTnI at 24 h ($ng \cdot mL^{-1}$)	1.6 (1.5; 2.2)	5.5 (4.0; 6.5)	0.03
cTnI at 48 h ($ng \cdot mL^{-1}$)	1.4 (1.3; 1.5)	3.2 (2.9; 3.6)	0.02
cTnI AUC during 48 h ($ng \cdot mL^{-1}$)	69.0 (65.8; 97.5)	250.9 (250.4; 296.6)	0.02

Discussion: The data from this pilot study suggest that the cardioprotective effects of RIPC should be evaluated in the selected anaesthesia technique group.

O-25
The influence of inotropic drugs on the outcome of the GLUTAMICS trial

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Introduction: The GLUTAMICS-trial (ClinicalTrials.gov Identifier: NCT00489827) investigated if intravenous glutamate infusion given in association with surgery for acute coronary syndrome could prevent myocardial injury and postoperative heart failure and reduce mortality. Two centres in the trial exhibited different policies regarding pre-emptive use of inotropes to facilitate weaning from cardiopulmonary bypass (CPB). The aim of this study was to investigate if pre-emptive use of inotropic drugs influenced the primary endpoint of the GLUTAMICS trial and if glutamate influenced outcome in patients receiving inotropes intra-operatively.
Methods: A post hoc analysis was made with regard to the aims above. The primary endpoint was a composite of 30-day mortality, peri-operative myocardial infarction and left ventricular heart failure on weaning from CPB.
Results: 166 out of 861 recruited patients received inotropes intra-operatively. Of the 166 patients receiving inotropes intra-operatively 88 were in the glutamate group and 78 in the placebo group. Pre-emptive use of inotropes was employed in 23.4% (59/252) of all patients at centre A and 4.5% (24/536) at centre B. This facilitated weaning from CPB contributing to a lower incidence of the primary endpoint at centre A (4.0% [10/252] v 8.1% [43/536]; P = 0.03). The incidences of severe circulatory failure according to pre-specified criteria were 3.6% (9/252) v 2.6% (14/536). Glutamate infusion was associated with significantly lower postoperative NT-proBNP levels (5,405 ± 6,064 vs. 9,885 ± 9,361 ng · L^{-1}; P = 0.02), fewer patients haemodynamically unstable at completion of surgery (1.3% [1/88] vs. 9.9% [7 /78]; P = 0.03) or admitted to the intensive care unit with an intra-aortic balloon pump (0% [0/88] v 6.4% [5/78]; P = 0.02).
Discussion: Pre-emptive use of inotropes appears to have influenced the primary endpoint of the GLUTAMICS-trial without lowering the incidence of severe circulatory failure. Intravenous glutamate infusion was associated with improved haemodynamic recovery in patients receiving inotropes intra-operatively.

Oral Session –
Transfusion and Haemostasis

O-26
Patients with continued antiplatelet therapy before coronary artery bypass grafting: does platelet transfusion influence outcome?

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Introduction: The use of antiplatelet agents at the time of coronary artery bypass grafting (CABG) carries both benefits and risks. The drugs are effective in reducing ischaemic events in high-risk patients, but unfortunately also aggravate the bleeding tendency and platelets are often administered to reduce bleeding complications. This was a hypothesis generating study evaluating risks and benefits of peri-operative platelet transfusion.
Methods: A multicentre study of 5,335 consecutive, prospectively registered patients

undergoing CABG at three Danish university hospitals. According to pre-operative medication, the patients were allocated to 3 groups; A: antiplatelet therapy; B: mixed antiplatelet and other anticoagulation treatment; C: control group, no treatment. They were further stratified by ± platelet transfusion. Outcome parameters were in-hospital myocardial infarction, stroke or dialysis, together with 30 day mortality and the frequency of coronary angiography and percutaneous coronary intervention during the first postoperative year.

Results: No difference was seen in events between group A (19.3%) and C (20.6%), while the frequency was higher in group B (27.3%). The postoperative bleeding was different between groups (A: 913 ± 928, B: 1,037 ± 1512 and C: 764 ± 771 mL; $P < 0.001$, ANOVA). The percentage of patients with postoperative bleeding and platelet infusion was different (A: 39.1%; B: 48.6%; C: 14.7%; $P < 0.0001$; χ^2-test). Within each group there was a higher fraction of individual outcomes in patients receiving platelet transfusion, but at the same time a significantly higher EuroSCORE was found in the transfused patients in all groups. Adjusted odds-ratio for each group showed that EuroSCORE and inotropic treatment were the major factors with impact on outcomes. Platelet transfusion had no independent impact on overall frequency of events.

Discussion: Transfusion of platelets does not seem to carry an independent risk in patients pre-operatively treated with antiplatelet or anticoagulation drugs or in patients without treatment. A randomised trial on the effect of prophylactic platelet transfusion on postoperative bleeding and ischaemic complications is needed.

O-27
Ticagrelor and acute cardiac surgery

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Introduction: The usage of ticagrelor (Brilique®, Brilinta®), a novel platelet aggregation inhibitor, in patients with acute coronary syndrome (ACS) is increasing. Ticagrelor is a selective and reversible blocker of the P2Y12 receptor with a fast onset and also fast offset (half time ~ 7 h). The Plato trial showed no significant increase in rates of CABG-related major bleeding or bleeding requiring transfusion of red cells in patients treated with ticagrelor vs. clopidogrel [1]. However, the protocol recommended ticagrelor/placebo to be withheld for 24 to 72 h. Therefore, less is known about managing patients needing urgent cardiac surgery, without withholding ticagrelor.

Methods: Transfusion of thrombocytes seems to be ineffective due to protein bounded active ticagrelor-metabolites, inactivating novel thrombocytes. To reduce active ticagrelor-metabolits we performed plasma-exchange (TPE) simultaneous to extracorporeal circulation (ECC) in two patients undergoing acute cardiac surgery. Both patients received their ticagrelor medication 12 hours before surgery.

Results: During TPE, calcium infusion and additional heparin administration were necessary according to repeated blood gas analysis and activated clotting times measurements every 15 to 20 minutes. Therefore, no serious complications due to TPE were detected. After extracorporeal circulation, three units of platelets were necessary to stabilise coagulation function in both patients. No massive bleeding was observed in these

patients to the end of surgery and in the post-operative period, respectively.
Discussion: TPE could be a safe and effective possibility to reduce bleeding risk in ticagrelor-treated patients undergoing acute cardiac surgery.

References

[1] Wallentin L, Becker RC, Budaj A, et al. Ticagrelor versus clopidogrel in patients with acute coronary syndromes. N Engl J Med 2009; 361: 1045-1057.

O-28
Postoperative bleeding associated with change in heparin supplier: experience of a British cardiothoracic centre

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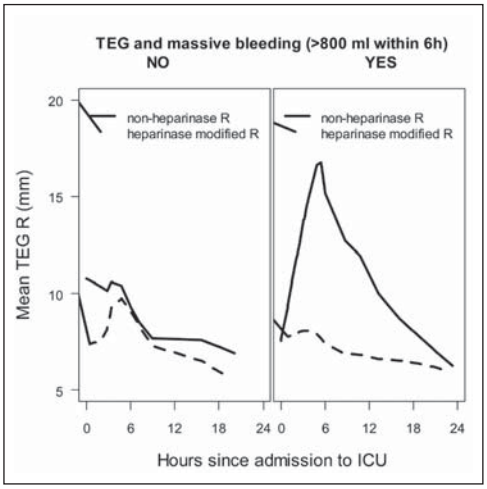
Introduction: Heparin preparations are mixtures of glycosaminoglycans, and there is significant inter-patient variability in the amount of heparin bound non-specifically to plasma proteins, and released after elimination of protamine [1]. The present study aimed to analyse factors associated with a significant increase in postoperative bleeding observed at a tertiary referral cardiothoracic centre. The working hypothesis was an increase in heparin rebound after having changed the heparin supplier.
Methods: Pre-, intra- and postoperative characteristics were compared retrospectively between patients undergoing cardiac surgery 'before' the heparin supplier has changed and 'afterwards'.
Results: 818 patients aged 65 ± 12 years underwent CABG (56%), valvular (38%) and other procedures between April 1, 2011 and April 30, 2012. The heparin supplier has changed on December 20, 2011. All patients received a weight-based anticoagulation protocol. Patient characteristics, case mix, redo, intra-operative heparin, protamine and tranexamic acid dosing, colloids and transfusion volumes, bypass and cross-clamping durations were similar 'before' and 'afterwards'. Postoperative bleeding was significantly larger 'afterwards', and massive bleeding, as defined by the upper decile of the chest drain output in the overall population, i.e > 800 ml within 6 h of ICU admission, occurred in 14% vs. 8%, P = 0.007. Transfusions were larger 'afterwards': 59% vs. 50% of patients received red blood cells, P = 0.02, 26% vs. 17% received plasma, P = 0.003 and 32% vs. 21% required platelets, P < 0.001. Thromboelastography (TEG) was performed in 254 patients, and was similar by the end of surgery. Postoperatively, the proportion of patients with a > 50% prolonged non-heparinase R phase when compared with the heparinase-modified R phase was higher 'afterwards', 47% vs. 14%, P = 0.03, and was higher in patients with massive bleeding, 33% vs. 19%.



Discussion: Heparin rebound results in significant postoperative bleeding, but is unpredictable for individual patients, and was likely due to the change in heparin supplier here. Individualised heparin and protamine management is an alternative to weight-based anticoagulation protocols, and is asso-

ciated with a lower risk of bleeding [2]. TEG is a useful tool to detect heparin rebound.

References

[1] Teoh KH, Young F, Bradley CA, et al. Heparin binding proteins. Contribution to heparin rebound after cardiopulmonary bypass. Circulation 1993; 88: II420-425.

[2] Gruenwald CE, Manlhiot C, Chan AK, et al. Randomised, controlled trial of individualised heparin and protamine management in infants undergoing cardiac surgery with cardiopulmonary bypass. J Am Coll Cardiol 2010; 56: 1794-1802.

Oral Session – Cardiac Anaesthesia

O-29
Diagnosis, perioperative monitoring, and treatment of patients with pulmonary hypertension and/or right ventricular dysfunction in Germany: results of a postal survey

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Introduction: The objective was to determine the modalities used for diagnosis, perioperative monitoring, and treatment of patients with pulmonary hypertension (PAH) and/or right ventricular dysfunction (RVD) scheduled for cardiac surgery in Germany.

Methods: A postal survey was sent to 81 German heart centres including questions on routine pre-operative diagnostic measures to evaluate right ventricular function, the modalities of peri-operative monitoring, and measures for prevention and treatment of postoperative PAH and RVD in patients undergoing cardiac surgery in 2009.

Results: Forty seven (58%) heart centres with a case load between 330 and 3312 patients returned the questionnaire. 49.8% of the procedures were isolated coronary artery bypass grafting (CABG), of which 64.2% included bypass grafting of the right coronary artery (RCA). Pre-operative echocardiography was performed in 45.3% of cases. Pre-operative right heart catheterisation was performed in only 5% of cases. Data on the prevalence of PAH and RVD were not available in 54% and 64.6% of centres, respectively. In the remaining centres, 10% of patients were reported to have pre-operative RVD and 19% to have PAH (PAP > 60 mmHg). 75% of the centres had standardised protocols for monitoring and treatment of patients with RVD and PH. Monitoring was most frequently accomplished by transoesophageal echocardiography (66%) and/or a pulmonary artery catheter (50%). A pre-operative pharmacological treatment was initiated in 71% of centres for patients with PAH (1st choice: sildenafil) and in 98% of centres for patients with pre-operative RVD (1st choice: inhaled prostanoids). PDE-III-inhibitors were the first line inotrope of choice in most centres.

Discussion: No pre-operative data on right ventricular function and pulmonary arterial pressures were available in more than 50% of cardiac surgical patients. This may lead to underestimation of peri-operative risk. Additionally, since the majority of patients presenting with recognised PAH and/or RVD are subjected to specific treatment and monitoring modalities, this lack of information on right heart function and/or PAP may lead to inappropriate management of this high risk population.

O-30
Effect of oral sildenafil on peri-operative pulmonary hypertension in patients undergoing mitral valve replacement surgery

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Introduction: Severe pulmonary hypertension (PHT) frequently induces acute right ventricle (RV) dysfunction following mitral valve replacement (MVR). Maintaining RV perfusion with reduction of RV afterload is crucial for its treatment. IV nitroglycerine (NTG) by causing hypotension may induce RV ischaemia and aggravate RV dysfunction. Oral sildenafil decreases PHT without causing significant systemic hypotension [1]. Its use for secondary PHT during the peri-operative period has been limited. We assessed the effectiveness of oral sildenafil in decreasing postoperative PHT and tested the hypothesis that by maintaining RV perfusion pressure while decreasing RV afterload, oral sildenafil may decrease the peri-operative inotropic requirement in comparison to NTG
Methods: After institute ethical committee approval 40 rheumatic mitral disease patients with severe PHT (mean PAP > 40mmHg) undergoing MVR were included. Exclusion criteria included: pre-operative RV or LV failure and/or severe renal or liver dysfunction. Patients were randomised into Group I (Sildenafil 50 mg via nasogastric tube after induction of anaesthesia and at 8 h intervals) and Group II (IV NTG 1 $\mu g \cdot kg^{-1} \cdot min^{-1}$ infusion started at rewarming). Similar looking 5% dextrose solution was administered after induction through nasogastric tube for Group II patients and as infusion during rewarming for Group I patients. In both groups medication was continued at least until 24h post extubation. Inotropes uses were titrated to achieve a pre-defined goal. In ICU after 10h of mechanical ventilation if PHT remains more than 75% of baseline value, opposite group drugs were added. Haemodynamic variables, ABG and mixed venous saturation were noted until 24 h post extubation. Number of attempt to wean CPB, total inotropic requirement, duration of mechanical ventilation and ICU stay were also noted.
Results: The demographics and base line haemodynamics were similar in both groups. There was similar decrease in pulmonary and systemic vascular resistance in both groups but the cardiac index (CI) was higher with Group I. Two patients in Group II required addition of sildenafil due to persistent PHT. The inotropic requirement and duration of mechanical ventilation were significantly higher in Group II compared to Group I. No complication related to sildenfil was observed.
Discussion: Oral sildenafil is useful for the control of PHT following MVR with the added benefit of higher CI, low inotropic requirement and less duration of mechanical ventilation.

References

[1] Ghofrani HA, Wiedermann R, Rose F, et al. Combination therapy with oral sildenafil and inhaled iloprost for severe pulmonary hypertension. Ann Intern Med 2002; 136: 515-522.

O-31
Effect of cardiopulmonary bypass (CPB) and deep hypothermic circulatory arrest (DHCA) on propofol pharmaco kinetics

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Introduction: Previous studies have reported that propofol plasma concentration decreases during CPB due to haemodilution, absorption, hypothermia, modified metabolism and

changes in the ratio free/bound drug [1]. There is no information about propofol pharmacokinetics during deep hypothermia. We designed a prospective observational study to assess the changes in propofol plasma concentrations in patients undergoing pulmonary endarterectomy (PEA).

