



# **EACTA 2007 Abstracts**

**The 22nd Annual Meeting of the  
European Association of Cardiothoracic Anaesthesiologists**

## **Edited by**

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## Organ Function and Protection

## O-01

**Effects of mannitol alone and mannitol plus furosemide on renal oxygen consumption, blood flow and glomerular filtration rate after cardiac surgery**

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**Introduction:** Mannitol is often used to increase urine output in oliguric acute renal failure (ARF) [1] and is frequently included in the priming solution of the heart-lung machine. Mannitol increases tubular sodium load and might potentially increase tubular sodium reabsorption and oxygen demand. We studied the effects of mannitol on renal oxygen consumption (RVO<sub>2</sub>), blood flow (RBF), oxygen supply/demand relationship and glomerular filtration rate (GFR).

**Method:** Mechanically ventilated and sedated patients (n = 10) with a normal preoperative serum creatinine were studied after uncomplicated cardiac surgery. After control measurements, all patients received mannitol (150 mg/mL, 1.5 mL/kg + 0.5 mL kg<sup>-1</sup> h<sup>-1</sup>), followed by the addition of furosemide (Furo, 0.25 mg/kg + 0.25 mg kg<sup>-1</sup> h<sup>-1</sup>). RBF was measured by retrograde thermodilution of the left renal vein. Arterial and renal vein oxygen content were analysed for measurement of RVO<sub>2</sub> and renal O<sub>2</sub> extraction (RO<sub>2</sub>Ex). Renal filtration fraction (FF) was measured by renal extraction of Cr-EDTA, and GFR was calculated as the product of FF and renal plasma flow = RBF × (1-Hct). Cardiac output was measured by a pulmonary artery catheter. Analysis of variance for repeated measurements (ANOVA) was used followed by paired *t*-tests.

**Results:**

	Control	Mannitol	Mannitol + Furo
MAP (mmHg)	80 ± 1	82 ± 2	83 ± 1
Cardiac output (l/min)	4.9 ± 0.3	4.8 ± 0.3	4.5 ± 0.4
RBF (ml/min)	550 ± 75	540 ± 91	544 ± 98
GFR (ml/min)	56 ± 7	59 ± 10	41 ± 8 <sup>#</sup>
RVO <sub>2</sub> (ml/min)	7.6 ± 0.8	9.0 ± 1.0 <sup>**</sup>	7.9 ± 0.9 <sup>#</sup>
RO <sub>2</sub> Ex (%)	10.7 ± 1.0	13.1 ± 1.4 <sup>**</sup>	11.4 ± 1.3 <sup>#</sup>
Urine flow (ml/min)	3.5 ± 0.5	5.4 ± 1.0 <sup>*</sup>	21.1 ± 2.6 <sup>###</sup>

\**P* < 0.05, \*\* < 0.01 mannitol vs control; <sup>#</sup>*P* < 0.01, <sup>###</sup> < 0.001 mannitol + furo vs. mannitol

**Conclusion:** Mannitol increases RVO<sub>2</sub>, which is not matched by a similar increase in RBF. Mannitol might thus impair renal oxygenation in ischaemic ARF. Furosemide blunts the mannitol-induced increase in RVO<sub>2</sub> most likely due to inhibition of tubular sodium reabsorption. Mannitol alone should be used with caution in ARF or should be combined with furosemide to avoid renal ischaemia.

**Reference:**

- 1 Sirivella S, Gielchinsky I, Parsonnet V. Mannitol, furosemide and dopamine infusion in postoperative renal failure complicating cardiac surgery. *Ann Thorac Surg* 2000; **69**: 501–506.

## O-02

**Do changes in brain venous pressure correlate with S100β blood concentrations during CABG?**

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**Introduction:** Central nervous system (CNS) injury is one of the main problems in patients undergoing coronary artery by-pass grafting (CABG). One factor is disorder of the brain circulation. The influence of brain venous pressure (BVP) on CNS damage has not been defined. The S100β protein is a very sensitive brain injury marker. The aim of the study was to analyse the correlation between changes in brain venous pressure (BVP) and S100β blood concentration in patients undergoing CABG.

**Method:** Patients having CABG under general anaesthesia, with ECC and normovolaemic haemodilution (NH), were examined. BVP was measurement at 11 stages after retrograde cannulation of the right jugular bulb: 1. just after radial artery cannulation; 2. during mammary artery preparation; 3.5 min after ECC starting; 4. during aorta cross clamping; 5. just before finishing ECC; 6. 10 min after finishing ECC; 7. just after surgery; 8. six hours after the operation; 9. in the morning of the 1st postoperative day; 10. on the evening of the 1st postoperative day; 11. in the morning of the 2nd postoperative day. The S100β blood concentration was measured in stages 1, 6, 7, 9, 11. The immunoassay method was used for S100β measurement. The Wilcoxon, U-test

and Spearman correlation test were used for statistical analysis. *P* < 0.05 was considered as significant.

**Results:** Fifty patients (41 men and 9 women) aged 53–72 were examined. BVP increased from stages 3 to 5 and at stage 7. Decreased levels of this variable were also observed at stages 9, 10 and 11. S100β increased at stages 6, 7, 9 and 11. There was significant correlation between BVP and S100β at stage 7 and between stage 2 (BVP) and stages 6, 7 (S100β), 3 (BVP) and 6, 7 (S100β), 5, 6 (BVP) and 7 (S100β).

**Discussion:** The increase of BVP may result in: transient global amnesia, headache and neurone-organic brain damage [1]. The raised BVP may effect an increase of brain water, possibly venous thrombosis or brain ischaemia. Therefore, it may be seen as one factor causing CNS dysfunction in patients after CABG. This pathology may be confirmed by an increase of S100β protein, since it is a useful marker for brain injury.

**Conclusions:** CABG resulted in an increase of brain venous pressure and blood S100β concentrations. The increase of S100β correlated with changes in brain venous pressure.

**Reference:**

- 1 Maalikiy Akkawi N, Agosti C, Anzola GP, et al. Transient global amnesia: a clinical and sonographic study. *Eur Neurol* 2003; **49**: 67–71.

## O-03

**Effects of vasopressin (AVP) on intestinal mucosal perfusion in patients with norepinephrine-dependent vasodilatory shock after cardiac surgery**

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**Introduction:** Vasopressin (AVP) has been suggested to be an alternative vasopressor drug for treatment of postcardiotomy vasodilatory shock (VS) [1]. We evaluated the effects of AVP on intestinal and gastric mucosal perfusion and haemodynamics in norepinephrine-dependent VS after cardiac surgery.

**Method:** Eight mechanically ventilated patients with VS after cardiac surgery and multiple organ failure with a cardiac index (CI) exceeding 2.5 litre min<sup>-1</sup> m<sup>-2</sup>, were included. After institutional ethics committee approval, informed consent was obtained from the closest relative. Incremental doses of AVP (1.2, 2.4, 4.8 U/h) were administered sequentially during three 30-minute periods. Norepinephrine (NE) dose was simultaneously decreased to maintain a constant mean arterial pressure (MAP) of 75 mmHg. Data on systemic (syst) haemodynamics (pulmonary artery catheter), jejunal mucosal perfusion (JMP), (endoluminal jejunal laser Doppler flowmetry) as well as gastric-arterial Pco<sub>2</sub> gradient (gastric tonometry) and splanchnic (Spl) oxygen and lactate (lact) extraction (hepatic vein catheter) were obtained during each period. Analysis of variance for repeated measurements (ANOVA) was used for statistical evaluation.

**Results:**

	Control	1.2 U/h	2.4 U/h	4.8 U/h	ANOVA
NE ng kg <sup>-1</sup> min <sup>-1</sup>	406 ± 317	297 ± 303	284 ± 251	229 ± 205	<0.01
S-AVP pg/mL	3.1 ± 1.8	24.0 ± 7.7	42.8 ± 12.8	89.0 ± 23.0	<0.0001
CI litre min <sup>-1</sup> m <sup>-2</sup>	2.9 ± 0.4	2.7 ± 0.5	2.5 ± 0.5	2.4 ± 0.6	<0.01
SVRI	1726 ± 304	2021 ± 504	2114 ± 537	2247 ± 703	<0.05
DO <sub>2</sub> l min <sup>-1</sup> m <sup>-2</sup>	414 ± 61	377 ± 60	356 ± 51	334 ± 62	<0.01
Syst O <sub>2</sub> extr %	33 ± 6	34 ± 5	37 ± 5	39 ± 8	<0.05
JMP (PU)	264 ± 56	266 ± 57	238 ± 68	210 ± 60	<0.01
Pco <sub>2</sub> grad kPa	2.2 ± 0.7	2.6 ± 0.8	3.3 ± 1.2	4.0 ± 1.1	<0.0001
Spl O <sub>2</sub> extr %	71 ± 18	72 ± 19	72 ± 19	73 ± 18	n.s.
Spl lact extr %	32 ± 18	26 ± 17	26 ± 16	25 ± 10	n.s.

DO<sub>2</sub>: systemic oxygen delivery index, SVRI; systemic vascular resistance index

**Conclusions:** Substituting NE for AVP, at a certain MAP, induces a dose-dependent intestinal mucosal vasoconstriction and impairs the gastric mucosal oxygen demand/supply relationship. AVP should be used with caution in vasodilatory shock after cardiac surgery.

**Reference:**

- 1 Dünser MW, Mayr AJ, Stallinger A, et al. Cardiac performance during vasopressin infusion in postcardiotomy shock. *Intensive Care Med* 2002; **28**: 746–751.

## O-04

**Cerebral energy metabolism and ultrastructure during cardiopulmonary bypass in pigs. Effects of different perfusion pressures**

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**Introduction:** Postoperative neurological dysfunction after cardiac surgery is common and the aetiology not fully understood. Recently we reported that a mean arterial pressure (MAP) of 40 mmHg by infusion of nitroprusside was associated with cerebral anaerobic metabolism in pigs during cardiopulmonary bypass (CPB). The present study addressed whether hypotension induced by phentolamine leads to similar metabolic changes during CPB.

**Method:** Sixteen pigs underwent 60 minutes of normothermic and 90 minutes of hypothermic CPB. A low pressure group (LP-group,  $n = 8$ ) was given phentolamine to keep MAP at about 40 mmHg. A high pressure group (HP-group,  $n = 8$ ) had norepinephrine to achieve MAP of 60–80 mmHg. Intracranial pressure (ICP) was measured and cerebral perfusion pressure (CPP) calculated. Brain tissue levels of glucose, lactate, pyruvate and glycerol were measured by microdialysis. From two animals in each group, cortical brain tissue was examined by electron microscopy, to determine the fraction of mitochondria with swelling, matrix clearing or destruction of cristae. Results are as mean (SD). Repeated measurements ANOVA with post-tests when appropriate and Fisher's exact test, were performed (SPSS 13.0).

**Results:** ICP increased during CPB to 26.6 (7.5) mmHg and 22.8 (4.5) mmHg in the HP-group and the LP-group, respectively (both  $P < 0.01$ ). No between-group differences were found. CPP differed significantly between the groups with 47.8 (8.0) mmHg and 23.5 (5.7) mmHg in the HP-group and the LP-group, respectively, at end of normothermic CPB ( $P < 0.001$ ). Cerebral glucose fell from 2.6 (0.9) to 1.5 (1.1) mmol/L in the LP-group ( $P < 0.05$ ) while it remained stable in the HP-group ( $P > 0.05$ ) during normothermic CPB. Lactate/pyruvate ratio increased from 14.5 (7.6) to 35.7 (23.8) in the LP-group ( $P < 0.05$ ) during normothermic CPB while the values remained stable below 20 in the HP-group ( $P > 0.05$ ). Cerebral glycerol of the LP-group was elevated from 27.5 (25.2) to 75.6 (55.4)  $\mu\text{mol/L}$  during normothermic CPB ( $P < 0.05$ ) while the values of the HP-group were stable below 50  $\mu\text{mol/L}$  ( $P > 0.05$ ). The fraction of cortical mitochondria with two of three criteria of pathology present, was 8.3% and 31.2% in the HP-group and the LP-group respectively ( $P < 0.001$ ).

**Conclusion:** A MAP of 40–45 mmHg during normothermic CPB, may lead to cerebral ischaemia, anaerobic metabolism and degradation of cellular membranes.

## O-05

### The effect of mannitol on renal function after CPB in patients with preoperative renal dysfunction

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**Introduction:** Renal dysfunction and failure after cardiopulmonary bypass (CPB) have a significant influence on postoperative morbidity and mortality. Mannitol has been widely used to preserve renal function during CPB, although there is little evidence that it is effective.

**Method:** We recruited 38 patients having routine cardiac surgery, whose serum creatinine was between 130 and 250  $\mu\text{mol L}^{-1}$ . Patients on any form of dialysis were excluded. Power analysis based on our previous studies [1] gave 16 individuals in each group to detect a 10% difference in either serum creatinine or urine output for a power of 90% at  $P = 0.05$ . Patients received a standardized anaesthetic based on fentanyl 10  $\mu\text{g kg}^{-1}$  and a propofol infusion at 3–4  $\text{mg kg}^{-1} \text{hr}^{-1}$ . All patients received aprotinin according to the Hammersmith regimen. The CPB circuit was primed with 1000 mL Hartmann's solution, 500 mL succinyl-linked gelatine, and 5000 iu heparin. Patients were randomly allocated to one of two groups. The treatment group receiving 0.5  $\text{g kg}^{-1}$  mannitol in the CPB prime and the control group receiving an equivalent volume of Hartmann's solution. The staff caring for the patient in theatre and on ICU were blinded to randomization. Intra-operative and postoperative fluid management were according to a standard protocol. Creatinine, urea and sodium concentrations, and daily fluid intake and output, were recorded daily from the day of surgery to day 3 post-operatively. Statistical analysis was by ANOVA using SPSS.

**Results:** We recruited 17 patients to the mannitol group and 21 patients to the control group, but in all other respects the groups were comparable. There were no significant differences between the groups in urea, creatinine or sodium concentrations, or in urine output in the postoperative period.

**Discussion:** Mannitol 0.5  $\text{g kg}^{-1}$  in the CPB prime does not appear to preserve renal function in patients with established preoperative renal dysfunction. This is in keeping with our previous results for patients with normal renal function [1].

#### Reference:

- 1 Yallop K, Twyman S, Tang A, et al. Mannitol in the bypass prime does not modify renal tubular function. *Eur J Anaesthesiol* 2003; **20**(Suppl 29): 18.

## Postoperative Care

### O-06

#### Is a more aggressive antithrombotic therapy warranted after coronary artery bypass grafting?

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**Introduction:** Many investigations focus on the differences in haemostatic response in patients undergoing coronary artery bypass grafting with (CABG) or without (OPCAB) the use of the heart-lung machine. OPCAB patients were found to be potentially more hypercoagulable compared to CABG [1] and thus were given Klexane postoperatively for 4 days in addition to aspirin, whereas CABG patients only receive aspirin. We evaluated the influence on the haemostatic system in patients undergoing OPCAB and CABG surgery with the whole blood coagulation test Thrombelastography (TEG) in the postoperative period until discharge.

**Method:** Patients scheduled for elective OPCAB ( $n = 29$ ) or CABG ( $n = 24$ ) were monitored with TEG prior to surgery (baseline) and at days 1 and 4 post-operatively. The TEG parameter maximal amplitude (MA) was investigated and Wilcoxon's test was performed with  $P < 0.05$  considered statistically significant.

**Results:** No demographic differences between groups were found. Twenty-three percent of the patients had a preoperative TEG MA above the normal range and at day 4 this was increased to 88%. No difference between groups in the TEG MA between baseline and day 1 was found, whereas a significant increase in TEG MA on day 4 compared to baseline was demonstrated for both groups ( $P < 0.001$ ). The OPCAB patients had a significantly higher TEG MA at day 1 compared to CABG patients ( $P < 0.05$ ).

**Discussion:** The TEG MA, a marker of platelet function, correlated with the incidence of thrombotic complications and ischaemic events in non-cardiac surgical patients and in patients undergoing percutaneous coronary interventions [2,3]. Here we preoperatively identified 23% of the patients to be in

the risk zone of developing a recurrent ischaemic event by having a TEG MA above the normal reference. This hypercoagulable state is significantly elevated at day 4, pointing towards a period with high haemostatic activity and thus increased risk of recurrent ischaemic events or thrombosis. Based on previous data [2,3] and the present findings it is worth considering introducing a more aggressive antithrombotic protection such as clopidogrel or Klexane in those patients with preoperatively high TEG MA values, not only in OPCAB but also in CABG patients.

#### References:

- 1 Møller CH, Steinbrüchel DA. Platelet function after coronary artery bypass grafting: is there a procoagulant activity after off-pump compared with on-pump surgery? *Scand Cardiovasc J* 2003; **37**: 149–153.
- 2 McCrath DJ, Cerboni E, Frumento RJ, et al. Thromboelastography maximum amplitude predicts postoperative thrombotic complications including myocardial infarction. *Anesth Analg* 2005; **100**: 1576–1583.
- 3 Gurbel PA, Bliden KP, Guyer K, et al. Platelet reactivity in patients and recurrent events post-stenting: results of the PREPARE POST-STENTING Study *J. Am Coll Cardiol* 2005; **46**: 1820–1826.

### O-07

#### A practical regimen for amiodarone use in preventing postoperative atrial fibrillation

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**Introduction:** Postoperative atrial fibrillation occurs in 5%–65% of patients undergoing cardiac surgery. Although postoperative AF is often regarded as

a temporary, benign, operation-related problem, it is associated with a two- to threefold increase in risk of adverse events, including permanent or transient stroke, acute myocardial infarction and death.

**Method:** Two-hundred-and-fifty eligible consecutively enrolled Coronary Artery Bypass Grafting patients were included in this randomized, controlled, double-blinded trial.

They received 300 mg of amiodarone or placebo administered intravenously over twenty minutes on the first postoperative day and an oral dose of 600 mg of amiodarone or placebo twice per day for the first five postoperative days.

**Results:** The patients receiving amiodarone prophylaxis experienced a reduction in risk of atrial fibrillation of 14% (5.0–24), with the number needed to treat 6.9 (4.2–20), while the results regarding symptomatic atrial fibrillation showed a risk reduction of 18% (9.4–26), with the number needed to treat 5.7 (3.9–11). Eighty-four percent of patients developing atrial fibrillation in the placebo group experienced a symptomatic attack versus only 43% in the amiodarone group.

**Conclusions:** Postoperative prophylaxis with a high dose of oral amiodarone after an intravenous bolus infusion is a safe, practical, feasible, and effective regimen for Coronary Artery Bypass Grafting patients. It significantly diminishes the occurrence of postoperative atrial fibrillation.

## O-08

### A predictive model for prolonged mechanical ventilation in a cohort of 5123 cardiac surgical patients

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**Introduction:** Prolonged mechanical ventilation (PMV) after heart surgery is associated with increased patient morbidity and mortality (4.9% vs. 22–38%) [1]. The aim of this prospective observational cohort study was to assess PMV predictors and their impact on ICU and hospital length of stay and survival in a cardiac surgical patient cohort admitted to our 8 bedded ICU, from 1997 to June 2005.

**Method:** All the patient pre-, intra- and post-operative variable were prospectively put into an electronic database. Patients were eventually divided into: (i) Early Extubation (EE) group, undergoing a successful extubation within 24 h; (ii) Delayed Extubation (DE) group, needing mechanical ventilation longer than 24 h.  $P < 0.05$  was considered statistically significant.

**Results:** A total of 5123 patients, with a median (IQR) age of 67 yr (59–73) were admitted. 63.5% underwent a CABG operation, 22.8% valve surgery and 13.6% aortic and lung surgery. A multivariate logistic regression model allowed us to identify chronic renal failure (OR = 1.5, 95% CI = 1.1–2.3), CCS or NYHA > 2 (OR = 2.1, 95% CI = 1.4–3.1), CPB time > 90 min (OR = 3.9, 95% CI 1.1–4.4), RBC transfusions > 4 units (OR = 6.8, 95% CI = 4.1–11.3) and experiencing a VAP (OR = 83.3, 95% CI = 41.6–166.6) as independent predictors of PMV. EE group showed a higher cumulative likelihood of being discharged from (i) ICU (Log-Rank = 1189.4,  $P = 0.0000$ ); (ii) cardiac surgical ward (Log-Rank = 550.3,  $P = 0.0000$ ); (iii) a significantly higher cumulative survival within 180 days from ICU admission (Log-Rank = 99.1,  $P = 0.0000$ ). The cumulative chance of being discharged (i) from ICU to the cardiac surgical ward overlapped for the first ICU day, whereas eventually it increased significantly in the EE group (Log-Rank = 1189.4,  $P = 0.0000$ ); (ii) from the cardiac surgical ward to a rehabilitation ward after overlapping in the first 5–6 days from ICU discharge, the probability was significantly higher in the EE group (Log-Rank = 550.3,  $P = 0.0000$ ).

**Conclusions:** This audit allowed us to define a predictive model helping us to identify patients likely to undergo PMV. These results ushered in crucial changes in our daily policy as we implemented (i) a shared preoperative policy of volume management therapy in patients with renal insufficiency (ii) our strategies to control the inflammatory response following cardiac surgery (iii) the use of early tracheostomy in the patient likely to undergo PMV.

#### Reference:

- Goldman SM, Sutter FP, Wertan MA, et al. Outcome improvement and cost reduction in an increasingly morbid cardiac surgery population. *Semin Cardiothorac Vasc Anesth* 2006; 10(2): 171–175.

## O-09

### Evaluation of the subcutaneous route for glucose monitoring in patients undergoing deep hypothermia

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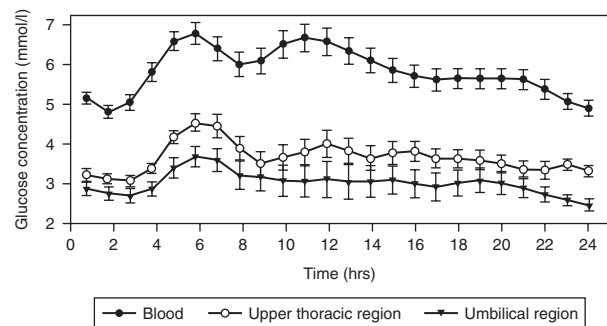
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**Introduction:** Tight glycaemic control improves outcome in critically ill patients but requires frequent glucose measurements. Subcutaneous adipose tissue (SAT) has been characterized as promising for glucose monitoring in diabetics, but it remains unknown whether it can also be used as an alternative site in critically ill patients. In our previous study [1] we demonstrated that in cardiac surgery, patients arterial blood glucose (BG) fluctuations are well described using interstitial fluid glucose measurements from SAT. The present study was performed to evaluate the correlation of glucose in SAT compared with BG in patients undergoing pulmonary endarterectomy (PEA) with deep hypothermia.

**Method:** Twenty patients undergoing perioperative deep hypothermia during PEA were investigated for 24 hours. Arterial blood and SAT microdialysis samples from umbilical and upper thoracic adipose tissues were taken hourly. The glucose concentration in dialysate was calibrated using a two-step approach, first using ionic reference technique to calculate the SAT glucose concentration (SATg) and second, using a one-point calibration procedure to obtain a glucose profile comparable to SAT-derived blood glucose (BgSAT).

**Results:** The correlation between BgSAT and arterial blood glucose (BG) was found with mean  $0.74 \pm 0.17$  ( $P < 0.01$ ) for upper thoracic tissue and  $0.74 \pm 0.23$  ( $P < 0.01$ ) for the umbilical region.



**Discussion:** The results indicate good correlation between SAT and BG even in patients with extreme hypothermia. Our data suggests that with minor limitations, glucose from SAT can be used to establish tight glycaemic control in critically ill patients.

#### Reference:

- Ellmerer M, Haluzik M, Blaha J, et al. Clinical evaluation of alternative-site glucose measurements in patients after major cardiac surgery. *Diabetes Care* 2006; 29: 1275–1281.

## O-10

### Immediate angiography in perioperative myocardial infarction after coronary surgery

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**Introduction:** Perioperative myocardial infarction (PMI) may occur in 5 to 10% of patients following CABG and can account for 60 to 70% of postoperative in-hospital deaths [1]. Immediate postoperative angiographic control in patients with signs of myocardial ischaemia offers additional diagnostic and therapeutic modalities.

**Method:** In a population of 3636 pts after primary CABG a group of 51 pts with diagnosis of PMI who underwent immediate angiography was identified (Group A) and compared with a randomly chosen control group of 50 elective primary CABG pts (Group B). PMI diagnosis was based on the European Society of Cardiology criteria and our own algorithm. Epidemiology and early results were compared between groups. Chi-squared and Student's *t* tests were used for statistical analysis.  $P < 0.05$  was considered significant.

**Results:** In Group B PMI was diagnosed in 7.9% of patients. Group A patients were older (65.12 yr vs. 61.42 yr), had a higher incidence of extracardiac arteriopathy (30% vs. 6%), left-main coronary stenosis (34% vs. 14%) and higher mortality (29.4% vs. 0%) compared with Group B. In Group A angiography revealed incomplete revascularization (51%), critical stenosis of graft distal anastomosis (38%), native coronary stenosis in site of anastomosis (8%), no pathology of graft anastomosis (28%), internal mammary artery pathology (24%), and coronary spasm (14%). In 20 cases (39%) a decision was made for repeat revascularization: re-do CABG (10%) and PCI (29%), while the remaining patients were treated medically, including IABP. In Group A a subset of patients who underwent repeat revascularization had a lower mortality than patients treated medically (15% vs. 38.7%).

**Discussion:** Extracardiac arteriopathy was the strongest predictor of PMI in the studied population, which is in accordance with the EuroSCORE system. Diagnosis of PMI based on a locally accepted algorithm should suggest the necessity of performing immediate postoperative angiography. Acute angiography allows optimizing treatment of patients with PMI.

## Myocardial Protection

### O-11

#### Mid-term significance of release of myocardial necrosis markers after off-pump coronary artery bypass grafting

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**Introduction:** Myocardial damage, measured by means of cTnI and CK-MB, is less pronounced in OPCAB compared to on-pump CABG. However, the threshold over which postoperative release of cTnI and CK-MB after OPCAB should be considered clinically relevant is still unknown. The primary end-point of the study was to evaluate the power of postoperative cTnI and CK-MB to predict mid-term survival after OPCAB. The secondary end-point was to evaluate their ability to predict hospital morbidity and mortality.

**Method:** Observational, single centre, retrospective study. 261 unselected patients undergoing OPCAB had cTnI and CK-MB measured pre-operatively and 9 times post-operatively. The study population was divided by means of the following cut-offs: 7.1 ng/ml for cTnI peak and 36.3 ng/ml for CK-MB peak.

**Results:** Patients with cTnI > 7.1 ng/ml or CK-MB > 36.3 ng/ml, had a longer mechanical ventilation and ICU length of stay. Nevertheless, hospital mortality did not differ between groups. Mid-term survival was 91.4 ± 2.6 and 73.6 ± 9.6% for patients with postoperative cTnI peak ≤ 7.1 ng/ml and > 7.1 ng/ml respectively ( $P = 0.003$ ). It was 91.5 ± 2.6% and 72.7 ± 9.3% for patients with CK-MB ≤ 6.3 ng/ml and > 36.3 ng/ml respectively ( $P = 0.005$ ). Adjusted hazard ratios for mid-term mortality were HR 2.72,  $P = 0.05$  for cTnI > 7.1 ng/ml and HR 3.06,  $P = 0.04$  for CK-MB > 36.3 ng/ml.

**Discussion:** Myocardial damage provoked during OPCAB should not be considered an innocuous event since mid-term survival is significantly worse in patients with higher postoperative peaks of cTnI and CK-MB. Nevertheless, the release of cTnI and CK-MB seem not to have the same predictive role on short term outcome.

### O-12

#### Does esmolol only act as a $\beta$ -blocker? A novel mode of action at higher doses in rats

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**Introduction:**  $\beta$ -blockade during cardiopulmonary bypass is a popular practice in anaesthesia for cardiac surgery. Esmolol, as an ultra-short acting  $\beta$ -blocker, is used to treat perioperative hypertension and arrhythmia. It has also been used at high (mM) doses during cardiac cardiopulmonary bypass for myocardial protection. We have previously demonstrated, in the isolated perfused rat heart, that infusion of 1 mM esmolol induces cardiac arrest [1]. However, there is no *a priori* reason why a  $\beta$ -blocker should induce complete arrest to an *in vitro* heart. In this study, we have characterised the mode of action of esmolol at higher doses used in cardiac surgical anaesthesia at the myocardial cell level.

**Method:** Isolated rat ventricular myocytes were superfused with Krebs buffer solution and electrically stimulated. Myocyte contractility was measured by recording sarcomere shortening. The calcium (Ca) transient was recorded (using the Ca-sensitive fura-2 340/380 dual wavelength fluorescence) during contractions.

**Results:** Esmolol (0.3 mM) decreased the sarcomere shortening of the myocytes by 72% from a control value of  $0.157 \pm 0.014 \mu\text{m}$  to  $0.044 \pm 0.01 \mu\text{m}$  (mean ± S.E,  $n = 7$ ) ( $P < 0.0001$ ). The corresponding Ca transient amplitude fell from  $0.129 \pm 0.02$  (control) to  $0.069 \pm 0.0164$  with esmolol ( $P < 0.001$ ), a decrease of 47%. In contrast, atenolol (1 mM), did not affect the sarcomere shortening or the Ca transient of the myocytes. This decrease in Ca transient induced by esmolol could be a result of blocking either the surface membrane (L-type) Ca channels or the Ca release from the sarcoplasmic reticulum (SR). Treating the cells with Thapsigargin (an SR blocker) did not alter the effect of esmolol on the sarcomere length shortening, which decreased from  $0.163 \pm 0.007$  to  $0.05 \pm 0.002 \mu\text{m}$ , a drop of 69% ( $n = 7$ ),

#### Reference:

- 1 Rasmussen C, Thijs JJ, Clemmensen P, et al. Significance and management of early graft failure after coronary artery bypass grafting. feasibility and results of acute angiography and re-re-vascularization. *Eur J Cardiothorac Surg* 1997; **12**: 847–852.

the Ca transient fell from  $0.119 \pm 0.006$  to  $0.06 \pm 0.003$  (50% of the original value), comparable to the unblocked cells. This suggests that esmolol has no significant effect on the SR Ca release, and the likely target is the surface L-type Ca channels. To study the effect of esmolol on myofilament Ca sensitivity, isolated cardiac myocytes pretreated with esmolol were skinned from their cell membrane and the remaining myofilaments were exposed to different Ca concentrations. Esmolol did not change the myofilament sensitivity to Ca.

**Discussion:** Esmolol has a negative inotropic effect on the myocardial cells by decreasing the Ca transient. This occurs by blocking L-type Ca channels at mM concentrations (doses already used in cardiac surgery). Those effects were not shown by a conventional  $\beta$ -blocker (atenolol).

#### Reference:

- 1 Bessho R, Chambers DJ. Myocardial protection: the efficacy of an ultra-short-acting beta-blocker, esmolol, as a cardioplegic agent. *J Thorac Cardiovasc Surg* 2001; **122**: 993–1003.

### O-13

#### Cardioprotective properties of sevoflurane in patients undergoing off-pump coronary surgery

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**Introduction:** A variety of laboratory and clinical studies clearly indicate that exposure to halogenated anaesthetic agents can lead to a pronounced protection of the myocardium against ischaemic injury [1]. The aim of this study was to determine whether sevoflurane possesses a cardioprotective effect against ischaemic injury and can be used for pharmacological preconditioning during the off-pump operation in coronary surgery.

**Method:** Twenty-one patients scheduled for off-pump coronary surgery, were enrolled. All patients, for maintenance of anaesthesia, received propofol. Patients were randomized to receive (group S,  $n = 11$ ) or not (group P,  $n = 10$ ) sevoflurane at inspiratory concentration 0.6–1.2% for 10 min before coronary occlusion.

For assessing myocardial injury troponin T was determined before CPB (T1), 4 h (T2) and 16 h (T3) after surgery. Perioperative cardiac complications of myocardial ischaemia and myocardial infarction (MI) were recorded. In addition, frequency of using inotropic therapy was noted. Data was analysed with Student's *t*-test. All values are given as mean ± SD.

**Results:** Please see Table below.

		Group S	Group P
Troponin T ng/mL	T1	0.01 ± 0.01	0.03 ± 0.01
	T2	0.08 ± 0.01 <sup>#</sup>	0.46 ± 0.1 <sup>#</sup>
	T3	0.12 ± 0.01 <sup>#</sup>	0.95 ± 0.25 <sup>#</sup>
Myocardial ischaemia		9% ( $n = 1$ )	20% ( $n = 2$ )
MI		0	1
Inotropic therapy		9% ( $n = 1$ )	30% ( $n = 3$ )

<sup>#</sup> $P > 0.05$  Group S vs. Group P, <sup>#</sup> $P > 0.05$  vs. baseline (T1).

**Discussion:** Using sevoflurane according to the given method induced pharmacological preconditioning during off-pump coronary artery surgery. This is indicated by a significantly lower release of troponin T in the patient group receiving sevoflurane, and who had less frequency of myocardial ischaemia and less requirement of inotropic therapy in the intra- and post-operative periods.

#### Reference:

- 1 Nader ND, Li CM, Khadra WZ, et al. Anesthetic myocardial protection with sevoflurane. *J Cardiothorac Vasc Anesth* 2004; **18**: 269–274.

### O-14

#### Affects of dexmedetomidine sedation combined with epidural anaesthesia on myocardial ischaemia in peripheral vascular surgery

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**Introduction:** Peripheral vascular surgery deserves special care in patients with ischaemic heart disease (IHD). Alpha-2 agonists have beneficial effects on heart rate and provide adequate sedation in the perioperative period [1]. We investigated the effects of dexmedetomidine added to epidural anaesthesia on myocardial ischaemia and postoperative analgesic requirements in peripheral vascular surgery.

**Method:** Twenty-eight patients with IHD undergoing peripheral vascular surgery were included in the study. Lumbar epidural anaesthesia was initiated in all patients. In the first group (GD n = 14) sedation was achieved with dexmedetomidine infusion, while the second (GM n = 14) was sedated with midazolam. In the perioperative period we collected haemodynamic data and sedation scale. Holter ECG was performed during the first postoperative 24 hours. Dexmedetomidine infusion continued during 24 hours postoperatively. Troponin-T levels were determined preoperatively, and at postoperative 4th, 8th, 24th, 36th, 48th hours. Postoperative analgesic requirements according to patient-controlled analgesic pumps and visual analogue scale (VAS) were registered.

**Results:** Demographic and operative data were similar between the two groups. There was no cardiac event in any group. Although heart rate was similar at the beginning of the study, it was slower at all times after dexmedetomidine infusion in GD. VAS were higher during postoperative 48 hours follow-up in GD. Analgesic requirements were higher in GM. Troponin-T levels decreased in GD during the study and were significantly lower at 8th, 24th, 36th hours in GD (0.036 vs. 0.15; 0.02 vs. 0.1 and 0.01 vs. 0.09 ng/mL respectively).

**Conclusion:** Peripheral vascular surgery constitutes a major risk for patients with IHD. Dexmedetomidine provides adequate sedation, decreases heart rate and also maintains haemodynamic stability. Dexmedetomidine is a safe alternative for perioperative sedation in ischaemic heart disease.

#### Reference:

- 1 Talke P, Chen R, Thomas B, et al. The hemodynamic and adrenergic effects of perioperative dexmedetomidine infusion after vascular surgery. *Anesth Analg* 2000; **90**: 834–839.

## O-15

### Cardiac protection by volatile anaesthetics in high risk cardiac surgery patients: a randomized controlled study

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**Introduction:** Myocardial ischaemic damage is reduced by volatile anaesthetics in patients undergoing CABG [1], but conflicting results exist in patients undergoing valvular surgery [2,3]. High risk patients undergoing cardiac surgery have never been studied.

**Method:** We compared cardiac troponin release in 30 patients receiving either sevoflurane (0.5–2MAC) or propofol (2–3 mg kg<sup>-1</sup> h<sup>-1</sup>) for mitral valve surgery plus coronary artery bypass grafting. All patients had an opioid based anaesthesia for mitral valve surgery. Peak postoperative troponin I release was measured as a marker of myocardial necrosis.

**Results:** There was no significant ( $P = 0.27$ ) reduction in median (25th 75th percentiles) postoperative peak of troponin: 16.1 (14.5–30.6) ng/dL in the sevoflurane group versus 14.9 (8.9–20.6) ng/dL in the propofol group. Three patients in each group experienced a low cardiac output syndrome and one of them (sevoflurane group) died.

**Conclusions:** Myocardial damage measured by cardiac troponin release is not reduced by volatile anaesthetics in high risk patients undergoing mitral valve surgery with concomitant coronary artery disease.

#### References:

- 1 Landoni G, Biondi-Zoccai GGL, Zangrillo A, et al. New volatile anaesthetics (desflurane or sevoflurane) in cardiac surgery. A meta-analysis of randomized clinical trials. *J Cardiothorac Vasc Anaesth*, in press.
- 2 Landoni G, Calabrò MG, Marchetti C, et al. Desflurane versus propofol in patients undergoing mitral valve surgery. *J Cardiothorac Vasc Anaesth*, in press.
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## O-16

### Treatment of refractory angina pectoris

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**Introduction:** Refractory angina pectoris is a clinical diagnosis which is characterized by chronic angina due to coronary artery insufficiency in patients who are refractory to conventional forms of treatment [1]. As the life expectancy is increasing, patients with angina pectoris refractory to conventional forms of treatment are an important problem. We review the nonconventional therapies to treat refractory angina pectoris, including pharmacotherapy, our experiences with videothoroscopic sympathectomy (VTSY), thoracic epidural analgesia (TEA) [2] and then the next therapeutic possibilities, such as transcutaneous electrical nerve and spinal cord stimulation, enhanced external counterpulsation and therapeutic angiogenesis.