Methods: Following Research Ethics Committee approval, blood samples were collected in 10 adult patients undergoing PEA. Anaesthetic and surgical techniques were strictly standardised [2]. A propofol infusion was started on anaesthetic induction and continued unchanged throughout the operation. Samples were processed with the Pelorus 1500, a new in vitro diagnostic point-of-care medical device that had shown excellent agreement with HPLC (high performance liquid chromatography) for clinical samples [3]. Values are median, (interquartile rank). Statistical significance was assessed with SPSS 20.0.

Results: Patients were 63 (51-75) years old. The propofol infusion was set at 4 (3.3-4.4) $mg \cdot kg^{-1} \cdot h^{-1}$ and started 50 (42-54) minutes before the first sample was obtained. CPB time was 323 (266-774) minutes and total DHCA at 20°C was 38 (35-41) minutes. A significant increase of the propofol plasma concentration was observed while the core temperature decreased (between DHCA: 6.46 (5.32-7.66) $\mu g \cdot mL^{-1}$, P = 0.005). Propofol concentrations after CPB (3.84 (3.13-4.27) $\mu g \cdot mL^{-1}$) were significantly lower than during DHCA (P = 0.005) but significantly higher than before CPB (1.94 (1.61-2.19) $\mu g \cdot mL^{-1}$) (P = 0.007).

Discussion: In this study, the plasma concentration of propofol increased as temperature decreased. This differs from previous studies in normothermic and hypothermic CPB [1]. Metabolic slowing has been suggested in patients undergoing hypothermic CPB with little impact in the plasma concentration but the effect of CPB may be different in normothermia, hypothermia and deep hypothermia.

References

[1] Takizawa E, Hiraoka H, Takizawa D, et al. Changes in the effect of propofol in response to altered plasma protein binding during normothermic cardiopulmonary bypass. Br J Anaesth 2006; 96: 179-185.

[2] Vuylsteke A, Sharple L, Charman G, et al. Circulatory arrest versus cerebral perfusion during pulmonary endarterectomy surgery (PEACOG): a randomised controlled trial. Lancet 2011; 378: 1379-1387.

[3] Cowley NJ, Laitenberger P, Lui B, et al. Evaluation of a new analyser for rapid measurement of blood propofol concentration during cardiac surgery. Anaesthesia 2012; 67: 870-874.

Oral Session – Cardiac and Antibiotics

O-32
Single dose aminoglycoside has an impact on renal function but does not increase postoperative dialysis after cardiac surgery

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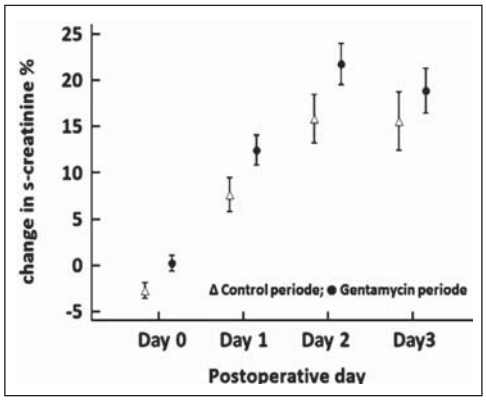
Introduction: A new prophylactic antibiotic policy in our department was introduced with a supplement of a single dose aminoglycoside intravenously (240 mg in patients with a weight < 120 kg; 480 mg in patients with a weight ≥ 120 kg) to standard teicoplanin and dicloxacillin. This study was undertaken to evaluate any possible effect on renal function.

Methods: Data from our heart registry was merged with clinical lab data from a period of 18 months before and 24 months after the changed antibiotic policy. 3,461 consecutive patients were identified. A total of 1,307

patients were identified in the control group and 1,716 in the gentamycin group. 438 patients were excluded either due to double entries, missing laboratory values, TAVI procedures or pre-operative creatinine > 200 μmol · L^{-1} S-creatinine from 6 days before to 15 days after surgery was obtained. Acute kidney injury was defined present if s-creatinine rose more than 26.2 μmol · L^{-1} or 50% from baseline.

Results: The change in postoperative s-creatinine in the first 72 hours was higher in the aminoglycoside group (figure; P < 0.0001, repeated measurements). The number of patients developing AKI was higher after gentamycin 27.1% vs. 22.7%; P = 0.007, χ^2-test). There was no difference in postoperative dialysis between the two groups (3.5% vs. 3.3%; 0.857; χ^2-test). Patient and procedure characteristics were comparable across the study periods.



Discussion: As this is an observational study we are not able to establish if there is a causal relationship between the use of prophylactic aminoglycoside and AKI after cardiac surgery. Results however may support a previous study where peri-operative aminoglycoside was found to be associated with a higher risk of AKI [1]. After adding aminoglycoside to pre-operative prophylactic antibiotics, an increased rate of AKI after cardiac surgery was observed.

References

[1] Nielsen DV, Hjortdal V, Larsson H, et al. Perioperative aminoglycoside treatment is associated with a higher incidence of postoperative dialysis in adult cardiac surgery patients. J Thorac Cardiovasc 2011; 142: 656-661.

O-33
Pharmacokinetics of cefetaxime in ICU-patients treated with continuous renal replacement: a pilot study

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Introduction: Data on the optimal dosage of cefotaxime (CTX) in patients receiving continuous renal replacement therapy (CRRT) is sparse and equivocal [1]. We conducted a trial investigating the concentrations of CTX in general ICU and post-cardiac surgery ICU patients who were treated with CRRT because of acute renal failure and who received CTX 4D 1 g iv. as part of selective gut decontamination.

Methods: Twenty seven patients (16 post-cardiac surgery and 11 general ICU) were included who received at least 48 h concomitant CRRT and CTX treatment. Plasma concentrations of CTX and its active metabolite desacetylcefotaxime (DAC) were measured in all plasma samples left over from routine laboratory tests. Pharmacokinetic values (CTX peak and trough levels) were calculated using MW\Pharm v3.70 (Medi\Ware, Groningen, The Netherlands)

Results: The results showed comparable peak and trough levels of CTX in both post-cardiac surgery and general ICU patient groups (Table 1).

Table 1: Cefotaxime plasma concentrations in median (range)

	CTX peak ($mg \cdot L^{-1}$)	CTX trough ($mg \cdot L^{-1}$)
Cardiac surgery	56 (30-97)	11 (1-33)
ICU	56 (19-84)	15 (1-37)

Peak CTX levels were within normal range with wide inter-individual variation. In all patients except one, CTX levels were above the minimum inhibitory concentration (MIC) (4 $mg \cdot L^{-1}$, Enterobacteriaceae) > 90% of the time. Five patients showed through levels below the MIC. DAC concentrations were comparable in both patient groups and corresponding with literature (median 15 $mg \cdot L^{-1}$, range 2-38 $mg \cdot L^{-1}$) and thus assumed to contribute to the effectiveness of the treatment.

Discussion: A regime of 4D 1 g CTX iv. leads to adequate concentrations in the majority of patients. Dose reduction to 2D 1 g CTX iv. as proposed by others, might lead to sub-therapeutic levels in at least 20% of these patients.

References

[1] Trotman RL, Williamson JC, Shoemaker DM, et al. Antibiotic dosing in critically ill adult patients receiving continuous renal replacement therapy. Clin Infect Dis 2005; 41: 1159-1166.

O-34
Mediastinitis after cardiac surgery

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Introduction: Mediastinitis is a severe complication of median sternotomy associated with morbidity and cost. The aim of this study was to determine pre-operative and intra-operative predictors of mediastinitis, in patients undergoing coronary artery by-pass surgery (CABG).

Methods: In five hundred consecutive patients who underwent CABG, 20 variables were retrospectively assessed. Analysis was performed by univariate and multivariate logistic regression model of 20 variables, as predictors of mediastinitis if final multivariate $P \leq 0.05$.

Results: The incidence of postoperative mediastinitis was 4% (n = 20) with a lethality rate of 35% (n = 7). Multivariate analysis identified three of twenty variables as highly significant independent predictors for the development of mediastinitis: obesity P = 0.001, chronic obstructive pulmonary disease P = 0.001 and bilateral grafting of the internal mammary artery P = 0.02. Additionally univariate analysis identified diabetes mellitus P = 0.01, NYHA congestive heart failure class > III P = 0.02, previous heart surgery P = 0.008, duration of cardiopulmonary by-pass P = 0.05, as variables with a significant impact.

Discussion: The present study suggests that obesity, chronic obstructive pulmonary disease and bilateral internal mammary artery grafting are the most important predictors of mediastinitis.

References

[1] Milano CA, Kesler K, Archibald N, et al. Mediastinits after coronary artery bypass graft surgery. Risk factors and long-term survival. Circulation 1995; 92: 2245-2251.

Oral Session –
Cardiac and Inflammation

O-35
Systemic inflammatory response syndrome after surgery for triple valve disease

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Introduction: Open-heart surgery is associated with the development of the inflammatory response [1]. However, the causes of progression of systemic inflammation still remain to be clarified.

Methods: After approval by the Ethics Committee, an observational study was performed in 10 patients aged 44-73 year (average 61.5). The patients underwent surgery for triple (mitral, aortic, and tricuspid) valve disease in condition of normothermic CPB and cold blood cardioplegia that was conducted by one operating team. The duration of surgery was 196 ± 39 min; CPB, 126 ± 16 min; aortic cross-clamping, 112 ± 19 min; the LOS in ICU, 45 ± 19 h. The levels of IL-6, IL-4, procalcitonin (PCT), cortisol and insulin, glucose and lactate before bypass (stage 1); immediately after surgery (stage 2) and the day after surgery (stage 3) were examined. Haemodynamic monitoring was performed by thermodilution. The data were statistically processed.

Results: We noticed the correlation between the LOS in ICU of patients with: CI; CvO_2; DO_2I ($r = –0.7$; $P < 0.05$); VO_2I ($r = –0.8$; $P = 0.01$) and the level of IL-6 ($r = 0.8$; $P = 0.01$) at stage 2 of the study, as well as the level of PCT and lactate ($r = 0.8$; $P < 0.05$) at stage 3. Release of IL-6 at stage 2 (260 times higher than the normal level, $P < 0.05$) was accompanied by an increase in VO_2I ($P < 0.05$) without increasing DO_2I ($P > 0.05$). One day after surgery, we found a strong correlation between the level of PCT and the lactate level ($r = 0.7$; $P = 0.02$), as well as the level of IL-6 at the end of surgery ($r = 0.8$; $P = 0.01$).

Discussion: Unfortunately, the classical SIRS criteria in patients immediately after surgery in condition of CPB and cold blood cardioplegia do not allow adequate diagnosing of the inflammatory response. A significant increase in IL-6 and high level of VO2I after surgery may be due to the development of SIRS.

References

[1] Sponholz C, Sakr Y, Reinhart K, et al. Diagnostic value and prognostic implications of serum procalcitonin after cardiac surgery: a systematic review of the literature. Critical Care 2006; 10: R145.

O-36
Is procalcitonin a valuable marker for identification of postoperative complications after coronary artery bypass graft surgery with cardiopulmonary bypass (CPB)?

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Introduction: The aim of our study was to investigate the value of C-reactive protein (CRP) and procalcitonin (PCT) in identification of the systemic inflammatory response syndrome (SIRS) and other complications in the early postoperative period.

Methods: In 93 patients undergoing coronary artery bypass graft surgery with CPB, after Ethical Committee approval in a prospective study, serum PCT and (CRP) values were collected before operation and daily until postoperative day 5. According to the definition of SIRS by the American College of Chest Physicians/Society of Critical Care Medicine (ACCP/SCCM), concentrations of

procalcitonin 0.5 to 1.1 ng/mL is considered as indicative of SIRS and above 1.1 ng/mL of sepsis [1]. All patients were divided post hoc into patients with SIRS (n = 42) and patients without SIRS (n = 51). Student's t-test, Mann-Whitney U-test and receiver operating characteristic (ROC) curves were used.

Results: Comparison of serum CRP values in SIRS and no SIRS groups in postoperative day 1 until postoperative day 5, demonstrated an increase in both groups with no significant differences ($P > 0.05$). The increase in PCT levels increased more significantly in SIRS patients (peak PCT 5.78 ± 3.21 ng · mL^{-1} vs. 1.23 ± 0.31 ng · mL^{-1}) compared with patients without SIRS ($P = 0.0001$) on postoperative day 1. In patients with postoperative complications (21/93, 22%) (circulatory failure = 10, pneumonia = 2, respiratory insufficiency = 9, sepsis = 0), PCT levels remained elevated until postoperative day 5 (6.11 ± 2.87 ng · mL^{-1}) but diminished in patients with SIRS (0.96 ± 0.23 ng ml^{-1}) ($P < 0.0001$). A PCT threshold value of 9.5 ng ml-1 was able to discriminate between sepsis and non-septic SIRS patients with a sensitivity of 96% and a specificity of 91% (area under the curve: 0.91, $P < 0.01$).

Discussion: PCT increased significantly after CPB in a SIRS group compared to patients without SIRS on postoperative day 1 and remained elevated until postoperative day 5. A PCT threshold value of 9.5 ng · mL^{-1} discriminates between sepsis related SIRS group of patients and non-septic SIRS patients.

References

[1] Giamarellos-Bourboulis EJ, Giannopoulou P, Grecka P, et al. Should procalcitonin be introduced in the diagnostic criteria for the systemic inflammatory response syndrome and sepsis? J Crit Care 2004; 19: 152-157.

O-37
Influence of the remote ischemic preconditioning on the inflammatory response in patients undergoing aortic valve replacement

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Introduction: This study was carried out to estimate whether remote ischaemic preconditioning (RIPC) affects the inflammatory response in patients undergoing aortic valve replacement.

Methods: Twenty seven patients were included in the prospective randomised study. In all cases aortic valve replacement was performed for aortic stenosis under the cardiopulmonary bypass (CPB). Thirtheen patients received RIPC (Group I) and 14 patients formed the control group (Group II). Anaesthesia was maintained either by propofol and fentanyl (8 patients in Group I, 7 patients in Group II) or by sevoflurane and fentanyl (5 patients in Group I, 7 patients in Group II). RIPC was induced by three 5-min cycles of lower limb ischaemia and reperfusion. Cytokines (interleukin-8 [IL-8], interleukin-6 [IL-6]) were analysed at baseline, 30 min, 12, 24 and 48 h after CPB completion. Quantitative data were presented as median (25^{th}-75^{th} percentile). According to nonparametric distribution, data were assessed by the Mann-Whitney *U*-test.

Results: Our study displayed a significant increase in the levels of cytokines after CPB completion in both groups. There were no statistical differences in IL-8 and IL-6 concentrations between the groups at 30 min and 12 h after CPB. Unexpectedly we found significantly higher IL-8 activity in the RIPC group at 24 h and 48 h after CPB. It was 12.3 (7.9: 16.5) pg · mL^{-1} vs. 6.5 (5.5: 10.4) pg · mL^{-1} in the control group ($P = 0.03$) at 24 h and 10.6

(5.8: 13.2) pg · mL^{-1} vs. 5.5 (4.5: 6.1) pg · mL^{-1} in the control group (P = 0.02) at 48 h.
The same tendency was found in IL-6 activity. However statistical significance between the RIPC group and the control was not confirmed: 27.6 (15.1: 38.5) pg · mL^{-1} vs. 15.3 (10.5: 28.8) pg · mL^{-1}, respectively (P = 0.32) at 24 h and 17.1 (13.0: 27.3) pg · mL^{-1} vs. 9.9 (6.8: 17.2) pg · mL^{-1}, respectively (P = 0.14) at 48 h.
Discussion: This pilot study indicates surprisingly that RIPC may enhance the inflammatory response after CPB. Our data suggest that large clinical trials evaluating this effect should be performed in order to study the underlying mechanisms.

Oral Session – ECHO

O-38
Prediction of fluid responsiveness and relationship with clinical outcomes in CABG: a comparison of available echocardiographic indices

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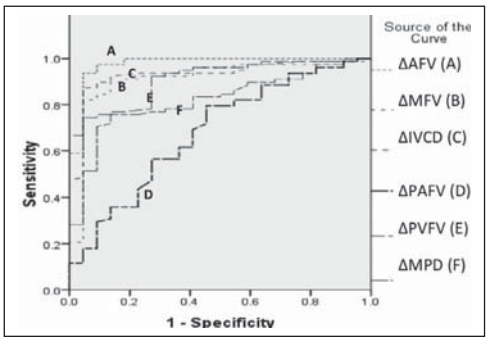
Introduction: Preload optimisation is the commonest intervention to enhance cardiac output in the peri-operative period. The authors' objective was to compare several transoesophageal echocardiographic indices to predict fluid responsiveness (The evaluated dynamic parameters were: the respiratory fluctuations in the aortic flow velocity ΔAFV, in the inferior vena cava diameter ΔIVCD, in the transgastric mid-papillary diameter ΔMPD, in the mitral E wave velocity ΔMFV, in the pulmonary venous flow velocity ΔPVFV, and in the pulmonary artery flow velocity ΔPAFV).

Methods: One hundred mechanically ventilated patients scheduled for coronary artery bypass grafting were studied. The echocardiographic indices and filling pressures were acquired at baseline and a cardiac output was recorded and repeated after volume expansion induced by passive leg raising. Responders were defined as patients increasing their cardiac output more than 15%. The clinical charts of the study population were revised retrospectively to detect differences in the clinical profile and outcomes, between the responders and not responders.
Results: After the passive leg raising manoeuvre, cardiac output increased ≥ 15% in 78 patients (78%) defined as responders. ΔAFV ≥ 7.78% had a sensitivity and specificity of 100% and 78%, respectively. The area under the ROC curve was 0.96 (95% CI: 0.8-1), for ΔIVCD ≥ 30% were 80.7% and 90.9%, and the area was 0.93 (95% CI: 0.87-0.99), for ΔMPD ≥ 10.5% were 70.7% and 90.9%, and the area was 0.81 (95% CI: 0.73-0.91), for MFV ≥ 17, 4% were 91% and 81.8%, and the area was 0.91 (95% CI: 0.83-0.99), for ΔPVFV ≥ 23.4% were 92.3% and 72.7%, and the area was 0.91 (95% CI: 0.85-0.97), for ΔPAFV ≥ 17, 86% were 79.4% and 54.4%, and the area was 0.68 (95% CI: 0.55-0.81); (Figure1). The post hoc analysis revealed that the not responders were older: – median age 70 years vs. 66 years in responders (P = 0.05), and also showed higher EuroSCORE II scores (median: 4.46 vs. 2.74, P = 0.02). They were also associated with poorer clinical outcomes especially with a composite outcome of two or more events (36.4% vs. 14.4%, P = 0.05).



Discussion: The dynamic echocardiographic indices were both sensitive and specific to predict fluid responsiveness, with the exception of the ΔPAFV and ΔMPD. The patients with preload exhaustion (not responders) seem to have a different clinical profile that could be linked to worse clinical outcomes.

O-39
Echocardiographic study of right ventricular systolic function after aortic valve replacement for stenosis

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Introduction: Right ventricular (RV) function is underestimated in left ventricular (LV) hypertrophic cardiomyopathy as observed in aortic stenosis [1]. Doppler and echocardiographic technologies allow a better evaluation of the RV function [2]. We have evaluated the RV function before and after aortic valve replacement (AoVR) for aortic stenosis by transthoracic echocardiography (TTE) using tricuspid annular mobility parameters.
Methods: Patients scheduled for surgical AoVR were prospectively included after consent. A TTE (Vivid i, GE) examination was performed the day before and after the surgery, during spontaneous breathing. LVEF, mitral inflow (E and A wave, E/A ratio), diastolic mitral (E'), systolic tricuspid annular plane velocity (St), tricuspid annular plane systolic excursion (TAPSE), and tricuspid annular plane isovolumetric acceleration (IVA) were recorded. Variance analysis and quantitative statistical test (Student's t test) were used to assess significance ($P < 0.05$).
Results: Eleven patients (63 to 82 years old) with pre-operative LVEF from 25 to 65% (mean 46 ± 12%) were included. At POD1, LV systolic and diastolic functions were impaired (LVEF decrease: 11.9 ± 12%, P = 0.04; E/A ratio increase: 52.6 ± 31.8%, P < 0.01). RV systolic function was significantly altered without change in RV size. All indices of RV systolic function decreased. Postoperative versus pre-operative measurements, respectively: TAPSE 12.9 ± 2.3 vs. 26.2 ± 3.4 mm (P < 0.001), St 9.1 ± 2.7 vs. 12.5 ± 3.4 cm/s (P < 0.02), IVA 2.0 ± 1.0 vs. 3 ± 1 cm/s^2 (P < 0.001).
Discussion: Tricuspid annular mobility is a good index of global systolic RV function [2]. After surgical AoVR for stenosis, we observe RV systolic dysfunction as assessed by TTE with significant reduction in TAPSE as well as less loading-dependent parameters like St and IVA [2].

References

[1] Mörner S, Linqvist P, Waldenström A, et al. Right ventricular dysfunction in hypertrophic cardiomyopthy as evidenced by the myocardial performance index. Int J Cardiol 2008; 124: 57-63.
[2] Haddad F, Couture P, Tousignant C, et al. The right ventricle in cardiac surgery, a perioperative perspective: I. Anatomy, physiology, and assessment. Anesth Analg 2009; 108: 407-421.

O-40
In vivo effects of volatile anaesthetics and positive pressure ventilation on left atrial dimensions and function in healthy adults

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Introduction: Animal and *in vitro* studies suggest that volatile anaesthetics impair atrial function [1,2] but *in vivo* data in humans are scarce. We hypothesised that human left

All patients (n = 59)	Baseline	SB	PPV	P value
Maximal volume (cm^3)	44.2 ± 18.9†	42.2 ± 16.9#	33.3 ± 16.1†#	0.002
Minimal volume (cm^3)	15.5 ± 8.2	16.1 ± 8.6	15.5 ± 9.0	0.895
Ejection fraction (%)	66 ± 10†	61 ± 12#	55 ± 12†#	< 0.001
Ejection force (kdynes)	12.9 ± 5.8*†	8.9 ± 4.1*	7.4 ± 4.1†	< 0.001
a' ($cm \cdot s^{-1}$)	7.6 ± 1.5*†	6.1 ± 1.7*#	4.6 ± 1.6†#	< 0.001
* Baseline vs. SB < 0.025; † baseline vs. IPPV < 0.025; # SB vs. IPPV < 0.025 by ANOVA and Bonferroni adjustment				

atrial (LA) function is impaired by volatile anaesthetics *in vivo*.

Methods: We performed a secondary analysis of digitally stored echocardiographic data previously obtained [3] in 59 unpremedicated healthy adults (aged 31 ± 9 years; 20 female) scheduled for minor surgery. Participants were randomly assigned to general anaesthesia with sevoflurane, isoflurane or desflurane. A transthoracic echocardiography (TTE) had been performed during stable haemodynamic conditions and spontaneous breathing (SB) before and after induction of anaesthesia by the volatile anaesthetic and placement of a laryngeal mask. After starting positive pressure ventilation (PPV), a third TTE had been performed. Maximal and minimal volumes of the LA, late diastolic velocity (a') of the mitral annulus, and calculated LA ejection fraction and force were evaluated by an investigator blinded to the type of volatile anaesthetic.

Results: The three volatile anaesthetics similarly reduced LA ejection fraction, ejection forces, a', and maximal LA volume. Addition of PPV markedly added to these effects.

Discussion: Volatile anaesthetics decreased LA maximal volume and impaired LA function in healthy adults. Addition of PPV further increased these effects. The clinical importance of this finding needs further evaluation, especially in patients with diastolic dysfunction.

References

[1] Gare M, Schwabe DA, Hettrick DA, et al. Desflurane, sevoflurane, and isoflurane affect left atrial active and passive mechanical properties and impair left atrial-left ventricular coupling in vivo: analysis using pressure-volume relations. Anesthesiology 2001; 95: 689-698.

[2] Hanouz JL, Massetti M, Guesne G, et al. In vitro effects of desflurane, sevoflurane, isoflurane, and halothane in isolated human right atria. Anesthesiology 2000; 92: 116-124.

[3] Bolliger D, Seeberger, MD Kasper J, et al. Different effects of sevoflurane, desflurane, and isoflurane on early and late left ventricular diastolic function in young healthy adults. Br J Anaesth 2010; 104: 547-554.

**Oral Session –
ECMO and VAD**

O-41
Anaesthetic management for off-pump implantation of left ventricular assist device: a case series

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Introduction: Mechanical circulatory support is a growing alternative for treatment for end-stage congestive heart failure. The miniaturisation of the systems may allow off-pump implantation as a "minimal invasive" procedure. We describe our experience with the off-pump implantation of 3rd generation left ventricular assist device (LVAD, HeartWare®) in 21 patients.
Methods: The minimally invasive surgical approach is a left anterolateral incision for insertion of the outflow cannula and an upper hemi-sternotomy for implantation of the aortic inflow cannula. Anaesthetic management includes insertion (with local anaesthesia) of a multi-lumen central venous line, pulmonary artery catheter and arterial blood pressure measurement in the awake patient. A standard antibiotic regimen contains imipenem/cilastatin and vancomycin. After induction of general anaesthesia and intubation, comprehensive TOE according to the guidelines of the SCA with a complementary rt 3 D TOE is performed to exclude relevant intracardiac shunts, valvular pathologies and thrombi and to guide implantation of the inflow cannula due to limited surgical exposure. For protection of the right ventricle nitric oxide (maximum 20 ppm) is given. Activated clotting time is held at 200-250 sec during implantation of the LVAD. First we tried rapid pacing to minimise blood loss during ventriculotomy and insertion of the outflow cannula, respectively. Since the epicardial pacer electrodes often lose contact and pacer function is not sure, we established an iv. bolus of 18-30 mg adenosine to achieve transient cardiac arrest for these manoeuvres with the last 7 implantations. For this period the regularly implanted internal pacer is turned off. The positioning of the inflow cannula and the de-airing are controlled by rt-3D TOE. Since LVAD regularly induces von Willebrand's syndrome, prophylactic desmopressin (0.4 μg · kg^{-1} body weight) is given over 30 min when starting the LVAD.
Results: In a series of consecutive 21 patients (male 18/female 3) with a mean age of 59 years and a mean ejection fraction of 23% scheduled for elective off-pump insertion, 20 insertions could be performed successfully without the use of cardiopulmonary bypass. One patient required emergency cardiopulmonary bypass due to perforation of the left ventricle after insertion of the inflow cannula. The average need of red blood cells was 1.3 units. The average need of platelets was 0.25 units. The mean heparin dose was 6,400 units. All patients could be delivered in stable conditions to the ICU. Additional right ventricular assist were not necessary. The average stay on ICU was 86 hours. All patients could be discharged from hospital.
Discussion: Off-pump implantation of LVAD is feasible. Without the use of cardiopulmonary bypass, only low dose heparin is needed, which may prevent excessive bleeding. For guidance of the implantation of the inflow cannula TOE is helpful.

O-42
Levosimendan infusion during ECMO weaning: effect on endothelial function and haemodynamics

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Introduction: Few preliminary data are available on the use of levosimendan in patients

undergoing mechanical circulatory support. The aim of the present observational study was to assess the effect of levosimendan on endothelial function and haemodynamics in adult patients during v-a ECMO support.

Methods: Ten adult patients (female/male; 5/5) aged 62 years on average (range 41-80) supported with v-a ECMO for post-cardiotomy cardiogenic shock were included in the study. An IABP was in place in 8 patients. We recorded haemodynamic and ECMO parameters and assessed endothelial function via flow-mediated dilation (FMD) of the brachial artery [1] before and after a continuous infusion of levosimendan (0.1 mcg · kg^{-1} · min^{-1} without a loading dose, for 24 hours). A paired-samples t-test was used to compare continuous variables, and a P value below 0.05 was considered as statistically significant.

Results: FMD of the brachial artery increased from 3.2 ± 4.2% at baseline to 17.8 ± 10.4% after levosimendan infusion ($P < 0.001$). From the haemodynamic point of view, CI increased from 1.9 ± 0.8 L · min^{-1} · m^{-2} to 2.6 ± 0.9 L · min^{-1} · m^{-2} ($P < 0.01$), with a parallel increase in SvO2 from 62.0 ± 10.0% to 72.0 ± 9.5% ($P < 0.05$).

ECMO blood flow index was reduced from 1.9 ± 0.6 L · min^{-1} · m^{-2} to 1.1 ± 0.5 L · min^{-1} · m^{-2} ($P < 0.0001$) during the study period.

Discussion: In our population of adult patients supported with v-a ECMO for cardiogenic shock, the infusion of levosimendan resulted in the recovery of endothelial function from markedly reduced to normal values. Haemodynamics also improved with an increase in CI and SvO_2, allowing a concurrent reduction in extracorporeal support.

References

[1] Corretti MC, Anderson TJ, Benjamin EJ, et al. Guidelines for the ultrasound assessment of endothelial-dependent flow-mediated vasodilation of the brachial artery: a report of the International Brachial Artery Reactivity Task Force. J Am Coll Cardiol 2002; 39: 257-265.

O-43
Fungal ventricular assist device (VAD) infections occur in colonised patients and are associated with high mortality rate

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Introduction: Infection is a common complication of VAD and is associated with poor outcome especially with fungi [1]. Relationship between colonisation and invasive fungal infection (IFI) in severely ill ICU patients with a VAD support is not well described. This study analyses the incidence and outcome of fungal colonisation and infection in patients on VAD in bridge to transplantation or in destination therapy.

Methods: We conducted a retrospective review of all patients admitted in ICU after VAD implantation between 2007 and 2012. IFI versus no IFI patients were compared with regard to incidence of fungal colonisation, antifungal prophylaxis, bacterial sepsis and mortality.

Results: Thirty four patients with severe heart failure or cardiogenic shock underwent a VAD implantation (9 in destination therapy). The overall mortality rate was 50% during mechanical assistance. Confirmed (8) and highly suspected (2) IFI occurred during ICU stay in 29% of patients who were treated with echinocandins, voriconasole and/or liposomal amphotericine B. The isolated fungi were: 6 candida albicans, 2 parapsilosis, 1 glabrata and one invasive pulmonary aspergillosis. Antifungal prophylaxis with fluconasole was administered in 18% patients for 6 days (median), mainly in the last implantations. In the no IFI population, 54% (n = 13) had a systemic or VAD bacterial sepsis with a mortality rate of 54%. Without sepsis the mortality rate was 18%. Fungal colonisation was observed more frequently before IFI (90% vs. 50%, P = 0.03). The mortality rate was significantly higher with IFI (80% vs. 38%, P = 0.02).