**Method:** Sixteen patients underwent VTSY between 1998 and 2005 at our institution. Two patients with comorbidities received a subcutaneously tunneled epidural catheter with self-administered home treatment.

**Results:** Average hospital stay after VTSY was 4.9 days, with no deaths occurring in our group. One-year results showed that pain decreased on average from 10 to 3.6 according to the visual analogy scale (VAS). Use of MIBG in patients after VTSY allows documentation of decreasing sympathetic innervation of the heart. One-year results in patients after TEA showed a similar effect (pain decreased on average from 10 to 4 according to VAS).

**Discussion:** VTSY was performed in 16 patients with refractory angina pectoris with very good early and one-year follow-up results. One-year self-administered home treatment with TEA seems to be an effective and safe adjuvant treatment for patients with refractory angina unsuitable for VTSY. Both methods were associated with symptomatic relief of angina. The results from the present experiences show that VTSY and TEA are safe methods for symptomatic patients with refractory angina pectoris. The beneficial effects were sustained during a 12-month follow-up period.

#### References:

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## O-17

### Extension of hypoperfused myocardium correlates with serum concentration of Fas and IL-6 in stable coronary artery disease

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**Introduction:** Ischaemic heart disease is more often considered as a chronic inflammatory process. This inflammation is situated within atheromatous plaques and in hypoperfused myocardium with activation of macrophages, monocytes and T lymphocytes mainly responsible for this process. It is associated with production of proinflammatory and pro-apoptotic particles, with local and systemic activation of the immune system [1]. Apoptosis and necrosis of cardiomyocytes occurs as a result of persistent ischaemia and inflammation. The aim of this study was to evaluate levels of IL-6 and Fas in peripheral blood serum taken from patients with 1, 2 or 3 vessel stable coronary disease undergoing coronary angiography.

**Method:** We examined serum levels of these particles by the use of enzyme-linked immunosorbent assay (ELISA). The study group consisted of 30 patients aged from 44 to 73 years with stable coronary disease. The analysed group was divided into two subgroups: with 1 or 2 vessel (group 1, n = 15) or with 3 vessel coronary disease including patients with stenosis of the left main (group 2, n = 15).

**Results:** We observed significantly higher values of IL-6 and Fas serum concentration in patients with 3-vessel coronary disease (group 2) in comparison to patients with 1 or 2-vessel coronary disease (group 1) (for Fas, median and range: 68.02 pg/mL, 55.65–103.10 versus 49.28 pg/mL, 45.94–53.78;  $P = 0.005$  and for IL-6: 2.43 pg/mL, 1.54–2.6 versus 1.37 pg/mL, 0.96–1.62;  $P = 0.02$ ).

**Discussion:** In the group of patients with a more extensive area of ischaemic myocardium (3-vessel coronary disease) higher levels of proinflammatory and pro-apoptotic particles were observed, such as IL-6 and Fas. They are probably the serum markers of inflammatory processes in the myocardium and correlate with the intensity of inflammation, apoptosis and total myocardial damage in coronary artery disease.

#### Reference:

- 1 Fichtlscherer S, Heeschen C, Zeiher AM. Inflammatory markers and coronary artery disease. *Curr Opin Pharmacol* 2004; **4**(2): 124–131. Review.

## Anaesthesia Techniques

### O-18

#### Epidural anaesthesia reduces NT-proBNP after cardiac surgery

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**Introduction:** Aminoterminal B-type pro-natriuretic peptide (NT-proBNP) and Cardiac Troponins I (cTPI) and T are reliable indicators of severity of heart failure and are the accepted standards to serologically identify myocardial necrosis and elevated wall stress [1]. Levels of NT-proBNP are markedly increased in patients with coronary artery disease and severely impaired left ventricular function [2]. The aim of our study was to assess the impact of different anaesthetic methods on NT-proBNP levels after cardiac surgery and correlate findings with postoperative haemodynamics.

**Method:** The study was performed according to the Helsinki declaration. 20 patients with EuroSCORE 3–8 scheduled for elective cardiac surgery were randomly assigned to receive either sevoflurane anaesthesia or propofol intravenous anaesthesia with or without supplementary epidural anaesthesia. Postoperatively the haemodynamics were guided by mean arterial blood pressure (MAP) 60–90 mmHg, cardiac index (CI) > 2.4 L/m<sup>2</sup> and central venous saturation (SvO<sub>2</sub>) > 60%. The enzymes were obtained 3, 9 and 18 hours after surgery.

**Results:** Patient groups were comparable with regard to EuroSCORE, age, sex and operative procedures.

The enzymes are given in Table 1. No difference was found in cTPI and CK-MB. NT-proBNP was significant lower in the epidural group and even after removing data from a patient with MI the NT-proBNP was still significant lower. The haemodynamics are seen in Table 2. No difference was found between the groups in any parameter. No difference was seen in the use of perioperative inotropics or vasodilators.

**Table 1.** Mean values of biochemical markers 3, 9 and 18 hours after surgery. \**P* < 0.001

GROUP	TPI 1	TPI 2	TPI 3	CKMB 1	CKMB 2	CKMB 3	BNP 1	BNP 2	BNP 3
Epidural	0.75	0.78	0.66	32.7	37.9	31.9	45.5*	122.2	245.7*
Non-Epidural	1.05	1.14	0.88	39.0	44.7	40.4	195.9*	355.3	540.6*

**Table 2.** Postoperative haemodynamic parameters (mean values). No statistical differences

GROUP	HR	MAP	MPA	CVP	CCI	SvO <sub>2</sub>	SVI	SVRI
Epidural	79.6	80.3	23.1	11.3	3.02	69.7	37.2	1910
Non-Epidural	79.7	81.4	22.7	10.9	3.06	70.9	39.4	1864

**Discussion:** The results indicate that patients with supplementary epidural anaesthesia had lower cardiac wall stress and/or presented less heart failure severity in the postoperative phase. In the non-epidural group all three enzymes seemed to support each other, while the NT-proBNP was not totally following cTPI and CK-MB in the epidural group. The fact that a lower wall stress/heart failure shown by NT-proBNP could not be supported by different haemodynamic parameters is interesting.

#### References:

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### O-19

#### Maintenance of anaesthesia during cardiopulmonary bypass

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**Introduction:** Approximately 25% less isoflurane, with a constant infusion of fentanyl, is required to maintain a BIS of 55 after CPB than before CPB [1].

**Method:** We studied four groups of 10 adult patients during CPB, based on power analysis for a 25% reduction in dose rate [1,2]. Anaesthesia was induced with propofol 1.0 mg kg<sup>-1</sup>. Maintenance was with a propofol infusion (Groups A and B) or isoflurane (Groups C and D). Fentanyl was given either by 10 µg kg<sup>-1</sup> bolus at induction (Groups A and C) or infused to an effect site concentration of 3 ng ml<sup>-1</sup> (Groups B and D). The PaCO<sub>2</sub> was kept at 4.5–5.5 kPa and α-stat pH management was used. The anaesthetic was titrated to maintain the BIS at 45 throughout surgery. BIS, nasopharyngeal

temperature and anaesthetic dose rates were recorded at five consecutive one-minute intervals before sternotomy, before CPB, at the end of CPB, after CPB, and at skin closure, and the mean value calculated. Blood pressure was kept within acceptable values with either phentolamine or phenylephrine. Heart rate was controlled if necessary with esmolol or glycopyrrolate. Analysis was by ANOVA and paired Student's *t*-test.

**Results:** The two sets of pre- and post-CPB data were averaged. The Table shows infusion rates of propofol in mg kg<sup>-1</sup> hr<sup>-1</sup> (Groups A and B) and end-tidal isoflurane concentrations (Groups C and D). Data are mean values ± SD.

	Group A	Group B	Group C	Group D
Pre-CPB	4.9 ± 1.6	4.1 ± 0.9	0.68 ± 0.17	1.03 ± 0.25
Post-CPB	3.7 ± 1.2	2.9 ± 0.7	0.60 ± 0.12	0.73 ± 0.05
<i>P</i> value	<0.12	<0.01	0.28	<0.001

**Discussion:** If fentanyl is given by infusion, about 30% less anaesthetic is required to maintain a BIS value of 45 after CPB than before, confirming previous work [1]. The situation after a fentanyl bolus is less clear, despite a 12–25% reduction in anaesthetic dose rate, because of larger SD in these groups. A study of 30 patients in Groups A and C is needed to provide sufficient power to validate the reductions in dose rate in these groups [2].

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### O-20

#### Anaesthesiological management for transcatheter transapical aortic valve implantation

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**Introduction:** Transapical minimally invasive beating heart aortic valve implantation (AVI) [1] requires modified anaesthesiological management. The intention was to perform this operation without the use of cardiopulmonary bypass.

**Method:** Thirty-four consecutive patients (pts) received beating heart transapical AVI from 02/06 until 11/06 at our centre. The Table shows the preoperative pts characteristics. After performing this procedure on-pump in 13 pts successfully, we developed a completely off-pump technique. Low dose heparin (5000 units) was used. An epicardial pacing wire was placed and used for rapid ventricular pacing during balloon valvuloplasty and delivery of the transapically placed transcatheter valve to prevent the left ventricle from ejecting. Routine intraoperative monitoring consisting of ECG, invasive blood pressure, CVP and transoesophageal echocardiography (TOE).

Age (years)	82 ± 5
Female gender	24
NYHA	3.5 ± 0.6
Logistic EuroScore (%)	27.1 ± 12.2
Cardiac index (litre min <sup>-1</sup> m <sup>-2</sup> )	1.8 ± 0.4
LVEDP (mmHg)	20 ± 9
Aortic valve orifice area (cm <sup>2</sup> )	0.5 ± 0.2

**Results:** 20 pts were off-pump. 1 pt had to be converted to conventional aortic valve replacement. From the entire group 18 pts were discharged to intensive care unit and 16 pts to the recovery room following our fast track protocol. 28 patients were extubated at the day of operation. There were no neurological complications. TOE monitoring demonstrated good valve and ventricular function in all patients.

**Conclusion:** Transapical AVI is a new surgical option for high risk patients. These procedures can be safely performed with specific anaesthesiological management, especially during off-pump AVI. Early results are encouraging and further clinical evaluation is required.

#### Reference:

- Walther T, Dewey T, Wimmer-Greinecker G, et al. Transapical approach for sutureless stent-fixed aortic valve implantation: experimental results. *Eur J Cardiothorac Surg* 2006; **29**: 703–708.

### O-21

#### The cardiovascular effects of inspired oxygen fraction in patients undergoing on-pump coronary artery bypass surgery

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**Introduction:** Increased inspired oxygen fractions (FiO<sub>2</sub>) have significant haemodynamic effects in awake volunteers [1]. These changes may be of great importance in cardiac surgery. The inspiratory gas during open heart surgery with the on-pump technique usually consists of 100% oxygen without any N<sub>2</sub>O because of the risks of bubble embolism during these procedures. We sought to establish whether the cardiovascular effects of increased FiO<sub>2</sub> are also present in cardiac surgery patients.

**Method:** In a randomized double-blind clinical trial study, after Ethics Committee approval and getting informed consent, sixty adult patients (40–70 yr) with cardiac ejection fraction (EF) of more than 40% and ASA II or III, undergoing elective on-pump coronary artery bypass were selected. They received either a mixture of 50% O<sub>2</sub> with 50% air (case group = 30) or 100% of oxygen (control group = 30) throughout the anaesthesia. Cardiac index (CI) was measured by a non-invasive cardiac output (NICO) technique using end tidal PCO<sub>2</sub>. Measurements of systolic, diastolic and mean blood pressure as well as heart rate (HR) and central venous pressure (CVP), PaO<sub>2</sub>, arterial pH and CI were obtained at pre-bypass, post bypass, end of surgery and 2 hours after ICU admission. Intra-operative requirements for inotropic drugs were also recorded. Data were analysed by SPSS.10 software using t-test and chi-squared as well as non parametric tests where appropriate.

**Results:** No differences were found between the two groups with regard to age, sex pump time, operation time, body mass index and preoperative EF. The mean values of systolic, diastolic and mean blood pressure as well as HR and CI were similar in the case and control groups ( $P > 0.05$ ) at all times of measurement. The mean pH was statistically higher in the control group but not clinically noticeable. The control group required more inotropic drug support than the case group (16 vs. 8 patients respectively;  $P < 0.05$ ). The mean CVP was higher in the control group compared with the case group ( $P < 0.05$ ).

**Discussion:** Hyperoxia increases CVP and inotropic requirements during cardiac surgery in anaesthetized patients. Therefore exposing patients during and after coronary artery surgery to hyperoxia induces significant haemodynamic changes which require more extensive studies with invasive CI measurements.

#### Reference:

- Harten JM, Anderson KJ, Angerson WJ, et al. The effect of normobaric hyperoxia on cardiac index in healthy awake volunteers. *Anaesthesia* 2003; **58**(9): 885–888.

## O-22

### Effects of early vital capacity manoeuvre during multivessel off-pump coronary artery bypass surgery

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**Introduction:** Despite the theoretical advantage of avoiding cardiopulmonary bypass, off-pump coronary artery bypass surgery (OPCAB) results in a similar degree of pulmonary impairment compared to on-pump coronary artery bypass surgery (CABG). A vital capacity manoeuvre (VCM) effectively re-expands collapsed lung tissue and favourable results have been demonstrated in patients undergoing on-pump CABG with regard to intrapulmonary shunt (Qs/Qt) and oxygenation [1]. However, evidence is lacking in OPCAB and in addition, VCM after grafting may disrupt internal mammary arterial grafts. We therefore evaluated the effects of early VCM during OPCAB on Qs/Qt and oxygenation in a prospective, randomized trial.

**Method:** After IRB approval and patients' informed consent, 17 patients were randomly allocated to either control group ( $n = 8$ ) or VCM group ( $n = 9$ ). After tracheal intubation, the lungs were ventilated with a tidal volume of 8–10 mL · kg<sup>-1</sup>, respiratory rate of 8–12 breaths · min<sup>-1</sup> at an inspired oxygen fraction (FiO<sub>2</sub>) of 0.4 and a positive end-expiratory pressure of 0.49 kPa. In patients assigned to VCM group VCM at 3.9 kPa (30 mmHg) for 10 sec was performed after sternotomy. Qs/Qt and PaO<sub>2</sub>/FiO<sub>2</sub> (P/F) ratio were measured 15 min after tracheal intubation (baseline), during Y-graft construction (T1), 15 min after completion of grafting (T2) and sternum closure (T3), and 3 h after arrival at the intensive care unit (ICU, T4).

**Results:** Patients' characteristics and intraoperative data were similar between the groups. Baseline Qs/Qt was significantly higher in the VCM group (10.1 ± 3.0% vs. 6.9 ± 3.1%,  $P = 0.049$ ). Percent changes of Qs/Qt from baseline at T3 was significantly less in the VCM group ( $P = 0.03$ ). Durations of ventilator care and ICU stay were similar between the groups.

**Table 1.** Percent changes of Qs/Qt and P/F ratio from baseline value.

	Group	T1	T2	T3	T4
% changes of Qs/Qt	Control	8 ± 82	12 ± 63	60 ± 78	11 ± 61
	VCM	-16 ± 31	-25 ± 14	-10 ± 37*	-23 ± 38
% changes of P/F ratio	Control	10 ± 19	3 ± 17	-16 ± 10	-3 ± 17
	VCM	19 ± 30	20 ± 25	-8 ± 15	17 ± 19

Values are mean ± SD. \* $P < 0.05$  compared to control group.

**Discussion:** In this preliminary study, VCM resulted in significant improvement in Qs/Qt after sternum closure and a trend could be seen toward decrease in Qs/Qt in the VCM group. Therefore, further study with larger number of patients is warranted.

#### Reference:

- Tschernenko EM, Bambazek A, Wisser W, et al. Intrapulmonary shunt after cardiopulmonary bypass: the use of vital capacity maneuvers versus off-pump coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 2002; **124**: 732–738.

## O-23

### Comparison of bispectral index and electroencephalographic entropy in patients undergoing aortocoronary bypass grafting

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**Introduction:** The primary objective of this study was to compare bispectral index (BIS) and the spectral entropy parameters response and state entropy (RE and SE) in patients undergoing opioid based anaesthesia for coronary artery bypass grafting (CABG). The two-parameter entropy might differentiate between the hypnotic state (SE) and nociception (RE) [1,2].

**Method:** Simultaneously, BIS, SE, and RE were recorded in 66 patients undergoing CABG. Anaesthesia was guided at two different levels using BIS. The doses of the anaesthetics sufentanil and midazolam were adjusted to achieve a "normal level of anaesthesia" indicated by BIS in a range of 45–55 in 33 patients (group BIS 50), while in 33 patients a "deep level of anaesthesia", BIS in a range of 35–44, was intended (group BIS 40).

**Results:** The targeted values of BIS were achieved in both anaesthetic groups and differed significantly during the whole duration of anaesthesia. Median RE and SE fell to 19–26 during anaesthesia in both groups. RE and SE values of both anaesthetic groups differed significantly only after induction of anaesthesia and did not differ during further anaesthesia. During anaesthesia, BIS was weakly correlated to the two entropy parameters in group BIS 40 (BIS/SE  $r = 0.22$ ,  $P = 0.004$ ; BIS/RE  $r = 0.24$ ,  $P = 0.001$ ). No correlation of BIS and entropy parameters was found in group BIS 50 during anaesthesia (BIS/SE  $r = 0.05$ ,  $P = 0.49$ ; BIS/RE  $r = 0.08$ ,  $P = 0.26$ ). The entropy parameters SE and RE were always significantly correlated (SE/RE  $r = 0.98$ ,  $P < 0.0001$ , both anaesthetic groups). Patients in group BIS 40 received significantly ( $P < 0.05$ ) more sufentanil (BIS 40, 704 ± 181 µg; BIS 50, 490 ± 107 µg) and midazolam (BIS 40, 18.5 ± 6.1 mg; BIS 50, 15.6 ± 3.8 mg).

**Discussion:** In patients undergoing CABG, no relationship was found between BIS as well as SE and RE at a lighter stage of an opioid anaesthesia indicated by a BIS level of 45–55. This BIS level reduced anaesthetic medication. The two entropy parameters SE and RE did not provide any additional differentiation in hypnosis and nociception indicated by their high correlation.

#### References:

- Viertio-Oja H, Maja V, Sarkela M, et al. Description of the Entropy™ algorithm as applied in the Datex-Ohmeda S/5™ entropy module. *Acta Anaesthesiol Scand* 2004; **48**: 154–161.
- Vakkuri A, Yli-Hankala A, Talja P, et al. Time-frequency balanced spectral entropy as a measure of anaesthetic drug effect in central nervous system during sevoflurane, propofol, and thiopental anaesthesia. *Acta Anaesthesiol Scand* 2004; **48**: 154–161.

## O-24

### Reliability of perioperative continuous monitoring of central venous oxygen saturation using the CeVOX system in cardiac surgery

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**Introduction:** The CeVOX device (Pulsion Medical Systems AG, Munich, Germany) using a spectrophotometric probe for continuously measuring central venous oxygen saturation (ScvO<sub>2</sub>) has recently been introduced [1]. The goal of this study was to compare ScvO<sub>2</sub> measured by the CeVOX device (S<sub>CeVOX</sub>O<sub>2</sub>) with ScvO<sub>2</sub> and mixed-venous oxygen saturation (S<sub>mv</sub>O<sub>2</sub>) determined by blood co-oximetry in adult patients during and after cardiac surgery.

**Method:** With ethics committee approval and written informed consent, 20 patients were enrolled. The CeVOX fibreoptic probe was introduced into a standard central venous catheter placed into the right or left internal jugular vein. After *in vivo* calibration of the fibreoptic probe, S<sub>CeVOX</sub>O<sub>2</sub>, ScvO<sub>2</sub>, S<sub>mv</sub>O<sub>2</sub>, haemoglobin, body temperature, heart rate, central venous and mean arterial pressure and cardiac index were recorded at 30 min intervals

during surgery and at 60 min intervals after arrival in the intensive care unit (ICU). Agreement between  $S_{\text{cevoxO}_2}$ ,  $\text{ScvO}_2$  and  $\text{SmvO}_2$  was assessed by Bland Altman analysis. In addition, sensitivity and specificity of changes in  $S_{\text{cevoxO}_2}$  to predict changes of  $\text{ScvO}_2$  were evaluated.

**Results:** Thirty-one data pairs had to be excluded because of detection failure of the CeVOX device due to ambient light during open chest surgery. 190 data pairs (84 during surgery and 106 in the ICU) were analysed.  $S_{\text{cevoxO}_2}$  and  $\text{ScvO}_2$  ranged between 45 and 89%, and between 43 and 90%, respectively. Mean bias (limits of agreement) of  $S_{\text{cevoxO}_2}$  and  $\text{ScvO}_2$  were  $-0.9$  ( $-8.0 \pm 6.0$ )% during surgery and  $-1.2$  ( $-10.5 \pm 8.2$ )% in the ICU. 37.9% of all analysed values fell outside clinically acceptable limits (defined as  $\pm 3$ %). Sensitivity and specificity of changes in  $S_{\text{cevoxO}_2}$  to predict

changes in  $\text{ScvO}_2$  were 73% and 80%, respectively. Limits of Agreement of both  $\text{ScvO}_2$  and  $S_{\text{cevoxO}_2}$  with  $\text{SmvO}_2$  were high ( $-6.7 \pm 8.4$  and  $-11.1 \pm 10.5$ )% during surgery and ( $-8.6 \pm 13.5$  and  $-15.2 \pm 18$ )% in the ICU.

**Conclusion:** The CeVOX device is unreliable to assess absolute values of continuous  $\text{ScvO}_2$  during and after cardiac surgery. Only the specificity of  $S_{\text{cevoxO}_2}$  to predict decreasing (or changes?) in  $\text{ScvO}_2$  values was acceptable. Agreement of both  $\text{ScvO}_2$  and  $S_{\text{cevoxO}_2}$  with  $\text{SmvO}_2$  was poor.

**Reference:**

- Reinhart K, Kuhn HJ, Hartog C, et al. Continuous central venous and pulmonary artery oxygen saturation monitoring in the critically ill. *Intensive Care Med* 2004; **30**: 1572–1578.

## Drugs and Fluids

### O-25

#### Levosimendan, a calcium-sensitizer with cardioprotective effects in patients with acute ischaemia undergoing cardiac surgery

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**Introduction:** Levosimendan is a calcium sensitizer with two major effects. First, levosimendan acts as a positive inotropic agent by binding calcium dependently to cardiac troponin C. Second, levosimendan activates ATP-dependent potassium channels [1]. Thus it has cardioprotective and vasodilatory properties at a dose enhancing myocardial contractility. These unique properties of levosimendan might be of great advantage in patients with myocardial ischaemia simultaneously requiring inotropic support [2].

**Method:** 26 patients with acute myocardial infarction (100%) and/or cardiogenic shock (52%) who were scheduled for emergency cardiac surgery are presented. EuroSCORE was 14, (9–21) with a predicted mortality of 44%, (14–90%) (median, range).

**Results:** Levosimendan (6  $\mu\text{g}/\text{kg}$  bolus; 0.2  $\mu\text{g}$   $\text{kg}^{-1}$   $\text{min}^{-1}$  continuous infusion) was started as early as possible before cardiopulmonary bypass (CPB) in addition to catecholamines. 23 patients were weaned successfully from CPB in the 1st attempt, 3 patients in the 2nd attempt. 19 (73%) patients survived (SP), 7 (27%) patients died (NSP). Survivors had a lower ( $P < 0.05$ ) predicted mortality (35%) than the NSP (71%). SP were younger ( $P < 0.05$ ) ( $59 \pm 10$  years) compared to NSP ( $69 \pm 7$  years). Cardiac index was significantly higher in SP compared to NSP during the procedure and at the intensive care unit (ICU). An intra-aortic balloon pump was inserted in 16% of the SP and in 86% of the NSP. Dialysis for renal failure was needed in none of the SP and in 43% of the NSP. Surviving patients were ventilated for  $26 \pm 20$  h, treated at the ICU for  $5.5 \pm 5.0$  days, and dismissed from hospital after  $13 \pm 11$  days.

**Conclusion:** The reduction in mortality supports the concept of using levosimendan as an “inoprotective” drug in ischaemic patients requiring inotropic support. In these patients with ongoing ischaemia, the currently available intravenous inotropes are more or less contraindicated by increasing metabolic demands and increasing the probability of severe arrhythmia. However, a randomized controlled trial is urgently warranted to prove this hypothesis.

**References:**

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- Maytin M, Colucci WS. Cardioprotection: a new paradigm in the management of acute heart failure syndromes. *Am J Cardiol* 2005; **96**: 26G–31G.

### O-26

#### Levosimendan to treat myocardial depression in septic shock after cardiac surgery: haemodynamics and neurohormonal effects

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**Introduction:** Septic shock is characterized by profound cardiovascular alterations including myocardial depression. Levosimendan has recently been shown to improve cardiac function in septic shock [1,2]. We evaluated haemodynamic and neurohormonal effects of levosimendan in cardiac patients with sepsis-induced cardiac dysfunction.

**Method:** Fifteen patients with myocardial depression related to septic shock were enrolled. All patients had SIRS criteria of culture isolation of 1 or more pathogens, positive PCT and SBP  $< 90$  mmHg unresponsive to load challenge.

We defined myocardial depression as reduced  $\text{Svo}_2$  in the presence of increased BNP secretion, Troponin I release and systolic and/or diastolic dysfunction by TOE evaluation of EF and mitral annulus TDI velocities. All patients received a levosimendan infusion for 24 hours at 0.1  $\mu\text{g}$   $\text{kg}^{-1}$   $\text{min}^{-1}$  combined with norepinephrine.

**Results:** Data from  $\text{Svo}_2$ , Trop. I and BNP were obtained by evaluating the average of percent variation between T0 (starting infusion) and T1 (24 h after infusion) T2 (48 h), T3 (72 h), T4 (96 h). Changes in EF and E' velocity were measured by TOE at the same times. Levosimendan significantly increased  $\text{Svo}_2$  and EF, and decreased Trop I and BNP. Levosimendan improved diastolic function by increasing E' velocity at TDI at 48 h. All data were analysed by Fisher's F test.

	T0	T1	T2	T3	T4
$\text{Svo}_2$	0%	4%	10%	17%	22%
Trop I	0%	-65%	-86%	-82%	-78%
BNP	0%	-55%	-41%	-56%	-50%
E' cm sec	<8	>8	>8	>8	>8
EF%	<30%	>40%	>40%	>40%	>40%

**Discussion:** Levosimendan seems to improve systemic haemodynamics and neurohormonal cardiac function in patients with septic cardiac dysfunction. The diastolic function is improved too.

**References:**

- Noto A, Giacomini M, Palandi A, et al. Levosimendan in septic cardiac failure. *Intensive Care Med* 2005; **31**: 164–165.
- Morelli A, De Castro S, Teboul JL, et al. Effects of levosimendan on systemic and regional hemodynamics in septic myocardial depression. *Intensive Care Med* 2005; **31**: 638–644.

### O-27

#### The effects of levosimendan compared with dobutamine in cardiac surgery patients

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**Introduction:** Levosimendan can be selected as an inotrope for cardiac surgery and low output heart failure [1,2]. The aim of the study was to compare the effect of levosimendan (L) to that of dobutamine (D) in high risk patients undergoing cardiac surgery.

**Method:** Twenty patients aged  $70 \pm 6$  years, ASA II–III undergoing elective CABG were randomly assigned to receive, after aortic clamp release, Group I ( $n = 10$ ) levosimendan in a single dose of 24  $\mu\text{g}$   $\text{kg}^{-1}$  followed in 10 min by start of infusion of 0.2  $\mu\text{g}$   $\text{kg}^{-1}$   $\text{min}^{-1}$  and Group II ( $n = 10$ ) dobutamine infused at a rate of 7.5  $\mu\text{g}$   $\text{kg}^{-1}$   $\text{min}^{-1}$ . All patients had measured ejection fraction of  $25 \pm 6$ %, sinus rhythm, cardiac index (CI)  $1.8 \pm 0.5$   $\text{litre} \cdot \text{min}^{-1} \cdot \text{m}^{-2}$ , mean arterial pressure (MAP) 60–80 mmHg, and pulmonary capillary wedge pressure (PCWP)  $19 \pm 4$  mmHg. Haemodynamic parameters were measured by Swan-Ganz catheter and thermodilution (Baxter-Edwards Lab) before starting the infusion of the drug and after 24 hours of treatment. Statistical analysis was performed by ANOVA for repeated measurements,  $P < 0.05$  significant.

**Results:** There were no significant differences in the demographic data. Haemodynamic results are shown in Table I.



Table 1.

	To		T24h	
	Group 1	Group 2	Group 1	Group 2
HR beats/min	87.20 (10.3)	85.15 (2.15)	88.1 (5.9)	97.6 (9.8)*
MAP mmHg	84.01 (10.55)	84 (9.2)	76.20 (13.5)*	83.20 (6.35)
CI litre min <sup>-1</sup> m <sup>-2</sup>	1.80 (0.5)	1.90 (0.31)	2.8 (0.6)*	2.2 (0.2)
SVR dyn cm <sup>-1</sup> sec <sup>-5</sup>	2530 (602)	2512 (335)	1791 (312.4)*	1896 (160)

\*P < 0.05 in comparison to To M(±SD)

All patients were weaned from CPB in the first attempt. Six patients from the L group needed additional norepinephrine (2–6 µg min<sup>-1</sup>) because of vasodilatation. Four patients from both groups needed in addition, intra-aortic balloon pump. Postoperative ventilation lasted from 8–72 hours and the mean stay in the ICU was 96 hours. Two patients died due to multi-organ failure and sepsis after 6–7 days.

**Conclusions:** Levosimendan is a good alternative, provides the necessary inotropic support during weaning from CPB and improves the haemodynamic stability in patients after CABG.

**References:**

- 1 Raja SG, Rayen BS. Levosimendan in cardiac surgery: current best available evidence. *Ann Thorac Surg* 2006; **81**:1536–1546. Review.
- 2 Follath F, Cleland JG, Just H, et al. Efficacy and safety of intravenous levosimendan compared with dobutamine in severe low-output heart failure (the lido study): a randomized double-blind trial. *Lancet* 2002; **360**: 196–202.

**O-28**

**Dexmedetomidine during coronary artery bypass grafting surgery: is it neuroprotective? A pilot study**

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**Introduction:** The search for a pharmacologic agent which has the potential for full neuroprotection from the adverse cerebral effects of extracorporeal circulation is still going on, due to lack of a consensus on this subject [1]. Our aim was to determine whether dexmedetomidine has protective effects against cerebral ischaemic injury during coronary artery bypass grafting (CABG) surgery.

**Method:** Patients aged between 50–70 (n = 24) undergoing CABG surgery were randomized into two groups as receiving dexmedetomidine (Group D, n = 12) or not (Group C, n = 12). As basal blood samples from arterial and jugular bulb catheters were drawn, dexmedetomidine 1 µg/kg bolus and infusion at a rate of 0.7 µg kg<sup>-1</sup> h<sup>-1</sup> were given in Group D. Arterial and jugular venous blood gas analysis, S-100B, NSE and lactate measurements were performed after induction, 10 min. after the initiation of cardiopulmonary bypass (CPB), 1 min. after declamping, at the end of CPB, at the end of operation, at the postoperative 24th h. Mann Whitney U and Wilcoxon's tests were used for statistical analysis.

**Results:** There were no significant differences between the groups regarding arterial and jugular venous pH, PO<sub>2</sub>, PCO<sub>2</sub> and O<sub>2</sub> saturations. S-100B, NSE and lactate levels were also similar between Group D and Group C. There were no clinically overt neurological complications in any patient in the postoperative period.

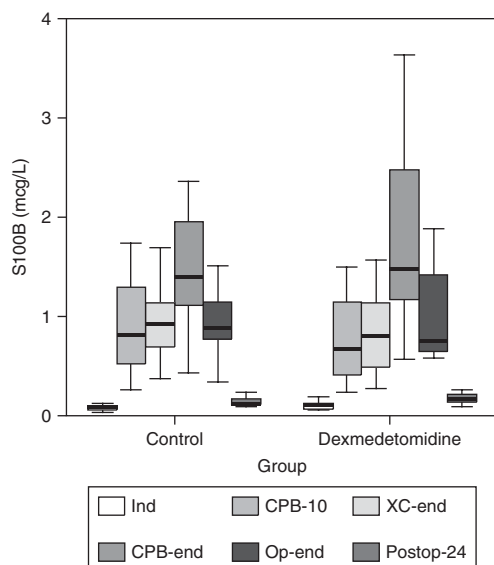


Figure 1. S100-B levels

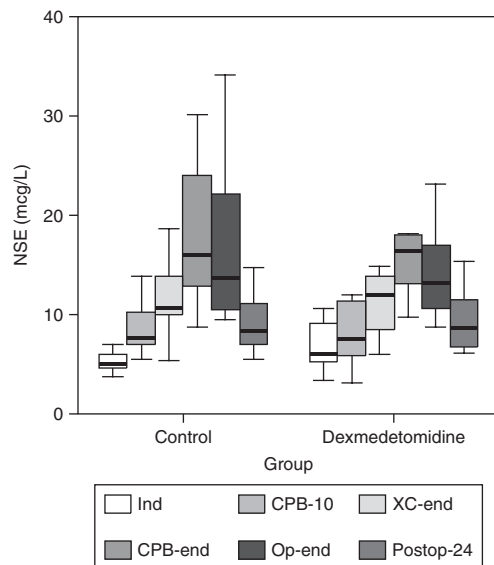


Figure 2. NSE levels

**Discussion:** Cerebral ischaemia marker (S-100B, NSE, lactate) patterns were as expected during CPB [2]. However, there were no differences between the groups; leading us to think that dexmedetomidine does not have neuroprotective effects in CABG surgery. Larger studies with higher doses of dexmedetomidine parameters may lead to different results.

**References:**

- 1 Ahonen J, Salmenpera M. Brain injury after adult cardiac surgery. *Acta Anaesthesiol Scand* 2004; **48**: 4–19. Review.
- 2 Gao F, Harris DN, Sapsed-Byrne S. Time course of neurone-specific enolase and S-100 protein release during and after coronary artery bypass grafting. *Br J Anaesth* 1999; **82**: 266–267.

**O-29**

**Comparison of three methods for prevention of postoperative nausea and vomiting after cardiac surgery**

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**Introduction:** Different methods have been suggested to prevent postoperative nausea and vomiting (PONV), such as gastric decompression and pharmacologic interventions, but the efficacy of these methods has been reported differently. So it was decided to compare the effectiveness of three methods of prevention of PONV after cardiac surgery.

**Method:** In a randomized double-blind clinical trial study, after Ethics Committee approval and getting informed consent, 120 patients (20–70 yr) with ASA II or III undergoing elective cardiac surgery, were selected. They were divided randomly into four groups: In the A, B and D groups, intravenous metoclopramide (0.1 mg kg<sup>-1</sup>) or granisetron (0.01 mg kg<sup>-1</sup>) or normal saline (equal volume) were administered, respectively, about 30 minutes before extubation in the intensive care unit (ICU). In Group C, a nasogastric (NG) tube was inserted after intubation in the operating room and removed about 30 minutes before extubation in the ICU. The incidence of nausea and the episodes of vomiting were recorded by a blinded investigator at the time of extubation and performed hourly for 4 hours and then every 4 hours until the patient was discharged from the ICU, or for a maximum of 24 hours. Assessment of severity of nausea was scored using a visual analogue scale (VAS) device. Data were analysed by SPSS.10 software using t-test and chi-squared as well as non parametric tests.

**Results:** The incidence of nausea was significantly lower in the granisetron and metoclopramide groups than in the placebo and NG tube groups (10% and 16% vs. 40% and 33%; P < 0.01). The incidence of vomiting was lower in the granisetron and metoclopramide groups than in the placebo and NG tube groups. (6.7% and 10% vs. 24% and 17%; P < 0.05). Postoperative antiemetic therapy was significantly required less in the A and B groups than that in the C and D groups (P < 0.01).

**Discussion:** According to this study, metoclopramide is an effective regimen for preventing PONV after cardiac surgery, while granisetron has similar prophylactic effects. But regarding the economics, we suggest metoclopramide as a routine prophylactic antiemetic in cardiac surgery.

**Reference:**

- 1 Burlacu CL, Healy D, Buggy DJ, et al. Continuous gastric decompression for postoperative nausea and vomiting after coronary revascularization surgery. *Anesth Analg* 2005; **100**(2): 321–326.

**O-30****Effects of sodium nitroprusside and phentolamine on tissue perfusion during paediatric cardiopulmonary bypass**

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**Introduction:** The use of vasodilation is important during paediatric cardiopulmonary bypass (CPB). The purpose of this study was to compare the effects of sodium nitroprusside and phentolamine on tissue perfusion during paediatric cardiopulmonary bypass.