Discussion: We observed a high incidence of IFI in ICU patients with VAD which was associated with 80% mortality, a result in agreement with the literature [1]. Detection of fungal colonisation appears to be crucial during ICU stay of VAD patients. Trials are nevertheless needed for investigating the use, the type and the timing of the antifungal prophylaxis that should be used for such high risk patients.

References

[1] Aslam S, Hemandez S, Thornby J, et al. Risk factors and outcomes of fungal ventricular-assist device infections. Clin Infect Dis 2010; 50: 664-671.

Oral Session – ICU

O-44
Does pre-operative NT-proBNP provide additional prognostic information to EuroSCORE II in patients undergoing CABG?

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Introduction: We wanted to evaluate whether pre-operative NT-proBNP provides additional prognostic information to the recently launched EuroSCORE II in patients undergoing isolated CABG for acute coronary syndrome.

Methods: As a substudy in a prospective clinical trial we studied patients with acute coronary syndrome undergoing isolated CABG. Patients were split into cohorts of low risk (EuroSCORE II < 2.0; n = 144), moderate-high risk (EuroSCORE II 2.0-10.0; n = 208) or very high risk (EuroSCORE II > 10.0; n = 13). Based on ROC analysis of NT-proBNP with regard to severe circulatory failure according to pre-specified criteria these cohorts were further divided into groups with pre-operative NT-proBNP below or above 1,028 ng · L^{-1}. Follow-up time averaged 4.1 ± 0.7 years.

Results: Overall EuroSCORE II was 3.3 ± 2.7 whereas observed in-hospital mortality was 1.4% (5/365). Patients with pre-operative NT-proBNP ≥ 1,028 ng · L^{-1} had significantly more inotropic support peri-operatively both in low risk and moderate-high-risk EuroSCORE II patients. In moderate-high risk EuroSCORE II patients NT-proBNP ≥ 1,028 ng · L^{-1} was associated with a higher incidence of postoperative severe circulatory failure (6.6% vs. 0%; P = 0.007), renal failure (14.8% vs. 5.4%; P = 0.03), stroke (6.6% vs. 0.7%; P = 0.03) and longer ICU stay (37 ± 35 vs. 27 ± 38 hours, P = 0.002). In-hospital plus 30-day mortality did not differ significantly (3.3% vs. 0%; P = 0.08) but crude 1-year mortality was higher (4.9% vs. 0%; P = 0.02). EuroSCORE II did not differ significantly between the groups with high and low NT-proBNP pre-operatively.

Discussion: Pre-operative NT-proBNP provides additional prognostic information to EuroSCORE II in patients with acute coronary syndrome undergoing isolated CABG, particularly in patients at moderate to high risk.

O-45
Predictive factors of survival in patients treated with polymyxin-B haemoperfusion for endotoxic shock following cardiac surgery

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Introduction: Polymyxin-B direct haemoperfusion (PMX-DHP) is generally used to treat septic shock of abdominal origin. However, recent studies have reported it may be beneficial in other patient populations such as endotoxic shock following cardiac surgery. Endotoxin is detrimental to myocardial contractility and peripheral vascular resistance, which in the presence of underlying cardiac disease could lead to haemodynamic instability. Therefore, PMX-DHP may protect myocardial function by reducing the endotoxic burden.

Methods: The factors predicting survival in 17 PMX-DHP treated patients with endotoxic shock following cardiac surgery were investigated in a retrospective study. Inclusion criteria were diagnosis of septic shock within 72 h of cardiac surgery and the presence of high endotoxin activity (EAA > 0.6). All patients received conventional medical therapy and two PMX-DHP treatments. Clinical parameters of haemodynamics, illness severity and organ dysfunction were monitored for 72 h, and 28-day survival was recorded. Student's t-test and Wilcoxon (Mann-Whitney) test for unpaired data were used as appropriate with significant $P < 0.05$.

Results: Baseline characteristics (age 63 ± 13 yr, 11/17 males, SAPSII = 53.8 ± 13.9, SOFA = 13.4 ± 3.8, MAP = 75.5 ± 14.1 mmHg, HR = 93.3 ± 20.0 bpm and inotropic score (IS) = 18.6 ± 16.6 were not significantly altered after 72 h. Overall 28-day ICU mortality was 59%. Division of patients based on their 28-day survival or non-survival showed no significant differences for SAPSII, SOFA, MAP, IS and DBP; but showed significantly higher SBP and significantly lower HR in survivors versus non-survivors. SOFA scores were significantly lower in survivors (15.5 ± 3.1) compared to non-survivors (9.6 ± 2.1) after 72 hr ($P = 0.003$). The table shows the baseline characteristics.

	Non-Survivors	Survivors	P value
SAPS II score	53.4 ± 15.7	50.0 ± 11.0	0.67
SOFA score	14.1 ± 3.8	12.4 ± 4.0	0.44
Mean arterial pressure (MAP)	71.1 ± 9.0	81.7 ± 18.3	0.13
Inotropic score (IS)	20.6 ± 15.2	15.9 ± 19.3	0.55
Systolic blood pressure (SBP)	103 ± 16	133 ± 21	0.005
diastolic blood pressure (DBP)	54.8 ± 8.2	56.3 ± 20.1	0.83
Heart rate (HR)	102 ± 22	81 ± 8	0.005

Discussion: While this study has the limitation of being an observational study, thereby lacking a control group, survivors were characterised by a higher SBP and lower HR at baseline, despite comparable vasopressor support, SAPSII and SOFA scores. Thus, we suggest that PMX therapy could relieve cardiac work leading to increased survival in septic patients following cardiac surgery who have improved haemodynamics following conventional medical therapy. In contrast, patients with baseline haemodynamic instability are less likely to survive despite PMX-DHP treatment. In conclusion, we evaluated the proof of concept that PMX-DHP treatment could be useful in septic patients after cardiac surgery. A larger numbers of patients, a control group and more complex statistical analyses, i.e. multivariate analysis, are needed to confirm our preliminary data.

O-46
Combined high central venous oxygen saturation and blood lactate levels and outcome in cardiac surgery patients

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Introduction: Central venous oxygen saturation ($ScvO_2$) and lactate levels indicate circulatory deficiencies and persistent tissue hypoxia [1, 2]. Microcirculation disorders may play an important role in the development of organ failure in critically ill patients. The aim of this study was to analyse the relation of outcome with postoperative values of the combination of $ScvO_2$ and lactate measurements in patients after cardiac surgery.
Methods: This was a prospective, observational study set in a 22-bed heart surgery intensive care unit (ICU) in a tertiary university hospital. Data at the point of highest $ScvO_2$ value on ICU were recorded. Patients were separated according to $ScvO_2 \geq 73\%$ (high-$ScvO_2$) and $ScvO_2 < 73\%$ (low-$ScvO_2$). The high-$ScvO_2$-group was separated according to lactate ≥ 3 mmol $\cdot L^{-1}$ (high-Lac) and lactate < 3 mmol $\cdot L^{-1}$ (low-Lac). Statistical analysis was performed using the SPSS v.20.0 software package. Chi-squared and Student's t-tests were used for comparisons between the groups ($P < 0.05$ was considered significant).
Results: Ninety six patients (66 males) were included in the study. No statistical differences in $ScvO_2$-groups (high- vs. low-$ScvO_2$) were detected for postoperative complications (13.5% vs. 4.2%; P = 0.26), mortality (3.1% vs. 0%; P = 0.29), ICU-stay (56.4 ± 50.31 h vs. 55.14 ± 53.95 h; P = 0.91), ventilation-time (14.54 ± 5.93 h vs. 16.01 ± 9.89 h; P = 0.67) and MODS on days 1, 2 and 5. In the high-$ScvO_2$-subgroups (high-Lac vs. low-Lac) differences were detected for WBC count (15.5 ± 4.9 ($10^3 \cdot mm^{-3}$) vs. 12.7 ± 3.7 ($10^3 \cdot mm^{-3}$); P = 0.012), ICU-stay (70.8 ± 62 h vs. 45.2 ± 36 h; P = 0.042), ventilation-time (16.2 ± 7.3 h vs. 13.2 ± 4.3 h; P = 0.046) and morbidity (15.6% vs. 4.7%; P = 0.008).
Discussion: High $ScvO_2$ may be the result of disorders of peripheral blood flow and altered oxygen extraction, rather than adequate perfusion [3]. Combination of high $ScvO_2$ and hyperlactataemia could indicate microvascular disorders (shunting and/or mitochondrial impairment). Further studies are necessary to assess the utility of $ScvO_2$ and lactate to guide therapy in cardiac surgery patients.

References

[1] Hu BY, Laine GA, Wang S, et al. Combined central venous oxygen saturation and lactate as markers of occult hypoperfusion and outcome following cardiac surgery. J Cardiothorac Vasc Anest 2012; 26: 52-57.
[2] Unic-Stojanovic D, Babic S, Lukic M, et al. Postoperative central venous oxygen saturation and lactate levels in cardiac surgery patients: a prospective observational study. Intensive Care Med Suppl 2012; 1: eP0312.
[3] Perz S, Uhlig T, Kohl M, at al. Low and "supranormal" central venous oxygen saturation and markers of tissue hypoxia in cardiac surgery patients: a prospective observational study. Intensive Care Med 2011; 37: 52-59.

Oral Session –
Thoracic and Non-cardiac

O-47
Cerebral saturation response to pre-oxygenation and induction of anaesthesia and cerebral desaturation during one-lung ventilation

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Introduction: Reduced cerebral saturation (ScO_2) during thoracic surgery is associated with a worse postoperative outcome [1]. The capability to increase ScO_2 with oxygen supplementation in patients with low 'baseline' ScO_2 reveals that non-responders have a significantly higher postoperative morbidity and mortality [2].

We investigated whether response of baseline ScO_2 to oxygen supplementation predicts desaturation during one-lung ventilation (OLV).

Methods: Fifteen patients undergoing thoracic surgery with (OLV) were studied. ScO_2, measured using the NIRO-200NX monitor (Hamamatsu Photonics UK Ltd), was recorded at 'Baseline' (FiO_2 0.21), during 3 minutes of pre-oxygenation and for 20 minutes after induction of anaesthesia, and during the period of OLV.

Results: Baseline ScO_2 [median (IQR)] was 70% (66.73). This increased to 75% (71.81) after pre-oxygenation, induction of anaesthesia and two-lung ventilation. During OLV ScO_2 fell to 72% (67.80). There was a strong correlation between area-under-the curve (AUC) ScO_2 response to pre-oxygenation/induction and the ScO_2 AUC during OLV $r^2 = 0.62$ ($P < 0.001$). The duration of relative cerebral desaturation < 10% $r^2 = 0.573$ ($P < 0.001$) and < 20% $r^2 = 0.391$ ($P = 0.05$) below 'Baseline' was also significantly correlated with cerebral oxygenation response to pre-oxygenation and induction. There was no correlation with absolute 'Baseline' values and OLV AUC. There was also no correlation between ScO_2 and the lowest systemic saturation measured.

Discussion: The degree and duration of cerebral desaturation during one-lung ventilation is predicted by the cerebral oxygenation response to oxygen supplementation and ventilation.

References

[1] Kazan R, Bracco D, Hemmerling TM. Reduced cerebral oxygen saturation measured by absolute cerebral oximetry during thoracic surgery correlates with postoperative complications. Br J Anaesth 2009; 103: 811-816.

[2] Heringlake M, Garbers C, Käbler JH, et al. Preoperative cerebral oxygen saturation and clinical outcomes in cardiac surgery. Anesthesiology 2011; 114: 58-69.

O-48
Precision and construct validity of extravascular lung water measurement following lung resection

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Introduction: Determination of extravascular lung water (EVLW) by trans-pulmonary thermodilution (TPTD) may be a useful monitoring modality following lung resection. The validity of TPTD has been questioned in this context. Pulmonary blood volume (PBV) might be expected to fall, potentially resulting in underestimation of EVLW [1].

Methods: The need for ethical approval was waived. We performed TPTD monitoring using the EV1000 platform (Edwards Lifesciences) in triplicate at 6 h intervals up to 42 h postoperatively in 8 patients undergoing lung resection. Construct validity was

Table 1: Association between ELWI, P/F, CXR_{score} and fluid balance. ELWIn – no adjustment, ELWIe – Edwards' proprietary algorithm, ELWIa – adjustment by segment counting.

	Pooled (Spearman)			Within subject (ANCOVA)		
	ELWIn	ELWIe	ELWIa	ELWIn	ELWIe	ELWIa
P/F	−0.52**	−0.06	−0.37**	−0.42**	−0.20	−0.39**
CXRscore	0.51*	0.31	0.59**	0.57#	0.14	0.57#
Fluid Balance	−0.20	−0.06	−0.11	0.15	0.07	0.17
** P < 0.01, * P < 0.05, # P = 0.054						

determined by assessing Spearman's correlation between pooled EVLW index (ELWI) values, PaO_2 : FiO_2 (P/F) ratio, chest x-ray scores (CXR_{score}) and fluid balance. Within subject testing by analysis of covariance (ANCOVA) was performed to adjust for repeated measures. We then compared unadjusted ELWI to values adjusted for the volume of resected lung tissue, hypothesising that adjustment would improve construct validity.

Results: Sixty-four triplicate sets of TPTD readings were available for analysis. The coefficient of variation for EVLW measurement was 8.0% (7.0-9.0), least significant change 11.5% (9.4-14.3) (median, [95% CI]) (see Table 1).

Discussion: Our data suggest that EVLW measurement has good precision following lung resection. Adjustment for the volume of resected lung did not improve construct validity, perhaps reflecting that PBV does not fall to the extent predicted by the algorithms.

References

[1] Brown LM, Liu KD, Matthay MA. Measurement of extravascular lung water using the single indicator method in patients: research and potential value. Am J Physiol Lung Cell Mol Physiol 2009; 297: L547-548.

O-49
The use of 7.2% Nacl/6% HES 200/0.5 provides extravascular lung water reduction in cardiac surgery patients: a randomised blinded study

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Introduction: Non-cardiogenic fluid shift into the lung extravascular space is a common morbidity that can result in lung injury following cardiopulmonary bypass (CPB). One of the strategies for decreasing excessive fluid extravasation involves the use of hypertonic saline. The aim of the study was to test the hypothesis that the infusion of 7.2% NaCl/6% hydroxyethyl starch 200/0.5 (HSH) would decrease extravascular lung water and consequently improve pulmonary function in coronary artery bypass graft surgery (CABG) patients.

Methods: Forty patients with ejection fraction above 40% scheduled for on-pump CABG were computer randomised to receive once either 7.2% NaCl/6% HES 200/0.5 (HSH group, n = 20) or 0.9% NaCl (control group, n = 20) at a dose of 4 ml · kg^{-1} for 30 min after anaesthesia induction. The primary end point was extravascular lung water index (EVLWI) obtained using a transpulmonary thermodilution (PiCCO plus) system. Index of arterial oxygenation efficiency (PaO_2/FiO_2),

Table 1

Group	Baseline	After CPB			
		5 min	2 h	4 h	24 h
EVLWI (ml · kg^{-1})					
HSH	9 (8–10)	9 (8–9)	8 (7–8)[a]	7 (6–8)[c]	7 (7–8)[b]
Control	8 (8–9)	10 (9–10)	9 (8–10)	9 (8–10)	9 (8–10)
PaO_2/FiO_2 (torr)					
HSH	378 (336–434)	298 (226–404)[b]	310 (232–362)[a]	383 (303–417)[a]	333 (305–394)
Control	334 (296–422)	206 (156–286)	235 (163–308)	316 (250–354)	302 (279–379)
$AaDO^2$ (torr)					
HSH	134 (106–168)	197 (131–231)[b]	168 (140–203)[b]	126 (114–169)[a]	46 (34–83)
Control	164 (119–203)	244 (213–313)	199 (188–294)	191 (135–238)	50 (41–71)
[a] $P < 0.05$; [b] $P < 0.01$; [c] $P < 0.001$					

alveolar-arterial O_2 difference ($AaDO_2$), and O_2 delivery index (DO_2I) were assessed during the first 24 h after CPB. Mann-Whitney's *U*-test was used for statistical analysis (MedCalc Statistical Software v12.1.4).

Results: EVLWI was lower in the HSH group as compared with the control group at 2 h after CPB and continued lower until 24 h after CPB. PaO_2/FiO_2 was significantly higher at 5 min, 2 h and 4 h after CPB in the HSH group; furthermore, $AaDO_2$ was significantly lower in the HSH group at the same time points of the study. DO_2I was much greater at 5 min after CPB, 465 (404–574) vs. 353 (319-403 ml · min^{-1} · m^{-2}, respectively ($P < 0.01$), and at 24 h after CPB, 504 (380-518) vs. 393 (358–447 ml · min^{-1} · m^{-2}, respectively ($P < 0.05$) (see Table 1).

Discussion: The administration of HSH to CABG surgery patients decreased extravascular lung water content, subsequently reducing oxygenation impairment after CPB. The oxygen delivery was more effective when HSH was used. Further studies are needed to investigate HSH effects in complicated patients undergoing surgery with CPB.

Oral Session – Thoracic Surgery and Postoperative

O-50
Comparison of the performance of standard double lumen tubes with VivaSight-DL™ double lumen tubes for lung isolation during thoracic surgery

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Introduction: Double lumen tubes (DLT) are the preferred option for lung isolation when selective lung ventilation is required. Ideally these tubes are inserted with bronchoscopic guidance to ensure correct position. [1]. However, many centres still perform blind insertion due to resource limitations or to lack of familiarity with bronchoscopic techniques.

The VivaSight-DL tube is a left-sided double lumen tube with an inbuilt high-resolution camera just below the tracheal lumen which allows for continuous display of tube position during and after the insertion process on an external screen.

Methods: Following ethics committee approval, we compared the success of insertion of a Viva-Sight DL with a Mallincrodt DLT inserted blindly with position immediately confirmed by bronchoscopic guidance in a randomised controlled trial. After consent, 24 ASA 1-3 patients were randomly assigned to the 37F VivaSight (VS) or 37F left double-lumen (DL) groups (12 per group). Exclusion criteria included anticipated difficult laryngoscopy and BMI > 35. The following endpoints were measured: 1. Ability to confirm correct tube position (sidedness and depth). 2. Time to confirm tube position. 3. Incidence of view obliteration by secretions. 4. Ability to detect malposition following correct tube placement. 5. Quality of lung collapse.
Results: Correct tube position was confirmed in 9 of 12 patients (75%) in the VS group and 11 of 12 (91.5%) patients in the DL group. Failure in the VS group was due to inability to clear secretions from the camera. Position was subsequently confirmed by rescue with a bronchoscope. The failure in the DL group was due to inability to pass the DLT through the vocal cords. This was rescued with a single lumen ETT and bronchial blocker. Time to confirmation of correct position was shorter in the VS group (106 vs. 178 seconds, P = 0.09, Student's t-test). The effects of learning did not influence results. Satisfactory lung deflation was achieved in all patients.
Discussion: Although faster, the VivaSight-DL was inferior to conventional DLT/bronchoscope for position confirmation. This was primarily due to difficulty in clearing secretions from the camera despite the integrated camera flushing system. Newer versions may provide solutions for this problem. The Viva-Sight system shows promise as an alternative to fibreoptic bronchoscopy for confirming DLT position, with the potential for faster placement times and lower overall cost per patient. Further studies are needed to verify our findings. We recommend having a fibreoptic bronchoscope as backup while experience with this system accumulates.

References

[1] Benumof JL. The position of a double-lumen tube should be routinely determined by fiberoptic bronchoscopy. J Cardiothorac Vasc Anesth 1993; 7: 513-514.

O-51
Isolated lung collapse in two stages with bronchial blocker: equivalent to double-lumen tube?

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Introduction: It is widely accepted that double-lumen tubes (DLT) tend to provide quicker and better quality lung collapse than bronchial blockers (BB). In 2003, Campos showed that the pulmonary collapse time of BB was longer compared to DLT (26:02 vs. 17:56 min, P < 0.006) during thoracotomy and video-assisted thoracoscopic surgery (VATS). In 2009, Slinger observed that in patients undergoing a left thoracotomy or VATS, BB allowed surgical exposure similar to DLT, but only at 10 and 20 minutes after pleural incision.

We hypothesised that apnoea periods during initiation of OLV using BB would allow for similar quality and time to complete lung collapse compared to DLT. The first objective was to compare the time to obtain complete lung collapse. The secondary objectives were to assess the quality of surgical exposure and to collect the surgeon guess about which device was being used.
Methods: After IRB approval, 40 patients requiring OLV for VATS were randomised in a prospective single blind (thoracic surgeons) trial. We compared left-side DLT (20 patients) to BB (20 patients) Uni-blocker® with the internal lumen occluded. In both groups OLV began once the patient was in a lateral decu-

bitus position (LDP). In the BB group, two 30 second periods of apnoea were performed: immediately after FOB verification of the BB position in LDP and just after incision of the pleura. Time from the start of OLV until complete lung collapse was recorded. The quality of the collapsed lung graded by the surgeon on a scale from 1 to 4 was also collected at 0, 5, 10 and 20 minutes (T_0, T_5, T_{10} and T_{20}) after pleural incision. The surgeon's guess on which device was used for lung isolation was recorded at the end of data collection.

Results: Of the 40 patients randomised, 38 were analysed. Fisher's exact test showed no difference in the demographics of our patients, for FEV1 or FEV1/FVC ratio. Mean time to complete lung collapse was 32.5 ± 11.8 min and 47.8 ± 35.9 min for BB and DLT groups respectively (P = 0.1). There was better lung collapse in BB-group at T_0 (P = 0.04), with a trend of better quality of lung collapse in the BB-group at T_5, T_{10} and T_{20}. The surgeon's guess about the device used was incorrect in 68% for the BB-Group and 50% in TDL-Group.

Discussion: Overall the hypothesis of similar collapse time and quality of lung collapse for BB and DLT was confirmed except at T0 where a statistically significant difference showed a better quality of lung collapse in the BB group. This latter result as well as an overall trend favouring the BB group was unexpected since there is a general belief that DLTs tend to provide quicker and better quality lung collapse than BBs. Thus BB induces lung collapse equivalent if not better than the DLT.

Oral Session – Cardiac and Renal Function

O-52
High thoracic epidural analgesia supplement may protect renal function in cardiac surgery patients

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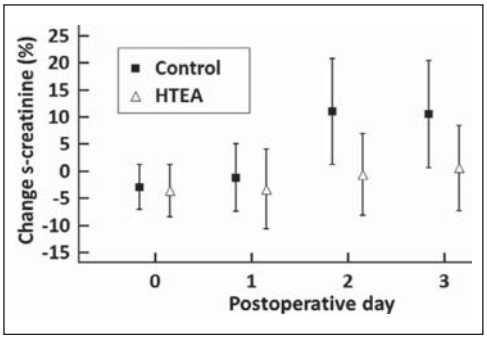
Introduction: The beneficial effects of a high thoracic epidural analgesia (HTEA) on outcome in cardiac surgery are still debatable as most trials are inadequately powered to draw firm conclusions. Recent studies have found a lower frequency of postoperative dialysis after HTEA. The purpose was to evaluate the effect of HTEA on renal function expressed as changes in s-creatinine.

Methods: Sixty low risk patients scheduled for CABG with or without AVR were randomised to HTEA or control group. General anaesthesia consisted of sufentanil and propofol and rocuronium for tracheal intubation. HTEA was continued to the 2nd and 3rd postoperative days.

S-creatinine was measured before and minimum 5 days after surgery and correlated to peri-operative haemodynamics and fluid balances.

Results: Fewer HTEA patients (13.3% vs. 36.7%, P = 0.074, χ^2-test) developed acute kidney insufficiency (AKI). The rise in s-creatinine was significantly lower from day 0-3



(P = 0.018, 2-way ANOVA) in HTEA group. Cardiac index was higher and perfusion pressure lower in HTEA group. Overall peri-operative fluid balances between groups were equal.

Discussion: In a previous study we concluded that flow was more important than the renal perfusion pressure in the development of AKI. This is in line with studies showing that systemic and localised impaired renal blood flow play a major role in AKI. HTEA reduces sympathetic nerve activity and influences the function of vital organ systems. There is limited data and methodological problems on the segmental distribution of a thoracic sympathetic block in humans. In animals it was found that a segmental sympathetic block resulted in a compensatory increased sympathetic nerve activity in unblocked segments, which might improve renal perfusion and thus increase creatinine excretion. As the patients presented an overall positive peri-operative fluid balance, it cannot be excluded that the findings are due to simple, group different, dilutions. More likely the lower creatinine in HTEA group is due to a higher creatinine excretion and better renal function, which could explain the lower frequency of postoperative dialysis, found in previous studies.

O-53
Preoperative renal function and risk identification in cardiac surgery

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Introduction: Pre-operative renal insufficiency is an important predictor of lower survival after cardiac surgery [1]. The new EuroSCORE II [2] applied creatinine clearance as a better predictor than absolute serum creatinine. We searched the best cut-off value for glomerular filtration rate (GFR) to predict survival after cardiac surgery.

Methods: 9,490 cardiac surgical patients (3,322 female), from 1997 to 2008 (follow-up until 2010) were included. GFR was estimated using the Cockcroft-Gault formula. To find a cut-off value, the data set was split into two groups iteratively for every value between minimum and maximum of GFR values with a step width of 5 ml · min^{-1} . Patients were assigned to group 1 if their GFR was less or equal to the potential cut-off value and to group 2 otherwise. At each step the non-parametric log-rank statistic, which measures the difference in survival functions, was calculated using PROC LIFETEST in SAS 9.3. The potentially ideal split point according to either test statistic was found as the cut-off value maximising this statistic.

Results: We found the best cut-off for GFR is ≥ 55 ml · min^{-1} to be predictive for survival. 30.9% (2931 patients) had a GFR below the estimated cut-off. Figure 1 shows the value of the log-rank statistic as function of potential cut-off values.

Discussion: The highest risk of mortality is in patients with severely impaired renal function. Calculating the GFR is recommended

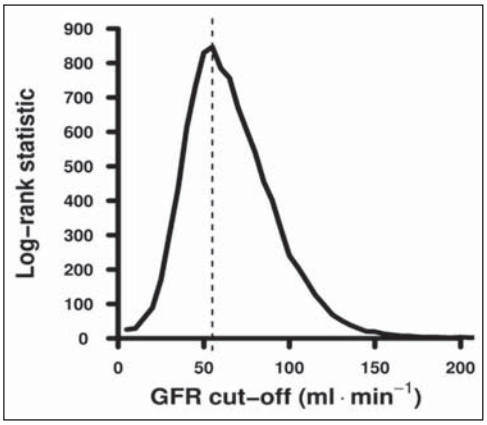

Figure 1

for assessing risk in general adult cardiac surgery.

References

[1] Borthwick E, Ferguson A. Perioperative acute kidney injury: risk factors, recognition, management, and outcomes. BMJ. 2010; 341: c3365.

[2] Nashef SA, Roques F, Sharples LD, et al. EuroSCORE II. Eur J Cardiothorac Surg 2012; 41: 734-745.

O-54
On-pump CABG is associated with more renal desaturation and higher biomarker values for acute kidney injury than off-pump CABG

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Introduction: Coronary artery bypass grafting (CABG) is frequently associated with impaired renal function, which is often attributed to cardiopulmonary bypass (CPB). "Off-pump" CABG surgery may avoid this complication. Neutrophil gelatinase associated lipocalin (NGAL) is a recently identified early biomarker for acute kidney injury. We determined if there is a difference in peri-operative haemodynamics, renal tissue oxygenation ($SrtO_2$) and kidney injury (determined by NGAL) between on-and off-pump CABG surgery.

Methods: In this prospective, randomised trial, 60 patients undergoing CABG were included after local IRB approval and written informed consent. Mean arterial pressure (MAP) and near-infrared spectroscopy derived peripheral tissue oxygenation ($SptO_2$, InSpectra, Hutchinson, thenar muscle) and $SrtO_2$ (above the kidney, INVOS 5100, Covidien) were continuously recorded during surgery. Blood samples were taken during and after surgery for plasma NGAL analysis.

Results: Twenty-nine on- and thirty off-pump patients, with no difference in patient characteristics, were analysed. MAP and $SptO_2$ were similar in both groups during surgery. However, $SrtO_2$ was significantly more decreased in the on-pump group, the median (range) area under baseline $SrtO_2$ was 698 (239-1980)% · min^{-1} in the on-pump (n = 17) vs. 233 (0-2956)% · min^{-1} in the off-pump group (n = 21), respectively. Additionally, on-pump CABG resulted in significantly higher median (range) NGAL values than off-pump CABG, with 100 (49-212) ng · mL^{-1} vs. 71 (29-127) ng · mL^{-1} at the end of surgery and 121 (52-359) ng · mL^{-1} vs. 95 (41-155) ng · mL^{-1} 6 hours after surgery. However, there was no change in creatinine levels and none of the patients required renal replacement therapy.

Discussion: While systemic haemodynamics (MAP) and systemic tissue oxygenation ($SptO_2$) were equal in both groups, $SrtO_2$ was lower and postoperative NGAL values were higher in the on-pump group compared to the off-pump group. CPB may therefore be associated with an increased risk of postoperative acute kidney injury and this complication may be predicted by.

O-55
The effects of 7.2% Nacl/6% HES 200/0.5 on renal function in on-pump coronary artery bypass graft surgery patients: a randomised blinded study

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Introduction: The influence of medium molecular weight hydroxyethyl starches (HES) on development of acute kidney injury (AKI) in cardiac surgery patients is not clearly defined. The aim of the study was to evaluate the effect of 7.2% NaCl/6% HES 200/0.5 (HSH) on kidney integrity in patients undergoing on-pump CABG surgery.
Methods: After Ethics Committee approval and informed consent, patients with glomerular filtration rate > 90 ml · min^{-1} were randomly assigned to receive once either HSH (HSH group, n = 20) or 0.9% NaCl (control group, n = 20) at a dose of 4 ml · kg^{-1} for 30 min after anaesthesia induction for fluid resuscitation. Primary end points were: s-creatinine (sCr), s-cystatin C (sCys-C), urine neutrophil gelatinase-associated lipocalin (uNGAL), measured at baseline, 5 min, 2 h, 4 h, and 24 h after cardiopulmonary bypass (CPB); as well as diuresis at the end of surgery and at 24 h after CPB. Peri-operative fluid management was guided by global end diastolic volume (PiCCO plus system). Results are given as median with IQR. Statistical testing was performed using Mann-Whitney's U test with MedCalc v12.1.4.
Results: There were no differences in perioperative haemodynamics and baseline renal markers. Of the 40 patients analysed, only 2 patients in the control group developed R-criterion of AKI at 24 h after CPB. The values of sCys-C were greater in the control group compared with the HSH group at 5 min, 2 h, and 4 h CPB. Significantly decreased uNGAL concentration was in the HSH group at 24 h after CPB. Diuresis was greater in the HSH group compared with the control group at the end of surgery (P = 0.01) and at 24 h after CPB (P < 0.01) (see Table 1).
Discussion: The use of HSH for fluid resuscitation at a dose of 4 ml · kg^{-1} in patients undergoing on-pump CABG surgery did not alter renal function. Moreover, less tubular damage was identified after infusion of HSH. In further controlled studies it has to be investigated whether HSH impairs kidney integrity in high risk cardiac patients.