**Method:** Twenty-three acyanotic infants who underwent open heart surgery were randomized into two groups. Infants in the first group (Group SNP,  $n = 12$ ) received  $3-5 \mu\text{g kg}^{-1} \text{min}^{-1}$  of sodium nitroprusside during bypass; those in the second group (Group P,  $n = 11$ ) were given  $0.2 \text{ mg/kg}$  of phentolamine both at the beginning of cooling and rewarming periods. Anaesthetic, surgical and perfusion techniques were standard in all patients. Haemodynamic parameters as well as central and peripheral temperatures (nasopharyngeal, rectal and skin of toe) were recorded. Blood samples were obtained from both superior and inferior vena cava at four time intervals: after venous cannulation (t1), after beginning of CPB and achieving full flow (t2), at lowest temperature (t3) and during rewarming at  $35^\circ\text{C}$  (t4).

**Results:** Haemodynamic data before and after CPB as well as mean arterial pressures during CPB were similar between the two groups. Temperature measurements and venous blood gas analysis at four time intervals were also similar. There were no differences in respect to central-peripheral temperature gradients between the groups. The only significance between the groups appeared for nasopharyngeal-rectal gradients measured at rewarming (t4) period ( $P = 0.019$ ). In both groups, venous  $\text{Pco}_2$  and lactate levels were higher in the superior vena cava samples at lowest temperature (t3) and rewarming (t4) periods.

**Conclusion:** Findings of this study revealed similar effects of sodium nitroprusside and phentolamine on tissue perfusion during paediatric cardiopulmonary bypass.

**O-31****Comparison of serum lipids and glucose levels during propofol 2% or midazolam infusions in coronary artery bypass surgery**A. Aygün<sup>1</sup>, I. Öztekin<sup>1</sup>, D.S. Öztekin<sup>2</sup>, G. Topcu<sup>1</sup>, S. Canik<sup>1</sup><sup>1</sup>*Siyami Ersek Thoracic and Cardiovascular Surgery Hospital, <sup>2</sup>Istanbul University, Florence Nightingale School of Nursing, Istanbul, Turkey*

**Introduction:** Plasma triglyceride (TRG) levels are preserved with propofol (P) 1% infusion whereas it is decreased compared to start level with midazolam (M) infusion during cardiac surgery [1]. We aimed to document changes in serum lipids and glucose (GLU) levels during P 2% or M infusions for cardiac surgery in normolipidaemic patients.

**Method:** 30 normolipidaemic patients undergoing CABG surgery were randomly assigned into two groups. The P group ( $n = 15$ ) received a continuous P 2% infusion and the M group ( $n = 15$ ) received an M infusion for induction and maintenance of anaesthesia. Serum total cholesterol (CHO), TRG, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL) and GLU levels were measured at five periods until postoperative 24th hour. Variance analysis in repeated measures and  $t$  test for coupled series were used.  $P < 0.05$  was accepted as statistically significant.

**Results and Discussion:**

	Grp	Pre-induction	Post-induction	End CPB	Post. 24 h
TRG	P	112 ± 29.5	106 ± 36.1	69 ± 21.3*	101 ± 26.4
	M	115 ± 29	101 ± 23.6	54 ± 16*	104 ± 23.1
CHO	P	147 ± 16.7	133 ± 20.1	84 ± 14.6*	119 ± 36.9*
	M	160 ± 26.9	148 ± 20.3	89 ± 12.8*	127 ± 17.2*
HDL	P	39 ± 11.1	35 ± 9.3	23 ± 7*	33 ± 14.7**
	M	41 ± 7.6	37 ± 7.8	24 ± 6.1*	34 ± 4.6*
LDL	P	86 ± 10.9	78 ± 17.2	49 ± 10.3*	70 ± 25.8**
	M	96 ± 23.9	91 ± 18.8*	54 ± 8.3*	72 ± 15.1*
VLDL	P	23 ± 6.9	21 ± 6.2	13 ± 3.9**	20 ± 5.2**
	M	23 ± 5.9	20 ± 4.7	11 ± 2.4*	26 ± 20.8
GLU	P	98 ± 6.9	124 ± 23.6**	149 ± 23.7*	148 ± 25*
	M	95 ± 10.5	119 ± 12.2*	144 ± 33.3*	148 ± 18.6*

\* $P < 0.05$  (in the same group); \*\* $P < 0.05$  (between the groups).

Use of P 2% infusion does not increase significantly the risk of hyperlipidaemia when used in cardiac surgery.

**Reference:**

- Inoue S, Takauchi Y, Kayamori Y, et al. Propofol as a continuous infusion during cardiopulmonary bypass does not affect changes in serum free fatty acids. *Eur J Anaesthesiol* 2001; **18**: 113–117.

**Cardiac Anaesthesia****O-32****Effectiveness of TCI remifentanyl in prevention of radial artery spasm during trans-radial coronary procedures**

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**Introduction:** The trans-radial approach is increasingly used for percutaneous coronary procedures (PCP). Radial artery spasm (RAS) may be a complication of this approach [1]. We hypothesized that anaesthesia could interfere with RAS occurrence and we compared the influence of two anaesthetic strategies.

	Group A	Group B	P
Age (years)	63.7 ± 10.7	63.4 ± 10.8	NS
Sex M/F (%)	73.5/26.5	74.5/27.5	NS
Height (cm)	168.9 ± 8.3	168.8 ± 12.1	NS
Weight (kg)	79.1 ± 15.3	80.2 ± 14.9	NS
Diabetes (%)	40	37.9	NS
Duration (min)	15.8 ± 12.9	16.9 ± 12.8	NS
No. of catheters	1.46 ± 0.65	1.47 ± 0.73	NS
Pain (VAS)	1.7 ± 1.4	2.8 ± 2.0	0.0001
SS (%)	1.3	11.8	0.0001
RAS (VAS)	2.6 ± 2.0	4.9 ± 2.3	0.0001
RAS >5 (%)	14.4	39.2	0.0001
MPF (gm)	212.8 ± 159.7	226.9 ± 147.6	NS
MPF >400 g (%)	11.5	19.8	0.05
MPF >400 g and SS 12.2	26.2		0.002

**Method:** Patients were premedicated with hydroxyzine dichlorhydrate  $1 \text{ mg/kg}$  and blindly randomized in 2 groups. Group A received systematic TCI remifentanyl ( $1.5 \text{ ng/mL}$ ) throughout the procedure. Group B received no systematic medication. In both groups, supplemental sedation (SS) was provided on a demand basis. After local anaesthesia, verapamil  $2.5 \text{ mg}$  and heparin  $5000 \text{ UI}$  were injected into the radial artery in both groups. After completion of the procedure, the patient's peroperative pain and the operator's

subjective appreciation of RAS were evaluated by a visual analogue scale. RAS was also evaluated by measuring the maximal pull-back force (MPF) required for sheath removal.

**Results:** Results show a significant difference in both groups regarding patient pain, RAS occurrence, SS, and MPF value when greater than  $400 \text{ g}$ .

**Conclusions:** In the trans-radial approach for PCP, results show a significant decrease of RAS occurrence and pain in patients treated by systematic TCI remifentanyl.

**Reference:**

- Kiemeneij F, Vajifdar BU, Eccleshall SC, et al. Measurement of radial artery spasm using an automatic pullback device. *Catheter Cardiovasc Interv* 2001; **54**: 437–441.

**O-33****Thoracic epidural anaesthesia versus general anaesthesia in cardiac surgery: which is better? A statistical point of view**

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**Introduction:** High thoracic epidural anaesthesia (HTEA) provides optimal control of the stress response and pain, a lower interference with the respiratory function [1] and better glycaemic control. The aim of the study was to estimate the incidence of the major complications in cardiac surgery and to proceed to a sample size estimation of a randomized study to evaluate whether the anaesthesia technique can modify the various end points by a preset per cent value.

**Method:** The complications mentioned below are extracted from PubMed. A sample size was estimated assuming that HTEA could reduce by 10% or by 25% the incidence of each one of these complications. Then composite end points were created for groups of complications. The estimated sample sizes ( $n$ ) are reported below.

**Results:**

	Reference value	Reduction 10%	Reduction 25%
Mortality (%)	3.8	38.3	5.7
ICU stay (days)	2.6 ± 5.3	6.5	1.0
Length of stay (days)	9.1 ± 7.0	929	149
Renal failure (%)	1.16	128.8	19.4
Gastrointestinal (GI) complications(%)	1.14	131.2	19.8
Deep wound infection (DWI)(%)	1.1	135.9	20.5
Mechanical Ventilation (VAM) >24 h (%)	4.1	35.4	5.46
Low Cardiac Output (LCO)(%)	5	28.8	4.4
Post Op. Myocardial Infarct (POMI)(%)	7.7	18.2	2.8
IABP use (%)	1.3	114.8	17.3
FEV <sub>1</sub> Reduction (%)	60	1.1	19
GI complications + renal failure (%)	2.30	64.3	9.7
Pulmonary infection + DWI + VAM > 24 h + ICU stay >7 days(%)	14.2	9.2	1.4
POMI + LCO + IABP (%)	14.0	9.4	1.4

**Conclusions:** The large number of patients required in both groups demonstrate therefore the great difficulty of making an exhaustive study on effectiveness of HTEA in reducing the incidence of complications in cardiac surgery. These samples sizes imply the participation of many centres for a long period of time, thus raising hardly controllable further variables.

**Reference:**

1 Mangano CT. Risky Business. *J Thorac Cardiovasc Surg* 2003; **125**: 1204–1207.

**O-34**

### A comparison of pressure recording analytical method (PRAM) with pulmonary artery catheter (PAC) based cardiac output (CO) method

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**Introduction:** PRAM is a recently described non-invasive method of estimation of CO. In small number studies it adequately correlated with CO bolus thermodilution in low risk patients in haemodynamic stable conditions. Scolletta *et al* [1] called for the evaluation of patients with unstable haemodynamic conditions in order to correlate conventionally measured CO with PRAM before it can be used to replace (PAC) based CO, both in the operating room and in the septic ICU patient.

**Method:** Twelve patients undergoing cardiac surgery involving cardiopulmonary bypass (CPB) were randomized to Edwards Life Sciences continuous CO or TRUCCOM-CO. All patients received PRAM. For the first 15 minutes immediately after the end of CPB the mean CO was calculated for both the PRAM and PAC based methods. Within group PRAM-PAC CO differences were determined by Wilcoxon's signed rank and any PRAM-PAC CO correlation determined using linear regression.

**Results:** There was no significant between-group PRAM-PAC CO difference for both PAC methods. However, we failed to show a correlation between PRAM and PAC based CO values in both PAC groups.

	PRAM CO	PAC CO
TRUCCOM group CO (L/min <sup>-1</sup> ) Mean ± SD	3.61 ± 0	4.47 ± 0
Edwards group CO (L/min <sup>-1</sup> ) Mean ± SD	3.79 ± 0.49	4.67 ± 0.03

**Discussion:** This is preliminary data of a much larger study which will involve 300 patients. At the post CPB period of common haemodynamic instability our results are in keeping with earlier reports of PRAM not correlating with CO determination using a standard thermodilution PAC method.

**Reference:**

1 Scolletta S, Romano SM, Biagioli B, et al. Pressure recording analytical method (PRAM) for measurement of cardiac output during various haemodynamic states. *Br J Anaesth* 2005; **95**: 159–165.

**O-35**

### Cardiac output measurement by arterial waveform analysis in cardiac surgery: a comparison of measurements derived from radial artery versus ascending aorta waveforms

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**Introduction:** In cardiac surgery advanced haemodynamic monitoring is frequently used to guide therapy with inotropes and volume replacement. In particular, precise measurements of cardiac output (CO) are required before

and after weaning from cardiopulmonary bypass (CPB). Recently, a device offering CO measurement by arterial waveform analysis (Vigileo™, Edwards Lifesciences LLC, Irvine, CA) was introduced. This device was developed to use the arterial waveform signal from the radial artery. The aim of this study was to compare the bias and the limits of agreement (2 SD) of CO derived from the radial artery waveform against that from the ascending aorta before and after weaning from CPB in patients undergoing CABG surgery.

**Method:** After approval of the local ethics committee and informed consent 30 patients with coronary artery disease (CAD) scheduled for CABG surgery were included in this study. In all patients a radial artery cannula was placed prior to induction of anaesthesia. Before and after weaning from CPB a 20 gauge cannula was placed in the ascending aorta and linked to the transducer of the Vigileo™ monitor. A prerequisite for all measurements was a stable haemodynamic condition. Three measurements of at least 30 seconds were taken in an alternating pattern from the radial artery and the ascending aorta. All data is expressed as mean and standard error of the mean. Statistical analysis was performed by linear regression analysis. Bias and limits of agreement (LOA) (2 SD) were assessed according to the method described by Bland and Altman.

**Results:** Pre- and post-CPB measurements (n = 120) were obtained in all patients. Cardiac output measurements derived from the ascending aorta compared to that from the radial artery showed a significant correlation with a r<sup>2</sup> = 0.228 and a P = 0.02 before CPB and a r<sup>2</sup> = 0.423 and a P = 0.02 after CPB. The Bland-Altman analysis showed a mean bias and LOA of +2.22 L and -1.9 L prior and +2.52 L and -2.72 L after weaning from CPB, respectively.

**Conclusion:** Cardiac output measurements were comparable for both techniques. However, a clinically relevant mean bias between these techniques was demonstrated. Assuming that CO measurements from the waveform analysis derived from the ascending aorta represent the "true" cardiac output, these results might indicate that cardiac output measured from the radial artery waveform, which are less invasive and easier to obtain than those from the ascending aorta, may not correctly reflect cardiac output.

**O-36**

### Effect of bispectral index monitoring on sevoflurane consumption and interrogation of awareness during coronary artery bypass surgery

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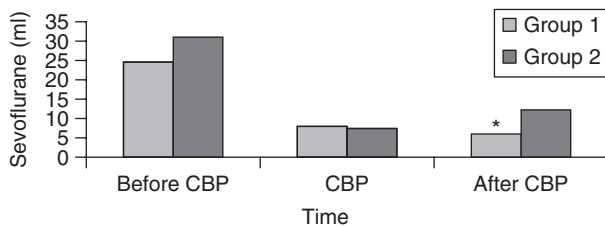
**Introduction:** Bispectral index (BIS) monitoring was used to measure depth of anaesthesia and guide anaesthetic drug titration [1]. Awareness may be a risk of cardiopulmonary bypass (CPB) during the rewarming phase and after CPB when anaesthetic agents may be reduced to avoid haemodynamic instability [2]. The aim of this study was to observe the effect of BIS monitoring on sevoflurane consumption and interrogation of awareness during coronary artery bypass surgery.

**Method:** After getting ethics committee approval and informed patient consent 50 adult patients undergoing coronary artery bypass grafting under cardiopulmonary bypass were studied in a prospective, randomized manner. BIS monitoring was used for all patients. In Group 1 (n = 25) sevoflurane concentration was titrated to keep BIS between 40 and 50. In Group 2 (n = 25) where the BIS monitor could not be viewed by the anaesthesiologist, necessary sevoflurane concentration was adjusted for haemodynamic interventions. Standardized Mini mental test was used at the preoperative visit. Patients were premedicated with i m morphine 0.1 mg kg<sup>-1</sup> 60 minutes before surgery. Anaesthesia was induced with fentanyl 10 µg kg<sup>-1</sup>, thiopental 1–2 mg kg<sup>-1</sup> and vecuronium 0.1 mg kg<sup>-1</sup>. Anaesthesia was maintained with fentanyl 10 µg kg<sup>-1</sup> h<sup>-1</sup> and sevoflurane in oxygen/air. Haemodynamic responses (heart rate, mean arterial pressure) and BIS were recorded at T<sub>0</sub>, baseline; T<sub>1</sub>, 5 min after the start of induction; T<sub>2</sub>, skin incision; T<sub>3</sub>, sternotomy; T<sub>4</sub>, 5 min before CPB; T<sub>5</sub>, cross-clamp; T<sub>6</sub>, 5 min before termination of CPB; T<sub>7</sub>, 5 min after termination of CPB; T<sub>8</sub>, skin closure.

The consumption of sevoflurane was computed. The oxygenator pump flows were maintained at 2–2.4 litre min<sup>-1</sup> m<sup>2</sup> with a mean systemic arterial pressure in range 40–80 mmHg. Fentanyl consumption was similar in both groups. Patients were given music during surgery. All patients were interviewed with standard questions after extubation and postoperative third day for evidence of explicit awareness. Statistical analysis was made by using Student's *t* and Mann-Whitney *U* tests. Data are expressed as mean ± SD. P < 0.05 was considered significant.

**Results:** We found a significantly increased mean arterial pressure after sternotomy but at the same time, BIS levels did not increase in either group. There was no explicit recall of surgery in either group. BIS monitoring was

associated with reduction of sevoflurane usage after termination of CPB in Group 1 (Figure 1). Group 1 patients had a reduced need for inotropic support after CPB. At the end of the surgery, epinephrine consumption was lower in Group 1 ( $15.4 \pm 27.3 \mu\text{g}$ ) than in the Group 2 ( $51.8 \pm 51.2 \mu\text{g}$ ).



**Figure 1.** Sevoflurane consumption  
\* $P < 0.05$ .

**Conclusion:** The small decrease of sevoflurane consumption after CPB with BIS monitoring, can be significant for decreasing the need of inotropic support. There was no explicit recall in this study which may be due to the small patient population. A much larger patient population is needed for detecting awareness during coronary artery bypass surgery.

#### References:

- 1 Puri GD, Murthy SS. Bispectral index monitoring in patients undergoing cardiac surgery under cardiopulmonary bypass. *Eur J Anaesthesiol* 2003; **20**: 451–456.
- 2 Laussen PC, McGowan FX, Sullivan LJ, et al. Bispectral index monitoring in children during mild hypothermic cardiopulmonary bypass. *Anesthesiol* 1998; **89**: 925.

## O-37

### Effects of volatile anaesthesia versus total intravenous anaesthesia on inotrope use and time of stay in Intensive Care Unit on CABG patients

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**Introduction:** Many studies have analysed the role of volatile anaesthetic agents in myocardial protection during coronary artery bypass graft (CABG) surgery and some have identified beneficial effects [1]. The purpose of the current study was to evaluate the effects of volatile anaesthesia versus total intravenous anaesthesia on dose and frequency of inotropes use and time of stay in Intensive Care Unit in on-pump CABG patients.

**Method:** From January 2000 to September 2004 367 consecutive patients underwent primary elective CABG performed exclusively by two selected cardiac surgeons with similar surgical experience. Of this group 159 patients received sevoflurane before cardiopulmonary bypass (CPB) (Treatment Group) and 208 patients received total intravenous anaesthesia (Control Group). Subsequently, with the use of cluster analysis, the whole studied population was divided into group A (175 patients) and group B (153 patients) based on the levels of creatine kinase activity determined at 12 h and 24 h postoperatively. Creatine kinase activity at 12 h was lower in group A than in group B ( $409.14 \pm 139.59$  vs.  $972.15 \pm 629.41$  U/l). Also creatine kinase myocardial fraction activity at 12 h was lower in group A ( $15.03 \pm 6.25$  vs.  $58.14 \pm 62.57$  U/l). Analysis of variance (ANOVA), followed by Kruskal-Wallis, chi squared, and Fisher's tests were used for statistical analysis. Data in A and B group of patients were determined separately.

**Results:** Lower number of patients in group A who received sevoflurane anaesthesia required postoperative inotropic support compared to total intravenous anaesthesia patients (28% versus 72%,  $P = 0.0429$ ). The effect of volatile and total intravenous anaesthesia on daily dose of inotropes and time of stay in Intensive Care Unit was not observed either in A or B group of patients.

## Thoracic Anaesthesia and Surgery

## O-39

### Multimodal management of post-thoracotomy pain. A preliminary report

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**Discussion:** In CABG patients with lower postoperative CK/CK-MB activity (group A) volatile anaesthesia decreased the need for inotropic support. It might suggest a protective influence of sevoflurane on myocardium.

#### Reference:

- 1 Symons JA, Myles PS. Myocardial protection with volatile anaesthetic agents during coronary artery bypass surgery: a meta-analysis. *Br J Anaesth* 2006; **97**(2): 127–136.

## O-38

### Comparison of haemodynamic parameters during and after propofol and desflurane anaesthesia for off-pump coronary operations

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**Introduction:** It has been reported that volatile anaesthesia can protect the heart against ischaemia and improve its function on reperfusion [1]. The aim of the present study was to compare haemodynamic parameters during and after off-pump coronary operations in patients receiving desflurane or propofol anaesthesia.

**Method:** Twenty-eight coronary surgery patients were randomized to be anaesthetized with desflurane (group D) or propofol (group P). For the induction of anaesthesia group D were given 0.3 mg/kg of etomidate and group P 1.5 mg/kg of propofol. Both groups received similar doses of fentanyl. A pulmonary artery catheter for continuous cardiac index (CI), haemoglobin saturation with oxygen (SvO<sub>2</sub>) and end-diastolic right ventricular volume (RVEDV) measurements, was introduced in every patient. Haemodynamic and oximetric data were collected at the following time-points: after sternum opening, directly before finishing each distal anastomosis, 40 min after finishing proximal anastomoses, as well as 6, and 24 hours after the operation. Blood samples were collected for CK-MB, troponin I, C-reactive protein levels as well as leukocyte count 18 hours after the operation. Groups were compared with Mann-Whitney *U* test. Data are expressed as median value and quartiles.

**Results:** No significant difference between the two groups in haemodynamic and oximetric parameters were observed. Haemodynamic and oximetric parameters in the two groups are presented in the Table. The concentrations of CK-MB and troponin levels were 4.6 (2.5; 5.9) and 0.5 (0.29; 0.68) in group P, and 3.3 (2.5; 4.9) and 0.47 (0.15; 1.15) in group D, respectively (NS). The concentrations of C-reactive protein levels and white blood count were 55 (45; 77.6) and 12.3 (11.2; 14.7) in group P, and 65 (41.7; 86.7) and 11.9 (10.3; 12.2) in group D, respectively (NS).

	Group	After sternum opening	During 2nd anastomosis	40 min after anastomosis	24 h post operation
Mean	D	83 (72;94)	76 (72;80)	77 (69;86)	74 (67;94)
ABP	P	89 (84;99)	86 (72;95)	81 (74;85)	77 (74;92)
CI	D	2.3 (1.9;2.7)	2.1 (1.8;2.6)	2.1 (1.9;2.5)	2.4 (2.3;2.7)
	P	2.7 (2.0;2.9)	1.9 (1.8;2.3)	2.2 (2.0;2.5)	3.0 (2.4;3.1)
LVSWI	D	33 (30;42)	25 (19;30)	27 (19;31)	29 (26;34)
	P	49 (40;54)	25 (20;29)	28 (20;34)	31 (29;36)
SvO <sub>2</sub> %	D	78 (77;82)	65 (61;70)	71 (66;75)	63 (60;70)
	P	77 (72;79)	65 (59;75)	70 (63;74)	64 (59;71)
RVEDV mL	D	232 (209;276)	187 (176;226)	201 (194;220)	245 (191;260)
	P	217 (189;274)	178 (153;213)	187 (155;208)	225 (189;247)

**Discussion:** Results from this pilot study do not indicate that desflurane provides better haemodynamic stability than propofol during anaesthesia for off-pump coronary surgery. Further studies are required to established whether there are any differences in other clinical parameters.

#### Reference:

- 1 De Hert SG, Cromhecke S, ten Broecke PW, et al. Effects of propofol, desflurane, and sevoflurane on recovery of myocardial function after coronary surgery in elderly high-risk patients. *Anesthesiol* 2003; **99**: 314–323.

**Introduction:** Inadequate management of post-thoracotomy pain has detrimental effects on pulmonary function, leading to increased postoperative morbidity [1]. The purpose of this study was to evaluate the efficacy of two different pain protocols following thoracotomy.

**Method:** Thirty-two patients scheduled for elective anterolateral thoracotomy, sparing the latissimus dorsi muscle, were included in a prospective, randomized study. Patients were assigned to receive either 40 mg parecoxib 20 min before removal of the endotracheal tube and 40 mg of parecoxib 12 h postoperatively (Group A, n = 16) or an infusion system providing continuous

administration of 0.6 % ropivacaine (at a fixed rate of  $0.1 \text{ mL kg}^{-1} \text{ h}^{-1}$ ) for 48 h via a catheter placed in the subpleural space (percutaneously) through the chest wall under direct surgeon's vision, just before thoracotomy closure (Group B,  $n = 16$ ). Postoperatively all patients had access to i.v. PCA with morphine for additional pain control. Pain was assessed on the basis of PCA morphine requirements and by using visual analogue pain scores at the following time points postoperatively:  $t_1 = 4 \text{ h}$ ,  $t_2 = 12 \text{ h}$ ,  $t_3 = 24 \text{ h}$  and  $t_4 = 48 \text{ h}$ . Demographic data, duration and type of procedure, duration of anaesthesia, length of stay in Intensive Care Unit, time to mobilization and bowel function, need for additional analgesics were also recorded in all patients. Patients of Group B were also observed for clinical signs of ropivacaine related toxicity. Statistical analysis was performed using *t*-test, analysis of variance (ANOVA) and Kruskal-Wallis test.  $P < 0.05$  was considered statistically significant.

**Results:** The groups did not differ significantly at any time points regarding morphine consumption via PCA. Patients of Group A experienced less pain 12 h postoperatively compared to Group B ( $P = 0.025$ ). No patients showed clinical signs of ropivacaine related toxicity. The two groups were comparable concerning all other parameters studied.

	Gp	4 h	12 h	24 h	48 h
VAS-score	A	$3 \pm 0.2$	$4.1 \pm 0.5^*$	$4 \pm 0.5$	$3.5 \pm 0.2$
	B	$3.1 \pm 0.3$	$5.7 \pm 0.3^*$	$4.2 \pm 0.6$	$3.3 \pm 0.4$
PCA (mg morphine)	A	$6.1 \pm 0.3$	$16.4 \pm 2.4$	$30.1 \pm 2.3$	$43 \pm 2.9$
	B	$7.3 \pm 0.2$	$18.2 \pm 3.0$	$32.2 \pm 3.2$	$40.4 \pm 3.1$

\*A vs. B,  $P < 0.05$

**Discussion:** Effective post-thoracotomy pain management is best accomplished using multimodal pain treatments. The administration of a COX-2 inhibitor postoperatively seems to improve pain control by controlling somatic pain during patient mobilization. Additional clinical experience is necessary to define the safety and efficacy of subpleural administration of a local anaesthetic.

#### Reference:

- 1 Koehler RP, Keenan RJ. Management of postthoracotomy pain: acute and chronic. *Thorac Surg Clin* 2006; **16**: 287–297.

## O-40

### Large airway stenting results in early respiratory improvement in patients with endobronchial malignancy

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**Introduction:** Endobronchial intervention has an established role in the management of selected patients with large airway malignancy [1]. We wished to assess whether this intervention produces early clinical benefit.

**Method:** Twelve consecutive patients (six males, six females) age range 50 to 82 (median 57) years who were referred with tracheal (six), right main (three) and left main (three) bronchial malignancy, had baseline assessment by dyspnoea score, peak flow, six minute walk test and oxygen saturation measurement. Rigid and fibreoptic bronchoscopy were performed under general anaesthesia. The tumour was debulked using Nd Yag laser therapy and subsequently a covered expandable metallic stent was deployed in the trachea (6) or main bronchus (6). Baseline investigations were repeated the day after the procedure.

**Results:** Peak flow (Litres/min) increased in each consecutive patient from 80, 180, 100, 85, unrecordable, 80, 100, 120, 95, unrecordable, 50 and unrecordable to 240, 280, 200, 150, 20, 230, 200, 205, 170, 210, 140 and 250 respectively. Six minute walk test (metres) increased in nine patients from 20, 160, 140, 0 (= unable to perform), 60, 5, 0, 50 and 0 to 240, 300, 300, 360, 105, 240, 220, 100 and 300 respectively. Six minute walk tests were not performed in three patients because of pneumonia (two) and poor mobility as a consequence of cerebral metastases (one). Baseline oxygen saturation increased in all patients and none required supplemental oxygen at the time of assessment post procedure. Dyspnoea score improved in each patient.

**Conclusion:** Endobronchial intervention for patients with large airway malignancy provides a rapid improvement in respiratory function and exercise capacity. Given the limited life expectancy of these patients we believe that such intervention should be considered early to promote functional improvement and to potentially maximise tolerance to other treatment modalities.

#### Reference:

- 1 Madden BP, Park JE, Sheth A. Medium-term follow-up after deployment of ultraflex expandable metallic stents to manage endobronchial pathology. *Ann Thorac Surg* 2004; **78**(6): 1898–1902.

## O-41

### High frequency jet ventilation or one lung ventilation for minithoracotomy

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**Introduction:** Double lumen tube (DLT) and one lung ventilation (OLV) facilitate immobilization of the operating area in order to perform lung surgery in suitable conditions. Two lung high frequency jet ventilation (TL-HFJV) may be considered an alternative way of ventilation during lung resection [1]. This mode of ventilation using a traditional endotracheal tube (ET) minimizes iatrogenic complications.

**Method:** Patients in the HFJV group ( $n = 25$ ) were intubated with a traditional ET. Patients in the OLV group ( $n = 25$ ) were intubated with a DLT. Patients in HFJV group were ventilated with a driving pressure (DP) of 1.0–1.2 atmospheres, at a respiratory rate  $200 \text{ min}^{-1}$ . Patients who underwent OLV received a tidal volume of  $8 \text{ mL kg}^{-1}$  and a constant respiratory rate of 12 breaths per minute. Surgeons were asked to give their opinions about operating conditions. Shunt fraction ( $Q_s/Q_t$  %Cl) was calculated using standard formula.

**Results:** Mean values of  $Q_s/Q_t$  %Cl were lower in patients undergoing OLV. In the HFJV group, operating conditions were assessed either as "very good" 12%, "good" in 80% and "unsatisfactory" in 8%. The corresponding numbers for the OLV group were: 80% rated "very good" and 20% rated "good" by the operating surgeon ( $P < 0.01$ ).

**Discussion:** Minithoracotomy as a surgical approach used by surgeons in our study as well as a partially inflated lung were an obstacle for surgeons [2]. Much higher values of  $Q_s/Q_t$  in the HFJV group were the result of the lung compression necessary to identify anatomical structures. Hypoxic pulmonary vasoconstriction mechanisms are inhibited as a consequence of local vasodilatation induced by thromboxane and prostacyclin when the operated lung is compressed [3].

#### References:

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- 2 Landreneau RJ, Pigula F, Luketich JD, et al. Acute and chronic morbidity differences between muscle-sparing and standard lateral thoracotomies. *J Thorac Cardiovasc Surg* 1996; **112**: 1346–1351.
- 3 Brodsky JB. Thoracic anesthesia. *Critical Care Medicine* 1999; **20**: 419–427.

## O-42

### Effectiveness and safety of thoracic continuous epidural analgesia (TCEA) following thoracotomy coordinated by nurse-based acute pain service (APS)

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**Introduction:** The solution to the problem of improving the quality of post-thoracotomy pain management lies not so much in the development of new techniques, but in developing better organisation of work on wards to exploit existing expertise.

**Method:** We have studied 1043 patients after thoracotomies treated with TCEA with a combination of bupivacaine and fentanyl. Level of postoperative pain (Prince Henry Hospital Pain Score-PHPS), systolic and diastolic blood pressure (SBP, DBP), sedation (Ramsay Score-RS), interventions and side-effects were recorded every ~7 hours.

**Results:** Mean treatment time was  $3.7 \pm 1.6$  days. Nurses conducted 84% of all visits concerned with TCEA. Epidural continuous infusion of 0.0625% bupivacaine and fentanyl  $6 \mu\text{g mL}^{-1}$  has been administered to 77% of patients for the whole treatment time. Satisfactory analgesia (PHPS  $\leq 1$ ) was found in 9985 (95%) measurements. Mean SBP/DBP amplitude was  $40 \pm 18/23 \pm 10$  mmHg. Optimal level of sedation (level 2 in RS) was registered in 10189 (97%) measurements. Easily curable side effects (hypotension, paresthesia, pruritus, nausea) or complications leading to premature finishing of TCEA (accidental removal, occlusion, inflammation of skin around the catheter) were noted in 275 (25.1%) patients. No major complications occurred.

**Discussion:** The results are in agreement with other studies, which suggests that the implementation of an organised APS, regular pain assessment, documentation of treatment with side-effects recording, beside using effective methods for pain control, are essential for safe and efficient postoperative analgesia [1]. This research has proved that effective and safe analgesia by epidural infusion of 0.0625% bupivacaine with fentanyl  $6 \mu\text{g mL}^{-1}$  can be obtained in most patients after thoracotomy, delivered by nurses under the supervision of anaesthesiologists.

**Reference:**

- 1 Rawal N. Results from an interactive audience survey of the current state-of-the-art practices for delivery of postoperative analgesia. *Eur J Anaesthesiol* 2006; **23**(Suppl 37): 221.

**O-43****Effects of recruitment manoeuvres on lung parenchyma during one lung ventilation in a rabbit model**

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**Introduction:** Recruitment manoeuvres are among the techniques to relieve hypoxaemia occurring during one lung ventilation [1]. This study aimed to show their effects on lung parenchyma in one lung ventilated healthy rabbits.

**Method:** Twenty-four male New Zealand rabbits were selected randomly into four groups: peak inspiratory pressure (PIP) 30, PIP40, PIP50 and control group. After anaesthesia induction, tracheotomy and intubation, the rabbits were ventilated with a Siemens Servo 900C ventilator (Siemens-Elma AB, Solna, Sweden). Ventilation was pressure controlled, inspiration/expiration ratio: 0.5, and fraction of inspired oxygen of 1. Pressure level and breathing frequency were adjusted to supply a tidal volume of 10 mL kg<sup>-1</sup> and an end-tidal CO<sub>2</sub> between lungs and fifteen minutes later, while maintaining a supine position, the endotracheal tube was advanced further into the right main stem bronchus until total collapse of the left lung while all lobes of the right lung were ventilated. Afterwards, all rabbits were one lung ventilated without any change in ventilation parameters for 10 minutes. Following this, PIP30, PIP40 and PIP50 groups were ventilated with PIP/PEEP levels at 30 cmH<sub>2</sub>O/10 cmH<sub>2</sub>O; 40 cmH<sub>2</sub>O/10 cmH<sub>2</sub>O, and 50 cmH<sub>2</sub>O/10 cmH<sub>2</sub>O respectively for ten consecutive breaths for alveolar recruitment. Rabbits in the control group were ventilated 10 more breaths with the same parameters as in the start of one lung ventilation. Arterial blood samples were withdrawn at the end of double lung ventilation, after 10 minutes of one lung ventilation and at the end of recruitment for blood gas analysis. Samples obtained from ventral part of the upper lobe, ventral part of the middle lobe, ventral (nondependent) part of the lower lobe and dorsal (dependent) part of the lower lobe were examined for injury by light microscopy. The data were analysed by analysis of variance, Tukey HSD test and paired samples *t*-test. *P* < 0.05 was considered significant.

**Results:** The groups ranked from lowest to highest value according to total severity scores are as follows; 1) PIP30, 2) PIP40, 3) PIP50, 4) control (*P* = 0.000). Only post-recruitment PaO<sub>2</sub> levels were statistically significantly higher in PIP30 and PIP40 group but no statistically significant difference in PIP50 group when compared with the control group (*P* = 0.031; *P* = 0.039; *P* = 0.076).

**Discussion:** As peak airway pressure increases in recruitment manoeuvres in one lung ventilation, the alveolar injury gets worse. On the other hand, ventilation without recruitment manoeuvres may cause more significant alveolar injury.

**Reference:**

- 1 Tusman G, Böhm SH, Melkun F et al. Alveolar recruitment strategy increases arterial oxygenation during one-lung ventilation. *Ann Thorac Surg* 2002; **73**: 1204–1209.

**O-44****Comparison of pre-emptive and postoperative thoracic epidural analgesia on respiratory function tests**

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**Introduction:** Adequate analgesia is of special interest in thoracic surgery for postoperative morbidity and pre-emptive analgesia is more effective in this kind of surgery [1]. Thoracic epidural analgesia (TEA) is the preferable method as it provides effective analgesia and also improves respiratory function after surgery [2]. We compared the effects of pre-emptive and postoperative TEA in thoracic surgery for pain control and respiratory function tests (RFT).

**Method:** Thirty patients for elective thoracotomy were included in the study and all patients had a thoracic epidural catheter (T7-8 or T8-9). In the first group

(G1) 0.1% bupivacaine + 1 µg/mL fentanyl infusion was started after a 10 mL bolus before skin incision; and 7 mL/h infusion continued during surgery. In the second group (G2) the bolus dose was given at the end of surgery. Anaesthesia was maintained with a propofol infusion. A postoperative analgesia protocol was the same for both groups (5 mL/h infusion with 3 mL bolus and lock out of 30 min). Postoperative follow-up included visual analogue scale (VAS), bolus doses and haemodynamic data at first, 12th, 24th, 36th hours. RFTs were performed at 36th hour and at first week postoperatively.

**Results:** VAS were significantly lower in G1 at all times of the study. RFTs were decreased in all patients, but the rate of decrease in G1 was significantly less (postoperative/preoperative FEV<sub>1</sub>: 74.6 ± 14.4% vs. 59.3 ± 9% *P* = 0.0016) (postoperative/preoperative FVC: 76.1 ± 13.3% vs. 55.9 ± 8.4% *p* < 0.001) at 36th hour. There was no difference in RFTs after one week.