Table 1

Group	Baseline	After CPB			
		5 min	2 h	4 h	24 h
Cystatin C (mg · L^{-1})					
HSH	0.8 (0.71-0.93)	0.72 (0.65-0.79)[b]	0.72 (0.63-0.82)[b]	0.75 (0.68-0.9)[b]	0.83 (0.73-0.87)
Control	0.89 (0.77-0.99)	0.9 (0.76-0.96)	0.91 (0.76-1.04)	0.91 (0.82-1.1)	0.91 (0.77-1.13)
uNGAL (ng · mL^{-1})					
HSH	2.4 (1.83-6.4)	7.6 (2.9-1.73)	8.0 (5.6-17.1)	9.9 (6.5-33.5)	16.6 (12.0-29.6)[a]
Control	5.9 (5.0-7.3)	9.2 (5.5-13.4)	6.2 (5.15-11.5)	12.8 (9.5-20.2)	29.6 (17.7-58.2)
[a] P < 0.05; [b] P < 0.01					

O-56
The influence of serum neutrophil gelatinase associated lipocalin levels on early detection of acute kidney injury in patients with insulin dependent diabetes mellitus undergoing cardiac surgery

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Introduction: The influence of serum neutrophil gelatinase associated lipocalin (NGAL) levels on acute kidney injury (AKI) in patients with insulin dependent diabetes mellitus undergoing cardiac surgery with cardiopulmonary bypass (CPB) was investigated.
Methods: In a prospective, double-blinded, randomised study, 127 patients were divided into two groups depending on measurement of serum NGAL levels, Group I (n = 63) and Group II (n = 64). A serum NGAL levels above 150 ng · mL^{-1} was considered NGAL (+), collected 2 and 24 h after CPB. Routine serum creatinine (sCr) levels were measured before surgery, and at 24 and 72 h after CPB and glomerular filtration rate (eGFR) estimated. AKI(+) is defined as an increase in serum creatinine from baseline by > 50% within 48 h postoperatively. Renal replacement therapy (RRT) and in-hospital mortality were recorded. Comparisons between groups were made by Student's *t*-test or Mann-Whitney *U* test. χ^2 test, Fisher's exact test was used as appropriate. $P < 0.05$ was considered significant.
Results: Peri-operative patient characteristics were similar between groups ($P > 0.05$). In Group I, 16 (25.4%) patients were considered AKI (+) at 2 h after CPB depending on serum NGAL (+) levels. However, in Group II, depending on sCr levels, no patient was considered AKI(+) ($P < 0.001$). Three patients (4.8%) in Group I whereas none in Group II were started on RRT within 24 hours after surgery ($P = 0.246$). In comparison between Group I and II at 24 h after CPB, 3 patients in Group I (4.8%) and 9 patients (14.6%) in Group II were considered AKI(+) depending on sCr values ($P = 0.002$). Overall, 3 patients (4.8%) in Group I and 5 patients in Group II (7.8%) required RRT at 72 h after surgery ($P = 0.453$). Intensive care unit stay was 2.6 ± 0.2 days in Group I and 6.6 ± 1.1 days in Group II ($P < 0.001$). Within group, in both Group I and II, in comparison to baseline sCr, values did not change at 24 h after CPB. However, they increased at 72 h after CPB ($P = 0.08$, $P = 0.005$). Within group, in both Group I and II, in comparison to baseline, eGFR values did not change at 24 h. after CPB. However, they decreased at 72 h after CPB ($P = 0.12$, $P = 0.004$). In comparison of baseline and serum NGAL values at 24 and 72 h after CPB, a statistically significant rise was observed within Group I ($P = 0.0001$).
Discussion: In patients with insulin dependent diabetes mellitus undergoing coronary artery bypass graft surgery, concentration of plasma neutrophil gelatinase associated lipocalin (NGAL) shows an accurate diagnosis of AKI as early as 2 h after CPB.

Best Oral session

O-57
Feasibility of contrast echocardiograpy in assessment of total aortic regurgitation following TAVI

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Introduction: Quantification of total aortic regurgitation (AR) following TAVI remains controversial. The reported incidence of moderate to severe AR is up to 20% and is associated with a less-favourable outcome. The purpose of this study was to assess the usefulness of retrograde contrast echocardiography (CE) in quantification of the total AR following TAVI.
Methods: In 245 patients following Edwards Sapien valve implantation, contrast echocardiography (CE) using TOE was performed immediately after TAVI. As contrast medium we used 20 mL agitated gelatinepolysuccinate (Gelafundin 4%, Braun, Germany). The contrast was given as a bolus injected into the sinotubular junction of the aorta using a pigtail catheter. We traced the area of the regurgitant cloud during mid-diastole, in the moment of clear demarcation between contrast and blood. A regurgitant area size ≥ 4.0 cm^2, representing approximately the LVOT area, was set as an indicator of significant AR. Sensitivity of this technique to identify AR was compared with radiographic aortography and Doppler echocardiography. To assess whether AR identified by CE independently determined survival a multivariate model was applied.
Results: CE with regurgitant area ≥ 4 cm^2 recognised 15 of 15 patients with AR > 1 identified by aortography and described additional 40 patients (16.3% of all) who were judged as AR ≤ 1 by aortography. Further CE recognised 14 of 23 (61%) assessed as AR > 1 by Doppler and identified 38 patients with regurgitant area ≥ 4 cm^2, who were categorised as AR ≤ 1 by Doppler. Multivariate analysis including regurgitant area ≥ 4 cm^2, log EuroSCORE, STS Score, NYHA class IV, age, gender, pre-operative LVEF < 40%, and severe patient prosthesis mismatch identified log EuroSCORE (P = 0.02) and regurgitant area ≤ 4 cm^2 (P = 0.02) as independent risk factors for 2-year survival.
Discussion: CE is a simple method for quantification of total AR following TAVI and is more sensitive than conventional angiography in detecting AR after TAVI. The clinical relevance of this increased sensitivity is demonstrated by the impact of such detected AR on survival.

O-58
Aetiology of preoperative anaemia in patients undergoing cardiac surgery

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Introduction: Pre-operative anaemia is highly prevalent and independently associated with increased transfusion and adverse outcomes in cardiac surgery [1]. Causes may be multifactorial, and correct diagnosis is essential for successful patient blood management. Despite this, there is a paucity of data on the aetiology of pre-operative anaemia in cardiac surgical patients. This study aimed to investigate the types of pre-operative anaemia in cardiac surgery, their relative frequency and prognostic implication.
Methods: In a prospective observational study, 150 elective adult cardiac surgical patients with pre-operative anaemia, as defined by the World Health Organisation criteria, were recruited at a cardiothoracic specialist centre in the UK. Blood and urine samples were collected from the patients prior to surgery. Bone marrow was sampled from the

open sternal edge immediately following sternotomy. Data regarding demographics, transfusion, critical care and hospital stay, mortality and adverse outcomes were collected.

Results: In our cohort 72.7% of the patients were male and the median (IQR) age was 76.5 (70-82) years. The pre-operative haemoglobin ($g \cdot dL^{-1}$) was 11.5 (10.5-12.0) for men and 10.1 (9.5-10.8) for women. The aetiology for anaemia was iron-deficiency in 11.3%, low vitamin B12 levels in 12.0%, folic acid deficiency in 0.7%, chronic renal disease in 9.3%, haemolysis in 0.7%, chronic haematological disorder in 3.3%, and suspected anaemia of chronic disease in 52% of the patients.

Discussion: At least one third of anaemic cardiac surgical patients present with a treatable reversible cause, such as iron or vitamin deficiency or chronic renal disease. The largest group however is associated with chronic disease and we plan to investigate this further with erythropoietin levels, as deciding on treatment for these patients is particularly important. Early identification and pre-operative optimisation could potentially significantly reduce the risk of peri-operative transfusion.

References

[1] Hung M, Besser M, Sharples LD, et al. The prevalence and association with transfusion, intensive care unit stay and mortality of pre-operative anaemia in a cohort of cardiac surgery patients. Anaesthesia, 2011, 66: 812-818.

O-59
The influence of dexamethasone on intraoperative and postoperative lactate levels and glycaemic control in cardiac surgery patients

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Introduction: Corticosteroids are often used to suppress the inflammatory response to cardiac surgery and are known to increase plasma levels of glucose, a direct precursor of lactate. Lactate is a strong predictor of outcome in intensive care (ICU) patients. The effect of corticosteroids on plasma lactate levels after cardiac surgery has not been studied in a large randomised trial. We aimed to investigate the effect of a single, intraoperative, high dose of dexamethasone on plasma lactate and glucose levels in patients who underwent cardiac surgery.

Methods: The DExamethasone for Cardiac Surgery (DECS) trial was a multicentre randomised trial (n = 4,494) that investigated the effect of dexamethasone on outcomes of cardiac surgery with cardiopulmonary bypass. We studied participants operated at one centre, where computerised glucose regulation (GRIP) was used routinely in the ICU. Patients were randomised to receive 1 mg/kg dexamethasone or placebo after induction of general anaesthesia. The primary outcome of this study was postoperative plasma glucose and lactate level, observed in the first 16 hours after ICU admission.

Results: 497 patients met the inclusion criteria. Of 476 (96%) patients, sufficient data on the primary outcome was available. 239 patients were randomised to dexamethasone and 237 to placebo. Plasma lactate and glucose area-under-the-curve in the first 16 hours after ICU admission ($mmol \cdot L^{-1} \cdot h^{-1}$) were significantly higher in the dexamethasone group: lactate 29.2 vs. 22.8, $P < 0.0001$

and glucose 112.9 vs. 98.9, P < 0.0001. Regression analysis showed that glucose level but not allocation to dexamethasone was an independent predictor of postoperative lactate levels.

Discussion: Dexamethasone administered for cardiac surgery causes an increase in lactate levels that can be explained by its hyperglycaemic effect, thus suggesting that dexamethasone has no direct impact on perioperative causes of hyperlactataemia such as the adrenergic stress response.

Trial Registration: clinicaltrials.gov Identifier NCT00293592

O-60
Association between platelet count and platelet function in paediatric cardiac surgery

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Introduction: Platelet count and function are essential for bleeding control during paediatric cardiac surgery. It is well known that platelet count is reduced during and after cardiopulmonary bypass (CPB), but little is known about platelet function. The primary aim was to describe platelet count and function during and after paediatric cardiac surgery and their potential correlation. A secondary aim was to determine if modified ultrafiltration influences platelet count and function.

Methods: Fifty-eight children (median age 5.4 months, median weight 5.8 kg) undergoing cardiac surgery with CPB, were studied. Platelet count, function and haematocrit were determined at five preset times: (T1) after induction of anaesthesia, (T2) at the end of CPB, (T3) after modified ultrafiltration, (T4) after surgery, and (T5) on the first postoperative day. Platelet function was assessed with whole blood impedance aggregometry (Multiplate®) with adeno-diphosphate (ADP), and thrombin receptor activating peptide (TRAP).

Results: Both platelet count and all aggregation tests were significantly reduced during surgery in comparison to pre-operative levels with the largest reduction at the end of CPB (T2). The reduction was largest in ADP-induced aggregation (62 ± 28%) followed by platelet count (56 ± 17%). Immediately after ultrafiltration (T4) platelet count was reduced by 53 ± 19% while the reduction in ADP and TRAP aggregation were less pronounced (38 and 20%). On day 1 (T5) platelet count was reduced by 47 ± 30% while platelet aggregation had returned to, or above pre-operative levels. There were moderate correlations between platelet count and platelet aggregation with the best correlation during CPB (T2) (ADP r = 0.55, TRAP 0.55, P < 0.001). Ultrafiltration increased haematocrit from 28 to 36% (P < 0.001) but did not significantly influence platelet count or ADP-and TRAP-induced aggregation.

Discussion: There are substantial reductions both in platelet count and platelet function during and immediately after paediatric cardiac surgery. Platelet count and function correlate moderately. The recovery in platelet function is markedly faster than the recovery in platelet count. Ultrafiltration has no or marginal effect on platelet count and function.

O-61
Selective antegrade cerebral perfusion: effect of increasing flow rate on cerebral oxygen saturation and transcranial Doppler flow velocity

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Introduction: Minimal safe selective antegrade cerebral perfusion (SACP) flow is close to 6 ml kg^{-1} min^{-1} in large animals [1], where-

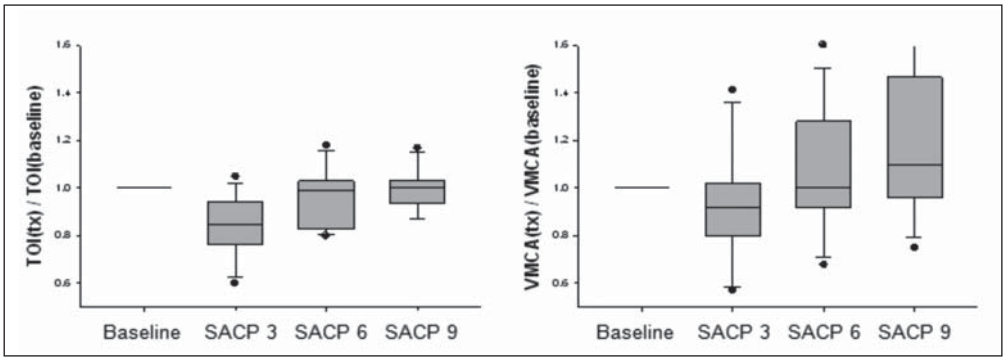

Figure 1

as it is uncertain in humans. We assessed the effect of 3 SACP flow rates on cerebral tissue oxygenation index (TOI) and middle cerebral artery flow velocity (VMCA) in patients undergoing hemi-arch replacement in hypothermic circulatory arrest (HCA).

Methods: With IRB approval, TOI and VMCA were measured (near-infrared spectroscopy and transcranial Doppler sonography) immediately prior to HCA (baseline), and during stable SACP at 3, 6, and 9 ml · kg^{-1} · min^{-1}, respectively. Data are mean ± SD; TOI/VMCA as a fraction of baseline. Statistics used were Friedman test for SACP flow rates and post-hoc analysis with Wilcoxon's signed-rank test with Bonferroni correction; $\alpha = 0.05$.