**Conclusion:** Besides providing better postoperative analgesia, pre-emptive TEA is also associated with better preserved RFTs compared to postoperative TEA.

**References:**

- 1 Senturk M, Ozcan PE, Talu GK, et al. The effects of three different analgesia techniques on long-term postthoracotomy pain. *Anesth Analg* 2002; **94**: 11–15.  
2 Slinger P, Shennib H, Wilson S. Postthoracotomy pulmonary function: a comparison of epidural versus intravenous meperidine infusions. *J Cardiothorac Vasc Anesth* 1995; **9**: 128–134.

**O-45****Carinal resection: anaesthetic management and results after two years' experience**

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**Introduction:** Carinectomy is considered the treatment of choice in lesions of the tracheal carina or tracheobronchial angle. Its usefulness for carcinoma is still controversial and represents a challenge for surgeons and anaesthesiologists [1,2]. The aim is to present our two years of surgery experience.

**Method:** Between April 2005 and November 2006, fourteen patients with non-small cell lung cancer underwent carinal resection and mediastinal dissection. Clinical notes were reviewed retrospectively: age, sex, length of stay, tumour staging, histopathological diagnosis, complementary treatment (chemotherapy, radiotherapy), type of surgery, approach, anaesthetic management (TIVA technique), monitoring of cerebral activity by BIS and Somanetics<sup>®</sup> (SrO<sub>2</sub> cerebral), protective ventilation with very low tidal volumes (TV) and apnoeic hyperoxygenation as a ventilation technique during the tracheobronchial anastomosis), postoperative complications, mortality and length of hospital stay.

**Results:** Twelve males and 2 females (mean age 55 ± 8.6 years), underwent carinal resection. Five had received neo-adjuvant chemotherapy; 9 underwent sleeve pneumonectomy, 4 right lobectomy with carinal resection and one, only carinal resection. The approach was median sternotomy in 6 patients and right thoracotomy in 8. Hypercapnia secondary to low TV and apnoeic oxygenation was the main anaesthetic management problem; hypoxaemia occasionally needed cross surgical field ventilation. Fluid overload, repetitive pulmonary atelectasis and high oxygen blood concentration were avoided. All patients were extubated within 24 hours after surgery. Mortality was 7% (1 patient in the first year) and morbidity rate was 64% (9 patients). Purulent tracheobronchitis, haemodynamic instability and pneumothorax, being the main complications. Suture dehiscence occurred in one case (7%). Length of hospital stay was 17 ± 21 days and survival was 79% after a follow-up (4–24 months).

**Conclusions:** Carinal resection is a feasible procedure despite previous neo-adjuvant treatment. The anaesthetic management is particularly difficult and requires a learning curve for intraoperative and postoperative events. However in centres with expertise these procedures show a low rate of pitfalls and complications.

**References:**

- 1 de Perrot M, Fadel E, Mercier O, et al. Long term results after carinal resection for carcinoma: does the benefit warrant the risk? *J Thorac Cardiovasc Surg* 2006; **131**: 81–89.  
2 Mitchell JD, Mathisen DJ, Wright CD, et al. Resection for bronchogenic carcinoma involving the carina: long-term results and effect of nodal status on outcome. *J Thorac Cardiovasc Surg* 2001; **121**: 465–471.

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**Introduction:** Even a rapidly degradable HES, i.e. HES 200 kDa/0.5, may increase the risk of postoperative blood loss when administered immediately after cardiac surgery [1]. HES 130/0.4 has been reported to have minimal effect on haemostasis [2] and may be suitable during the period of increased

**Haemostasis****O-46****Similar deleterious effects of HES 130/0.4 and HES 200/0.5 on blood coagulation after cardiac surgery**

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risk for bleeding due to cardiopulmonary bypass induced coagulation defects. Therefore, we examined the effect of HES 130 on thromboelastometry assessed whole blood coagulation after on-pump cardiac surgery.

**Method:** Forty-five patients scheduled for elective primary cardiac surgery were included in the study. Immediately after admission to the cardiac surgical intensive care unit, the patients were allocated in random order to receive 15 mL/kg of 6% HES 130/0.4, 6% HES 200/0.5 or 4% Albumin solution. Modified thromboelastometry coagulation analysis (ROTEM®) using four activators was performed before the infusion, after the completion of the infusion and 2 hours thereafter.

**Results:** Clot formation time was prolonged and maximum clot firmness decreased (all activators of ROTEM) immediately after completion of both HES solutions ( $P = 0.05$ ). Coagulation disturbances slightly recovered at 2 hours after HES completion, but not to the baseline level. No abnormalities in blood coagulation were observed after albumin infusion. The cumulative chest tube drainage until the first postoperative morning was not different between the groups.

**Conclusion:** As a relatively rapid infusion HES 130/0.4 produces similar coagulation disturbance as HES 200/0.5 after cardiac surgery. In this clinical setting albumin seems not to impair haemostasis. The cumulative chest tube drainage at 16 h was comparable in the study groups.

#### References:

- Niemi TT, Suojaranta-Ylinen RT, Kukkonen SI, et al. Gelatin and hydroxyethyl starch, but not albumin, impair hemostasis after cardiac surgery. *Anesth Analg* 2006; **102**: 998–1006.
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## O-47

### Von Willebrand disease in patients with intracardiac high shear conditions: a PFA-100 analysis

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**Introduction:** Intracardiac high shear conditions are known to cause acquired vW type IIA disease [1]. The aim of this study was to evaluate the prevalence of primary haemostasis defects in patients with aortic stenosis or periprosthetic leaks (without a history of pathological mucocutaneous bleeding) by means of PFA-100, and to correlate these results with the effects of surgery and postoperative bleeding.

**Method:** Twenty-three patients undergoing aortic valve replacement or repair of a mitral periprosthetic leak (study group) were retrospectively compared to 39 patients undergoing other open heart operations (control group). Platelet-related haemostasis was tested with a platelet-function analyser (PFA-100, Dade Behring) by determining closure time (CT) of adenine diphosphate cartridges (normal value, less than 118 seconds). The PFA-100 is a high shear system for in vitro testing of platelet function that simulates primary haemostasis after injury to a small vessel. It is a highly sensitive way to screen patients for von Willebrand factor deficiency.

**Results:** The main finding of our study is that patients with aortic stenosis or periprosthetic leaks have a higher median value of CT preoperatively (169 vs. 144 sec.,  $P = 0.2$ ) and after heparin administration (242 vs. 142 sec.,  $P = 0.01$ ). However these values are normalized a few hours after valve replacement (111 vs. 86,  $P = 0.212$ ).

Five patients in the study group had no formation of the platelet plug at baseline (CT > 300 sec.). This subgroup showed a statistically significant higher postoperative bleeding as compared to the rest of the study population ( $354 \pm 86$  mL vs.  $250 \pm 90$  mL).

**Conclusions:** Patients with intracardiac high shear stress have a certain degree of proteolysis of high molecular weight von Willebrand factor. This defect of primary haemostasis is quickly corrected by valve replacement due to the quick restoration of vW factor levels. However it is responsible for a higher postoperative bleeding in those patients with the most severe deficiencies.

#### Reference:

- Vincentelli A, Susen S, Le Tourneau T, et al. Acquired von Willebrand syndrome in aortic stenosis. *N Engl J Med* 2003; **349**: 343–349.

## O-48

### Antithrombin administration after cardiac surgery: a propensity treatment-control matched study

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**Introduction:** Recent studies showed that low antithrombin (AT) levels are associated with worse clinical outcome in critically ill patients [1], such as those who have undergone cardiac surgery [2]. Nevertheless, it is not yet clear that AT administration achieves real benefits after cardiac operations.

**Method:** In 272 of 1538 patients who underwent cardiac surgery between May 2000 and June 2003, AT levels were available preoperatively and postoperatively (ICU-arrival, postoperative days 1 and 3). None of these patients required AT administration during CPB. Of these 272 patients, 189 were found having ICU-arrival AT below 75%. Seventy-six of these patients received human AT concentrate (1000 UI) at ICU arrival. Through a multiple logistic regression, including all preoperative and intraoperative variables, the probability of receiving AT after the operation (Propensity Score, PS), was calculated. Subsequently, 53 patients who received AT were matched with 53 patients with an identical PS who did not receive AT. Postoperative mortality and morbidity was compared between the groups.

**Results:** After PS matching, no significant difference concerning preoperative and intraoperative variables was found comparing Treatment with Control. As shown in Table 1, patients receiving AT at arrival in ICU had a trend towards higher AT levels in POD3, however no difference in mortality and morbidity rates was observed.

Table 1

	Not Treated	Treated	<i>P</i>
Patients	53	53	
Preoperative ATIII	81.8 ± 13.3	79.7 ± 13.7	0.43
ICU arrival ATIII	61.5 ± 11.7	61.3 ± 13.1	0.94
POD1 ATIII	67.1 ± 15.7	66.4 ± 15.4	0.81
POD3 ATIII	66.3 ± 16.5	71.7 ± 13.8	0.07
In-hospital mortality	3 (5.7%)	3 (5.7%)	0.99
Mechanical ventilation (h)	26.5 ± 61.1	24.3 ± 33.8	0.81
ICU stay (h)	58.2 ± 63.9	65.6 ± 55.2	0.53
Overall stay (d)	8.5 ± 4.1	9.7 ± 4.4	0.15
Low Cardiac Output Syndrome	10 (18.9%)	10 (18.9%)	0.99
Continuous haemodialysis	2 (3.8%)	3 (5.7%)	0.99
Postoperative creatinine peak mg/100 mL	1.5 ± 0.7	1.5 ± 0.6	0.78
Blood loss (mL)	888.9 ± 499.8	846.8 ± 442	0.65
Blood Units	2 ± 2.1	2.2 ± 2.6	0.59
FFP Units	0.15 ± 0.63	0.52 ± 2.07	0.2
Platelet Units	0.18 ± 0.78	0.34 ± 1.09	0.41

**Discussion:** This is the first study evaluating the effects of AT reintegration in patients with low AT levels following cardiac operations. A low AT dose restored almost normal levels of circulating AT after cardiac operation. Nevertheless, after propensity matching, low dose AT replacement seems not to have any significant influence on mortality and morbidity after cardiac surgery. Further prospective evaluations, using higher AT dose administration, should be performed to verify possible clinical benefit.

#### References:

- Martinez MA, Pena JM, Fernandez A, et al. Time course and prognostic significance of hemostatic changes in sepsis: relation to tumor necrosis factor- $\alpha$ . *Crit Care Med* 1999; **27**: 1303–1308.
- Ranucci M, Frigiola A, Menicanti L, et al. Postoperative antithrombin levels and outcome in cardiac operations. *Crit Care Med* 2005; **33**: 355–360.

## O-49

### Influence of gelatin versus 6% hydroxyethyl starch 130/04 CPB priming on postoperative chest tube drainage and transfusion requirements after CABG surgery

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**Introduction:** Concerned about high dose starches and coagulopathy, we performed a double-blinded prospective study on the influence of gelatin (Geloplasma) or 6% HES 130/04 (Voluven) pump prime on postoperative blood loss and transfusion requirements after CABG surgery.

**Method:** After informed consent, 154 electively scheduled patients were randomly allocated to 6% HES ( $n = 82$ ) or gelatin ( $n = 72$ ) CPB priming. Postoperatively, chest tube drainage was noted hourly during the first 24 hours and every unit of colloid, albumin, FFP or Packed Red Cells needed to maintain haemodynamic stability was recorded. Blood losses were standardized as mL blood loss/kg body weight. Data analysis consisted in unpaired *t*-test and Fisher's exact test where appropriate.

**Results:** Chest tube drainage was significantly higher at 1 and 3 hours in the HES group (2.38 mL/kg vs. 3.15 mL/kg and 4.18 mL/kg vs. 5.22 mL/kg respectively). At 24 hours, total blood loss was still higher in the HES group without reaching statistical significance ( $P = 0.07$ ). Albumin supplements occurred more frequently in the HES group between 2 and 3 hours postoperatively ( $P = 0.02$ ). Total colloid supplement was significantly higher in the gelatin group (12.25 vs. 8.48 mL/kg,  $P = 0.002$ ), even after adjustment for albumin

administration. There were no differences in blood products transfused between the two groups.

**Discussion:** A dilution phenomenon, evident by lower thrombocyte count (115,000 vs. 135,000,  $P = 0.004$ ) and hypoproteinaemia requiring more albumin substitution, persisted in the postoperative phase in the 6% HES group. Significantly higher blood loss during the first postoperative hours in the 6% HES group caused no difference in Packed Red Cells transfusion requirements because total blood loss (with low haematocrit) may have been too small to demonstrate higher transfusion needs in that period of time.

**Conclusion:** 6% HES is a safe alternative to gelatin pump prime but its intravascular dilution and volume effect extends longer in the postoperative phase. This is in agreement with earlier studies [1].

**Reference:**

- 1 Van der Linden PJ, De Hert SG, Deraedt D, et al. Hydroxyethyl starch 130/0.4 versus modified fluid gelatin for volume expansion in cardiac surgery patients: the effects on perioperative bleeding and transfusion needs. *Anesth Analg* 2005; **101**: 629–634.

## O-50

### Coronary artery bypass grafting in abciximab treated non-elective patients

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**Introduction:** Glycoprotein IIb/IIIa receptor antagonists along with the use of intracoronary stents are the most important recent advances of interventional cardiology. However, a small number of patients, usually those at high

risk, still require emergency or urgent surgery after a percutaneous coronary intervention (PCI). The widespread and growing use of glycoprotein IIb/IIIa inhibitors as an adjunct to PCI may complicate the management and outcome of patients who have emergency CABG [1].

**Method:** Between January 2002 and September 2005 abciximab was used in 1150 patients who underwent PCI in the Interventional Cardiology Department. We retrospectively analysed their data and among them identified 48 patients who underwent CABG with the use of cardiopulmonary bypass (CPB). 12 of them had an urgent operation not later than 14 days after administration of abciximab (Group A). Group A was compared with a group of 80 CABG patients also operated on urgently (Group B). The two groups had similar baseline characteristics. Both groups received heparin and aspirin during the preoperative period. We analysed postoperative drainage and use of blood and blood products. A Student's *t*-test was used for analysis and  $P < 0.05$  was considered significant.

**Results:** Frequency of adverse events was comparable between the two groups. Of note, no difference was observed between the two groups in the frequency of surgical re-exploration for bleeding. Blood loss and transfusions of packed red cells and fresh frozen plasma were similar in both groups. The transfusion of platelets was higher in the abciximab treated group ( $P < 0.01$ ).

**Discussion:** Risk of postoperative bleeding is similar in non-elective CABG patients receiving heparin/aspirin after abciximab compared with heparin/aspirin alone treated group. Abciximab therapy should not be considered a contraindication to non-elective CABG.

**Reference:**

- 1 Singh M, Nuttall GA, Ballman KV, et al. Effect of abciximab on the outcome of emergency coronary artery bypass grafting after failed percutaneous coronary intervention. *Mayo Clin Proc* 2001; **76**(8): 784–788.

## Outcome

## O-51

### Gas exchange and metabolic parameters as predictors of morbidity after cardiac surgery

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**Introduction:** Under normal resting conditions, oxygen delivery ( $DO_2$ ) matches the overall metabolic demands of the organs. Oxygen consumption ( $VO_2$ ) is about 25% of  $DO_2$  and energy is produced basically through the aerobic mechanism. In cardiac surgery with extracorporeal circulation (ECC) several factors (e.g. myocardial stunning resulting in a low cardiac output [CO]) can determine an imbalance between oxygen demand and  $DO_2$  and affect the outcome. Below the critical  $DO_2$  there is a linear decrease of both  $VO_2$  and  $CO_2$  production ( $VCO_2$ ), but due to the anaerobic  $VCO_2$ , the respiratory quotient increases [1]. This study is aimed at evaluating the role of  $O_2$  and  $CO_2$  derived parameters to predict postoperative morbidity in cardiac surgery.

**Method:** 827 consecutive adult patients who underwent coronary artery bypass grafting were studied. We selected 38 intra and postoperative oxygen and carbon dioxide derived parameters, which could be associated with postoperative morbidity. Postoperative data were collected in the first three hours after ICU admission. Morbidity was defined as one or more of the following events: cardiovascular, respiratory, neurological, renal, infectious, or haemorrhagic complications. Multivariate analysis was performed. ROC curve analysis was used to define the best predictive variables.

**Results:** Intraoperative predictors of morbidity were ECC and aortic cross-clamp times, and lowest haematocrit during ECC. The area under the ROC curve (AUC) was 0.74 for the lowest haematocrit on ECC, and its cut-off value was 24%. Among the postoperative variables,  $DO_2$ , oxygen extraction ratio ( $O_2ER$ ),  $DO_2/VCO_2$  ratio, and  $VCO_2/CO$  ratio were related to morbidity. AUCs were 0.80, 0.76, 0.75, and 0.70 for  $DO_2$ ,  $O_2ER$ ,  $DO_2/VCO_2$  ratio, and  $VCO_2/CO$  ratio, respectively. The predictive cut-off values were  $590 \text{ mL min}^{-1}$ , 38%, 3.9, and 40, for  $DO_2$ ,  $O_2ER$ ,  $DO_2/VCO_2$  ratio, and  $VCO_2/CO$  ratio, respectively.

**Conclusions:** In critically ill patients good correlations have been found for  $CO_2$  derived parameters alone or in association with  $O_2$  derived parameters. Several authors demonstrated that long ECC and ischaemia times play a major role in the balance between  $VO_2$  and  $DO_2$ . Our results are in line with those findings and demonstrated that metabolic,  $O_2$  and  $CO_2$  derived parameters could be used as markers to predict morbidity after cardiac surgical operations.

**Reference:**

- 1 Ranucci M, De Toffol B, Isgro G, et al. Hyperlactatemia during cardiopulmonary bypass: determinants and impact on postoperative outcome. *Crit Care* 2006; **29**: 10(6): R167.

## O-52

### Follow up at 30 days and one year of patients who underwent cardiac surgery and had an additive EuroSCORE more than 10

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**Introduction:** Various studies have focused on the problem of the real mortality in high risk patients in cardiac surgery [1]. It was demonstrated that EuroSCORE underpredicts the real risk in this category of patients. We wanted to study the mortality at 30 days and at 1 year, the number of hospital readmissions and the evolution of the NYHA functional class of the patients with an additive EuroSCORE  $>10$ .

**Method:** We studied 1269 patients who underwent heart surgery in our hospital between June 2003 and September 2005. During follow-up periodical clinical exams were made and when that was not possible, telephone interviews were made to all patients with an additive EuroSCORE  $>10$ .

**Results:** Among 1269 patients who underwent cardiac surgery 233 (18.4%) had an additive EuroScore  $\geq 10$  (average 11.8, range 10–20) with an expected mortality of 29.7%. The observed in hospital mortality was of 17% ( $n = 40$ ). Among the 193 patients discharged from the hospital 6 (3%) cannot be contacted. Thus 187 patients were followed up: at 1 year 22 (11.7%) were deceased with an average survival period of  $2.8 \pm 2.2$  months (0.5–7.4 months). Among the 165 survivors at 1 year 26 (15.7%) had experienced new hospital admissions, 15 (9.1%) were in NYHA class I, 121 (73.3%) were in NYHA class II and 29 (17.6%) were in NYHA class III.

Statistical analysis following a logistic regression model showed as significant factors: emergency ( $P = 0.001$ ), acute myocardial infarct less than 30 days before ( $P = 0.035$ ), severe left ventricular dysfunction ( $P = 0.002$ ), pulmonary hypertension ( $P = 0.01$ ) and postinfarct septal rupture ( $P = 0.005$ ) influenced the 30 days bad outcome of those critically ill patients. We used the same statistical analysis in order to find the long-term outcome determining factors. We found that acute myocardial infarction at less than 30 days before intervention and previous neurological events were the factors that influenced the late mortality ( $P < 0.004$  and  $P < 0.044$  respectively).

**Conclusion:** In patients who have an additive EuroSCORE  $\geq 10$  and the contributing factors of pulmonary hypertension, recent myocardial infarct or neurological events, it is mandatory to consider alternative care strategies because the mortality risk is almost 30% and among the discharged patients, 17% remain in NYHA III functional class.

**Reference:**

- 1 Gogbashian A, Sedrakyan A, Treasure T. EuroSCORE: a systematic review of international performance. *Eur J Cardiothorac Surg* 2004; **25**: 695–700.



## O-53

## Hospitalization and role of psychosocial factors after cardiac surgery – 5 year follow up

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**Introduction:** In the last decade mortality has become relatively low after cardiac surgery. Therefore the effectiveness of the operation is measured by the quality of life of the individual patients and the rate of rehospitalization [1].  
**Method:** After informed patient consent, 180 patients undergoing cardiac surgery between July, 2000 and May, 2001 were prospectively followed. During the follow-up period patients were contacted annually by mail. Beck Depression Inventory (BDI), Self Rated Health, Spielberger State-Trait anxiety inventory (STAI-T, STAI-S), number and reason for rehospitalization were assessed each year, Illness Intrusiveness Scale, Social Support Inventory, Dennolet distressed personality test, Hostility Scale were fulfilled at the 2nd and 5th year. Patients who did not respond were contacted by telephone and national registries were searched for deaths. Paired *t*-tests, partial correlations were performed.

**Results:** Twenty-one patients died (11.6%) and 47 patients were lost (*n* = 27) or refused (*n* = 20) during follow-up. BDI and STAI scores highly correlated with each other (*r* = 0.73; *P* < 0.001). STAI-T score was associated with distressed personality score (*r* = 0.68; *P* < 0.001). Illness Intrusiveness Scale was related to STAI-T scores and to number of hospitalization. Dennolet score was linked to Self Rated Health and hostility (*r* = 0.55; *P* < 0.001). Distressed personality and BDI scores were relatively stable during follow-up, while scores of Illness Intrusiveness increased with the years. Perioperative factors, such as Intensive Care Unit days or congestive cardiac failure had no role in the long-term hospitalization.

**Discussion:** Assessment of psychosocial factors could further help in identifying patients at high risk for hospital readmission after cardiac surgery.

**Reference:**

- 1 Stump DA. Selection and clinical significance of neuropsychologic tests. *Ann Thorac Surg* 1995; **59**: 1340–1344.

## O-54

## Very long term follow-up after cardiac surgery: when does “survived” mean “continued to live”?

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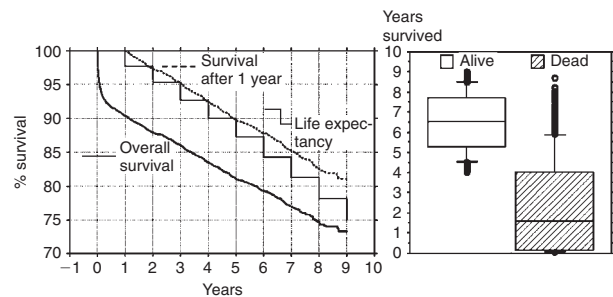
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**Introduction:** Cardiac surgery is thought to be a repair procedure in more or less diseased patients with a more or less severely reduced life expectancy. Overall long term results are sparse and in risk groups analysis there seems to be a steeply decreasing mortality after one year [1]. It was the aim of the present data analysis, triggered by a quality control initiative, to find the proportion of patients dying several years after cardiac surgery.

**Method:** Data from patients operated on between 1997 and the end of 2001 at a single tertiary university hospital were taken from the in-house data base. The national statistic office provided the numbers of any death until the end of 2005 and, for comparison, life expectancy rates of our cohort according to the mortality Table for the year 2002.

**Results:** A total of 4118 patients (2672 men, 1446 women) were included in the analysis. Minimal individual follow-up was 4 years, maximal 9 years. As presented in the Figure and the Table, patients surviving one year after cardiac surgery have a more than normal life expectancy.

We conclude that in our single centre survey “continue to live” means living more than one year after the operation.



From (≥) To (<) Total end of follow-up Dead

0	1.0	397	0	397
1.0	2.0	101	0	101
2.0	3.0	77	0	77
3.0	4.0	102	0	102
4.0	5.0	736	646	90
5.0	6.0	688	636	52
6.0	7.0	714	666	48
7.0	8.0	684	655	29
8.0	9.0	619	612	7
Total		4118	3215	903

**Reference:**

- 1 Mazzoni M, De Maria R, Bortone F, et al. Long-term outcome of survivors of prolonged intensive care treatment after cardiac surgery. *Ann Thorac Surg* 2006; **82**(6): 2080–2087.

## O-55

## Effects of postoperative antithrombin levels on short and mid-term outcome following cardiac surgery

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**Introduction:** Antithrombin (AT) is a circulating serin-protease inhibitor, acting as endogenous anticoagulant. During cardiac surgery, it is well known that AT activity falls but the causes and the effects of this phenomenon are not clear.

**Method:** Single-centre, retrospective, observational study. From May 2000 to June 2003, among 1538 patients undergone cardiac operations at our Institution, 272 had available AT level preoperatively, at the arrival in ICU and on postoperative days 1 and 3. The primary endpoint of the study was evaluating the effects of low ICU-arrival AT on short-term outcome and on 4-year survival, whereas, the secondary end-point was to find out risk factors responsible for low levels of ICU-arrival AT.

**Results:** In-hospital mortality was 4.4%, whereas mean EuroSCORE was  $4.5 \pm 2.6$ . Four-years survival after surgery was  $82.8 \pm 4.7\%$ . ICU-arrival AT was significantly lower than preoperative AT ( $68.2 \pm 14.8\%$  vs.  $84.6 \pm 15.1\%$ , *P* < 0.0001). Factors independently associated with ICU-arrival AT were preoperative AT (*r* = 0.54, *P* < 0.0001), female sex (*r* = -3.64, *P* = 0.03), cardiopulmonary bypass (CPB) duration (*r* = -0.10, *P* = 0.004), X-clamp duration (*r* = -0.13, *P* = 0.01) and perioperative drop of haematocrit (*r* = -0.59, *P* < 0.0001). ICU-arrival AT was independently associated with intubation >24 h (OR = 0.96, *P* = 0.01), low cardiac output syndrome (OR = 0.96, *P* = 0.04), blood loss > 75th percentile (OR = 0.95, *P* < 0.0001), transfusion of blood (OR = 0.94, *P* < 0.0001), fresh frozen plasma (OR = 0.94, *P* = 0.0009) and platelet (OR = 0.96, *P* = 0.03), whereas, during the follow up ICU-arrival AT was found as independent factor of mortality (HR = 0.95, *P* = 0.05).

**Discussion:** After cardiac surgery, low ICU-arrival AT is mainly influenced by preoperative AT, female sex, CPB and X-clamp duration and perioperative drop of haematocrit. Low ICU-arrival AT is independently associated with a worse short and mid-term outcome after cardiac surgery.

## Cardiopulmonary Bypass

## O-56

## Does an increase in intra-abdominal pressure correlate with duration of normovolaemic haemodilution during CABG?

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**Introduction:** The measurement of intra-abdominal pressure (IAP) may be useful in the diagnosis of postoperative multi-organ failure. The increase of IAP can cause cardiac, respiratory, renal and splanchnic insufficiency. However,

the changes of IAP are not explicitly defined, particularly during extracorporeal circulation (ECC). An increase in cell permeability is the main cause of intestinal oedema during ECC with normovolaemic haemodilution (NH). Therefore, the duration of ECC may play an important role in IAP changes. The aim of the study was to analyse the IAP changes and their correlation with the duration of ECC with NH.

**Method:** The patients undergoing CABG with ECC and NH under general anaesthesia were enrolled in the study. The prime of 1800 mL included: crystalloids 1000 mL, colloids 500 mL, mannitol 250 mL, NaHCO<sub>3</sub> and Mg<sub>2</sub>SO<sub>4</sub>. The degree of NH was confirmed by haematocrit (Ht). The IAP was measured

in the urinary bladder at seven measurement points: 1. just after the induction of anaesthesia, 2. just after the initiation of ECC, 3. 10 min after the completion of ECC, 4. just after surgery, 5. one hour after surgery, 6. 6 hours after surgery, 7. 18 hours after surgery. According to the mean ECC time, patients were divided into two groups: A with ECC time shorter and B with ECC time longer than mean. The Wilcoxon, Mann Whitney *U*-test and Spearman correlation test were used for statistical analysis,  $P < 0.05$  was considered as significant.

**Results:** Twenty-five male patients aged 53 to 67 ( $63.1 \pm 4.5$ ) were examined. Mean body weight was  $84.48 \pm 12.15$  kg (group A –  $88.13 \pm 8.14$ ; group B –  $79 \pm 15.34$ ). The mean time of ECC was  $96.6 \pm 22.67$  min. 15 patients were in group A and 10 in group B. In both groups IAP increased from point 3 to 6. In group A IAP increased from point 3 to 6 and in group B from point 2 to 7 (Table 1). The IAP were significantly higher in group B than A at points 3, 4, 5, 6. There was a positive correlation between the duration of ECC and IAP at points 3, 4, 5, 6 (Table 1). The beginning of ECC was associated with a decrease in Ht in both groups. The degree of NH was higher in group B in points 2 and 3.

**Table 1.** The analysis of IAP in group A and B. \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$

The changes of IAP (mmHg) at individual measurement points								
Points		1	2	3	4	5	6	7
Group A	Mean	9	9	12***	10**	10*	10*	9
	Quartile 1	7	7	10.5	9	9	9	8
	Quartile 3	9	9.5	13	12.5	12	10.5	10
Group B	Mean	8.5	9*	15**	16**	16.5**	12**	9.5*
	Quartile 1	7	8.25	13.25	13.5	14	12	9
	Quartile 3	9	9	15.75	17.75	17	13.75	10

The relationships between group A and B (Mann-Whitney *U*-test)

A:B (P value)	0.495	0.764	0.011	0.0029	0.0001	0.0006	0.338
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**Discussion:** An increase in IAP may be an important diagnostic measurement in unconscious patients. The IAP depends on many factors, including NH [1]. Interestingly, the IAP correlated with duration of NH. Therefore it can be assumed that the length of ECC is likely to induce many postoperative complications, e.g. an increase in IAP.

**Conclusions:** The extracorporeal circulation resulted in increased intra-abdominal pressure. Intra-abdominal pressure depended on the degree and duration of normovolaemic haemodilution.

#### Reference:

- Czajkowski M, Dabrowski W. Changes in intra-abdominal pressure during CABG with normovolemic hemodilution. *Med Sci Monit* 2006; **12**: 487–492.

## O-57

### Determinants of cerebral oxygenation during normothermic extracorporeal circulation

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**Introduction:** Neurological dysfunction after cardiac surgery is a major cause of postoperative morbidity and mortality. During cardiopulmonary bypass (CPB), cerebral oxygenation is affected by some factors. Cerebral vascular diameter is directly affected by arterial carbon dioxide partial pressure ( $P_{aCO_2}$ ), haematocrit (Ht) influences the resistance of cerebral flow; delivery of oxygen ( $DO_2$ ) is strictly correlated with arterial oxygen partial pressure ( $P_{aO_2}$ ) and MAP could influence both cerebral perfusion pressure and risk of embolization [1].

The aim of the study was to settle which factors mainly influence cerebral oxygenation during normothermic extracorporeal circulation.

**Method:** Twenty consecutive adult patients, undergoing elective valvular surgery, were enrolled. We excluded patients older than 70 years or with a story of carotid disease, neurological disease, hypertension or diabetes.

During CPB, pump flow was maintained at  $2.4 \text{ litre min}^{-1} \text{ m}^{-2}$ . Every 10 minutes, cerebral saturation ( $rSO_2$ ), percent changes from  $rSO_2$  to baseline values ( $\Delta rSO_2$ ), MAP, Ht,  $P_{aO_2}$  and  $P_{aCO_2}$  were simultaneously recorded.

$P_{aO_2}$ ,  $P_{aCO_2}$ , MAP and Ht were used as predictor variables to determine a correlation with  $\Delta rSO_2$ . To eliminate the variability due to the difference within subjects, those were treated as categorical factors, using dummy variables [2]. An ANCOVA was performed, using GLM with SPSS software.

**Table 1.** Analysis of variance

	Degree of freedom	Sum of squares	Mean square	Variance ratio	Sig.	beta
Subjects	19	11031	580.58	11.38	0.000	
Ht	1	295	295	5.78	0.02	0.108
$P_{aO_2}$	1	1	1	0.02	0.888	0.0001
$P_{aCO_2}$	1	13.5	13.5	0.26	0.610	0.005
PAM	1	227	227	4.45	0.04	0.085
Residual	48	2448	51			
Total	71	14015.5	197.4			

No patients died within the first 30 P.O. day, neither suffered any type I neurological injuries.

**Discussion:** During CPB,  $P_{aO_2}$  was always above 200 mmHg, so the delivery and the extraction of oxygen were not influenced. Each patients was maintained in a normocapnic state during CPB: such narrow variations in  $P_{aCO_2}$  could not influence the diameter of cerebral vessels. We found a direct correlation between Ht and MAP with cerebral saturation. Although blood viscosity and therefore resistance are proportional to the amount of haemoglobin, a reduction in Ht is probably related to a similar variation in the  $DO_2$ . The relationship between MAP and  $rSO_2$  could be explained by a loss of autoregulation. In our patients the cerebral perfusion pressure was probably dependent on systemic pressure.

#### References:

- O'Dwyer C, Prough DS, Johnston WE. Determinants of cerebral perfusion during cardiopulmonary bypass. *J Cardiothorac Vasc Anesth* 1996; **10**: 54–65.
- Bland JM, Altman DG. Calculating correlation coefficients with repeated observations: Part 1 – Correlation within subjects. *BMJ* 1995; **310**: 446.

## O-58

### Narcotrend® monitoring to predict brain damage in patients undergoing deep hypothermic circulatory arrest

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**Introduction:** Deep hypothermic circulatory arrest (DHCA) is a commonly used procedure in cardiac surgery to diminish hypoxic brain damage. Despite isolated brain perfusion, patients are at high risk for adverse neurological outcome. Once brain injury has occurred intraoperatively, postoperative neuroprotective strategies are required as early as possible to optimize neurological recovery. Until now there have been no monitoring devices in the operating room available to easily predict brain injury. The Narcotrend® monitor classifies EEG traces into different stages from A (awake) to F (burst suppression/electrical silence), including a dimensionless Index from 100 (awake) to 0 (electrical silences). The aim of this study was to investigate the predictability of Narcotrend® monitoring on potential brain injury in patients undergoing DHCA.

**Method:** Patients who underwent DHCA were evaluated retrospectively with special regard to the recovery of the EEG pattern during the rewarming period, as well as postoperative adverse neurological outcome (confirmed by CT-scan). Data for the investigation were: oesophageal temperature (T), size of pupils, Narcotrend® stage (S) and -index (I) and EEG pattern at the beginning of patient cooling (b), during circulatory arrest (a) and at the ending of the operation (e).

**Results:** A total of 10 female and 15 male patients aged between 30 and 89 years could be evaluated. Having a time of circulatory arrest between 9–66 min, all patients received the same anaesthetic management and isolated cerebral perfusion combined with external head cooling. The main results are shown in the Table.

Adverse neurological outcome	Stage; Index [b]	Stage; Index [a]	Stage; Index [e]
No (n = 21)	D <sub>2</sub> 37 – E <sub>1</sub> 24	F <sub>0</sub> 2 – F <sub>1</sub> 4	D <sub>0</sub> 57 – E <sub>0</sub> 32
Yes (n = 4)	D <sub>2</sub> 38 – E <sub>2</sub> 13	F <sub>1</sub> 2 – F <sub>1</sub> 3	F <sub>0</sub> 7 – F <sub>0</sub> 9

Additionally, great differences could be seen in oesophageal temperature at the beginning of burst suppression ( $34^\circ\text{C}$ – $26^\circ\text{C}$ ), whereas no differences in pupil size or EEG pattern between the 2 groups could be found during the whole observation period.

**Discussion:** This study suggests for the first time that Narcotrend® monitoring is able to predict brain damage in patients undergoing DHCA. One has to note a stage of persisting burst suppression or electrical silence at the ending of the operation, but not the lack of complete recovery of Stage or Index during the rewarming phase.

## O-59

### Comparison of activated clotting time and whole blood heparin concentration on anticoagulation management in patients undergoing open heart surgery

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**Introduction:** To investigate the changes in perioperative anticoagulation management using a heparin-concentration based system and its effect on postoperative outcome.

**Method:** Thirty-nine patients undergoing elective primary open heart surgery were randomly assigned to a heparin-concentration based system approach (study group, 17 patients) or a standard ACT based anticoagulation system (22 patients, control group).

**Results:** Patients in the study group received a statistically significant higher dose of heparin (median 29,000 IU with IQR 22,500–33,500 IU vs. median 19,000 IU with IQR 17,775–21,500 IU;  $P < 0.001$ ) and a smaller dose of protamine (median 170 mg with IQR 145–190 mg vs. median 200 mg with IQR 180–250 mg;  $P = 0.008$ ) as compared to the control group. Postoperative platelet count was significantly higher in the study group ( $164 \pm 45 \times 10^9/L$  vs.  $125 \pm 27 \times 10^9/L$ ,  $P = 0.002$ ). None of the study patients and 6 patients in the control group required transfusion of blood products ( $P = 0.02$ ). No differences were recorded in postoperative antithrombin activity, bleeding and other clinical outcomes.

**Conclusion:** The HMS system, by facilitating maintenance of a stable heparin concentration and by determining an appropriate dose of protamine, is associated with reduced platelet consumption and does not increase AT-III consumption and postoperative bleeding.

## O-60

### Minimal extracorporeal circulation (MECC): our experience

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**Introduction:** Minimal extracorporeal circulation (MECC) is an extracorporeal circuit (EC) assembled without a reservoir [1]. The aim is to abolish, as much as possible, the blood-air contact surface by using a closed circuit and consequently decreasing an inflammatory reaction.

**Method:** When assembling EC, it is important to avoid the input of air. For the same reason, the surgeon prepares double purse string sutures on aorta and right atrium, while saphenous proximal anastomoses are stitched with

partial aortic clamping. In addition we must avoid a decrease of preload before MECC, so that the anaesthetist compensates blood and other fluid losses by maintaining CVP  $\geq 8$ –10 mmHg. The circuit is made up with an arterial line, a venous line, a centrifugal pump with flow probe and a low prime oxygenator. Ventricular aspiration is connected to the venous line which also has a line to the cell saver to prevent air suction into the circuit. In addition to standard monitoring, we measure the venous circuit pressure, etCO<sub>2</sub> of the oxygenator and CVP during MECC. Anticoagulation is measured with ACT (400 sec). To minimize haemodilution, at the beginning of MECC we substitute crystalloid prime with patient blood. The crystalloid is collected in a 1000 mL bag and infused should the patient need quick filling. The final static prime is usually 200 mL. We have now performed 276 MECC CABG operations. 216 were male; average age was 69.7 (range 41–89). 14.7% were urgent, 3.1% emergency and 17 patients required an intraortic balloon pump (IABP) before surgery (6.67%). Ejection fraction (FE) was  $< 35\%$  in 48 pts (18%). We excluded only 1 pt where traditional ECC was used due to a calcific ascending aorta.

**Results:** Mean MECC fluid balance was  $97 \pm 68$  mL, Hb variation pre and post MECC was  $1.31 \pm 0.7$  g/dL. In the ICU, duration of intubation was  $3.36 \pm 1.18$  h and mean blood drainage within 12 hours was  $305 \pm 67$  mL. Myocardial infarction occurred in 4 pts and acute renal failure (20% increase of creatinine from preop. value) in 4 pts. 8 pts (2.9%) died within 7 days. A transient increase of bilirubin was recorded in 20% of patients, perhaps related to Hb  $> 9$  g/dL during MECC or excessive venous negative pressure.

**Discussion:** We use only MECC for coronary artery bypass surgery. We consider it a good balance between off-pump (O/P) surgery with less inflammatory response (our data is similar to O/P) and EC which carries more risks. We modified our management especially with respect to control of preload and fluid balance, with the cooperation of the perfusionists.

#### Reference:

- 1 Wiesmack C, Liebold A, Philipp A, et al. Four years' experience with miniaturized extracorporeal circulation system and its influence on clinical outcome. *Artif Organs* 2004; **28**: 1082–1088.

## Risk Factors

### O-61

#### Could we predict post-operative hospitalization duration in cardiac surgical patients?

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**Introduction:** Cardiac surgery (CS) is associated with a large expenditure of healthcare resources. Identifying factors that affect the duration of patient hospitalization after CS could improve healthcare management and its costs [1].

**Method:** We prospectively analysed data of all patients (pts) undergoing CS between January 1998 and June 2005, and discharged from our ICU within 24 hours of surgery. We collected: (i) demographics, risk factors and gravity scores, (ii) intra-operative variables [i.e. type of operation, cardiopulmonary by-pass (CPB) and aortic cross clamp (ACC) times], (iii) ICU-related variables. ANOVA test was used for continuous variables, differences in proportions were compared using Chi-squared test. A binary Logistic Regression Model (b-LRM) was used to estimate the effect of each considered risk factor on discharge from CS to a rehabilitation ward, considered as a binary outcome (yes = early  $\leq 7$  days/no = late  $> 7$  days). Statistical analyses were performed with SPSS 14.1.  $P$  values less than 0.05 were considered significant.

**Results:** A total of 1488 pts with median (IQR) age 65 (56–72) yr, were discharged from our ICU within 24 hours after CS. 67% of them underwent coronary artery by-pass grafting (CABG), 28% valve procedures (VP) and 5% CABG + VP with a median (IQR) post-operative hospital length of stay of 7 (7–8) days. The b-LRM was performed, considering discharging from CS to rehabilitation ward as the categorical dichotomous (yes = early  $\leq 7$  days/no = late  $> 7$  days) dependent variable and as independent dichotomous variables (i) age ( $>$  or  $\leq 65$  yrs), gender, diabetes, hypertension, arteriopathy, renal failure, COPD (all yes/no) (ii) NYHA and CCS score ( $>$  or  $\leq 2$ ), mitral/aortic pathology and/or coronary artery disease (all yes/no) (iii) operation time ( $>$  or  $\leq 240$  min), CPB- ( $>$  or  $\leq 90$  min), ACC- ( $>$  or  $\leq 60$  min) times and transfusion (plasma or red blood cells) need (yes/no) (iv) mechanical ventilation MV time ( $>$  or  $\leq 8$  hours). The b-LRM showed that predictors of longer postoperative hospitalization are (i) MV time  $> 8$  hr ( $P = 0.0000$ , O.R. = 0.615 95% CI 0.488–0.775) (ii) experiencing both mitral ( $P = 0.046$ , O.R. = 0.671 95% CI 0.453–0.993) and aortic ( $P = 0.038$ , O.R. = 0.624 95% CI 0.4–0.975) disease.

**Discussion:** The model established that early weaning from mechanical ventilation is the strongest predictor of a shorter hospitalization after ICU care, together with coronary artery surgery without a valve pathology.

#### Reference:

- 1 Loubani M, Mediratta N, Hickey MS, et al. Early discharge following coronary bypass surgery: is it safe? *Eur J Cardiothorac Surg* 2000; **18**(1): 22–26.

### O-62

#### B-type natriuretic peptide as a possible predictor of left ventricular stroke work index after uncomplicated coronary artery surgery

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**Introduction:** Left ventricular stroke work index (LVSWI) is an important parameter of left ventricular function after coronary artery bypass grafting (CABG) [1]. The aim of this study was to evaluate B-type natriuretic peptide (BNP) and traditional prognostic factors to predict LVSWI after CABG.

**Method:** After informed consent, we studied 14 patients (pts) who underwent uncomplicated CABG ( $3.4 \pm 0.5$  grafts). The left ventricular ejection fraction (LVEF) was  $58 \pm 8\%$  and age  $54 \pm 8$  years. The aorta cross clamping (ACC) time was  $68 \pm 15$  min and cardio-pulmonary bypass (CPB) time  $110 \pm 17$  min. The preoperative BNP level was measured by radioimmunoassay. LVSWI was calculated at the end of surgery. Statistical data manipulation was performed using the correlation analysis.  $P < 0.05$  was considered statistically significant. Data are given as mean  $\pm$  standard deviation.

**Results:** Blood level of BNP before surgery was  $102 \pm 90$  pg/mL. LVSWI at the end of surgery was  $33 \pm 5.1$  gm-m-m<sup>-2</sup>-beat<sup>-1</sup>. Dosages of dopamine and/or dobutamine were no more than  $5 \mu\text{g}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ . LVSWI was independent of dosages of dopamine and/or dobutamine:  $r = 0.28$ ;  $P = 0.15$ . BNP but not others parameters significantly ( $P < 0.05$ ) predicts LVSWI at the end of surgery (table).

Parameters	Pearson coefficient	$P$
BNP	-0.59	0.033
LVEF	0.13	0.66
Age	-0.11	0.71
ACC time	-0.17	0.78
CPB time	-0.18	0.56

**Discussion:** The increased level of natriuretic peptides is an early marker of heart failure [2]. This study shows the potency of BNP to predict left ventricular functional status following uncomplicated CABG.

**References:**

- 1 Shuhaiber HJ, John V, Juggi JS, et al. Preservation of left ventricular function during coronary artery bypass grafting surgery. *Can J Cardiol* 1989; **5**: 105–109.
- 2 Richards AM, Nicholls MG, Espiner EA, et al. B-type natriuretic peptides and ejection fraction for prognosis after myocardial infarction. *Circulation* 2003; **107**: 2786–2792.

## O-63

### Outcomes from cardiac surgery in patients aged eighty or more years

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**Introduction:** Advances in surgical, perioperative and postoperative care combined with an ageing population have resulted in an increase in cardiac procedures in older patients. This study presents data collected on predicted operative risk (EuroSCORE), 30 day mortality and other complications.

**Method:** Data were extracted from the Patient Analysis and Tracking system (PATS) used at our Cardiac Surgical Unit between April 1996 and October 2006.

**Results:** Of 12,722 cardiac surgical operations, 417 (3.3%) were carried out in patients aged 80 years or older (mean 82.1 years). The proportion of elderly patients undergoing surgery in this group has increased progressively from 37 patients in 2003, to 67 patients in 2005. Mean EuroSCORE was 8.8 in those aged 80 and over compared to 3.9 for all other age groups. 30 day mortality independent of procedure was 7%. This increased to 13.1% at 12 months and 23.5% at 5 years. 165 patients (39.6%) underwent coronary artery bypass grafting only, 132 patients (31.6%) underwent valve replacement only and 120 patients (28.8%) underwent combined procedures. For isolated coronary artery bypass grafting in this age group mortality was 1.8% at 30 days. The 30 day mortality was 9.1% for isolated valve surgery. Major morbidity was more common in patients aged 80 and over, particularly neurological (7.9%) and renal (14.9%) complications.

**Discussion:** Previous studies have shown that cardiac surgical patients aged 80 and over are more depressed and less mobile than younger patients [1]. The present study shows that for a higher perioperative risk, the early mortality in isolated cardiac procedures is acceptable but post-operative morbidity is higher in this age group.

**Reference:**

- 1 Chocron S, Rude N, Dussaucy A, et al. Quality of life after heart surgery in patients over 75 years old. *Age Ageing* 1996; **25**: 8–11.

## O-64

### Which are the quantitative variables that may impact on patients undergoing CABG surgery?

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**Introduction:** The mortality of CABG surgery ranges from 2 to 5% although it continues to decrease [1]. The aim of this prospective observational cohort study was to assess whether a number of selected quantitative variables influence patient hospital outcome.

**Method:** On all the patients undergoing CABG surgery admitted to our ICU from 1997 to June 2005, we collected the following variables (i) age, (ii) cardiopulmonary by-pass (CPB) time, (iii) aortic cross clamp (ACC) time, (iv) duration of mechanical ventilation (MV), (v) red blood cells (RBC) transfusion units, (vi) fresh frozen plasma (FFP) transfusion units, (vii) ICU length of stay (LOS) and put them into an electronic database. ROC curve analysis was performed with a view to assessing which one of the variables was the best predictor of patient hospital outcome. Statistical analysis was performed using SPSS Software.  $P < 0.05$  was considered statistically significant.

**Results:** We considered a total of 3269 CABG patients, with a median (IQR) age of 67 yr (59–73). ROC curve analysis results are shown in the Table.

Variables	Area	Spec	Sens	P	0.95% C.I.	
					Low. B.	Up. B.
MV length $\geq$ 11.5 h	0.844	75%	70%	0.000	0.7	0.9
ICU-LOS $\geq$ 36 h	0.732	74%	70%	0.000	0.6	0.8
Age $\geq$ 68.5 yrs	0.569	61%	59%	0.230	0.4	0.6
CPB-time $\geq$ 90 min	0.682	79%	73%	0.001	0.5	0.7
ACC-time $\geq$ 60 min	0.523	58%	55%	0.682	0.4	0.6
RBC transfusions $\geq$ 2.5 U	0.882	79%	78%	0.000	0.8	0.9
FFP transfusions $\geq$ 3.5 U	0.813	75%	80%	0.000	0.7	0.9

**Conclusions:** We found that the best quantitative variables predicting patient hospital outcome were MV length  $\geq$ 11.5 h, RBC transfusions  $\geq$ 2.5 units and FFP transfusions  $\geq$ 3.5 units. CPB and ACC times together with patient age and ICU LOS are likely to impact less importantly on patient outcome.

**Reference:**

- 1 Rajakaruna C, Rogers CA, Angelini GD, et al. Risk factors for and economic implications of prolonged ventilation after cardiac surgery. *J Thorac Cardiovasc Surg* 2005; **130**(5): 1270–1277.

## O-65

### Evaluation of the EuroSCORE in high risk patients undergoing cardiac surgery

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**Introduction:** There is an important role for accurate risk prediction models in cardiac surgery [1]. The aim of this study was to assess the performance of the European System for Cardiac Operative Risk Evaluation (EuroSCORE) model in patients who were considered at high risk (EuroSCORE equal or higher than 6). In these patients we found a difference between actual and predicted mortality. We therefore looked for a different relevance of the EuroSCORE components in our patients.

**Method:** From 2004 to April 2006 EuroSCORE models were applied to all patients ( $n = 753$ ) undergoing cardiac surgery, 394 of them being at high risk, with predicted mortality of 17.7% and observed mortality of 6.9%. After analysing all correlations between risk factors and the outcome, a multivariate stepwise logistic regression model was applied in order to reveal only significant predictors. The impact of each predictor on patients outcome is expressed by the odds ratio (OR).

**Results:** Multivariate analysis revealed that predicted risk is reliable when prevalent risk factors are pulmonary hypertension (OR = 6.74,  $P = 0.003$ ), emergency operation (OR = 6.17,  $P = 0.02$ ), critical preoperative state (OR = 11.1,  $P = 0.003$ ), severe LV dysfunction (OR = 7.61,  $P = 0.001$ ). When the same estimated risk is due to other factors such as redo, advanced age, major cardiac procedure other than isolated CABG, extracardiac arteriopathy, observed mortality is significantly lower than that predicted.

**Conclusions:** In our experience the additive and logistic EuroSCORE does not accurately predict outcome in a subset of high risk patients. Therefore we consider an extended study is necessary in order to re-evaluate the risk model for patients in critical conditions.

**Reference:**

- 1 Michel P, Roques F, Nashef SA: EuroSCORE Project Group. Logistic or additive EuroSCORE for high-risk patients? *Eur J Cardiothorac Surg* 2003; **23**: 684–687.

## O-66

### Preoperative NTproBNP levels predict prolonged intensive care unit stay in CABG patients with reduced left ventricular ejection fraction

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**Introduction:** The aminoterminal prohormone of the B-type natriuretic peptide (NTproBNP) is an established hormonal marker for the severity of myocardial dysfunction in medical patients and may also be used for risk stratification in the setting of chronic heart failure [1]. No data is available for the suitability of this peptide for risk stratification in patients undergoing cardiac surgery. The present pilot study analyses the relation between preoperative NTproBNP levels and clinical outcome in patients with a left ventricular ejection fraction (LVEF)  $< 40\%$  scheduled for on-pump CABG surgery.

**Method:** Following approval by the local ethics committee and preoperative written informed consent, 51 consecutive patients were studied. Worse outcome was defined as a combined endpoint of 28-day mortality, postoperative myocardial infarction, stroke, use of intra-aortic counterpulsation, or need for further revascularization. Prolonged ICU-length of stay (LOS) was defined as an ICU treatment  $> 24$  h. A multivariate analysis of preoperative parameters with respect to clinical endpoints was performed.

**Results:** Median preoperative NTproBNP levels were 1801 pg/mL and were significantly correlated with an ICU length of stay  $> 24$  h but not with the combined clinical endpoints. No correlation was observed between preoperative LVEF and the combined endpoint or ICU LOS. ROC analysis revealed that a NTproBNP cut-off level of 1960 pg/mL significantly predicted an ICU-LOS  $> 24$  h ( $P = 0.012$ ; sensitivity 77.8%, specificity 60.9%; AUC 0.68).

This remained predictive even after adjustments for preoperative LVEF, sex, and age (Odds Ratio 5.3, 95% confidence interval 1.5–18.7).

**Conclusions:** A preoperative NTproBNP plasma level of > 1960 pg/mL predicts prolonged ICU length of stay in CABG patients with a LVEF < 40% independent from the LVEF before surgery. The cut-off level observed in our study is in the range of the median NTproBNP defining a doubling in 1 year mortality or hospitalization rate in the COPERNICUS study (1767 pg/mL) and may thus define a high risk population that may benefit from preoperative optimization strategies. With respect to a relatively low number of adverse events in the present study, a larger study population will be necessary to define the relation between long-term clinical outcome and NTproBNP levels in patients undergoing cardiac surgery.

#### Reference:

- Hartmann F, Packer M, Coats AJ, et al. Prognostic impact of plasma N-terminal pro-brain natriuretic peptide in severe chronic congestive heart failure: a substudy of the Carvedilol Prospective Randomized Cumulative Survival (COPERNICUS) trial. *Circulation* 2004; **110**: 1780–1786.

## O-67

### Preoperative statin treatment is associated with reduced postoperative stratified mortality in patients undergoing coronary surgery

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**Introduction:** Preoperative statin (S) therapy has been shown to reduce mortality after cardiac surgery [1]. However, patients receiving S in that paper were at a lower risk. The aim of this study was to see whether S therapy reduces operative mortality according to risk stratification with three different risk scores.

**Method:** 594 consecutive patients undergoing non-emergency coronary surgery, treated preoperatively with S (Gr 1), were retrospectively compared to 335 patients not treated with S (Gr 2). Postoperative mortality was adjusted with the 3 different scores: the Parsonnet score, and the additive and logistic EuroSCORE. S and the scores were entered into 3 stepwise logistic regression models to determine if S therapy was associated with a reduction of mortality.

**Results:** Preoperative statin therapy was associated with significant reduction of mortality. The odds ratio for mortality adjusted on the 3 different scores in patients receiving preoperative S was between 0.16 and 0.2.

	Gr 1	Gr 2	P
Age (years)	65 ± 10	68 ± 9	ns
EF (%)	60 ± 14	59 ± 16	ns
EuroSCORE	3.6 ± 2.4	4.4 ± 2.7	0.02
Mortality (%)	0.6	5.2	< 0.0001
	P	Odds ratio	
Statin	0.002	0.16 [0.05–0.51]	
Additive EuroSCORE	< 0.0001	1.66 [1.37–2.0]	
Statin	0.005	0.19 [0.06–0.61]	
Logistic EuroSCORE	< 0.0001	1.48 [1.26–1.75]	
Statin	0.005	0.20 [0.06–0.62]	
Parsonnet score	< 0.0001	1.12 [1.06–1.19]	

**Discussion:** Preoperative S therapy may reduce the risk of early mortality after coronary surgery with CPB.

#### Reference:

- Pan W, Pinter T, Anton J, et al. Statins are associated with a reduced incidence of perioperative mortality after coronary artery bypass graft surgery. *Circulation* 2004; **110**(Suppl 1): I445–49.

## Echocardiography

## O-68

### Implications of paravalvular leaks after valve replacement surgery

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**Introduction:** Perivalvular leaks (PVL) after aortic (AVR) and mitral valve replacement (MVR) surgery contribute to patients' short and long-term morbidity. Reports have identified that 6% and 32% of patients after AVR and MVR had PVL in the operating room [1].

**Method:** After Hospital Ethics Board approval, we reviewed surgical demographics and TOE reports on 442 patients after AVR and/or MVR (December 2002 and January 2004). PVL was classed as trivial, mild, moderate or severe. Patient groups with and without PVL were compared using ANOVA and Chi-squared analysis. Multivariate analysis was performed to identify risk factors for PVL.

**Results:** Fifty-two (12%) patients had PVL intraoperatively. 23 after AVR (7 mild, 3 moderate, and 13 severe), and 29 after MVR (13 trivial, 7 mild, 4 moderate, and 5 severe). Transthoracic echocardiography (TTE) was performed 1 week after surgery, and TOE was done 1 year after surgery. All severe PVLs were repaired intraoperatively after AVR and 4 out of 5 after MVR. Only 1 trivial and 1 mild PVL after AVR and 1 mild PVL after MVR were repaired intraoperatively. One week after surgery, PVL remained unchanged in 9 patients,

regressed in 6 patients, and could not be detected in 31 patients. 1 year follow-up TTE showed all aortic PVL healed, 2 patients had PVL after MVR.

**Discussion:** Prevalence of PVL after MVR and AVR is lower than previously reported. Patients who suffer PVL are older, undergo more complex surgery, and have increased perioperative morbidity, which is associated with longer ICU and hospital LOS. Patients with moderate and severe PVLs require immediate repair during primary surgery.

#### Reference:

- Am Heart J* 1999; **138**(2 Pt 1): 51–57.

## O-69

### Intraoperative trans-prosthetic Doppler gradient after aortic valve replacement with homograft

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**Introduction:** The use of a homograft for aortic valve and aortic root replacement is the best option in patients with aortic valve endocarditis or in young patients. However, the peak and mean pressure gradients (peak PG and mean PG) measured with transoesophageal echocardiography (TOE) immediately after weaning from cardiopulmonary bypass (CPB), are often higher than expected. The aim of our study was to compare in the operating room Doppler gradients to the catheter-measured gradients. Moreover, we verified the persistence of these gradients prior to discharge from the hospital.

**Method:** Fifteen patients from January to October 2006 were evaluated. In ten of them only the aortic valve was substituted (free-hand), while in the others the entire aortic root. The trans-prosthetic peak and mean PGs were calculated with the Doppler TOE through the transgastric view after CPB. At the same time a catheter was introduced in the left ventricle and connected to a transducer. The peak-to-peak catheter PG was calculated subtracting the systolic arterial pressure from the left intraventricular pressure. The TOE Doppler peak values were then compared to the catheter-derived values. After one week each patient underwent a transthoracic echo exam to evaluate the peak and mean Doppler PGs from different apical views.

**Results:** There was an excellent correlation between the peak Doppler and the catheter-derived PGs intraoperatively (mean values respectively  $38 \pm 21.25$  and  $31.89 \pm 19.85$  mmHg;  $r = 0.98$ ;  $P < 0.001$ , standard error mean 1.28 mmHg). The Doppler peak and mean PGs significantly decreased after

Variable	PVL present	No PVL
Preoperative	(N1 = 52)	(N2 = 389)
Age (yr)	67 ± 12	63 ± 13
Renal Dysfunction (%)	33	20.82
HX of Heart Failure (%)	62.26	46.53
Intra-op Mitral bioprosthetic (%)	63.33	36.11
Intra-op By-pass time (min)	149.57	122.38
Post-op ICU LOS (days) median	2 (1.5)	2 (1.4)
Post-op HOS LOS (days) median	10(8.12)	8 (6.11)
Post-op LCOS (CI < 2l/m <sup>2</sup> ) (%)	13.2	4.4
Post-op Atrial Fibrillation (%)	41.5	27.3
Post-op Sepsis (%)	9.43	2.3

ICU LOS = ICU length of stay, HOS LOS = Hospital length of stay, MI = myocardial infarction, LCOS = Low Cardiac Output Syndrome; stroke, MI, re-operation and rate of blood product transfusion did not differ among groups.

one week (mean values  $16.22 \pm 5.29$  and  $8.22 \pm 3.19$  mmHg,  $P < 0.008$  and  $P < 0.004$  respectively).

**Discussion:** In our experience the TOE Doppler estimate of the homograft trans-prosthetic PGs has been demonstrated to be an accurate method. The correlation with the peak-to-peak catheter values was excellent, considering that the instantaneous Doppler gradient is always higher than the peak-to-peak left ventricle-arterial pressure value. Moreover, when these gradients seem to be excessively high, this is due in most cases to oedema surrounding the aortic annulus caused by surgical trauma and to the haemodynamic alterations induced by various drugs used at the end of CPB. The values will turn to normal in the following days.

#### References:

- 1 Weyman AE. *Principles and Practice of Echocardiography*. Lea & Febiger, 1994; 516–520.
- 2 Melina G, De Robertis F, Gaer JA, et al. Mid-term pattern of survival, hemodynamic performance and rate of complications after medtronic freestyle versus homograft full aortic root replacement: results from a prospective randomized trial. *J Heart Valve Dis* 2004; **13**(6): 972–975.

## O-70

### No difference in improved diastolic function after CPB-CABG versus OPCAB surgery: a comprehensive transthoracic echocardiographic investigation

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**Introduction:** The influence of CPB-CABG versus OPCAB surgery on LV diastolic function shortly after the operation (12–20 hours) remains unclear. We hypothesized that avoidance of cardioplegia induced ischaemic arrest results in a more pronounced improvement in diastolic function the day after CABG surgery.

**Method:** After IRB approval and written informed consent, elective CPB-CABG and OPCAB surgery patients with EF > 35% were included. Patients with unstable angina, recent myocardial infarction, valvular heart disease or heavy arrhythmias were excluded. Cardiac medication was continued until the day of surgery, except digitalis, ACE-inhibitors and diuretics. The day before and the day after surgery, mean arterial pressure (MAP) and heart rate (HR) were recorded together with Doppler mitral inflow (E/A), deceleration time (DTCHR) and isovolumic relaxation time (IVRTCHR) corrected for HR, pulmonary vein flow (PVs/PVd), pulmonary vein atrial reversal flow (PVar) and its duration (ARdur), colour M-mode flow propagation velocity (Vp), and the mean of the mitral annulus velocity of the anterior, lateral, inferior and septal left ventricular wall (Em) [1]. SPSS 12.0.2 was used for statistical analysis (significant level  $P < 0.05$ ).

**Results:** Sixteen CPB-CABG (15 m, 1 f) and 11 OPCAB patients (10 m, 1 f) participated. Pre-operative demographic, haemodynamic and TTE values were not significant. No patient received inotropes during the measurements. Significant post-operative changes were: increased HR; decreased MAP and decreased IVRTCHR which was significantly different between both groups.

Variable	OPCAB		CPB-CABG	
	Pre-op	Post-op	Pre-op	Post-op
MAP (mm Hg)	101 ± 16	76 ± 8*	100 ± 10	78 ± 13*
Heart Rate (bpm)	63 ± 8	89 ± 10*	61 ± 8	81 ± 10*
E/A	1.06 ± 0.24	1.21 ± 0.30	0.94 ± 0.28	1.15 ± 0.26*
DTCHR (msec)	200 ± 38	190 ± 40	216 ± 67	176 ± 24*
IVRTCHR (msec)	103 ± 17	88 ± 8 <sup>§</sup>	109 ± 21	99 ± 15 <sup>§</sup>
PVS/PVD	1.39 ± 0.35	1.09 ± 0.25	1.47 ± 0.40	1.36 ± 0.40
PVar (m/sec)	33 ± 10	29 ± 4	31 ± 4	24 ± 5*
ARdur (msec)	153 ± 32	111 ± 28	149 ± 47	130 ± 22
Vp (m/sec)	50 ± 14	86 ± 33*	48 ± 25	67 ± 37
E/Em	9.3 ± 3.0	8.9 ± 2.3	10.0 ± 3.3	9.5 ± 2.9

\* $P < 0.05$  pre-op versus post-op, <sup>§</sup> $P < 0.05$  post-op CPB-CABG versus post-op OPCAB

**Conclusion:** OPCAB surgery did not result in a more pronounced improvement in diastolic function the day after surgery compared to CPB-CABG surgery.

#### Reference:

- 1 Khouri SJ, Maly GT, Suh DD, et al. A practical approach to the echocardiographic evaluation of diastolic function *J Am Soc Echocardiogr* 2004; **17**: 290–297.

## O-71

### The impact of transoesophageal echocardiography on intra-operative decision making

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**Introduction:** The role of transoesophageal echocardiography (TOE) in cardiac surgery is expanding. Presently in many centres apart from its role as a monitoring device, TOE has the capacity to affect intraoperative management [1]. In our institution TOE is targeted to patients who are likely to benefit including a proportion of CABG cases. We audited the records of cardiothoracic fellows from a 2 year period to assess TOE's impact on such decision making.

**Method:** Cases were categorized as 'scheduled for coronary artery bypass grafts' (CABGs) or 'other cardiac procedures'. We then quantified TOE's impact according to the following scoring system:

- Level 0 TOE had no clear effect on decision making/therapy.
- Level 1 TOE confirmed and quantified known pathology.
- Level 2 TOE evaluated a surgical intervention intra-operatively.
- Level 3 TOE led to a change in the operative plan.

We also reviewed records for morbidity attributed to TOE.

**Results:** Of 38 patients scheduled for CABG surgery, there was no impact (level 0) in 32 (84%) and level 2 and 3 impacts occurred in 3 patients each (8% each). Of those scheduled for non-CABG surgery (n = 145), there was a level 1 impact in 9 (6%), a level 2 impact in 118 (81%) and a level 3 impact in 18 (12%) (see Table). No attributable morbidity was recorded.

Impact	CABGs (n = 38)	Non-CABGs (n = 145)
0	32 (84%)	0 (0%)
1	0 (0%)	9 (6%)
2	3 (8%)	118 (81%)
3	3 (8%)	18 (12%)

**Discussion:** While the impact of TOE was predictably greater in the non-CABG patient group, it led to a major change in the operative plan in 8% of patients scheduled for CABG. In the non-CABG patient it is a very useful adjunct to decision-making and leads to a major change in intervention in 12% of cases. The absence of significant injury implies that as a risk-benefit analysis this study can only be favourable.

#### Reference:

- 1 Click RL, Abel MD, Schaff HV. Intraoperative transesophageal echocardiography: 5-year prospective review of impact on surgical management. *Mayo Clin Proc* 2000; **75**: 241–247.

## O-72

### Myocardial performance index measured with transoesophageal echocardiography: comparison between flow and tissue Doppler analysis

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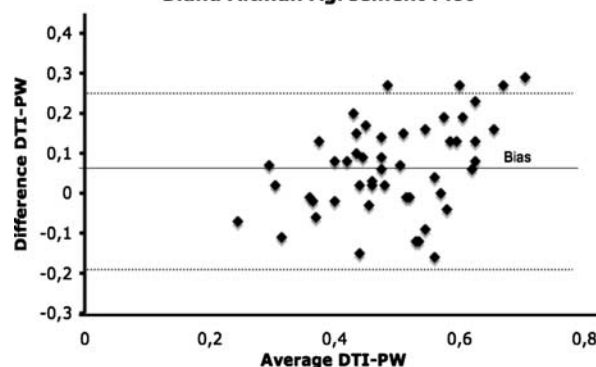
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**Introduction:** The Myocardial Performance Index (MPI) [1] is an indicator of both ventricular systolic and diastolic functions. It is the sum of isovolumic relaxation and contraction times over the injection time as measured with pulsed wave Doppler (PWD) analysis. MPI has been used preoperatively with TOE. The PWD components required to calculate the MPI are sampled on different views and hence not on the same cardiac cycle. The MPI has been measured with ETT on a single cardiac cycle using tissue Doppler imaging (TDI). However correlation with PWD remains controversial [2,3].

**Method:** Following IRB approval, TOE was used to measure MPI with PWD and TDI in 50 patients with an ejection fraction > 40%. All TDI intervals were obtained at the septal side of the mitral annulus from the midesophageal 4 chamber view.

**Results:** Mean MPI values were  $0.46 \pm 0.09$  and  $0.52 \pm 0.13$  for PWD and TDI respectively. Correlation between PW and TDI values was  $0.570$  ( $P < 0.01$ ). Bias between the 2 methods was 0.065 and limits of agreement were  $-0.16$  to  $0.29$ . These data do not support substitution of the PWD MPI by the TDI MPI.

#### Bland Altman Agreement Plot



**Conclusion:** We found only a poor agreement between MPI measured with PWD and TDI. Further studies including different groups should be done to assess whether MPI measured by TDI is able to discriminate healthy from sick patients when using TOE.

#### References:

- 1 Tei C. New non-invasive index for combined systolic and diastolic ventricular function. *J Cardiology* 1995; **26**: 135–136.
- 2 Tekten T, Onbasili AO, Ceyhan C, et al. Novel approach to measure myocardial performance index: pulsed-wave tissue Doppler echocardiography. *Echocardiography* 2003; **20**: 503–510.
- 3 Gaibazzi N, Petrucci N, Ziacchi V. Left ventricle myocardial performance index derived either by conventional method or mitral annulus tissue-Doppler: a comparison study in healthy subjects and subjects with heart failure. *J Am Soc Echocardiogr* 2005; **18**: 1270–1276.

## O-73

### Intraoperative evaluation of splanchnic blood flow: comparison of two transoesophageal approaches

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**Introduction:** Splanchnic blood flow monitoring has great clinical interest, because splanchnic ischaemia induces organ failure and increases mortality. Since all the blood from the splanchnic region comes to the liver, total liver blood flow (LBF) mirrors the splanchnic blood supply. The close proximity of the distal oesophagus to the hepatic hilum allows intraoperative evaluation of LBF by transoesophageal duplex ultrasound of the hepatic veins [1]. However, a correct angle of insonation can often be obtained for only one or two hepatic veins. LBF can also be calculated as the sum of portal vein (PVF) and hepatic arterial (HAF) flows, measured by transoesophageal Doppler. We have compared these two transoesophageal approaches, in order to evaluate whether blood flow changes of the sole right hepatic vein (RHVF) can be used as an estimate of total LBF during surgery.

**Method:** In 12 cardiac surgery patients changes in both RHVF and total LBF (THF, measured as the sum of PVF and HAF) were assessed during mild hypothermic (32°C) CPB at three times: T1 (CPB, normotension), T2 (reduction by at least 20% of mean arterial pressure (MAP) as a result of peripheral vasodilation), T3 (MAP restored to baseline values by increasing pump flow). In each vessel, blood flow was calculated as the product of time averaged mean velocity and cross-sectional area. ANOVA for repeated measures was used to compare the haemodynamic changes.

**Results:** Blood flow changes are shown in Table 1. RHVF and THF had a good correlation at the linear regression analysis ( $r = 0.83$ ;  $P < 0.01$ ).

**Table 1.** Haemodynamic changes.

	T1	T2	T3
MAP (mmHg)	68 ± 10	49 ± 6*	75 ± 7
Pump Flow (litre*min <sup>-1</sup> )	4.6 ± 0.5	4.5 ± 0.6	5.1 ± 0.5
RHVF (mL*min <sup>-1</sup> )	480 ± 52	295 ± 64*	501 ± 51
THF (mL*min <sup>-1</sup> )	1287 ± 170	806 ± 84*	1312 ± 198

\* $P < 0.001$  compared to T1.

**Discussion:** In our patients hypotension during CPB induced a significant reduction of LBF. The two methods used to evaluate splanchnic perfusion

underwent similar changes (–38.6% RHVF vs. –37.4% LBF at T2), and were linearly related. We conclude that Doppler RHVF can be used to approximate splanchnic blood flow during CPB.

#### Reference:

- 1 Meierhenrich R, Gauss A, Georgieff M, et al. Use of multi-plane transoesophageal echocardiography in visualization of the main hepatic veins and acquisition of Doppler sonography curves. Comparison with the transabdominal approach. *Br J Anaesth* 2001; **87**(5): 711–717.

## O-74

### Hepatic arterial buffer response during off-pump coronary surgery: a transoesophageal Doppler study

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**Introduction:** A reduction of mesenteric blood flow has been previously found during off-pump coronary surgery (OPCABG) because of the haemodynamic effects of heart displacement [1]. Although this could compromise portal blood supply to the liver, the net effect on total hepatic flow is less predictable, given the potential buffer effect of the hepatic artery.

**Method:** In 23 patients scheduled for elective multivessel OPCABG the effects of heart displacement on systemic and regional haemodynamics were assessed. Cardiac output (CO) was measured by transpulmonary thermodilution. Blood flows in the superior mesenteric artery (SMABF), vena porta (PVBF) and hepatic artery (HABF) were assessed by transoesophageal duplex ultrasound. In each vessel, the time averaged mean velocity (TAMV) and diameter (d) measurements were used to estimate blood flow (BF) according to the following equation:  $BF (ml/min) = \pi * (\frac{1}{2} d)^2 * TAMV * 60$ . Total hepatic blood flow (THBF) was calculated as the sum of the flows in the portal vein and the hepatic artery. Measurements were taken at four times: T0 (baseline), T1 (left anterior descending anastomosis), T2 (heart displacement), T3 (end of surgery).

**Results:** No significant change in systemic and regional haemodynamics was seen at T1. At T2, the decrease in CO induced a reduction of SMABF and PVBF, whereas HABF increased. As a result, THBF was better preserved (–20.7%) in comparison with SMABF (–49.6%) and PVBF (–39.1%). The ratio of HABF to THBF increased from 0.28% at T0 to 0.45% at T2. At T3 an increase in CO, SMABF and PVBF were coupled with a reduction of HABF; THBF remained unchanged.

**Discussion:** The marked changes in PVBF and HABF indicate that a hepatic arterial buffer response is active in patients undergoing off-pump myocardial revascularization under general anaesthesia. This effect reduces the impact of gastrointestinal hypoperfusion on liver blood supply.

**Table 1.** Systemic and regional blood flows.

	T0	T1	T2	T3
CO (L*min <sup>-1</sup> )	5.8 ± 1	5.6 ± 0.8	3.8 ± 0.6 <sup>a</sup>	6.8 ± 1 <sup>a</sup>
SMABF (ml*min <sup>-1</sup> )	470 ± 88	471 ± 101	236 ± 63 <sup>a</sup>	674 ± 143 <sup>a</sup>
PVBF (ml*min <sup>-1</sup> )	926 ± 160	888 ± 147	565 ± 144 <sup>a</sup>	1067 ± 186
HABF (ml*min <sup>-1</sup> )	345 ± 60	340 ± 55	443 ± 61 <sup>a</sup>	288 ± 45 <sup>a</sup>

<sup>a</sup> $P < 0.01$ .