Results: In 8 patients (age 67 ± 7 yr; HCA 19 ± 10 min; SACP 17 ± 16 min at 23.1 ± 0.6°C), complete NIRS/TCD data sets were analysed (Figure 1). There was a significant difference in TOI ($P < 0.001$) and VMCA ($P = 0.003$) during different SACP flow rates. TOI at SACP 3 differed significantly from all other time points (P against baseline, SACP 6 and 9: 0.003, 0.001, and 0.002, respectively). VMCA differed significant between SACP 3, 6, and 9 (P 0.013, 0.002, and 0.015, respectively).

Discussion: SACP flow augmentation is reflected by increasing TOI and VMCA. At SACP ≥ 6 ml kg^{-1} min^{-1}, TOI recovers to pre-HCA baseline. Our preliminary human data support animal findings of a lower SACP limit of 6 ml · kg^{-1} · min^{-1} [1].

References

[1] Jonsson O, Morrel A, Zemgulis V, et al. Minimal safe arterial blood flow during selective antegrade cerebral perfusion at 20o centigrade. Ann Thorac Surg 2011; 91: 1198-1205.

Oral Session – Transplantation and Pulmonary Complication

O-62
Prone oosition ventilation in cardiac surgery patients with ALI/ARDS: effect on lung volumes and lung strain

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Introduction: Patients submitted to multiple valve operation or combined operation have a reduced respiratory function in the post-operative period (long CPB time, pulmonary hypertension) [1], but data on direct measurement of EELV and respiratory mechanics are scanty The aim of the study is to evaluate the postoperative changes of lung volumes, the cardiorespiratory effect of a recruiting manoeuvre, and the effect of the best PEEP.

Methods: Twenty patients submitted to multiple valve operation were ventilated with an Engstrom-Carestation ventilator (GE Health Care, Helsinki, Finland). EELV measurement was carried out with the COVX module integrated within the ventilator by a NMBW (nitrogen multiple washout technique). Every patient had a postoperative EELV measurement and then a recruited manoeuvre (RM). After the RM, Best PEEP was set on the data of EELV and of the compliance, during a de-recruiting manoeuvre. At every time we performed a TOE examination (GE, VIVID I). All data are reported as mean ± SD. ANOVA test was used to compare changes during the times.

Results: Table 1 shows the main results of this study.

	POST OP	RM	Best PEEP
EELV mL	1395 ± 418	2003 ± 512*	1732 ± 462
Compliance mL · cmH_2O	35 ± 15	33 ± 13	40 ± 20
PaO_2/FIO_2 mmHg	207 ± 62	313 ± 84*	237 ± 57
Peak pressure cmH_2O	28 ± 6	41 ± 3*	27 ± 4
* P < 0.05 vs. POST OP			

Discussion: EELV is reduced during multiple valve operation and a RM improves EELV and oxygenation with a transient decrease of RV function. Best PEEP preserves lung recruitment.

References

[1] Miranda D, Struits A, Koetsier P, et al. Open lung ventilation improves functional residual capacity after extubation in cardiac surgery. Crit Care Med 2005; 33: 2253-2258.

O-64
Effect of body mass index on morbidity and stratified mortality after cardiac surgery

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Introduction: Obesity is associated with increased mortality and the development of chronic disease. However, an "obesity paradox" has been described in several pathologies including ICU patients [1]. This study examined the relationship between body mass index (BMI) and mortality and early complications after cardiac surgery.

Methods: Data of 6437 consecutive patients undergoing cardiac surgery in our hospital were prospectively collected. The patients were divided into 5 groups on the basis of BMI: underweight (A: BMI < 18.5; n = 138), normal weight (B: BMI 18.5 to 24.9; n = 2,340), overweight (C : BMI 25.0 to 29.9; n = 2,815), class I obese (D: BMI 30 to 34.9; n = 931), class II obese (E: BMI 35; n = 213). The association between obesity, morbidity and mortality was assessed by univariate analysis. The independent association between BMI and mortality was assessed by the ratio of the Estimed mortality with the logistic EuroSCORE [2] and to the Observed mortality (E/O ratio).

Results: Group B, C and D had a similar postoperative mortality but the E/O ratio differed significantly (Table 1).

Discussion: After cardiac surgery, overweight and obese patients had a higher mortality than patients with normal BMI while very lean patients had the highest risk of mortality. Postoperative complications differed according to BMI.

References

[1] Hutagalung R, Marques J, Kobylka K, et al. The obesity paradox in surgical intensive

Table 1

Group	A	B	C	D	E	P value
Age (yr)	63 (18)	66 (13)	67 (11)	66 (10)	63 (10)	< .0001
Hosp stay (D)	12 (7)	12 (7)	11 (10)	12 (9)	14 (15)	.0062
PRC (unit)	1.9 (2.5)	1.3 (2.4)	0.9 (2.7)	0.9 (2.2)	0.9 (1.9)	< .0001
Low cardiac output syndrome	28.3%	17.3%	14.9%	15.4%	21.6%	< .0001
Mechanical ventilation > 6 h	19.6%	18.1%	13.2%	13.6%	20.7	< .0001
Atrial fibrillation	19.6%	20.3%	20.9%	23.1%	31.5%	< .0001
EuroSCORE	6.6 (3.1)	5.8 (3.4)	5.2 (3.3)	5.0 (3.1)	4.9 (3.2)	< .0001
Log EuroSCORE	10.1 (10.5)	8.5 (10.5)	7.1 (9.6)	6.4 (8.2)	6.5 (8.2)	< .0001
Mortality (%)	11.6	4.4	3.4	3.4	5.6	< .0001
E/O ratio	0.9 (.9)*	2.5 (3.1)	2.1 (2.8)*	1.5 (1.9)*	1.2 (1.5)*	< .0001

care patients. Intensive Care Med 2011; 37: 1793-1799.

[2] Michel P, Roques F, Nashef SA, et al. Logistic or additive EuroSCORE for high-risk patients? Eur J Cardiothorac Surg 2003; 23: 684-687.

Oral Session – Paediatric Anaesthesia

O-65
A comparison of the effects of midazolam and sevoflurane on myocardial protection during Arterial Switch operation: a preliminary study

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Introduction: Peri-operative myocardial injury is a major determinant of postoperative cardiac dysfunction especially in neonates and those with prolonged duration of cardiopulmonary bypass. Studies have demonstrated that inhalation anaesthetics may have cardio-protective properties in adult cardiac surgery. However, the cardio-protective effect of inhalation anaesthetics has not been extensively investigated in paediatric cardiac surgery. The aim of this study is to compare the cardio-protective effects of midazolam and sevoflurane in neonates undergoing arterial switch operation (ASO) for transposition of the great arteries (TGA).

Methods: It is estimated that this study will be completed by the end of December 2013 after a total of 80 neonates undergoing ASO have been included. Here we present the results of the first 40 neonates who were enrolled between June 2011 and December 2012. Neonates were randomly and evenly allocated into groups of sevoflurane (n = 20) and midazolam (n = 20). Neonates in group midazolam received a continuous infusion of midazolam 0.2 mg $kg^{-1} \cdot h^{-1}$ throughout the surgery. Group sevoflurane received 1-2% of end-tidal concentration of sevoflurane intraoperatively. Serum concentrations of cardiac troponin I (cTnI) were determined before skin incision, at the end of surgery, and at 4, 16, 24, and 48 hours postoperatively. Neonates' intra-operative and postoperative maximum inotropic drug requirements, amounts of blood products and fluids used, urine output, haemodynamic parameters, duration of mechanical ventilation and length of intensive care unit and hospital stay were recorded.

Results: Demographic features and durations of surgery, aortic clamping, and cardiopulmonary bypass were not significantly different between the groups ($P > 0.05$ for all). Both groups had similar baseline serum cTnI levels ($P > 0.05$). Compared to baseline cTnI levels, cTnI levels were significantly elevated

at each measurement time point in both groups ($P < 0.001$). However, the cTnI levels were not significantly different between the groups at measurement time points ($P > 0.05$). The amounts of peri-operative fluids used and urine output, haemodynamic parameters, dose of positive inotropes, duration of mechanical ventilation, and lengths of intensive care unit and hospital stay were similar in both groups ($P > 0.05$ for all).There was no mortality.

Discussion: Our preliminary results demonstrate that sevoflurane is not better than midazolam in terms of its cardio-protective effects in neonates undergoing ASO for TGA. We acknowledge that this is an ongoing study that is recruiting patients and after the completion of the study more definitive conclusions may be drawn.

O-66
Impact of the insulin and glucose content of postoperative fluid on the outcome after pediatric cardiac surgery

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Introduction: Several studies have reported independent relationships between insulin treatment, hyperglycaemia and adverse outcomes after adult cardiac surgery. However, paediatric reports have revealed different Results. Therefore, the aim of the present study was to investigate the possible role of the insulin and glucose content of the maintenance fluid in influencing the outcomes of paediatric patients undergoing heart surgery.

Methods: After Ethics Committee approval, 2060 consecutive paediatric patients were retrospectively analysed. We accounted for selection bias with propensity-based matching. Two separate propensity-matched models were constructed: the insulin model and the glucose model. In the glucose model, 5% and 10% glucose maintenance infusions were compared in patients below 20 kg weight. The groups were subsequently matched using propensity scores to compare their morbidity, length of stay, duration of mechanical ventilation, and in-hospital mortality. The propensity scores were developed using a multivariable logistic regression model, adjusted for potential confounding variables.

Results: Propensity score matching yielded 171 and 298 pairs of patients in the insulin model and glucose model, respectively. Postoperative mean blood glucose levels on the day of surgery were 6.69 ± 1.9 mmol $\cdot$ L^{-1} and 6.15 ± 1.71 mmol $\cdot$ L^{-1} for the insulin and glucose groups, respectively. The mortality was lower in the insulin group (12.9% vs. 7%, $P = 0.049$). The insulin group had a longer intensive care unit stay [days, 10.9 (5.8-18.4) vs. 13.7 (8.2-21), $P = 0.003$], a longer hospital stay [days, 19.8 (13.6-26.6) vs. 22.7 (17.6-29.7), $P < 0.01$)], a longer duration of mechanical ventilation [hours, 67 (19-140) vs. 107 (45-176), $P = 0.006$], a higher incidence of severe infections (18.1% vs. 28.7%, $P = 0.01$) and a higher incidence of dialysis (11.7% vs. 24%, $P = 0.001$). In the dextrose model, the incidence of pulmonary complications (13.09% vs. 22.5%, $P < 0.01$), low cardiac output syndrome (17.11% vs. 30.9%, $P < 0.01$) and severe infections (10.07% vs. 20.5%, $P < 0.01$) were higher.

Discussion: Insulin treatment appeared to decrease mortality. Lower glucose content in the maintenance fluid was associated with a lower occurrence of adverse events.

O-67
Fluid overload and adverse outcomes following paediatric cardiac surgery

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Introduction: This study investigated the relationship between postoperative fluid overload and adverse outcomes in paediatric patients undergoing cardiac surgery.
Methods: We have retrospectively analysed the data of 1,520 consecutive paediatric patients undergoing cardiac surgery between 2004 and 2008. In the first 72 h, percentage of daily fluid balance was calculated by admission weight. Urine output was also calculated for body weight. Study endpoints were in-hospital mortality, cardiac failure and the need for dialysis. Multivariable logistic regression was used.
Results: Sixty-three patients (4.1%) died. 332 (21.8%) patients had postoperative cardiac failure and 99 (6.5%) patients needed dialysis. The association between degree of fluid overload and outcomes remained after adjusting for demographic and intraoperative variables (Table 1).
Discussion: Our results indicate that fluid overload in the early postoperative period is associated with adverse outcomes. Monitoring fluid balance and early correction of fluid overload should be standardised in the paediatric cardiac surgery setting.

Table 1

Outcome		Urine (mL · kg^{-1})		Fluid balance (mL · kg^{-1})	
		OR (95% CI)	**P value**	**OR** (95% CI)	**P value**
Dialysis	DOS	0.981 (0.968-0.994)	0.004	1.014 (1.004-1.025)	0.007
	Day 1	0.978 (0.967-0.989)	< 0.001	1.002 (0.991-1.013)	0.751
Cardiac	DOS	1.004 (0.997-1.011)	0.243	1.017 (1.010-1.024)	< 0.001
	Day 1	1.001 (0.994-1.007)	0.862	1.004 (0.997-1.012)	0.261
Mortality	DOS	0.996 (0.983-1.009)	0.515	1.016 (1.005-1.027)	0.003
Cumulative	DOS	1 (0.998-1)	0.975	1.01 (1.005-1.018)	< 0.001
	Day 1	0.998 (0.991-1.004)	0.502	1.004 (0.996-1.012)	0.363

Oral Session – Extra Corporeal Circulation

O-68
Hypothermic versus normothermic cardiopulmonary bypass in patients with valvular heart disease

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Introduction: Attempts to reduce the adverse effects of cardiopulmonary bypass (CPB) on patients have led to widespread use of hypothermia in adults. Up to date, most of the studies on the optimal temperature during CPB proved that hypothermia is lacking

the ability to reduce complication rates after cardiac surgery. On the other hand, routine use of hypothermia often requires prolonged CPB which tends to increase overall an embolic load to the patient. We hypothesised that normothermic CPB could be as safe as hypothermic perfusion in terms of cardiac protection and complication rates in valvular heart disease (VHD) patients.

Methods: 126 patients with VHD and without coronary artery disease were randomised equally to hypothermic (Hypo group, T = 31-32 °C) or normothermic (Normo group, T = 36 ± 0.5 °C) CPB. Primary and secondary endpoints were plasma troponin I concentration and post-CPB complication rates, respectively. Mann-Whitney *U* test with Holm correction was used for multiple comparisons of the two groups. A two-sided $P < 0.05$ was considered significant.

Results: Groups were comparable in demographics, duration of CPB and aortic cross-clamp time. Peri-operative levels of plasma troponin I did not differ significantly between the groups. During subgroups analysis, patients who had undergone isolated aortic valve intervention, demonstrated significantly lower levels of troponin I in the Hypo group compared to the Normo group at 6 h post-bypass, median (IQR) 4.3 (3.5-5.4) and 7.2 (5.6-9.9) ng · L^{-1}, respectively, $P < 0.05$. No other differences were found in levels of troponin I across the subgroups. Also, complication rates did not differ significantly between the groups and subgroups, based on the type of surgery.

Discussion: Hypothermic (31-32 °C) CPB only confers some cardioprotection to patients undergoing isolated aortic valve surgery. However, this effect is confined to biochemical changes as no improvement in clinical course was observed.

O-69
Optimisation of both macro and microcirculation with low dose noradrenaline confirmed by microvision imaging

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Introduction: Microvision is a side stream dark field (SDF) imaging tool allowing accurate analysis of sublingual micro vessel perfusion which reflects splanchnic microcirculation. This may offer the ability to identify early hallmarks of organ micro-malperfusion in Cardiac Intensive Care Units.

Methods: We conducted a prospective pilot study in 60 patients undergoing cardiac surgery using SDF imaging to assess sublingual microcirculation at pre- cardiopulmonary bypass CPB (T0), on CPB (T1), after rewarming on CPB (T2), on arrival in ICU (T3) and 6 hours post-arrival in ICU (T4). Microvascular flow was estimated with total vessel density (TVD), proportion of perfused vessels (PPV), microvascular flow index (MFI) and heterogeneity index (HI). Cardiac index was not analysed. Continuous data was analysed using Mann-Whitney U test. Kendall's tau rank correlation coefficient was used to measure association between variables.