#### Reference:

- 1 Fiore G, Brienza N, Cicala P et al. Superior mesenteric artery blood flow modifications during off-pump coronary surgery. *Ann Thorac Surg* 2006; **82**: 62–67.

## Free Poster Sessions

### Cardiac Anaesthesia and Postoperative Care

## P-75

### Comparison of alfentanil and remifentanil based balanced fast-track cardiac anaesthesia

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**Introduction:** We have been using a fast-track technique of cardiac anaesthesia (alfentanil and remifentanil based, respectively) routinely at our department since 2001 [1, 2]. The aim of the study was to compare these two methods.

**Method:** The prospective follow-up study of 71 consecutive patients (alfentanil 32, remifentanil 39) including all types of standard cardiac procedures

(coronary artery bypass surgery and valve operations). Opiate dosage was as follows. Alfentanil: induction –20 µg kg<sup>-1</sup> in 3–5 minutes, followed by decreasing doses of 1.5–0.2 µg kg<sup>-1</sup> min<sup>-1</sup>. Remifentanil: continual anaesthetic doses of 0.5–0.1 µg kg<sup>-1</sup> min<sup>-1</sup> during the operation, followed by analgesic doses of 0.02–0.05 µg kg<sup>-1</sup> min<sup>-1</sup> post-operatively.

**Results:** The distribution of patients' demographic data, EuroSCORE, left ventricle ejection fraction (LVEF) and operation types were similar in the two groups. There was no statistically significant difference in average time to extubation (27.5 vs. 20 min), length of ICU stay (25.3 vs. 23.8 hours), in-department stay (6 vs. 6 days), incidence of postoperative atrial fibrillation (30.7 vs. 34.3%). A statistically significant difference in Pao<sub>2</sub> at the end of the procedures was detected, with higher values on average in the remifentanil group (32.7 kPa) in comparison to the alfentanil group (26.9 kPa,  $P = 0.013$ ). Two hours after the extubation average Paco<sub>2</sub> levels were higher in the remifentanil group (5.72 vs. 5.36 kPa,  $P = 0.025$ ). Postoperative pH (2 h after

extubation and on the 1st postoperative day (POD)) did not significantly depend on opiates, but on LVEF ( $P = 0.018$ ,  $P = 0.006$ , respectively). We found no significant differences ( $P = 0.353$ ) in a postoperative pain grade (measured 1 h after extubation and on 1st POD by visual analogue scale of pain and SF McGill's questionnaire) and in the number of analgesic doses.

**Discussion:** There was no significant difference between these two fast-track methods of cardiac anaesthesia (except for some blood gas values). Both methods provide an early and safe extubation of patients undergoing cardiothoracic surgery. Anaesthesia with alfentanil seems to be a comparable and cost-saving alternative to remifentanyl.

#### References:

1. Vanek T, Brucek P, Straka Z. Fast track as a routine for open-heart surgery. *Eur J Cardiothorac Surg* 2002; **21**: 369–370.
2. Brucek PJ, Straka Z, Vanek T, et al. Less invasive cardiac anaesthesia: an ultra-fast-track procedure avoiding thoracic epidural analgesia. *Heart Surg Forum* 2003; **6**: 528–530.

## P-76

### The effect of amino acid infusion on core body temperature during off-pump CABG

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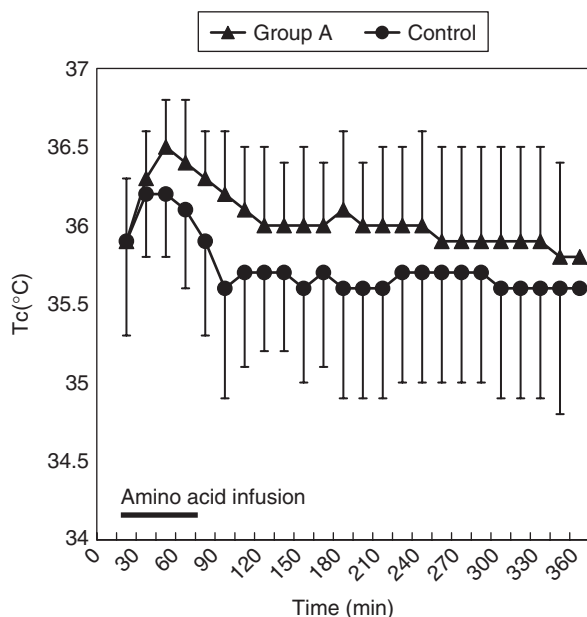
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**Introduction:** Thermal management during off-pump CABG (OPCAB) is often difficult. We tested whether an amino acid infusion, known to facilitate heat production, helped to maintain the core temperature during OPCAB.

**Method:** We retrospectively reviewed the anaesthesia records of 28 patients who underwent elective OPCAB. Ambient temperature in the operating theatre was kept around 22°C. Standard temperature management of our institute was employed in all cases. Mixed amino acid solution (5–7 KJ/kg) was administered in 14 patients (Group A) and the remainder ( $n = 14$ ) were assigned to a control group. Bladder temperature was recorded every 15 minutes as core body temperature ( $T_c$ ). The difference of the mean  $T_c$  between the groups was analysed by repeated measures ANOVA.  $P < 0.05$  was considered to be statistically significant.

**Results:** The mean  $T_c$  tended to be maintained higher in Group A than in the control group, although the difference was not statistically significant ( $P = 0.24$ ). The duration of mechanical ventilation or the length of ICU stay did not differ between the groups.

**Conclusion:** The findings of this retrospective study might support the potential role of amino acid infusion on thermal management during OPCAB. A prospective, double-blind study is indicated for further investigation.



#### Reference:

1. Umenai T, Nakajima Y, Sessler DI, et al. Perioperative amino acid infusion improves recovery and shortens the duration of hospitalization after off-pump coronary artery bypass grafting. *Anesth Analg* 2006; **103**: 1386–1393.

## P-77

### Levosimendan – modality of treatment in cardiac surgery patients

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**Introduction:** Levosimendan (LS), a new calcium sensitizer with positive inotropic effect [1,2] is indicated for patients with severe cardiac systolic dysfunction. The aim of our study was to evaluate the effects of LS in such patients undergoing cardiac surgery.

**Method:** Thirty-six patients undergoing cardiac surgery with administration of LS were investigated retrospectively in the period Jan 2006–Dec 2006. The indication for LS therapy included high risk patients with low ejection fraction (EF) perioperatively (EF < 30%) or onset of low cardiac output syndrome (LCOS) 1–4 days postoperatively (Table 1).

Table 1. Indications for LS treatment

Type of cardiac surgery	Time of administration LS	
	Perioperatively	Postoperatively
Coronary artery bypass grafting (CABG)	9(2)	15(1)
Valve surgery (mitral/aortic/tricuspid)	3	1
Combined (CABG + valve surgery)	3	3
Aortic replacement (arrest circulation)	0	2(1)
Total	15(2)	21(2)

In brackets ( ) are the numbers of patients who died.

LS 24  $\mu\text{g}/\text{kg}$  was given over 10 minutes followed by 0.1  $\mu\text{g}/\text{kg}/\text{min}$  over the next 24 hours. Echocardiographic systolic ejection fraction by Simpson method (EF), diastolic left ventricle diameter (LVd) and haemodynamic parameters of cardiac (CI) and stroke volume index (SI) before and after 24 hours infusion of LS were measured. Wilcoxon's paired test was used for statistical analyses.

**Results:** Four patients died (11.11%). EF before surgery (median EF 30%) significantly increased ( $P \leq 0.001$ ) after LS infusion (median EF 34.5%) postoperatively. LVd significantly reduced from a median value of 59 mm to 58 mm ( $P \leq 0.05$ ). CI improved (median CI before 2.43  $\text{l}/\text{min}/\text{m}^2$  vs. after LS infusion 2.98  $\text{l}/\text{min}/\text{m}^2$ ,  $P \leq 0.001$ ) and SI increased (median SI before 21.65  $\text{ml}/\text{m}^2/\text{beat}$  vs. after 30.1  $\text{ml}/\text{m}^2/\text{beat}$ ,  $P \leq 0.05$ ).

**Discussion:** In patients with severe systolic dysfunction undergoing cardiac surgery the administration of levosimendan improves cardiac performance as well as haemodynamic parameters. Levosimendan is effective in treatment of those patients.

#### References:

1. Moiseyev VS, Poder P, Andrejevs N, et al. Safety and efficacy of a novel calcium sensitizer, levosimendan, in patients with left ventricular failure due to an acute myocardial infarction. A randomized, placebo-controlled, double-blind study (RUSSLAN). *Eur Heart J* 2002; **23**: 1422–1432.
2. Toller WG, Stranz C. Levosimendan. A new inotropic and vasodilator agent. *Anesthesiology* 2006; **104**: 556–569. Review.

## P-78

### Haemodynamic effects of levosimendan in patients with very low ejection fraction undergoing cardiac surgery

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**Introduction:** Levosimendan is a new inodilator acting as a calcium-sensitizer on cTnC. It does not increase  $\text{Ca}^{++}$  concentration in the cells and oxygen consumption as other inotropic agents do. Nevertheless, the high cost and the lack of multicentre studies on the haemodynamic effects of severe acute heart failure, have limited its use until now. The aim of our work was to evaluate the efficacy of levosimendan in improving haemodynamics in patients with severely decompensated heart failure undergoing cardiac surgery.

**Method:** Eighteen patients with ejection fraction (EF)  $\leq 25\%$  scheduled for different cardiac procedures but no other criteria of selection, were studied. After induction of anaesthesia, a Swan-Ganz thermodilution catheter was inserted and all the haemodynamic parameters of flow and pressure were recorded (base). A levosimendan infusion of 0.1–0.15  $\mu\text{g}/\text{kg}/\text{min}$  without a primary bolus was started at the beginning of cardiopulmonary bypass (CPB) and maintained for 24 hours. A complete haemodynamic record of the parameters obtained with the Swan-Ganz catheter was taken at arrival in ICU and every six hours for at least 48 hours. Means and standard deviations of the recorded values were compared to the base to assess significant differences.



**Results:** In all patients there was a significant increase in cardiac index (CI) during the levosimendan infusion from  $2.0 \pm 0.67$  litre  $\text{min}^{-1} \text{m}^{-2}$  to  $3.1 \pm 0.68$  ( $P < 0.001$ ), with the peak at the arrival in ICU. The increase was significant until the 12th hour in ICU (mean  $2.89 \pm 0.8$ ;  $P = 0.001$ ), with a significant decrease in systemic vascular resistance (SVR) from  $1831.71 \pm 897.73$  to  $881.87 \pm 294.98$  dyn  $\text{s cm}^{-5}$  ( $P < 0.0001$ ) at six hours. The pulmonary vascular resistance (PVR) also decreased from  $227.54$  to  $129.0 \pm 58.36$  dyn  $\text{s cm}^{-5}$  ( $P = 0.003$ ). In all cases adrenaline and/or nora-adrenaline were also infused, but in a dose less than  $0.15 \mu\text{g kg}^{-1} \text{min}^{-1}$  and for no longer than a mean of 12 hours. Dobutamine infusion was avoided. Two patients died after dismissal from ICU, one from mesenteric ischaemia and one due to severe restrictive diastolic heart failure.

**Discussion:** In our experience, the noticeable rise of systemic flow and the decrease of SVR and PVR are a major advantage for patients with severe heart failure, enabling them to overcome the very acute period and to be introduced to chronic therapy. This haemodynamic behaviour occurred in the first 48 hours in all patients, including those who later developed fatal complications. The use of other inotropic drugs was not avoided, but considerably reduced in quantity and duration.

#### Reference:

- 1 Follath F, Cleland JG, Just H, et al. Efficacy and safety of intravenous levosimendan compared with dobutamine in severe low-output heart failure (the LIDO study): a randomised double-blind trial. *Lancet* 2002; **360**: 196–202.

## P-79

### The use of dexmedetomidine in paediatric cardiac surgery

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**Introduction:** The stress response is the hormonal and metabolic change that follows injury or trauma. This is part of the systemic reaction to injury, which encompasses a wide range of endocrinological, immunological and haematological effects. Dexmedetomidine is a highly specific, potent and selective alpha-2 adrenoceptor agonist [1]. We have tested it for its ability to decrease heart rate, blood pressure, and neuroendocrine responses during paediatric cardiac surgery.

**Method:** In a randomized, placebo-controlled study, thirty paediatric patients undergoing open heart surgery were randomly assigned to one of two equal groups. The control group received saline, whereas the treatment group (DEX group) received an initial bolus dose of dexmedetomidine ( $0.5 \mu\text{g/kg}$ ) over 10 minutes, followed immediately by a continuous infusion of  $0.5 \mu\text{g kg}^{-1} \text{h}^{-1}$ . Arterial pressure, heart rate and sequential concentrations of circulating cortisol, epinephrine, norepinephrine, and blood glucose were measured.

**Results:** Relative to base line, arterial blood pressure and heart rate decreased significantly after the administration of dexmedetomidine through skin incision. In the control, patients heart rate and arterial blood pressure measures increased after skin incision until the end of bypass ( $P < 0.05$ ). In both groups, plasma cortisol, epinephrine, norepinephrine and blood glucose increased significantly relative to baseline, after sternotomy, and after bypass. However the increase was significantly higher in the control group compared with the DEX group ( $P < 0.05$ ).

**Table 1.** Demographic data: mean (SD) or ratio.

	DEX group (n = 15)	Control group (n = 15)
Age (year)	2.3 (1.3)	2.5 (1.6)
Gender (M/F)	8/7	9/6
Weight (kg)	12.1 (2.5)	12.7 (3.0)
Ventricular septal defect (VSD)	6	5
Atrial septal defect (ASD)	6	7
Sub-aortic membrane	2	3
Cor-triatriatum	1	0

**Discussion:** An infusion of intraoperative dexmedetomidine, an  $\alpha_2$  agonist, attenuated increases in heart rate, blood pressure and plasma cortisol, and catecholamine concentrations in paediatric patients undergoing open heart surgery for congenital heart disease.

#### Reference:

- 1 Savola JM, Virtanen R. Central alpha-2 adrenoceptors are highly stereoselective for dexmedetomidine, the dextro enantiomer of medetomidine. *Eur J Pharmacol* 1991; **195**:193–199.

## P-80

### Relationship between echocardiographic index of ventricular filling pressure and intraoperative haemodynamics during off-pump coronary bypass surgery

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**Introduction:** During off-pump coronary artery bypass surgery (OPCAB), heart enucleation causes impaired diastolic filling, leading to decreased cardiac output and mixed venous oxygen saturation (SvO<sub>2</sub>). We have hypothesized that even with preserved systolic ventricular function, patients with diastolic dysfunction would be more prone to haemodynamic derangements during OPCAB. The ratio of mitral velocity to early diastolic velocity of the mitral annulus (E/E') correlates well with left ventricular (LV) filling pressure [1]. We therefore evaluated the relationship between E/E' and intraoperative haemodynamic changes during OPCAB in a prospective trial.

**Method:** After IRB approval and patients' informed consent, 23 patients with LV ejection fraction >50% were divided into 2 groups according to their E/E' value; E/E' < 8 (normal LV filling pressure, n = 11) and E/E' > 15 (increased LV filling pressure, n = 12). Haemodynamic measurements were performed after induction of anaesthesia (T1, baseline), during grafting of left anterior descending artery (T2), obtuse marginal (T3) and posterior descending and/or posterior lateral branches (T4) and after sternum closure (T5).

**Results:** Patients' characteristics and intraoperative data were similar between the groups. In intergroup comparisons, cardiac index (CI) and SvO<sub>2</sub> were significantly lower in the E/E' > 15 group during grafting. In intragroup comparisons to values at T1, E/E' < 8 group had no significant changes in CI during the study period and SvO<sub>2</sub> was only decreased at T3. In the E/E' > 15 group, both CI and SvO<sub>2</sub> were significantly decreased during grafting and SvO<sub>2</sub> was decreased also at T5. Other haemodynamic variables were similar between the groups.

**Table 1.** Changes in cardiac index and mixed venous oxygen saturation

	Group	T1	T2	T3	T4	T5
CI	E/E' < 8	$2.8 \pm 0.4$	$3.0 \pm 0.5$	$2.5 \pm 0.4$	$2.9 \pm 0.4$	$2.9 \pm 0.4$
(litre $\cdot \text{min}^{-1} \cdot \text{m}^{-2}$ )	E/E' > 15	$3.0 \pm 0.6$	$2.5 \pm 0.5^{\dagger}$	$2.0 \pm 0.4^{\dagger}$	$2.0 \pm 0.4^{\dagger}$	$2.5 \pm 0.5$
SvO <sub>2</sub>	E/E' < 8	$80 \pm 4$	$77 \pm 5$	$75 \pm 3^{\dagger}$	$75 \pm 6$	$78 \pm 5$
(%)	E/E' > 15	$78 \pm 4$	$71 \pm 7^{\dagger}$	$65 \pm 8^{\dagger}$	$65 \pm 6^{\dagger}$	$71 \pm 4^{\dagger}$

Values are mean  $\pm$  SD.  $^*P < 0.05$  for intergroup comparisons;  $^{\dagger}P < 0.05$  for intragroup comparisons to values at T1.

**Discussion:** In patients with preserved systolic ventricular function, patients with E/E' > 15 were more prone to undergo significant decrease in CI and SvO<sub>2</sub> during OPCAB. Whether these intraoperative findings are associated with postoperative morbidity and mortality should be validated.

#### Reference:

1. Ommen SR, Nishimura RA, Appleton CP, et al. Clinical utility of Doppler echocardiography and tissue Doppler imaging in the estimation of left ventricular filling pressures. A comparative simultaneous Doppler-catheterization study. *Circulation* 2000; **102**: 1788–1794.

## P-81

### Diastolic dysfunction in patients with preserved systolic function undergoing cardiac surgery: is there a role for BNP in preoperative diagnosis?

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**Introduction:** Plasma BNP levels can be useful to diagnose and manage heart failure [1]. We evaluated the preoperative BNP level as a means of detecting diastolic dysfunction in patients undergoing cardiac surgery.

**Method:** Sixty patients with preserved LVEF (>40%), were enrolled. Thirty-five were scheduled for CABG and twenty-five for aortic valve replacement (AVR). Basal plasma BNP levels were measured preoperatively. After induction of anaesthesia we performed a comprehensive TOE with assessment of left ventricular diastolic function with transmitral flow velocity and pulmonary vein flow interrogation, and by measuring flow propagation velocity and mitral annular velocities with colour M-mode (CMM) and tissue Doppler imaging (TDI).

**Results:** We found grade I diastolic dysfunction in 71% of CABG pts and 75% in AVR pts. Median plasma BNP levels were elevated in both groups compared with patients without diastolic dysfunction. Using mitral annular velocities with CMM and TDI, we observed grade I diastolic dysfunction in 88% of the CABG group and 92% in the AVR group. In 17% of both the CABG and AVR groups (grey zone), diastolic dysfunction was detected only by mitral annular velocities with CMM and TDI. Basal BNP in these subgroups were respectively  $134 \pm 74$  and  $145 \pm 80$  pg/mL.

**Table.** BNP values pg/mL

	BNP Group CABG	BNP Group AVR
Diastolic dysfunction	161 ± 43	178 ± 58
Normal pattern	26 ± 11	20 ± 8
Grey zone	134 ± 74	145 ± 80

**Discussion:** Plasma BNP levels and newer diastolic indices measured from TDI and CMM both detect diastolic dysfunction. Plasma BNP levels reflect diastolic dysfunction also in patients with preserved left ventricular function, whereas standard Echo evaluation can miss diastolic dysfunction in 17% of cases.

**Reference:**

1. Troughton RW, Frampton CM, Yandle TG, et al. Treatment of heart failure guided by plasma aminoterminal brain natriuretic peptide (N-BNP) concentrations. *Lancet* 2000; **355**: 126–130.

**P-82****Prognostic value of selected echocardiographic parameters in children with pulmonary hypertension**

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**Introduction:** Pulmonary hypertension (PH), as a complication of congenital heart defects, still remains a significant clinical problem and is a cause of postoperative morbidity and mortality in children with left to right shunts. The aim of the study was to verify whether preoperative echocardiography examination enables a prognosis for pulmonary hypertension in the early and late postoperative periods.

**Method:** The study population consisted of 191 children with preoperative echocardiographic diagnosis of PH who underwent surgery from 1 October to 31 December 2004 in our hospital. There were 88 boys and 103 girls, mean age 4 months (3 days to 8 years). The population was divided into two groups: with (PH-1) and without (PH-0) symptoms of postoperative PH. Patients with postoperative PH were classified according to presence (PHC-1) or absence (PHC-0) of PH crises. The later group was further divided into two groups: patients treated with NO (NO-1) inhalation and treated conventionally (NO-0).

The selected echocardiographic parameters were analysed in all groups: pulmAT, AT/RVET, %RV. Clinical data concerning patient, operative procedure and postoperative course were analysed for mortality, complications, cardio-pulmonary bypass time (CPB), aortic cross-clamp time (AoX) and mechanical ventilation time.

**Results:** PH-0:66 pts, PH-1:125 pts, PHC-0:45 pts, PHC-1:80 pts, NO-0:45 pts, NO-1:35 pts. pulmAT was: in PH-0: 62 ms, in PH-1: 60 ms.  $P = 0.1$ ; in PHC-0: 60 ms, in PHC-1: 60 ms.  $P = 0.1$ ; in NO-0: 65 ms, in NO-1: 55 ms.  $P = 0.06$ . AT/RVET was: in PH-0: 86.0, in PH-1: 92.2  $P = 0.3$ ; in PHC-0: 87.4, in PHC-1: 93.8  $P = 0.8$ ; in NO-0: 0.27, in NO-1: 0.25  $P = 0.07$ . %RV was: in PH-0: 62 ms, in PH-1: 60 ms.  $P = 0.1$ ; in PHC-0: 60 ms, in PHC-1: 60 ms.  $P = 0.1$ ; in NO-0: 86.6, in NO-1: 99.3  $P = 0.08$ .

In PH-0: 4.5%, in PH-1:20%, in PHC-0:2.2%, in PHC-1: 29.6%, in NO-0: 28.2%, in NO-1: 31.4% pts died. CPB was in PH-0: 8 min, in PH-1: 100 min, in PHC-0: 99 min, in PHC-1: 109 min, in NO-0: 98 min, in NO-1: 109 min. AoX was in PH-0: 40 min, in PH-1: 47 min, in PHC-0: 45 min, in PHC-1: 47 min, in NO-0: 43 min, in NO-1: 54 min.

**Conclusions:** Echocardiographic examination does not enable prognosis of postoperative PH symptoms. It is impossible to foresee the magnitude of these symptoms in the early postoperative period.

**P-83****Transoesophageal echo Doppler of the renal arteries: off-pump versus on-pump myocardial revascularization**

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**Introduction:** Cardiopulmonary bypass (CPB) is a risk factor for renal hypoperfusion and damage [1]. Off-pump surgery, avoiding CPB, could affect renal blood flow to a lesser extent, thus improving renal outcome. Transoesophageal echo Doppler has been used to measure intraoperatively flow velocity profile in renal arteries, providing the clinician with information about renal blood flow and vascular resistance. In the present study we have compared changes in renal artery Doppler waveform in patients undergoing myocardial revascularization with or without CPB. Our aim was to evaluate the effects of both techniques on renal haemodynamics.

**Method:** Renal artery Doppler waveforms were assessed at the level of the left renal hilum in 26 patients with preop creatinine,  $<120 \mu\text{mol/L}$ , divided in

2 groups: nonpulsatile, mild hypothermic ( $32^\circ\text{C}$ ) CPB (14 patients), and off-pump (12 patients). Measurement was performed at two time points: during left internal mammary artery harvesting and just before chest closure. The following Doppler parameters were recorded: peak systolic velocity PSV, end diastolic velocity EDV and resistive index RI =  $(\text{PSV}-\text{EDV})/\text{PSV}$ . Statistical analysis was performed by one way ANOVA for repeated measures.

**Results:** After CPB there was a significant increase in both PSV ( $58 \pm 10$  vs  $71 \pm 10 \text{ cm}^3\text{sec}^{-1}$ ,  $P < 0.01$ ) and RI ( $0.59 \pm 0.08$  vs  $0.77 \pm 0.06$ ,  $P < 0.01$ ), with a decrease in EDV ( $24 \pm 6$  vs  $16 \pm 5 \text{ cm}^3\text{sec}^{-1}$ ,  $P < 0.01$ ). On the contrary, no change in Doppler values was seen in the off-pump group (PSV  $59 \pm 10$  vs  $60 \pm 13 \text{ cm}^3\text{sec}^{-1}$ ; EDV  $23 \pm 5$  vs  $22 \pm 6 \text{ cm}^3\text{sec}^{-1}$ ; RI  $0.6 \pm 0.1$  vs  $0.61 \pm 0.13$ ).

**Discussion:** Doppler RI, despite its name, is a complex parameter reflecting global impedance of the downstream vascular bed. In our patients CPB induced a significant increase of RI as a result of both an increase in PSV and a reduction of EDV. Several factors (circulating catecholamines, nonpulsatile blood flow, embolic load and rewarming) can modify the compliance and resistance characteristics of intrarenal vessels after CPB, accounting for the changes in Doppler waveform seen in these patients. The absence of such modifications in off-pump surgery agrees with the observation that avoiding CPB attenuates transient renal damage [2].

**References:**

1. Mori A, Watanabe K, Onoe M, et al. Regional blood flow in the liver, pancreas and kidney during pulsatile and nonpulsatile perfusion under profound hypothermia. *Jpn Circ J* 1988; **52**: 219–227.
2. Loef GB, et al. OPCABG attenuates transient renal damage compared with on-pump coronary revascularization. *Chest* 2002; **121**:1190–1194.

**P-84****Which image of the mitral ring correlates better? Comparison of two slices in TOE to predict the diameter of the annuloplasty prosthesis in mitral valve repair**

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**Introduction:** The procedure of mitral valve repair for the adjustment of mitral valve regurgitation has become of significant importance during recent years. Independent of the specific method for repair, the insertion of an annuloplasty ring (AR) in addition, is necessary. In most cases the size of this AR is determined by the surgeon under direct vision of the mitral valve. The aim of our study was to investigate whether one can predict the size of the AR by use of two standard views of the routine examination with transoesophageal echocardiography (TOE), and which of the views gives the better accuracy for prediction of AR before the heart is arrested [1].

**Method:** From April to November 2006 digitally stored TOE examinations of 98 patients (pts) who underwent mitral valve repair were evaluated for determination of the size of the AR. In all patients we obtained the transgastric (TG) basal short axis (SAX) as well as the midesophageal (ME) left ventricular (LV) long axis (LAX)-view for evaluation. In the TG BASAL SAX views the distance between the anterolateral and the posteromedial commissures was measured. In addition we measured the length of the anterior mitral leaflet in the ME LV LAX (Enconcert™, Philips). Each measurement was done by two independent anaesthesiologists. Both examiners were blinded regarding the implanted AR size.

Statistical evaluation was done to compare the expected AR size based on the measurements in the two standard images with the size of the inserted AR (SPSS).

**Results:** Image quality was excellent in 20, moderate in 35 and fair in 42 pts. A positive correlation was found for both the TG and the LV LAX (Spearman Product Moment Correlation,  $P < 0.001$ ). The mean value for differences in between the inserted AR and TG was  $-1.24$  (standard deviation 2.79). In contrast the mean value for differences between the inserted AR and LV LAX was found to be 0.17 (standard deviation 3.26).

**Discussion:** LV LAX and TG are reliable methods to determine the size of AR for for mitral valve repair by TOE. Compared with TG SAX, LV LAX seems to be superior for determination of AR.

**Reference:**

1. Hellemans IM, Pieper EG, Ravelli AC, et al. Prediction of surgical strategy in mitral valve regurgitation based on echocardiography. *Am J Cardiol* 1997; **79**: 334–338.

**P-85****Transoesophageal echocardiography during stent placement in the thoracic aorta**

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**Introduction:** Stent placement in the thoracic aorta has become a major treatment for dissections, aneurysms and intramural haematoma [1]. Transoesophageal echocardiography (TOE) is an important tool to identify true and false lumina, assess proper insertion of the guidewires, placement and deployment of the stent, and to verify the existence of residual endoleak and patency of vital blood vessels [2]. This study was aimed at the qualification of the usefulness of TOE in the different conditions.

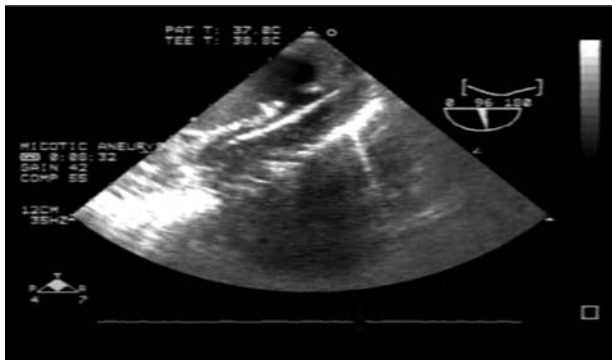
**Method:** After every stent placement the anaesthesiologist and radiologist present gave a score of 1 (not useful), 2 (useful), or 3 (essential) concerning the application of TOE in different pathological conditions.

**Results:** In 58 consecutive patients TOE was assessed as essential in mycotic aneurysm (n = 16) (fig 1) and Type A dissection (n = 18). Useful was scored in merely guide wire insertion (n = 12), and in fenestration of dissections (n = 6).

**Conclusion:** The result of this study shows the evolution of TOE in stent placement. Initially TOE was applied for diagnostic reasons in aortic dissections, but today is assessed as an essential tool in the treatment of thoracic aortic disease. Its role in the proper placement of the stent in mycotic aneurysms was crucial. TOE could detect post-deployment patency of vital blood vessels such as the left carotid and coronary arteries.

#### References:

1. Grabenwoger M, Fleck T, Czerny M, et al. Endovascular stent graft placement in patients with acute thoracic aortic syndromes. *Eur J Cardiothorac Surg* 2003; **23**: 788–793.
2. Rapezzi C, Rocchi G, Fattori R, et al. Usefulness of transoesophageal echocardiographic monitoring to improve the outcome of stent-graft treatment of thoracic aortic aneurysms. *Am J Cardiol* 2001; **87**: 315–319.



## P-86

### A comparative study of haemodynamic effects of intubation with Macintosh and McCoy blades in patients with coronary artery disease

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**Introduction:** We compared the haemodynamic effects of laryngoscopy and intubation with Macintosh or McCoy blade in patients with coronary artery disease undergoing elective coronary artery bypass grafting surgery (CABG).

**Method:** With ethics committee and written informed consent, we studied 32 patients (NHYA II–III, LVEF > 40%) scheduled for elective CABG. Patients with obesity and signs of difficult intubation were excluded. After premedication, they were monitored for heart rate (HR), arterial pressures (AP), pulmonary arterial pressure (PAP) and ST-segment change. Patients received midazolam 0.05 mg kg<sup>-1</sup>, propofol 1 mg kg<sup>-1</sup>, fentanyl 5 µg kg<sup>-1</sup> and rocuronium 0.6 mg kg<sup>-1</sup> for induction. Maintenance was obtained with sevoflurane 2% in oxygen 50%. Patients were hand ventilated for 1 min and randomly assigned to groups; Macintosh (n = 16) and McCoy (n = 16). Mallampati classification of patients, number of intubation attempts, laryngoscopy time, intubation time and complications were recorded. Haemodynamic data (HR, SAP, DAP, MAP, SpO<sub>2</sub>, PAP, PCWP, CO, CI, SvO<sub>2</sub>, CVP) was collected before (T1, control) and after (T2) induction, during laryngoscopy (T3) and at 1 (T4), 2 (T5), 3 (T6) and 5 (T7) min after intubation. Pulmonary and arterial blood gases were measured after induction and 1 min after intubation. We used Wilcoxon's signed ranks, Kruskal-Wallis and Mann-Whitney tests for statistical analysis.

**Results:** There was no difference in demographic and airway assessment data and control values between the groups. The number of intubation attempts was similar. There were no complications during the study. There were significant differences within the groups in HR, SAP, MAP, DAP, PAP, CVP, CO and CI at T2, T3, T4, T6, T7. During laryngoscopy, the increase in HR in the McCoy group was lower than Macintosh group ( $P = 0.038$ ). Other significant differences between the groups are shown in the Table (mean (SD)). ( $^1P = 0.002$ ,  $^2P = 0.045$ )

	Macintosh (n = 16)	McCoy (n = 16)
Laryngoscopy time (sec)	13.3 (1.2)	20.5 (1.8) <sup>1</sup>
Intubation time (sec)	7.1 (1.3)	9.7 (2.4)
PaCO <sub>2</sub> (kPa)	5.05 (0.62)	5.54 (0.68) <sup>2</sup>

**Discussion:** The main finding of this study indicates that the duration of laryngoscopy and PaCO<sub>2</sub> at 1 min after intubation in the McCoy group was more than the Macintosh group. The increase in PaCO<sub>2</sub> in the patients intubated by McCoy blade was due to the longer laryngoscopy time, but remained in normal limits. During laryngoscopy, McCoy blade caused less increase in heart rate.

## P-87

### The effect of a novel hydroxyethyl starch solution (130/0.4) 6% on haemostasis in patients undergoing coronary artery bypass surgery – a comparative study with gelatin 3%

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**Introduction:** In this prospective, randomized study, volume effectiveness and effect on haemostasis of a new hydroxyethyl starch solution 130/0.4 6% (Voluven®, Fresenius Kabi) and modified gelatin 3% solution have been compared in cardiac surgery.

**Method:** Patients undergoing elective coronary artery bypass grafting with extracorporeal circulation were randomized to receive either Voluven (n = 16) or gelatin 3% (n = 17) perioperatively in doses necessary to maintain adequate volume status, including CVP 4–12 mmHg. Haemostatic parameters (platelet count, aPTT, INR, ACT and platelet function using PFA-100 analyser) were recorded, as well as postoperative chest drainage and use of blood/blood products.

**Results:** The two groups did not differ with regard to volume of infused colloids (Voluven 1718 ± 576 mL, gelatin 1852 ± 580 mL) and haemodynamic changes during the study period. In both groups platelet count decreased significantly during the study but still remained within normal limits. APTT did not change significantly, while INR increased significantly, but irrespective of the type of colloid infused. Platelet function assessed in tests with collagen/epinephrine (CEPI) and collagen/ADP (CADP) was not impaired, with CADP closure times being shorter in the Voluven group. Chest drainage as well as mean volume of transfused blood/blood products were higher in the gelatin group, but the difference was not significant.

**Discussion:** Volume therapy with a new HES 130/0.4 in cardiac surgery is equally safe with regard to haemostasis as with modified gelatin 3% [1].

#### Reference:

1. Haisch G, Boldt J, Krebs C, et al. Influence of a new hydroxyethylstarch preparation (HES 130/0.4) on coagulation in cardiac surgical patients. *J Cardiothorac Vasc Anesth* 2001; **15**(3): 316–321.

## P-88

### Relationship between pre-operative levels of antithrombin III and anticoagulation during extracorporeal circulation

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**Introduction:** Resistance to heparin is a recognized clinical problem and is characterized by an inadequate response to the high doses of heparin demanded for the safe initiation or maintenance of cardiopulmonary by-pass (CPB). Heparin resistance is generally explained in terms of a decrease in plasma antithrombin III (AT III) levels. The aim of the present study was to assess whether the pre-operative value of plasma AT III affects the dose of heparin necessary to achieve correct anticoagulation, determined by an activated coagulation time (ACT) equal to or greater than 480 seconds before CPB.

**Method:** Forty-four patients undergoing different heart surgery procedures with CPB were studied. In 57% of the cases they were subjected to coronary revascularization; 31% underwent surgery for repair and/or valve replacement, and 12% underwent mixed procedures. Prior to the start of CPB, AT III plasma level and ACT was determined, after which 3 mg/kg of heparin was administered i.v. If the ACT obtained was lower than 480 seconds, 1 mg/kg of heparin was added i.v. together with 500, 750 or 1000 U of AT III concentrate, initiating CPB after adequate anticoagulation had been established. Demographic data, pre-operative medication, the antifibrinolytic agent employed and plasma urea, creatinine and prothrombin activity values were recorded prior to surgery.

**Results:** Fifty-nine percent of the patients had low plasma AT III levels before CPB (levels <80%). Of these, 64% required the administration of AT III concentrate for correct anticoagulation to be attained, since the mean ACT after the first dose of heparin was 404 seconds. In 37.5% of the cases, the patients received 500 U of AT III; 12.5% 750 U of AT III, and 50% 1000 U of AT III.

**Conclusions:** We consider that a low pre-operative plasma AT III level predicts and an ACT value lower than 480 seconds after heparin indicates resistance to heparin and the need to administer AT III concentrate to achieve correct anticoagulation during CPB. The optimum dose of AT III concentrate in cases of heparin resistance is 1000 U.

## P-89

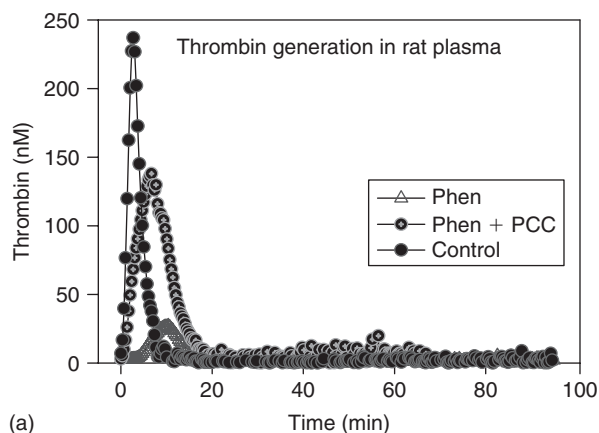
### Continuous thrombin generation for monitoring phenprocoumon anticoagulation

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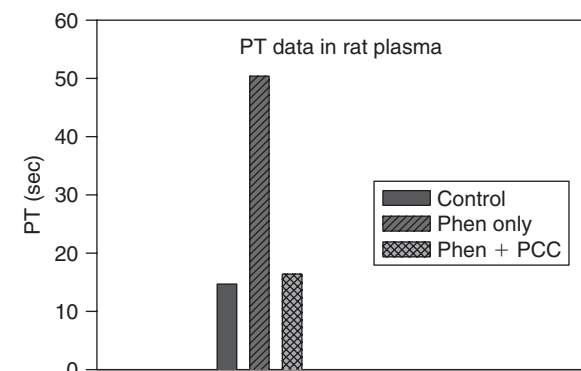
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<sup>2</sup>ZLB Behring GmbH, Marburg, Germany

**Introduction:** Phenprocoumon (Phen) therapy is usually monitored with prothrombin time (PT), but the total amount of generated thrombin is not reflected in this test. Because a thrombin generation (TG) test is currently available (Thrombinoscope, Synapse BV, Netherlands), we hypothesized that TG measurement may be better suited for monitoring phenprocoumon anticoagulation and its reversal with prothrombin complex concentrate (PCC, Beriplex P/N, ZLB Behring, Marburg, Germany).



(a)



(b)

**Method:** After the study was approved by the local ethics committee, rats in Group 1 received a single oral dose (2.5 mg/kg) of phenprocoumon (Marcumar, Grenzach-Wyhlen, Germany); Group 2 received the same treatment as Group 1 plus 50 U/kg of intravenous PCC at 15.75 h after phenprocoumon; Group 3 served as control. Blood samples were drawn at 16.00 h, and plasma was obtained by centrifugation. PT in sec was measured in plasma using Neoplastine CI plus kit and SStart 4 instrument (Diagnostica Stago, Asnieres, France). For thrombin generation, the assay method of Hemker was followed [1].

**Results:** TG assay showed a decreased peak and total thrombin (Fig. 1a) and phenprocoumon prolonged the PT (Fig. 1b). Treatment with PCC reversed the anticoagulation parameters toward control values.

**Conclusion:** TG assay can monitor anticoagulation and reversal of coumarin type drugs allowing for a more complete coagulation profile than PT testing.

#### Reference:

1. Hemker HC, Giesen P, Aldieri R, et al. The calibrated automated thrombogram (CAT): a universal routine test for hyper- and hypocoagulability. *Pathophysiol Haemost Thromb* 2002; **32**(5-6): 249-253. Review.

## P-90

### Analysis of citrated blood with thromboelastography: comparison with fresh samples. Which one is right?

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**Introduction:** Thromboelastography (TEG) is used to evaluate the viscoelastic properties of whole blood. Citrated blood has been used after recalcification when the blood cannot be analysed immediately [1-3]. In this study we assessed the reliability of TEG analysis performed on citrated blood compared to fresh blood at various time intervals (1, 2 and 3 h) using fresh, native blood, and activated (kaolin and tissue factor) samples.

**Method:** After Research Ethics Board approval, 10 healthy volunteers were enrolled for the study. Using TEG technology, measurements were obtained by analysing the fresh blood immediately and citrated blood at 1, 2 and 3 h after collection. The reaction time (r), k time (K), alpha angle ( $\alpha$ ) and maximum amplitude (MA) were measured from each TEG tracing for native and activated (kaolin and tissue factor) blood samples.

**Results:** The results of TEG analysis of fresh and citrated blood were different. In citrated native samples at 1, 2 and 3 hours the r and K values were significantly lower whereas the alpha angle and MA values were significantly higher than the fresh blood. Comparison of activated thromboelastogram values to native values at baseline show significantly shorter r and K values and greater MA values in the tissue factor activated samples. The differences among values obtained at 1, 2 and 3 h after citration were not statistically significant.

**Discussion:** Citrate storage of the whole blood offers stable and repeatable conditions for TEG measurements from 1 to 3 h of storage. Additionally, citrate storage of native and TF activated whole blood "accelerates" the coagulation process by lowering r and K times, and increasing the value of alpha angle and MA. It is of importance to be aware of this phenomenon during clinical decision-making. These findings are in agreement with those of others and there are several possible explanations for the relative hypercoagulability of citrate stored samples. Camenzind et al. postulated that the relative hypercoagulability of the citrated blood is due to incomplete inhibition of thrombin formation by citrate. However, the important point is not aetiology of the hypercoagulable state but an awareness of the storage-induced hypercoagulability when interpreting TEG results obtained with blood stored with citrate, so that TEG results are not misinterpreted.

#### References:

1. Camenzind V, Bombeli T, Seifert B, et al. Citrate storage affects Thromboelastograph analysis. *Anesthesiol* 2000; **92**: 1242-1249.
2. Zambruni A, Thalheimer U, Leandro G, et al. Thromboelastography with citrated blood: comparability with native blood, stability of citrate storage and effect of repeated sampling. *Blood Coagul Fibrinolysis* 2004; **15**: 103-107.
3. Bowbrick VA, Mikhailidis DP, Stansby G. The use of citrated whole blood in thromboelastography. *Anesth Analg* 2000; **90**: 1086-1088.

## Risk Factors and Outcome

### P-91

#### HbA1c and perioperative outcome following coronary artery surgery in diabetic patients – preliminary results

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**Introduction:** Diabetic patients have poorer short-term outcome after coronary artery surgery [1]. It has been suggested that preoperative HbA1c may predict length of stay in such patients [2]. The aim of this study was to find out the impact of long-term glycaemic control expressed by preoperative HbA1c on perioperative outcome in diabetic patients following coronary artery surgery.

**Method:** 145 consecutive diabetic patients underwent first-time coronary artery surgery in a period of 11 months and had their HbA1c assessed

preoperatively. HbA1c of 7% or greater was used as a threshold for long-term uncontrolled hyperglycaemia. The overall incidence of postoperative complications, incidence of the isolated, most common complications and 30-day mortality were compared between the groups. Descriptive statistics and *t*-test were used.  $P < 0.05$  was considered significant.

**Results:** 92 patients (63%) were found to have elevated levels of HbA1c. No differences were found between the groups but there was a clear trend towards a better outcome in patients with low HbA1c levels (Table).

	HbA1c $\geq$ 7% (n = 92)		HbA1c < 7% (n = 53)	
Age (years)	65	$\pm 8.6$	64.5	$\pm 7.7$
EuroSCORE	4.5	$\pm 2.5$	4.5	$\pm 2.1$
OPCAB surgery	35	(38%)	20	(38%)
ICU stay > 5 days	4	(4.3%)	1	(1.9%)
Ventilation > 24 hours	5	(5.4%)	0	(0.0%)
Stroke	0	(0.0%)	0	(0.0%)
Renal replacement therapy	3	(3.3%)	0	(0.0%)
Wound infection	3	(3.3%)	0	(0.0%)
Multiorgan failure or sepsis	1	(1.1%)	0	(0.0%)
Complications (overall)	9	(9.8%)	1	(1.9%)
Early postoperative death	2	(2.2%)	0	(0.0%)

**Conclusion:** Perioperative outcome in patients with lower and higher HbA1c levels following coronary artery surgery seems to be similar, but a number of patients studied is not sufficient to draw firm conclusions.

#### References:

- 1 Medhi M, Marshall MC Jr, Burke HB, et al. HbA1c predicts length of stay in patients admitted for coronary artery bypass surgery. *Heart Dis* 2001; **3**: 77–79.
- 2 Carson JL, Scholz PM, Chen AY, et al. Diabetes mellitus increases short-term mortality and morbidity in patients undergoing coronary artery bypass graft surgery. *J Am Coll Cardiol* 2002; **40**: 418–423.

## P-92

### Patients with decreased glomerular filtration rate are at increased risk of postoperative complications after coronary artery surgery

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**Introduction:** Renal function can be impaired in patients with heart disease and scheduled for coronary artery surgery (CABG). End-stage renal disease substantially increases the risks of death, cardiovascular disease and use of specialized health care. Effects of less severe kidney dysfunction in cardiac surgical patients are less well defined [1]. We examined the association between the calculated preoperative glomerular filtration rate (GFR) and the risks of postoperative death or major cardiovascular event, prolonged ventilation and ICU stay, the need for renal replacement therapy and infection following CABG.

**Method:** 687 consecutive patients who underwent first-time coronary artery surgery in a period of one year had their GFR calculated preoperatively by the use of Cockcroft-Gault formula. Group I (n = 520) had a preoperative GFR  $\geq 65$  mL min<sup>-1</sup> 1.73 m<sup>2</sup> while group II (n = 167) had GFR < 65. Number and type of postoperative complications were noted. Patients in a critical preoperative condition were excluded. Descriptive statistics and chi squared were used and  $P < 0.05$  was considered significant. Data are expressed as mean  $\pm$  SD.

**Results:** The risk of death and complication increased as the GFR decreased below 65 mL per minute per 1.73 m<sup>2</sup> (see Table below).

	GFR $\geq 65$ (n = 520)		GFR < 65 (n = 167)		<i>P</i>
Death	0	(0.0%)	7	(4.2%)	< 0.001
ICU stay > 5 days	6	(1.2%)	12	(7.2%)	< 0.001
Ventilation > 24 h	16	(3.1%)	13	(7.8%)	0.016
Wound infection	2	(0.4%)	3	(1.8%)	0.18
Renal replacement	0	(0.0%)	6	(3.6%)	0.0001
Multiorgan failure	0	(0.0%)	4	(2.4%)	0.003
Adrenaline > 0.1 $\mu$ g	12	(2.3%)	10	(6.0%)	0.04
Low cardiac output	98	(18.9%)	56	(33.5%)	< 0.001

**Conclusion:** Patients with low GFR have an increased risk of death and serious postoperative complications. These findings highlight the clinical importance of chronic renal insufficiency.

#### Reference:

- 1 Go AS, Chertow GM, Fan D, et al. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med* 2004; **351**: 1296–1305.

## P-93

### Standard and strict (adjusted) chronic obstructive pulmonary disease (COPD) criteria and the risk of postoperative complications following coronary artery bypass surgery (CABG)

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**Introduction:** The aim of this study was to estimate the usefulness of conscientious interpretation of spirometry including not only the GOLD diagnostic criteria for COPD (FEV1/FVC < 70%), but also these criteria adjusted to demographic patient data: mean normal value of FEV1%FVC adjusted to age (MNA) and lower limit of normal values for FEV1%FVC (LLN: defined as n-1,64 SD).

**Method:** All 168 consecutive patients with the diagnosis of COPD scheduled for coronary artery surgery in years 2003–2006 were analysed. Standard spirometry results were obtained and additionally adjusted to LLN and MNA. Data from patients with confirmed COPD were compared with 3449 patients without COPD. Pulmonary complications were defined as pleural effusions, pneumothorax, prolonged pleural drainage, pneumonia and/or pulmonary oedema. Ventilation >10 hours was considered prolonged ventilation, ICU stay >24 hours was classified as prolonged ICU stay and hospital stay >6 days as prolonged hospital stay. Chi squared and Mann-Whitney statistics were used.

**Results:** Only 30 patients (17.9%) suffered from COPD according to the unadjusted GOLD criteria, but only 23 (13.7%) could be classified as COPD if the criteria were adjusted to MNA and 17 (10.1%) if the criteria were adjusted to LLN. Pulmonary complications occurred more often in COPD patients (diagnosed according to classic criteria as well as the criteria adjusted to MNA and LLN): 20%, 26% and 29% for COPD pts vs. 8% for pts without COPD,  $P < 0.05$ . COPD has not contributed to prolonged ventilation time, prolonged ICU stay, prolonged hospital stay and increased mortality according to all given criteria.

**Discussion:** COPD is considered to be one of the risk factors for postoperative complications following CABG [1], but in our study it contributed only to increased number of pulmonary complication with no influence on the time of mechanical ventilation, ICU and hospital stay.

**Conclusion:** Basic GOLD criteria are sufficient for the interpretation of spirometry prior to cardiac surgery.

#### Reference:

- 1 Rosenfeld R, Smith JM, Woods SE, et al. Predictors and outcomes of extended intensive care unit length stay in patients undergoing coronary artery bypass graft surgery. *J Card Surg* 2006; **21**(2): 146–150.

## P-94

### Should patients who are symptomatic despite six months adequate anticoagulation for pulmonary embolism, be a cause for concern?

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**Introduction:** Pulmonary embolism (PE) is common and can be fatal. Pulmonary hypertension can follow [1] and furthermore there are shared risk factors for venous thromboembolic disease and coronary artery disease such as advancing age and smoking. Ongoing symptomatology at six months may reflect the development of pulmonary hypertension, ventricular dysfunction or progression of underlying respiratory disease.

**Method:** Thirty-five consecutive patients (18 male, 17 female, age range 21 to 80 [median 54] years) with dyspnoea at six months following therapeutic anticoagulation for pulmonary embolism, were assessed. The initial diagnosis of PE was made on ventilation perfusion scan (VQ) and computed tomography (CT) pulmonary angiogram appearances. At six months these investigations were repeated and 2D echocardiography, right heart catheterization and full lung function tests were performed.

**Results:** On repeated VQ and CT pulmonary angiogram, 27 patients had segmental or large vessel thrombus and eight patients had multiple defects throughout both lungs. On echocardiographic assessment 27% (n = 9) had isolated right heart dysfunction, 15% (n = 5) had reduced ejection fraction and left ventricular dysfunction and 6% (n = 2) had biventricular dysfunction. The remaining echocardiographic studies were normal. At right heart catheterization, the following measurements were obtained (all measurements are presented with mean value followed by range in brackets): right atrial pressure 10 mmHg (3–26 mmHg), right ventricular systolic pressure 41 mmHg (16–130 mmHg), pulmonary artery mean pressure 31 mmHg (6–85 mmHg), pulmonary capillary wedge pressure 19 mmHg (6–50 mmHg), cardiac output 5 L/min (2.3–12 L/min) and pulmonary vascular resistance 2.6 Wood units

(0.4–8.3 Woods units). Overall 15 patients (42%) had clear evidence of impaired left ventricular function. Nine patients (26%) had pulmonary hypertension. The median FEV<sub>1</sub>, FVC, TLCO and KCO were 73%, 81%, 62% and 85% predicted.

**Conclusion:** Patients with ongoing dyspnoea following six months anticoagulation for PE may have significant underlying pathology. This may require further investigation and treatment and may have implications for ongoing anticoagulation and anaesthetic technique.

#### Reference:

1. Pengo V, Lensing AW, Prins MH, et al. Incidence of thromboembolic pulmonary hypertension after pulmonary embolism. *N Engl J Med* 2004; **350**(22): 2257–2264.

## P-95

### The predictors of the quality of life in diabetic and non-diabetic coronary artery surgery candidates

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**Introduction:** Coronary artery disease and diabetes are among the most common causes of morbidity with deterioration in patients' daily life. We carried out this study to determine the impact of diabetes on quality of life in candidates for coronary artery bypass grafting surgery (CABG).

**Method:** In addition to cardiologic evaluation, we used the short form health survey (SF-36) questionnaire for quality of life measurement among isolated CABG candidates.

**Results:** 268 patients entered the study. 197 patients (73.5%) were men and 113 patients (42.2%) were diabetics. Total scores of the eight domains of SF-36 were lower than those of the normal population in both diabetics and non-diabetics [1]. Total scores of diabetics were lower than those of non-diabetics in all domains but the differences were significant in physical functioning, bodily pain and role emotional domains as well as physical health (PH) component ( $P < 0.05$ ). We observed the relationship of PH component with body mass index (BMI), haematocrit, pulmonary function test parameters and blood sugar levels before/after CABG ( $P < 0.03$ ). Then we performed logistic regression to find the predictors of low health related quality of life (HRQL). Predictors of PH were function class (FC), age and peripheral vascular disease (PVD) among diabetics and FC, respiratory compromise (RC), hypertension (HTN) and history of alcoholic consumption among non-diabetics. PH predictors were FC, RC, HTN and alcohol in men and FC, RC, HTN and BMI in women.

**Conclusions:** HRQL is lower than normal in diabetic and non-diabetic CABG candidates. PH in diabetics is lower than non-diabetics. FC and RC are the most important predictors of HRQL in CABG candidates. PVD and age are HRQL predictors specific to diabetics. There are some differences in PH predictors among men and women.

#### Reference:

1. Montazeri A, Goshtasebi A, Vahdaninia M, et al. The Short Form Health Survey (SF-36): translation and validation study of the Iranian version. *Qual Life Res* 2005; **14**: 875–882.

## P-96

### Mortality prediction following CABG surgery: comparison of EuroSCORE vs. general risk scoring systems

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**Introduction:** The aim of the study was to evaluate the general risk scoring systems: Acute Physiology and Chronic Health Evaluation (APACHE II), Simplified Acute Physiology Score (SAPS II) and Multiple Organ Dysfunction Score (MODS) and to compare them to EuroSCORE [1] for prediction of mortality following coronary artery bypass grafting surgery.

**Method:** This prospective observational study consisted of all consecutive CABG patients operated on during a four months period and admitted to our ICU. Evaluation with EuroSCORE was performed preoperatively and with general risk scoring systems on ICU admission. Probabilities of hospital mortality were compared with actual mortality rates. The performance of risk scoring systems was assessed with receiver operating characteristics (ROC) curves.

**Results:** There were 197 patients in the study. 1 patient died during surgery and was excluded from further analysis. Data of 196 patients who were admitted to surgical ICU after CABG surgery were analysed. 3 patients of those admitted to ICU died (mortality rate 1.53%). The predicted mortality for EuroSCORE was 3.7%, for SAPS II – 4.8%, for APACHE II – 12.5% and

for MODS – 7.1%. The mean area under the ROC curve was 0.87 for EuroSCORE, for SAPS II – 0.91, for APACHE II – 0.77 and 0.81 for MODS.

**Conclusions:** EuroSCORE risk evaluation system based on preoperative data showed excellent performance and accuracy in CABG patients. General severity scoring systems on ICU admission also performed well, although they do overestimate the mortality risk after CABG surgery.

#### Reference:

1. Michel P, Roques F, Nashef SA: EuroSCORE Project Group. Logistic or additive EuroSCORE for high-risk patients? *Eur J Cardiothorac Surg* 2003; **23**: 684–687.

## P-97

### Outcomes of surgical revascularization in women

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**Introduction:** Cardiovascular disease is the leading cause of death in most of the developed world. The goal of the study was the retrospective assessment of early results of surgical revascularization in women and a comparison with those obtained for men.

**Method:** The study population consisted of 2881 patients who underwent coronary artery bypass surgery as an isolated procedure during 2003–2005, performed at the author's home centre. The amount of on-pump and off-pump surgery was comparable among men and women.

**Results:** At the time of surgery women tend to be older ( $P < 0.001$ ), more overweight ( $P < 0.001$ ) compared to men and have more co-morbidities, such as diabetes mellitus ( $P < 0.001$ ), hypertension ( $P < 0.001$ ) and hypercholesterolaemia ( $P < 0.001$ ). The cardiovascular complications were significantly more common in women. Perioperative myocardial infarction and a low cardiac output occurred more frequently in female than in male patients ( $P < 0.001$ ). The incidence of prolonged lung ventilation was higher in women ( $P < 0.001$ ). Women were more likely to require a blood transfusion ( $P < 0.001$ ) and renal replacement therapy for treatment of acute renal failure ( $P < 0.001$ ). The total intensive care unit and hospital stays were significantly longer for women ( $P < 0.001$ ). The in-hospital mortality for women undergoing surgical revascularization remains significantly higher than that for men (3.6% vs. 1.6%). The age, gender, EF%, BMI and peripheral vascular disease were factors significantly associated with mortality rate in the multivariate analysis.

#### Table

	Women	Men	P
Mortality	24 (3.55%)	36 (1.63%)	<0.01
Off-pump mortality	6 (2.18%)	12 (1.35%)	NS
On-pump mortality	18 (4.48%)	24 (1.83%)	<0.01

**Conclusion:** The female gender is an independent risk factor affecting higher in-hospital mortality and morbidity in patients undergoing CABG [1–3].

#### References:

1. Edwards FH, Carey JS, Grover FL, et al. Impact of gender on coronary bypass operative mortality. *Ann Thorac Surg* 1998; **66**: 125–131.
2. Naidoo VV, Fox KM. Fashioning a new approach to coronary care in woman. *Heart* 2006; **92**(suppl III): i1.
3. Lansky AJ. Outcomes of percutaneous and surgical revascularization in women. *Prog Cardiovasc Diseases* 2004; **46**: 305–319.

## P-98

### Do preoperative positive laboratory findings for infection have any impact on postoperative clinical outcome in paediatric cardiac surgery

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**Introduction:** The effect of preoperative C-reactive protein levels in adult cardiac patients has been shown before [1]. The aim of this study was to investigate the effect of preoperative positive laboratory findings for infection on postoperative clinical outcome in paediatric cardiac surgery.

**Method:** A retrospective analysis was made of children who underwent congenital heart surgery in our hospital between 2003–2005 and had preoperative positive laboratory data indicating infection without clinical evidence. Positive laboratory findings of infection were defined as presence of leukocytosis ( $>12,000/\text{mL}$ ), high C-reactive protein levels ( $>10 \text{ mg/L}$ ), leukocytes in the urine analysis. Study patients (group INF,  $n = 37$ ) identified from the preoperative evaluation forms of the anaesthesiology department were compared to pathology and age matched control patients (group C,  $n = 37$ ) who did not have any laboratory or clinical evidence suggestive of infection. Postoperative data included fever, requirement and duration of inotropic support, durations

of mechanical ventilation, ICU and hospital stays. Other system complications were also recorded.

**Results:** Postoperatively in the ICU, the number of patients using inotropic agents, duration of inotropic requirements and use of multiple inotropes were similar between two groups. The number of patients who had fever postoperatively was similar whereas duration of fever was longer in the INF group ( $1.84 \pm 1.5$  vs.  $1.03 \pm 0.68$  days,  $P = 0.001$ ). Durations of mechanical ventilation, ICU and hospital stay did not reveal any differences. High creatinine levels and convulsion were observed in one patient for the control group. Two patients in the INF group (5.4%) and one in the control group (2.7%) died in the postoperative period.

**Conclusion:** Findings of this study did not reveal any detrimental effects of the presence of preoperative positive laboratory parameters on postoperative clinical outcome in paediatric cardiac surgery. However, these findings do not apply to children with clinical signs of infection and remain to be further investigated.

#### Reference:

- 1 Fransen EJ, Maessen JG, Elenbaas TW, et al. Enhanced preoperative C-reactive protein plasma levels as a risk factor for postoperative infections after cardiac surgery. *Ann Thorac Surg* 1999; **67**: 134–138.

## P-99

### NT-proBNP levels in patients undergoing coronary artery bypass grafting surgery

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**Introduction:** Brain natriuretic peptide (BNP) release due to increased left ventricular wall tension, has been used in the early diagnosis of myocardial damage and heart failure after cardiac surgery [1,2]. The most recent studies have shown that increased BNP levels may be associated with risk of cardiac malfunction. A prolonged cross clamp time, complexity of surgery and preoperative clinical risk factors, have in particular been emphasized as being related to increased BNP levels.

This study was designed to examine the plasma concentration of BNP and its relation to haemodynamic parameters in patients with coronary artery disease (CAD) undergoing coronary artery bypass grafting (CABG). On this account, we aimed to investigate whether BNP levels are relevant to the haemodynamic parameters recorded during and after surgery.

**Method:** Thirty patients were allocated to two groups, Group 1 undergoing only coronary artery bypass grafting surgery (CABG) and Group 2 having CABG with valve replacement surgery.

Anaesthesia was induced with  $10 \mu\text{g kg}^{-1}$  fentanyl,  $0.1\text{--}0.2 \text{ mg kg}^{-1}$  etomidate,  $0.15 \text{ mg kg}^{-1}$  cisatracurium and maintained with isoflurane 1% and  $0.15 \mu\text{g kg}^{-1} \text{ h}^{-1}$  fentanyl. Arterial, central venous and pulmonary artery pressures were monitored continuously. In both groups NT-proBNP levels were recorded preoperatively, at 4 hours and 12 hours postoperatively and troponin T and CK-MB levels preoperatively and postoperatively.

Statistical analysis was performed using Student's *t*-test and Mann-Whitney *U* test. Correlation analysis used Pearson's correlation. Significance was considered for  $P < 0.05$ .

**Results:** There were no significant differences between the demographic and haemodynamic data of the two groups.

Table. NT-BNP pg/mL

	Group 1	Group 2
Preop NT-BNP	959.11 $\pm$ 1913.14	1897.86 $\pm$ 2926.55
Postop 4 h NT-BNP	1287.82 $\pm$ 2394.68	2268.62 $\pm$ 2637.65
Postop 24 h NT-BNP	5736.03 $\pm$ 7773.21	7002.17 $\pm$ 6955.36

In both groups postoperative BNP increased to a peak 24 h postoperatively. Although BNP concentrations were high 24 h postoperatively, haemodynamic parameters were improved in both groups. In both groups the BNP peak did not correlate with any haemodynamic parameter. There was no correlation with inotropic support.

**Discussion:** Consequently in both groups there is no statistical difference between NT-proBNP levels. However in those cases with long cross-clamp and cardiopulmonary bypass times, NT-proBNP levels were higher than in those without, at 4 and 24 hours postoperatively. Additionally the patients with a high level of NT-proBNP preoperatively had a longer intensive care unit and hospital stay than those undergoing only CABG surgery.

#### References:

- 1 Cuthbertson BH, McKeown A, Croal BL, et al. Utility of B-type natriuretic peptide in predicting the level of peri- and postoperative cardiovascular support required after coronary artery bypass grafting. *Crit Care Med* 2005; **33**(2): 437–442.

- 2 Georges A, Forestier F, Valli N, et al. Changes in type B natriuretic peptide (BNP) concentrations during cardiac valve replacement. *Eur J Cardiothorac Surg* 2004; **25**(6): 941–945.

## P-100

### Fenoldopam reduces hospital mortality and the need for renal replacement therapy in patients undergoing cardiovascular surgery. A meta-analysis of randomized and propensity matched clinical trials

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**Introduction:** A recent meta-analysis [1] demonstrated that fenoldopam reduces hospital mortality and need for renal replacement therapy in critically ill patients or those undergoing major surgery with or at risk for acute renal failure. We conducted a review of randomized and propensity matched studies to confirm these results in a more homogeneous population of patients undergoing cardiovascular surgery.

**Method:** BioMedCentral, CENTRAL, Google Scholar, PubMed, and conference proceedings were searched (updated November 2006) for randomized and propensity matched trials which used fenoldopam in the prevention of renal replacement therapy in cardiovascular surgery.

**Results:** A total of 917 patients from 10 randomized studies were included in the analysis. Pooled estimates showed that fenoldopam significantly reduced the need for renal replacement therapy (OR = 0.38 [0.23–0.65],  $P = 0.0003$ ), and in-hospital death (OR = 0.54 [0.31–0.95],  $P = 0.03$ ). These benefits were associated with shorter intensive care unit stay (Weighted Mean Difference =  $-1.00$  days [ $-1.35$ ;  $-0.66$ ],  $P < 0.00001$ ).

**Conclusions:** This analysis suggests that fenoldopam reduces hospital mortality and the need for renal replacement in patients undergoing cardiovascular surgery.

#### Reference:

- 1 Landoni G, Biondi-Zoccai GG, Tumlin JA, et al. Beneficial impact of fenoldopam in critically ill patients with or at risk for acute renal failure: a meta-analysis of randomized clinical trials. *Am J Kidney Dis* 2007; **49**: 56–68. Review.

## P-101

### Delirium after coronary artery bypass graft surgery. Evaluation of preliminary predictors based on an analysis of 931 patients

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**Introduction:** Coronary by-pass graft surgery gives better results, with reduced patient mortality, frequency of post-surgery myocardial infarction and other significant complications. Certain post-surgery delirium disorders still cause problems as they extend the duration of hospitalization, increase the cost of medical treatment, influence the effect of rehabilitation as well as the consequences of the operation on patients and their families. In this analysis we tried to identify the factors which may have an influence on the occurrence of post-surgery delirium.

**Method:** Medical records of 931 consecutive patients who underwent coronary by-pass graft surgery during 2005 were analysed. 30 medical records which included descriptions corresponding to the criteria of delirium according to ICD10 were chosen. 20 pre- and intra-surgery variables which may have a potential predictive significance were analysed.

**Results:** Transient post-surgery delirium was recorded in 3.2% of patients. In univariate analysis, 6 of 20 variables were evaluated as being connected with its occurrence: age, NYHA III-IV, EuroSCORE, LVEF, extracorporeal circulation (ECC) and its duration and the aorta cross-clamping time. In the logistic regression analysis the two most important independent factors having an influence on occurrence of delirium were identified as the age of the patient and the aorta cross-clamping time.

**Conclusions:** The age of the patient and the aorta cross-clamping time seem to be the most important independent factors which may cause transient post-surgery delirium. However, verification of this observation requires prospective research. This analysis also demonstrates that coronary operations without ECC should be preferred, especially for elderly patients with advanced atherosclerosis and severe comorbidities.

**P-102****Are duration of mechanical ventilation and cardiopulmonary bypass or aortic cross-clamp times correlated with hospital length of stay?**F. Cislighi<sup>1</sup>, M. Munari<sup>1</sup>, A. Corona<sup>2</sup>, AM. Condemmi<sup>1</sup><sup>1</sup>Luigi Sacco-Cardioanaesthesia Department, Milano, <sup>2</sup>Mario Negri Institute, Clinic. Epidem. Laboratory, Ranica, Italy**Introduction:** Prolonged ICU and hospital lengths of stay after heart surgery are associated with increased patient morbidity and mortality [1].

The aim of this prospective observational cohort study, was to assess whether cardiopulmonary bypass (CPB), aortic cross-clamp (ACC) time or duration of mechanical ventilation (MV) may impact on ICU and hospital length of stay in a cardiac surgical patient cohort admitted to our 8 bed ICU, from 1997 to June 2005.

**Method:** All the patient pre-, intra- and post-operative variables were prospectively put into an electronic database. On all patients the following data was collected: (i) demographics, risk factors and gravity scores anamnestic illnesses, (ii) intra-operative variables (i.e. type of operation, CPB and ACC times), (iii) ICU-related variables (i.e. duration of mechanical ventilation (MV), use and type of inotropes). Statistical analysis was performed using SPSS software.  $P < 0.05$  was considered statistically significant.**Results:** A total of 5123 patients with a median (IQR) age of 67 yr (59–73) were admitted during the study period. 63.5% underwent a CABG operation, 22.8% valve surgery and 13.6% aortic and lung surgery. A bivariate linear regression analysis (Table 1) was performed considering as independent variables respectively the natural logarithm (nL) of (i) CPB time, (ii) ACC time, (iii) MV duration and as dependent variable the nL of the total hospital stay.**Table 1**

Variable X	Linear regression equation	Adjusted R <sup>2</sup>	P
x = variable values	y = duration of MV		
CPB time	Y = 0.073x + 2.093	0.035	0.000
ACC time	Y = 0.066x + 2.023	0.021	0.010
MV	Y = 0.215x + 2.593	0.261	0.000

Spearman sensitivity test corroborated the bivariate correlations among the above variables nL as Table 2 shows:

**Table 2**

Variable	Spearman rho	P
CPB time and LoS	0.119	0.01
ACC time and LoS	0.127	0.01
MV and LoS	0.275	0.01

**Conclusions:** This audit allowed us to assess that the longer the CPB, ACC time or MV duration, the greater the likelihood of the total hospital length of stay of patients undergoing heart surgery.**Reference:**1 Herlihy JP, Koch SM, Jackson R, et al. Course of weaning from prolonged mechanical ventilation after cardiac surgery. *Tex Heart Inst J* 2006; **33**(2): 122–129.**P-103****The prognostic value of troponin release after adult cardiac surgery – a systematic review**G.L. Buse, M. Seeberger, E. Seeberger, D. Bolliger, M. Filipovic  
*University Hospital, Basel, Switzerland***Introduction:** The aim was to assess by a systematic review the association of Troponin (Tn) release after cardiac surgery with adverse outcome in adult patients.**Method:** Studies were identified by electronic search of MEDLINE and Biological Abstracts databases and completed by manual search of the articles' reference lists. A medical librarian developed the search strategy based on the terms "Troponin", "Cardiac Surgical Procedure" and "Prognosis". Primary end-points were mortality and major adverse cardiac events  $\geq 1$  year after surgery (long-term), secondary end-points were events within 30 days after surgery (short-term). Excluded were: not fully published studies, interventional studies with Tn levels as an outcome parameter, studies lacking information on inclusion or exclusion criteria and event definition, studies assessing congenital heart disease and studies reporting on multiple published data.**Review Results:** Inclusion criteria were fulfilled in 10 of the 264 identified studies. One study reported on long-, 3 on short-term results and 6 on both, with a total of 150 late events in 2854 patients and 111 short-term events in 3907 patients. Five studies were focussed on coronary artery bypass grafting (CABG) and 1 study on valvular surgery; 4 studies investigated a mixed population (isolated CABG procedures 37% – 77%). Two studies investigated Tn T (cut-off value 0.46 and 1.58  $\mu\text{g/L}$ , respectively) and 8 studies Tn I (different assays and cut-off values). Blood samples were withdrawn 0 – 48 hours after surgery. Of all studies, 9 found a positive association of Tn release with adverse outcome. However, the reported odds ratios (OR) and confidence intervals (CI) of the 6 studies that adjusted for potential confounders were broad (95% CI 1.02 – 23.9 to 4.5 – 232.5 for long-term and 2.3 – 9.3 to 5.5–54 for short-term mortality, respectively). One study found a stepwise increase in adverse outcome per 10  $\mu\text{g/L}$  TnI release [OR 1.1 (95% CI 1.03 – 1.18) for 30-day and 1.14 (95% CI 1.05 – 1.24) for 12-month mortality] [1]. Only 1 study (9 events in 92 patients) found no association of Tn I release with long-term outcome.**Conclusion:** There is clear evidence for an association of postoperative Tn release with adverse short- and long-term outcome after cardiac surgery. However, differences in the study designs, populations, outcome definitions, timing of the Tn testing, Tn assays and statistics make a conclusion on the effect size and on cut-off values impossible.**Reference:**1 Croal BL, Hillis GS, Gibson PH, et al. Relationship between postoperative cardiac troponin I levels and outcome of cardiac surgery. *Circulation* 2006; **114**: 1468–1475.**Postoperative Care****P104****Reactivity of the monocytic cell pool in children under age one after cardiac surgery in the conditions of artificial circulation**

S. Oleg, G. Iouri, S. Anatoli

*Research Institute of Circulation Pathology, Novosibirsk, Russia***Introduction:** Upon investigating children with congenital cardiac disease in their first year of life, during surgery with cardiopulmonary bypass (CPB), it was found that these patients characteristically had an activation of their monocytic cell pool with an increase in quantity of HLA-DR-positive cells without the inclusion of a regulating mechanism – apoptosis.**Method:** Sixteen children with congenital cardiac disease, ventricular septal defect (VSD) and atrial septal defect (ASD), undergoing surgery using CPB were studied. There were 9 males and 7 females. The age ranged from 3 to 11.5 months. The average length of CPB was  $79.6 \pm 35.1$  minutes. The absolute and relative contents of the monocytic cells were investigated. The functional state of monocytes was rated according to the contents of HLA-DR positive cells. Similarly the quantity of apoptotic monocytes was determined. The research covered the period before the operation, 24 hours and three days after the operation. The local ethics committee approved the study.**Results:** Surgical intervention was shown to positively influence the quantity of circulating monocytes. On the first day after operation the quantity of monocytes in the blood was increased by 17% ( $P = 0.02$ ; criterion Wilcoxon) and remained increased for three days. On day three after operation the absolute contents of HLA-DR-positive cells statistically increased from  $683.3 \pm 268.3/\text{mkl}$  (before the operation) to  $1214.6 \pm 787.9/\text{mkl}$  ( $P = 0.07$ ; criterion Wilcoxon). At the same time, the quantity of apoptotic monocytes did not change compared with the pre-operative level. In children who developed Systemic Inflammatory Response Syndrome (SIRS) the absolute contents of monocytes and their HLA-DR positive form indeed increased to a greater degree than in the group without SIRS, while the absolute contents of apoptotic monocytes increased compared with the initial phase, which testified to the activation of a mechanism of regulation according to the principle of feedback.**Discussion:** In the monocytic pool it was found that surgical intervention influenced the increase of the circulating pool of monocytes and their active form. This conforms with the data of other authors about the increase in circulating monocytes of the blood in response to CPB and surgical intervention [1,2]. The lack of activation of a limiting mechanism of apoptosis testifies to an imbalance of inflammatory and anti-inflammatory mechanisms (probably with insufficiency of the latter) after undergoing surgery using CPB in children in their first year of life.