Results: Early analysis of 16 patients is reported (Group A, 6 patients on low dose noradrenaline (NA) and Group B, 10 patients on no inotropes). NA was used to achieve mean arterial pressure MAP ≥ 65 mmHg. Log EuroSCORE was significantly higher in Group A ($P = 0.031$). Lactate and MAP were also higher in Group A at all intervals but significant only at T2 ($P = 0.042$). Deranged TVD, PPV, MFI and HI in Group A at T0 were normalised at T3 and T4. However this was not statistically significant. Lactate correlated significantly with TVD and PVD at T1, T2

(P = 0.027, P = 0.021) and with MFI at T4 (P = 0.028) in both groups.

Discussion: Preliminary results show adequate correlation between clinical data and microvision results. Use of low dose noradrenaline in optimisation of macrocirculation seems to have a positive effect on microcirculation normalisation as well. Completion of total data analysis will be necessary to confirm our finding.

O-70
On-pump CABG safety assessment using the artificial neural networks

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Introduction: As opposed to the minimised mortality rates after open-heart surgery in the last decades, the levels of CPB associated complications even after CABG still are not about zero. The EuroSCORE and QMMI (Quality Measurement and Management Initiative) scales are very good for pre-operative risk assessment, but the problem of intra-operative monitoring of CPB safety seems to be still unsolved. The one of most of interest is the group of patients in whom the routinely monitored parameters during CPB are within the reference range and is thought to be normal and safe, yet after the operation suffer organ disorders.

Methods: The data of 107 patients from two independent cardiac surgery centres were used retrospectively for neural network simulation. The patients were men and women from 42 to 73 years old (58.4 ± 8.5) with EuroSCORE risk = 2.3 ± 1.8%. They all underwent on-pump CABG.

Results: There was no statistical difference between groups by site. In the presence of one or more of the following conditions, the early post-operative period (first 6 days after the procedure) was assessed as complicated by acute renal failure or serum creatinine level more than 200 μmol · L^{-1} or increased 50% or more from the pre-operative level, respiratory disorders, lasting hypotension with the need of vasopressors and/or IABP, acute myocardial infarction, atrial fibrillation, mental disorders or stroke signs. The data of routine intra-operative monitoring (CBP and aortic cross-clamp duration, arterial and central venous blood pressure levels, serum lactate concentration, haematocrit level, PO_2 in the arterial and venous blood) were used to train the neural network to predict the occurrence of complications. The multilayer perception model was chosen as the best of more than 10,000 artificial neural networks (AUC = 0.986; P < 0.001). The predictive validity of this network was assessed on the test sample of 40 patients prospectively and found to be good with AUC = 0.839; P = 0.013.

Discussion: The artificial neural network was shown to be more effective in 'on-line' CPB-safety monitoring during on-pump CABG, especially in those patients in whom the routinely monitored parameters rates were not outside the reference range.

O-71
Myocardial sevoflurane postconditioning during cardiac operation with prolonged aorta cross-clamp period

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Introduction: The study was to assess the efficacy of pharmacological post-conditioning (PPC) of sevoflurane, in patients with a prolonged aorta cross-clamp time.

Methods: The data of 43 patients who underwent combined cardiovascular surgery was analysed. Myocardial protection was

provided using antegrade perfusion of the coronary arteries with cardioplegic solution "console" in a dose of 10 mL · kg^{-1} with reperfusion after 30 ± 2 minutes, during aortic cross-clamping. Extracorporeal circulation was with a central temperature of 33.4 ± 0.3 CO. The average cross-clamp time was 112 ± 7 min. Patients were divided into 2 groups. PPC group (n – 25), 20 minutes before aortic declamping and for the first 20 min of reperfusion sevoflurane was administered directly into the oxygenator of the CPB machine with a concentration to 2.0 vol%. In the CON group (n – 17), PPC was not used. The severity of ischaemic injury was assessed using lactate and glucose determined in blood from the coronary sinus, and ECG (ST dynamics, QRS width). To assess the damage from reperfusion, we use data of transoesophageal echocardiography (ejection fraction (EF); cardiac index (CI)), frequency of reperfusion arrhythmias (RA) and frequency of cardiotonic support (CS). Also we compared the inflammatory response by cytokines (IL-6, IL-8, TNF-α).

Results: Troponin-T CON – 0.87 ± 0.09 mmol · L^{-1}, PPC – 0.93 ± 0.15 mmol · L^{-1}; lactate CON 2.85 ± 0.24 mmol · L^{-1}, PPC 2.93 ± 0.18 mmol · L^{-1}; glucose CON 9.82 ± 1.13 mmol · L^{-1}, PPC 10.05 ± 1.13 mmol · L^{-1}. Thus the ischaemic protection was the same in both groups. RA was common: CON 35%, PPC 4%; CS CON 31%, PPC 4.5%; EF was CON 49 ± 2%, PPC 54 ± 3.5%; CI CON 1.90 ± 0.12 L · min^{-1} · m^{-2}, PPC 2.3 ± 0.11 L · min^{-1} · m^{-2}; IL-6 level CON 66.45 ± 2.73 pg · mL^{-1}, PPC 43.62 ± 3.12 pg · mL^{-1}; IL-8 CON 67.81 ± 2.74 pg · mL^{-1}, PPC 16.32 ± 3.32 pg · mL^{-1}; TNF-α CON 24.10 ± 1.13 pg · mL^{-1}, PPC 19.4 ± 2.04 pg · mL^{-1}.

Discussion: However, pharmacological post-conditioning by sevoflurane had a beneficial cardio-protective effect and reduced reperfusion injury of cardiomyocytes. Thus, it is justified to combine cardioplegia and sevoflurane pharmacological post-conditioning to protect the myocardium against reperfusion injury.

O-72
Putative biomarkers of acute kidney injury are related to the duration of cardiopulmonary bypass

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Introduction: The aim of this study was to determine the effects of cardiopulmonary bypass (CPB) duration on putative biomarkers of cardiac surgery associated acute kidney injury (CSA-AKI) and humoral markers of cardiopulmonary function in a heterogeneous cohort of cardiac surgery patients with preserved postoperative renal function in comparison with patients developing CSA-AKI.

Methods: This is a retrospective analysis of 136 consecutive patients enrolled in a prospective observation trial on the relation between pre-operative cerebral oxygen saturation and postoperative organ dysfunction in 2009. Plasma and urinary neutrophil-gelatinase-associated-lipocalin (NGAL), urinary kidney-injury-molecule-1 (KIM-1), urinary L-fatty-acid-binding-protein (L-FABP) and plasma N-terminal-pro-B-type-natriuretic-peptide (NTproBNP), high-sensitive-troponin-T (hsTNT), and growth-differentiation-factor-15 (GDF-15) were determined pre-operatively, immediately postoperatively, and on the morning of first to third postoperative days. Patients were grouped into "no AKI – CPB short" (CPBS: n = 51), "no AKI – long CPB" (CBPL: n = 56), and "AKI" (n = 29) according to the AKI network criteria [1] and the median duration of CPB in this cohort (118 min).

Results: Plasma and urinary levels of NGAL, urinary KIM-1 and L-FABP as well as NT-proBNP and hsTNT showed a significant increase in the CPBL and the AKI groups in comparison with the CPBS group. Putative

AKI-biomarkers failed to conclusively discriminate between patients developing AKI or not in the early postoperative period and on the first postoperative day. Plasma GDF-15 levels were significantly different at baseline and showed a pronounced increase in the AKI group. Multivariate analysis revealed that only GDF-15 levels before and immediately after surgery were independent predictors of AKI in this cohort of patients.

Discussion: Duration of CPB is an important confounder for the expression of putative AKI biomarkers in cardiac surgery patients. The present data suggest that CPB-time has to be taken into account when defining cut-off levels for NGAL, KIM-1, and L-FABP for the early detection of AKI in this setting and question the clinical usefulness of these peptides without adjustments for potential confounders. The findings regarding the humoral stress marker GDF-15 require confirmation in an independent sample.

References

[1] Mehta RL, Kellum JA, Shah SV, et al. Acute kidney injury network: report of an initiative to improve outcomes in acute kidney injury. Crit Care 2007; 11: R31.

O-73
Blood lactate level and venous oximetry in cardiac surgery patients

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Introduction: Central venous oxygen saturation ($ScvO_2$) reflects the balance between oxygen delivery and oxygen demand. Hyperlactataemia during cardiopulmonary bypass (CPB) is a common event and is associated with a high morbidity after cardiac operations. The objective was to assess the association between central venous oxygen saturation ($ScvO_2$) and arterial lactate with complications in patients undergoing elective cardiac surgery.

Methods: This was a prospective observational study on 96 patients undergoing cardiac surgery with CPB in a tertiary university hospital. Serial $ScvO_2$ and blood lactate assays were performed during CPB and after ICU admission. Complications included development of renal dysfunction or failure; prolonged ventilation; shock; cardiac arrest; heart failure, or acute respiratory distress syndrome, respiratory failure, sepsis, or an infection.

Results: Total number of patients included in the study was 96, average age 62.7 ± 9.1 years. Postoperative complications were recorded in 17 patients. Patients with complications had significantly longer hospital length of stay (LOS) (11.5 ± 4.3 vs. 8.2 ± 2.7 days, P = 0.000), ICU LOS (107.9 ± 61.6 vs. 44.8 ± 41.3 hours, P = 0.000), longer duration of mechanical ventilation (18.9 ± 14.4 vs. 14.2 ± 4.6 hours, P = 0.015), higher lactate values 10 minutes after de-clamping of the aorta during cardiopulmonary bypass (4.7 ± 8.7 vs. 2.6 ± 1.0 mmol · L^{-1}, P = 0.032), on ICU the highest lactate value (4.2 ± 2.0 vs. 3.0 ± 1.4 mmol · L^{-1}, P = 0.003), higher $ScvO_2$ 10 min. after cardiopulmonary bypass (78.3 ± 6.3 vs. 73.9 ± 8.9 P = 0.029) and higher WBC count on ICU arrival (15.5 ± 5.4 vs. 10.5 ± 4.8, P = 0.001). These patients also exhibited numerically higher $ScVO_2$ on ICU arrival (72.2 ± 6.6 vs. 67.9 ± 10.7, P = 0.125), although none proved to be statistically significant.

Discussion: Hyperlactataemia during cardiopulmonary bypass is related to a condition of insufficient oxygen delivery. Cardiac surgery is associated with an inflammatory reaction that may promote microcirculatory alterations and organ dysfunction, associated with intensive care unit (ICU) length of stay and morbidity. Combined analysis of $ScVO_2$ and lactate levels may be used to identify patients at risk for postoperative complications.

References

[1] Hu BY, laine GA, Wang S, et al. Combined central venous oxygen saturation and lactate as markers of occult hypoperfusion and outcome following cardiac surgery. J Cardiothorac Vasc Anesth 2012; 26: 52-57.

[2] Ranucci M, Isgrò G, Carlucci C, et al. Central venous oxygen saturation and blood lactate levels during cardiopulmonary bypass are associated with outcome after pediatric cardiac surgery. Critical Care 2010; 14: R149.

Oral Session – "Quality Management"

O-74
Patient experience end satisfaction with cardiac anaesthesia: a dual centre service evaluation study

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Introduction: Positive patient experience and satisfaction is an important outcome measure of service quality. Quantifying patients' perceptions may guide quality improvement measures for anaesthetic service provision.

Methods: SOPPCAS (scale of patients' perceptions of cardiac anaesthesia services) is a validated psychometric tool [1]. All eligible patients undergoing elective major cardiac surgery were given a SOPPCAS questionnaire for completion on postoperative day four or five during a five week period. All questionnaires were coded to maintain patient anonymity during data collection and analysis.

Results: A 76% response rate across both Trusts was achieved from 124 eligible elective cases undertaken. In general, patients reported high levels of satisfaction with their peri-operative interaction with the anaesthetic service. 64% of patients reported postoperative pain, but this was relieved effectively in the majority. The SOPPCAS revealed a significant incidence of several complications such as nausea (35%), vomiting (28%), sleep disturbance (58%), sore throat (35%) and hallucinations (31%). 8 out of 124 patients reported being conscious between onset of anaesthesia and end of operation. Further investigation is underway to re-examine the reliability of this particular question and whether these responses did indeed manifest true awareness.

Discussion: This study presents important feedback relating to patients' perceptions of their peri-operative journey and may serve as a robust tool for service evaluation. Service improvement at our institutes will focus on reduction of reported pain and other complications. With the advent of professional revalidation, evidence of patient satisfaction with anaesthetic care is likely to become a major aspect of staff appraisal.

References

[1] Le May S, Hardy JF, Harel F, et al. Patients' perception of cardiac anaesthesia services: a pilot study. Can J Anaesth 2001; 48: 1127-1142.

O-75
Management and outcome of out-of-hospital cardiac arrest

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Introduction: There are around 50,000 cardiac arrests in the UK each year. One eighth of these patients are admitted to ICU and a third of them survive until ICU discharge [1]. Cooling patients after VF out-of-hospital cardiac arrest (OHCA) who remain comatose with spontaneous circulation to a temperature of 32-34 °C for 12-24 hours has been shown to improve outcome [2]. There is also

benefit from therapeutic hypothermia after non-VF arrest [3].

Methods: We retrospectively examined electronic patients' records of 65 OHCA patients admitted to our unit over 2 years with a total stay of 334 ICU days. Fifty one of these patients were actively cooled. We systematically reviewed patient management, complications and outcome.

Results: The mean patient age was 59 years; about a third of the patients had known cardiac disease before presentation. Initial heart rhythm was VF in 73% of cases and bystander CPR was performed in 91% of patients. The mean cardiac arrest duration was 24 min and the mean Glasgow Coma Score (GCS) after restoration of circulation was 4.8. Angiographic evidence of coronary artery disease was established in 77% of cases. Active cooling started after a mean duration of 4.5 hours using Blanketrol® in 42 cases and conventional cooling methods in 9 cases. Left ventricular systolic impairment was observed in 76% of patients, half of the patients required IABP, 88% required inotropes and 66% required muscle paralysis. During cooling, arrhythmias were observed in half of the cases, 16% developed seizures, 39% were treated for pneumonia, 10% required tracheostomy and 4 patients had further cardiac arrest in ICU. During rewarming 18% of patients had temperature overshoot of ≥ 38°C. Survival rate was 66% with 53% of survivors having GCS of 15 and 72% having GCS of ≥ 14 at the time of discharge. Three of the surviving patients had persistent focal neurological deficit.

Discussion: Our study showed a high survival rate and good neurological outcome, supporting the benefit of cooling. Care of these patients is resource intensive with a relatively high rate of complications and an average ICU stay of 5.1 days.

References

[1] Nolan JP, Laver SR, Welch CA, et al. Outcome following admission to UK intensive care units after cardiac arrest: a secondary analysis of the ICNARC Case Mix Programme Database. Anaesthesia 2007; 62: 1207-1216.

[2] Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. N Engl J Med 2002; 346: 549-556.

[3] Bernard SA, Jones BM, Horne MK. Clinical trial of induced hypothermia in comatose survivors of out-of-hospital cardiac arrest. Ann Emerg Med 1997; 30: 146-153.