**References:**

- Gessler P, Pfenninger J, Pfammatter JP, et al. Inflammatory response of neutrophil granulocytes and monocytes after cardiopulmonary bypass in pediatric cardiac surgery. *Intensive Care Medicine* 2002; **28**(12): 1786–1791.
- Bocsi J, Hamsch J, Osmancik P, et al. Preoperative prediction of pediatric patients with effusions and edema following cardiopulmonary bypass surgery by serological and routine laboratory data. *Crit Care* 2002; **6**(3): 226–233.

**P-105****Values of cerebral saturation during simple and complex cardiac surgical procedures. Preliminary report**

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**Introduction:** Cardiac surgical procedures may impair cerebral perfusion. Cerebral saturation measurement (CS) may be a valuable tool providing patient safety during such procedures [1–3]. The aim of our study was to establish whether there is difference in CS measurements between simple and complex cardiac surgical procedures.

**Method:** CS monitoring (INVOS Cerebral Oximeter, Somanetics, USA) was used in 17 randomly chosen patients undergoing either isolated coronary artery surgery (CABG) or complex procedures (combined CABG and valve replacement or replacement of two valves). During the period of cardiopulmonary bypass (CPB) and aortic cross-clamping (AXC) at normothermia or moderate hypothermia, inhalational agents were continued through the oxygenator of the CPB circuit. Mean, minimum and maximum values as well as the range of CS values were extracted from the trend of the CS monitor for each individual patient. Demographic data and major postoperative complications were compared between the groups. Mann-Whitney test, chi squared test and Spearman's rank correlation were used.  $P < 0.05$  was considered significant.

**Results:** Demographic data, left ventricular ejection fraction and preoperative EuroSCORE were comparable in the two groups. Mean CS values correlated significantly only with time of ICU stay ( $r = 0.57$ ,  $P = 0.015$ ). Other results of our study are presented in the Table below.

	Cardiac surgical procedures	
	Complex (n = 8)	Simple (n = 9)
CPB time (min.)	*147 (122–273)	81 (35–147)
AXC time (min.)	84 (53–193)	62 (26–106)
CPB temp. (°C)	*28 (26–32)	35 (32–36)
Mean CS (%)	51 (37–70)	62 (49–69)
Minimal CS (%)	36 (17–60)	44 (21–50)
CS range (%)	31 (16–48)	36 (21–58)
CS < 40% (n)	5 (63%)	3 (33%)
Ventilation (h)	*12 (8–428)	7 (4–17)
ICU stay (days)	2 (1–22)	1 (1–4)
Death (n)	2 (25%)	1 (11%)

**Conclusion:** Complex cardiac surgical procedures with longer CPB time and lower temperatures tend to be associated with lower CS values, although our results did not reach statistical significance. A larger sample size is required to confirm these findings.

**References:**

- Edmonds HL Jr, Ganzel BL, Austin EH 3d. Cerebral oximetry for cardiac and vascular surgery. *Semin Cardiothorac Vasc Anesth* 2004; **8**(2): 147–166. Review.
- Goldman S, Sutter F, Ferdinand F, et al. Optimizing intraoperative cerebral oxygen delivery using noninvasive cerebral oximetry decreases the incidence of stroke for cardiac surgical patients. *Heart Surg Forum* 2004; **7**(5): E376–381.
- Murkin JM. Perioperative detection of brain oxygenation and clinical outcomes in cardiac surgery. *Semin Cardiothorac Vasc Anesth* 2004; **8**(1): 13–14.

**P-106****Effect of aprotinin on renal function after off-pump coronary surgery**

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**Introduction:** The use of aprotinin (A) during off-pump coronary surgery (OPCAB) is now proposed. A has been associated with an increased frequency of kidney injury [1]. The aim of this study was to evaluate the risk of renal dysfunction in patients undergoing OPCAB with or without A in non-dialysis dependant patients.

**Method:** Seventy-five consecutive patients undergoing OPCAB with perioperative use of A (Gr A) were retrospectively compared to 156 patients operated without A (Gr C). Patients in Gr A received a bolus of  $2 \times 10^6$  KIU during 30 minutes, followed by a continuous infusion of  $0.5 \times 10^6$  KIU/h until

the end of surgery. Creatinine levels (Cr, normal value  $< 80 \mu\text{mol/L}$ ) and clearance (Cr Cl, Cockcroft-Gault formula) were assessed preoperatively, during stay in ICU or hospital, and at discharge. Statistical analysis was performed with *t* test and ANOVA for repeated measures.

**Results:** The 2 groups were similar for age, weight, ejection fraction and EuroSCORE. 24% of the patients in Gr C and 29% in Gr A had a blood creatinine level increase  $>20\%$  ( $P = 0.45$ ) (Table).

	Gr A	Gr C	P
Postoperative blood loss	500 ± 250	850 ± 370	<0.0001
Preoperative Cr Cl	66 ± 25	74 ± 28	0.023
Cr Cl during ICU stay	69 ± 25	74 ± 29	0.14
Cr Cl during surgical ward stay	62 ± 25	66 ± 28	0.31
Cr Cl at discharge	69 ± 27	71 ± 25	0.72
Preoperative Cr ( $\mu\text{mol/L}$ )	111 ± 51	103 ± 63	0.29
Highest Cr during ICU stay ( $\mu\text{mol/L}$ )	113 ± 75	106 ± 72	0.53
Highest Cr during surgical ward stay ( $\mu\text{mol/L}$ )	123 ± 85	126 ± 79	0.77
Cr at discharge ( $\mu\text{mol/L}$ )	112 ± 74	110 ± 71	0.82

**Conclusion:** During OPCAB, A reduced blood loss and had no effect on renal function. This was obtained despite lower preoperative Cr Cl in Gr A, usually associated with an increase in postoperative renal dysfunction [2].

**References:**

- Karkouti K, Beattie WS, Dattilo KM, et al. A propensity score case-control comparison of aprotinin and tranexamic acid in high-transfusion-risk cardiac surgery. *Transfusion* 2006; **46**: 327–338.
- Noyez L, Plesiewicz I, Verheugt FW. Estimated creatinine clearance instead of plasma creatinine level as prognostic test for postoperative renal function in patients undergoing coronary artery bypass surgery. *Eur J Cardiothorac Surg* 2006; **29**: 461–465.

**P-107****The assessment of correlation between left ventricular internal dimension in diastole and concentrations of selected peripheral blood cytokines**A. Korycinska-Dragan<sup>1</sup>, W. Dabrowski<sup>2</sup>, M. Dragan<sup>3</sup>, A. Tomaszewski<sup>1</sup>, T. Zapolski<sup>1</sup>, A. Wysokinski<sup>1</sup><sup>1</sup>Department of Cardiology, Skubiszewski Medical University, <sup>2</sup>Department and I Clinic of Anaesthesiology and Intensive Care, Skubiszewski Medical University, <sup>3</sup>Department of Clinical Immunology, Lublin, Poland

**Introduction:** The heart is one of the main sources of blood cytokines that are important for maintaining organism homeostasis [1]. Changes in their serum levels are connected with many heart diseases reflecting ongoing pathological processes, such as inflammation and apoptosis of cardiomyocytes [2]. Limited data are available so far concerning the correlation between heart structure and function and blood level of cytokines. The purpose of this study was to obtain some data.

**Method:** We examined serum levels of proinflammatory and proapoptotic particles, such as IL-6, TNF- $\alpha$ , sFas and cytochrome C, by the use of enzyme-linked immunosorbent assay (ELISA). The assessment of heart structure was done by the echocardiographic parameter, left ventricular internal dimension in diastole (LVIDd). The study group consisted of 25 patients aged from 42 to 64 years with stable angina pectoris. Patients were excluded from the study if they revealed any signs of infection, or were treated for severe heart failure or other serious illnesses.

**Results:** In our study we observed significant correlation between values of LVIDd and serum concentrations of all measured cytokines: for IL-6:  $R = 0.64$ ,  $P = 0.001$ ; for TNF- $\alpha$ :  $R = 0.53$ ,  $P = 0.01$ ; for sFas:  $R = 0.64$ ,  $P = 0.001$  and for cytochrome C:  $R = 0.46$ ,  $P = 0.03$ .

**Discussion:** Our data confirm the opinion that changes in heart structure and function affect serum levels of cytokines and pro-apoptotic particles which are most probably connected with ongoing pathological processes in the heart.

**References:**

- Dibbs Z, Kurrelmeyer K, Kalra D, et al. Cytokines in heart failure: pathogenetic mechanisms and potential treatment. *Proc Assoc Am Physicians* 1999; **111**(5): 423–428. Review.
- Petretta M, Condorelli GL, Spinelli L, et al. Circulating levels of cytokines and their site of production in patients with mild to severe chronic heart failure. *Am Heart J* 2000; **140**(6): E28.

**P-108****Predictors of tracheostomy in cardiac surgical patients and its impact on ICU & hospital length of stay and survival**F. Cislighi<sup>1</sup>, C. Villa<sup>1</sup>, A. Corona<sup>2</sup>, A.M. Condemi<sup>1</sup><sup>1</sup>Luigi Sacco Cardioanaesthesia, Milan, <sup>2</sup>Mario Negri Institute, Ranica, Clin. Epidemiol. Laboratory, Ranica, Italy

**Introduction:** No consensus exists on tracheostomy (T) predictive risk factors and their impact on survival, ICU- and hospital lengths of stay and costs in cardiac surgical patients [1].

**Method:** The aim of this study was to assess predictors of T and the impact on ICU- and hospital-length of stay and costs in a cardiac surgical patient cohort admitted to our 8 bedded ICU, from 1997 to June 2005.

All the pre-, intra- and post-operative variables were prospectively put into an electronic database. Patients were divided into: (i) nTG group, not needing a T; (ii) TG group, undergoing a tracheostomy. *P* values <0.05 were considered significant.

**Results:** A total of 5123 patients with a median (IQR) age of 67 yr (59–73) were admitted during the study period. 63.5% underwent a CABG operation, 22.8% valve surgery and 13.6% aortic and lung surgery. 112 (2.2%) underwent a T with a median (IQR) timing of 8 (5–12) days from the beginning of mechanical ventilation (MV). A logistic regression model allowed us to identify MV length (OR = 10.2 95% CI = 10.1–10.4), cardiopulmonary bypass (CPB) time (OR = 1.5 95% CI 1.1–2.3), red blood cell (RBC) (OR = 5.1 95% CI = 2.5–9.7), fresh frozen plasma (FFP) (OR = 2.3 95% CI = 1.9–3.5) unit transfusions and VAP (OR = 2.1 95% CI = 1.5–3.3) as the T independent predictors. Moreover (i) MV length  $\geq 96$  hours, related to a sensitivity of 100% and specificity of 97.7% (Area under ROC: 0.999) and (ii) RBC unit transfusions  $\geq 4$ , related to a sensitivity of 93.2% and specificity of 89.5% (Area under ROC: 0.942) were confirmed as best T predictors. FFP unit transfusions and CPB time were related to a lower sensitivity (71.5% and 75%) and specificity (90% and 70%). The cumulative hazard of patient discharging (i) from post-operative ICU to the cardiac surgical ward and (ii) from the cardiac surgical ward to the rehabilitative one, increased more significantly in the nTG group than in TG group (respectively: Log-Rank = 260.9, *P* = 0.0000 and Log-Rank = 77.1, *P* = 0.0000). The nTG group showed a lower mortality (3.2% vs. 36.6%, *P* = 0.000) than the TG group.

**Conclusion:** This study allowed us to define a predictive model for identifying patients who are likely to undergo a T and to assess the impact of T on ICU and hospital stay, costs and survival.

#### Reference:

- Goldman SM, Sutter FP, Wertan MA, et al. Outcome improvement and cost reduction in an increasingly morbid cardiac surgery population. *Semin Cardiothorac Vasc Anesth* 2006; **10**(2): 171–175.

## P-109

### Haemodynamics and oxygen transport in patients with differing tracheal extubation times after coronary artery bypass surgery

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**Introduction:** Early tracheal extubation following coronary artery bypass grafting (CABG) is an important aspect of fast-track cardiac surgery (1).

**Method:** After informed consent, 20 patients (pts) scheduled for CABG surgery with cardiopulmonary bypass (CPB) were prospectively included. In all cases anaesthesia with fentanyl, midazolam, propofol (during CPB), sevoflurane and rocuronium was used. Including criteria were: cardiac index (CI) > 2.5 litre·min<sup>-1</sup>·m<sup>-2</sup> with dopamine and/or dobutamine doses below 7 µg·kg<sup>-1</sup>·min<sup>-1</sup>. Pts were randomized into 2 groups. Pts of the 1st group (n = 10) who were extubated in the operation room within 23 ± 18.9 min after surgery received flumazenil. Pts of the 2nd group (n = 10), extubated in recovery room within 141 ± 44 min after surgery did not receive flumazenil. Haemodynamic and oxygen transport parameters were studied in two stages: Stage 1 – before tracheal extubation, and Stage 2 – 15 min following extubation. Statistical analysis was performed using Student's *t* test. *P* < 0.05 was considered statistically significant. Data are given as mean ± standard deviation.

**Results:** There were no differences in age (57 ± 7.9 and 58 ± 9.4; *P* > 0.05), CPB-time (108 ± 44 and 103 ± 50 min; *P* > 0.05), and aorta cross-clamping time (67 ± 31 and 61 ± 31 min; *P* > 0.05). Results are shown in the Table.

Parameters	Group 1		Group 2	
	Stage 1	Stage 2	Stage 1	Stage 2
CI (L·min <sup>-1</sup> ·m <sup>-2</sup> )	2.7 ± 0.31	3.4 ± 0.31*	3.3 ± 0.6	3.4 ± 0.6
PAWP (mmHg)	8.3 ± 1.6	7.6 ± 1.7	10 ± 5.3	11 ± 5
DO <sub>2</sub> l (ml·min <sup>-1</sup> ·m <sup>-2</sup> )	426 ± 61	471 ± 62	472 ± 93	431 ± 72
VO <sub>2</sub> l (ml·min <sup>-1</sup> ·m <sup>-2</sup> )	140 ± 30	158 ± 30	138 ± 24	143 ± 36
Lactate (mmol/L)	2.5 ± 0.6	2.2 ± 0.6	2.9 ± 0.9	2.2 ± 1.2

PAWP – pulmonary artery wedge pressure, DO<sub>2</sub>l – delivered oxygen index, VO<sub>2</sub>l – index of oxygen consumption, \**P* < 0.05 vs. stage 1.

**Discussion:** A fast-track anaesthetic protocol with flumazenil does not alter haemodynamic and oxygen transport in pts following CABG.

#### Reference:

- Lee TW, Jacobsohn E. Pro: tracheal extubation should occur routinely in the operating room after cardiac surgery. *J Cardiothorac Vasc Anesth* 2000; **14**: 603–610.

## P110

### Haemodynamic and respiratory impact of inhaled nitric oxide after cardiac surgery: a two year retrospective analysis

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**Introduction:** Inhaled nitric oxide (iNO) is frequently used for postoperative cardiac surgery complications [1,2]. We retrospectively reviewed the impact of iNO on clinical management and short term survival at 90 days after cardiac surgery.

**Method:** Fifty-five patients (pts) received postoperative iNO: 16 pts. for pulmonary hypertension (PH) after mitral valve surgery (mean pulmonary artery pressure (MPAP) > 30 mmHg); 34 pts. for refractory hypoxaemia (PaO<sub>2</sub>/FiO<sub>2</sub> < 150 mmHg); 4 pts. for right ventricular (RV) dysfunction defined as tricuspid annular plane systolic excursion (TAPSE) < 10mm, and CI < 2.0 litre min<sup>-1</sup>·m<sup>-2</sup>. Haemodynamic and respiratory variables were measured before the initiation of iNO, 60 min. after and 6, 12, 24 hours later. iNO was started at 40 ppm and then titrated, with average of 10 ppm.

**Results:** Within 24 hours iNO significantly decreased MPAP and PVR in PH pts, and significantly increased PaO<sub>2</sub>/FiO<sub>2</sub> in hypoxaemic pts. In RV dysfunction TAPSE and CI significantly improved after 6 hours. The average length of time on iNO was 52.6 hours. No adverse events related to iNO were experienced. Survival at 90 days was 77%. Student's *t* test was used for statistical analysis, and *P* < 0.05 was considered significant.

	Basal	60 m	6 h	12 h	24 h
MPAP* (mmHg)	68 ± 5	52 ± 5	48 ± 6	45 ± 4	44 ± 5
PVR* (dyn sec cm <sup>-3</sup> )	326 ± 8	294 ± 8	268 ± 6	246 ± 5	235 ± 7
TAPSE* (mm)	8 ± 1	8 ± 1 <sup>∇</sup>	12 ± 1	12 ± 1	12 ± 0.5
CI* (litre min <sup>-1</sup> ·m <sup>-2</sup> )	1.8 ± 0.2	1.91 ± 0.1 <sup>∇</sup>	1.93 ± 0.3	1.95 ± 0.1	2.71 ± 0.1
PaO <sub>2</sub> /FiO <sub>2</sub> *	62 ± 3	150 ± 4	160 ± 6	183 ± 5	210 ± 6

\*pts with PH; <sup>∇</sup>pts with RV infarction; \*pts with hypoxaemia; <sup>∇</sup>*P* = NS.

**Discussion:** According to our preliminary and limited experience iNO is a safe and effective therapy to treat PH in mitral pts, postoperative refractory hypoxaemia and RV dysfunction. The haemodynamic and respiratory effects occur early after the initiation of treatment. However, further prospective evaluation and comparison with a control group is needed.

#### References:

- George I, Xydas S, Topkara VK, et al. Clinical indication for use and outcomes after inhaled nitric oxide therapy. *Ann Thorac Surg* 2006; **82**(6): 2161–2169.
- Fattouch K, Sbraga F, Sampognaro R, et al. Treatment of pulmonary hypertension in patients undergoing cardiac surgery with cardiopulmonary bypass: a randomized, prospective, double-blind study. *J Cardiovasc Med* 2006; **7**(2): 119–123.

## P-111

### Alterations in laboratory values after uncomplicated infant open-heart cardiac surgery

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**Introduction:** Cardiopulmonary bypass causes perturbation in laboratory values without adverse outcomes [1]. The aim of this study was to investigate these changes in patients <1 yr of age.

**Method:** The two-year database of our paediatric cardiac intensive care unit was analysed in regard to 0–24 h postoperative laboratory parameters and outcome. An uncomplicated case was defined as extubation <72 hours. Laboratory data were analysed with independent *t* test and Mann-Whitney *U*-test, as appropriate, a *P* value of 0.05 or less was considered as statistically significant. Mean values, standard deviation of laboratory parameters are shown.

**Results:** 264 patients were younger than 1 year, 130 of them were extubated before the 72nd hour. In this group creatinine kinase (1057 ± 506 U/L), CKMB (61 ± 28 U/L), maximum base excess (–6.27 ± 2.29 mmol/L), haematocrit (31.05 ± 4.61%), creatinine clearance (54.1 ± 14.0 mL/min), C-reactive protein (70.7 ± 10.7 mg/L) and maximum level of blood sugar (8.1 ± 1.6 mmol/L) were out of the reference range in the first 24 hours. Significant differences were found in maximum base excess (*P* = 0.022) and creatinine clearance (*P* < 0.001) between patients who needed short versus long-term mechanical ventilation.

**Conclusions:** Certain laboratory values change substantially after uncomplicated open-heart paediatric cardiac surgery. Furthermore, renal function seems to have a strong influence on the duration of mechanical ventilation.

**Reference:**

- Mohnle P, Schwann NM, Vaughn WK, et al. Perturbations in laboratory values after coronary artery bypass graft surgery with cardiopulmonary bypass. *J Cardiothorac Vasc Anesth* 2005; **19**: 19–25.

## P-112

### Clinical predictors for reintubation after cardiac surgery

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**Introduction:** Recent efforts to improve the cost-effectiveness of surgical procedures have resulted in a trend toward early weaning from ventilatory support after cardiac surgery. Unfortunately, premature extubation may lead to hypercarbia, hypoxaemia, pulmonary hypertension, heart failure, myocardial ischaemia and unavoidable reintubation [1]. The aim of this study was to identify factors involved in the reintubation after cardiac surgery.

**Method:** 2,351 consecutive patients undergoing cardiac surgery with cardiopulmonary bypass (CPB) between January 2002, and December 2006 were studied. The computerized database located 40 patients who had undergone reintubation for cardiorespiratory or neurological reasons. Patients reintubated for other reasons (e.g. reoperation) were excluded from the study. An equal number of control subjects not requiring reintubation were randomly selected from the same sample of 2,351 patients. Standard anaesthesia and criteria for extubation were applied to all patients [2]. Several preoperative patient characteristics, process of care, and postoperative respiratory variables were analysed. A multivariate analysis was conducted. The goodness of fit was assessed using the Hosmer-Lemeshow (H-L) test. The area under (AUC) the receiver operating characteristic (ROC) curve was used.

**Results:** Thirty-seven patients required intubation for cardiorespiratory reasons, and 3 for neurological complications. After multivariate analysis, four variables were found to be associated with reintubation: CPB time, pulmonary dynamic compliance, tidal volume (TV), and the respiratory rate (RR)/TV ratio. Using the multivariate model, a calculated probability of 0.71 or greater predicted the need for reintubation, with 82% sensitivity and 83% specificity. The H-L goodness-of-fit test indicated the model fit of the data for a test statistic of 6.967, 7 degrees of freedom, and a  $P = 0.43$ . The AUC of the multivariate model was 0.84, indicating a high probability of correctly identifying patients as needing reintubation.

**Discussion:** Patients who needed reintubation had longer CPB time and worse respiratory function before extubation. Protocols for early extubation should be modified in the presence of predictors of reintubation and intervention should be focused on treating the problems leading to reintubation.

**References:**

- Engoren M, Buderer NF, Zacharias A, et al. Variables predicting reintubation after cardiac surgical procedures. *Ann Thorac Surg* 1999; **67**: 661–665.
- Simeone F, Biagioli B, Scolletta S, et al. Optimization of mechanical ventilation support following cardiac surgery. *J Cardiovasc Surg (Torino)* 2002; **43**: 633–641.

## P-113

### Cognitive dysfunction after valvular heart surgery cannot be predicted with cerebral oximetry

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**Introduction:** Postoperative cognitive dysfunction commonly develops after cardiac surgery and little has been studied about its incidence after valvular heart surgery (VHS). Cerebral oximetry noninvasively measures regional cerebral oxygen saturation (rSO<sub>2</sub>) and significant correlation has been demonstrated between changes in intraoperative rSO<sub>2</sub> values and cognitive dysfunction after cardiac surgery [1]. We therefore investigated the incidence of early postoperative cognitive dysfunction and its relationship with intraoperative rSO<sub>2</sub> values in patients undergoing VHS.

**Method:** After IRB approval and patients' informed consent, 80 patients scheduled for VHS without pre-existing neurological disease were studied. Neurocognitive evaluation was performed with Mini-Mental State Exam (MMSE), Trail-Making Test, and Grooved Pegboard Test 1 day before and 7th day after surgery. Cognitive dysfunction was defined as 20% decrease in individual test scores compared to preoperative scores. During surgery, the incidence and duration of decrease in rSO<sub>2</sub> values were recorded as follows; 1) decrease in absolute rSO<sub>2</sub> values to less than 50% and 2) 40% and 3) a 20% decrease compared to baseline value [1].

**Results:** A total of 16 patients, 8 in Trail-Making Test, 6 in Grooved Pegboard Test, and 2 in both tests, demonstrated postoperative cognitive dysfunction. However, none showed dysfunction at MMSE. The incidence and duration of decrease in rSO<sub>2</sub> values below the predefined 3 cutoff values were similar between patients with and without cognitive dysfunction and were not associated with the incidence of cognitive dysfunction.

**Table 1.** Incidence and duration of decrease in rSO<sub>2</sub> below critical values

	Normal	Cognitive dysfunction	P
Nadir rSO <sub>2</sub> < 40%	22/64 (34%)	3/16 (19%)	0.562
rSO <sub>2</sub> < 40% duration > 5 min	22/64 (34%)	2/16 (13%)	0.128
rSO <sub>2</sub> < 50% duration > 5 min	41/64 (64%)	12/16 (75%)	0.558
rSO <sub>2</sub> 20% drop duration > 5 min	27/64 (42%)	5/16 (31%)	0.571

Values are expressed as number of the patients (%).

**Discussion:** The incidence of postoperative cognitive dysfunction in VHS was 20% in this study, which was lower than the values previously reported in coronary artery bypass graft surgery. Changes in rSO<sub>2</sub> during surgery were not predictive for postoperative cognitive dysfunction in patients undergoing VHS.

**Reference:**

- Yao FF, Tseng CC, Ho CY, et al. Cerebral oxygen desaturation is associated with early postoperative neuropsychological dysfunction in patients undergoing cardiac surgery. *J Cardiothorac Vasc Anesth* 2004; **18**: 552–558.

## P-114

### Effectiveness of intravenous iron sucrose (Venofer) in the treatment of postoperative anaemia after cardiac operations

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**Introduction:** Even 20 years ago it was routine to transfuse several units of donor blood during open cardiac operations [1]. Due to technical progress, improvement of surgical technique, anaesthesia methods and the quality of CPB, it became possible to talk about "bloodless" cardiac surgery [2]. From the early 1990s adult patients, as a rule, do not receive haemotransfusion during open heart operations [1]. However the problem of anaemia in the early postoperative period still needs to be solved. The aim of our study was to estimate the effectiveness of intravenous iron sucrose (Venofer) in the treatment of postoperative anaemia immediately after cardiac operations.

**Method:** From 2002 to 2006 in our Clinic 710 cardiac operations were performed; 410 CABG and 250 valve and aortic aneurysms. None of them received blood during operation. After transfer to ICU in patients with Hb <8 g/dL, or Ht <22% an infusion of Venofer 100 mg/day was began and continued for the next 3 days (total dose of 300 mg of Venofer). In patients with Hb <7 g/dL or Ht <20% red blood cells were given in addition. The changes of Hb and Ht were followed for 7 days after Venofer infusion. The data were compared with data of 708 surgical patients in our Clinic between 1996 and 2001, when Venofer was not used. For statistical analysis we used Students *t*-test criteria.

**Results:** Venofer infusion was given in 90 patients (12.7%). None of them developed allergic, pyrogenic or other reactions. Increase of Hb began on days 4–5 after the first infusion of Venofer and the increase before discharge was a mean of  $2.2 \pm 0.4$  g/dL. The mean level of Hb before discharge was  $9.2 \pm 0.9$  g dL<sup>-1</sup> ( $P < 0.05$ ). Transfusion of red blood cells was needed in 35 patients (4.9%). These were 17 redo operations, 8 patients with initial low Hb level, re-thoracotomy (6 patients) and 4 patients with loss of blood by drain tubes of more than 1000 mL. Mean number of transfused blood cells was  $1.1 \pm 0.3$  units. For 708 surgical patients before 2002, 198 patients (27.9%,  $P < 0.01$ ) received a blood transfusion. The mean number of transfused units was  $2.9 \pm 1.1$  ( $P < 0.01$ ).

**Conclusion:** The use of Venofer in the early postoperative period is one of the effective and safe methods for treating anaemia after cardiac operations.

**References:**

- Koch CG, Khandwala F, Li L, et al. Persistent effect of red cell transfusion on health-related quality of life after cardiac surgery. *Ann Thorac Surg* 2006; **82**: 13–20.
- Renton MC, McLelland DB, Sinclair CJ. Use of blood products in cardiac surgery. *Perfusion* 1997; **12**: 157–162.

## P-115

### Role of anaesthesiologist in prevention of sternal surgical site infection after cardiac surgery – before and after study

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**Introduction:** Sternal surgical-site infection (SSI) is a serious and costly complication following cardiac surgery. These infections are associated with substantial morbidity and mortality, double the length of hospitalization and importantly increase the cost of health care [1].

**Method:** To evaluate the effect of evidence-based interventions on rate of SSI after cardiac surgery we compared all patients undergoing cardiac surgery in 2004 (retrospectively analysed historical group) and all consecutive patients having cardiac surgery in 2005 (prospectively followed up intervention group). The set of interventions was chosen from related articles in the medical literature. Implemented measures included: preoperative chlorhexidine shower, accurate timing of antibiotic prophylaxis, timing and type of preoperative shaving and hair removal, tight perioperative glycaemic control, appropriate hand hygiene of healthcare workers in the perioperative period [2]. The criteria of the National Nosocomial Infection Surveillance (NNIS) system were used to determine SSI rates [3].

**Results:** There were 730 patients with 59 sternal SSI in the historical group and 823 patients with 28 sternal SSI in the intervention group. Patients from both groups were similar with regard to main risk factors for SSI (age, obesity, diabetes, EuroSCORE, surgical team). The rate of sternal SSIs declined from 8.08% to 3.4% ( $P < 0.05$ ) in the study period.

**Discussion:** Implementation of multiple preventive measures statistically decreased rates of postoperative sternal SSI in cardiac surgery. The relative contribution of each measure is rather difficult to determine due to the study design and simultaneous initiation of various interventions. Nevertheless, the lower infection rate supports the introduction of these preventive measures in cardiac surgery.

#### References:

- 1 Kirkland KB, Briggs JP, Trivette SL, et al. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. *Infect Control Hosp Epidemiol* 1999; **20**: 725–730.
- 2 Mangram AJ, Horan TC, Pearson ML, et al. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol* 1999; **20**: 250–278.
- 3 Sharma M, Berriel-Cass D, Baran J Jr. Sternal surgical-site infection following coronary artery bypass graft: prevalence, microbiology, and complications during a 42-month period. *Infect Control Hosp Epidemiol* 2004; **25**: 468–471.

## P-116

### Infiltration of the sternotomy wound and mediastinal tube sites with levobupivacaine for postoperative pain after cardiac surgery

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**Introduction:** The median sternotomy incision and mediastinal tube insertion sites are major sources of pain for patients undergoing cardiac surgery [1]. This study aimed to investigate the effect of levobupivacaine infiltration of the sternotomy wound and mediastinal tube sites on postoperative pain and morphine consumption in patients undergoing cardiac surgery.

**Method:** After obtaining ethics committee approval and informed consent, 50 patients aged 18–65 years, undergoing coronary artery bypass grafting, were included in this study. Anaesthesia was induced with  $5 \mu\text{g kg}^{-1}$  fentanyl,  $0.3 \text{ mg kg}^{-1}$  etomidate,  $1 \text{ mg kg}^{-1}$  lidocaine,  $0.1 \text{ mg kg}^{-1}$  vecuronium and maintained with 1–2% sevoflurane, 50% oxygen in air and fentanyl. Patients were randomized into two groups before sternal wire placement: sternotomy and mediastinal tube sites were infiltrated with either 60 mL 0.25% levobupivacaine (Infiltration Group,  $n = 25$ ) or 60 mL saline placebo (Control Group,  $n = 25$ ). At the end of surgery, patients were transferred to the intensive care unit and sedated with propofol ( $0.5\text{--}1 \text{ mg kg}^{-1} \text{ m}^{-2} \text{ h}^{-1}$ ) until weaning. All patients received i.v. morphine PCA (bolus dose: 2 mg, lock-out time: 15 min, 4 h limit: 20 mg) after extubation. Postoperative pain at rest and on coughing was assessed by visual analogue scale (VAS, 0–10). Pain scores, sedation scores (Ramsay scale), haemodynamic and respiratory parameters, arterial blood gases and morphine consumption were recorded. Chi-squared, *t*-test, Mann-Whitney and Friedman tests were used for statistical analysis.  $P < 0.05$  was accepted as significant.

**Results:** The times to extubation and VAS scores were similar between groups. Morphine consumption at 24 h was significantly less in the Infiltration Group when compared with the Control Group ( $29.52 \pm 5.10 \text{ mg}$  vs.  $42.84 \pm 77 \text{ mg}$ , respectively,  $P < 0.05$ ). The sedation scores were found to be significantly higher in the Control Group when compared with the Infiltration Group ( $P < 0.05$ ).

**Discussion:** Infiltration of the median sternotomy incision and the mediastinal tube insertion sites with 0.25% levobupivacaine resulted in reduced morphine consumption and lower sedation scores in patients undergoing cardiac surgery.

#### Reference:

- 1 McDonald SB, Jacobsohn E, Kopacz DJ, et al. Parasternal block and local anesthetic infiltration with levobupivacaine after cardiac surgery with desflurane: the effect on postoperative pain, pulmonary function, and tracheal extubation times. *Anesth Analg* 2005; **100**: 25–32.

## Case Report Session

## P-117

### Acute postoperative paraplegia after surgical repair for type A aortic dissection

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Postoperative paraplegia complicating type A dissection is extremely rare [1]. We describe a case of paraplegia after emergency graft replacement of the ascending aorta for type A dissection.

**Case Report:** A 26-year-old hypertensive man presented to hospital with intense chest pain. Computed tomography demonstrated an aortic dissection of ascending, descending thoracic and thoracoabdominal aorta. Graft replacement of the ascending aorta was performed under hypothermic cardiopulmonary bypass by way of the right axillary artery and bicaval cannulation. Deep hypothermic circulatory arrest was necessary for 4 minutes with rectal temperature at  $20^\circ\text{C}$ , only for surgical exploration.

Six hours after the operation the patient regained consciousness and after 9 hours he was extubated. At this moment neurological examination was normal. In the following 2 hours he developed paraplegia with all sensation lost below the level of T 12. Magnetic resonance imaging showed normal findings without any sign of infarction or haemorrhage.

A catheter for spinal drainage was inserted immediately. The measured spinal pressure was 22–25 mmHg. The aim of spinal drainage was to maintain cerebrospinal pressure between 10–12 mmHg. It was continued for 4 days, and a total amount of fluid drainage was 1389 mL. Concomitantly the patient received steroids, mannitol and systemic anticoagulation. Fortunately, our patient recovered gradually and he was walking independently after 6 days. The urinary catheter was retained until day 8 postoperatively because of

difficult control of sphincters. He was discharge from hospital on the 20th postoperative day, fully recovered.

In our case of paraplegia after emergency aortic graft replacement for type A dissection, spinal drainage instituted immediately after the occurrence of neurological impairment proved to be beneficial.

#### Reference:

- 1 Yamashiro S, Kuniyoshi Y, Miyagi K, et al. Acute postoperative paraplegia complicating with emergency graft replacement of the ascending aorta for the type A dissection. *Ann Thorac Cardiovasc Surg* 2003; **9**: 330–333.

## P-118

### Undiagnosed pheochromocytoma during mitral valve repair

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**Case Report:** A 46-yr-old male, NYHA class II, with severe mitral regurgitation due to bi-leaflet prolapse presented for mitral valve repair. Induction of anaesthesia was achieved with midazolam  $0.05 \text{ mg/kg}$ , fentanyl  $10 \mu\text{g/kg}$ , pancuronium  $0.1 \text{ mg/kg}$  and propofol titrated to loss of consciousness. Pulmonary artery catheter insertion, sternotomy, aortic and bi-atrial cannulation were performed uneventfully.

As cardiopulmonary bypass (CPB) was initiated, a very high mean systemic arterial blood pressure (MBP) was measured ( $>90 \text{ mmHg}$ ). Anaesthesia was then deepened with additional fentanyl, isoflurane and propofol without any subsequent decrease in MBP. All cannulation sites were inspected and found in order. At this time it was not possible to maintain pump flow at full

calculated cardiac output. Sodium nitroprusside was administered resulting in a sudden dramatic drop in MBP to 35 mmHg.

The recurrence of extreme swings in MBP during the first minutes after initiation of CPB brought us to consider the possibility of a catecholamine-secretion phenomenon. The patient thus received 2 gm of magnesium sulphate and two boluses of 5 mg of labetalol with subsequent stabilization of the haemodynamics. Discontinuation of CPB was uneventful. In the early post-operative period the patient had recurrence of haemodynamic instability that was successfully treated with labetalol and amlodipine.

An abdominal CT scan performed on post-operative day 1 revealed a left sided adrenal mass. Urine samples were found positive for catecholamine metabolites. The patient was then stabilized with phenoxybenzamine and worked up for pheochromocytoma and adrenalectomy. He underwent uneventful laparoscopic adrenalectomy 6 weeks after primary surgery and was discharged home in a stable condition.

**Discussion:** Catecholamine release during cardiac surgery is a life-threatening event. The differential diagnosis of hypertensive crisis during CPB is not always easy. In our case the effectiveness of the treatment confirmed the hypothesized aetiology.

## P-119

### Transoesophageal Echo (TOE) for adult type anomalous origin of the left coronary artery from the pulmonary artery; Bland-White-Garland syndrome

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**Introduction:** Adult type anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a rare congenital anomaly occurring in approximately 1 in 300,000 living and stillbirths (0.25–0.5% of all congenital heart disease).

It is characterized by a left main coronary artery arising from the main pulmonary artery and dilatation of the right coronary artery. It leads to myocardial ischaemia, ventricular failure, mitral insufficiency, congestive heart failure and death.

Only a minority of the patients survive early childhood without surgical intervention (90% mortality in first year of life).

**Case Report:** A 29-yr-old male patient presented with a history of increasing shortness of breath, congestive heart failure and severe mitral insufficiency. TOE performed after induction of anaesthesia showed:

1. Severely dilated right coronary artery.
2. Absence of a left main coronary artery at its normal origin.
3. Left main coronary artery originating from the pulmonary artery.
4. Severe mitral regurgitation due to a flail anterior leaflet.

The procedure consisted in a repair of the mitral valve and corrective coronary surgery (pericardial patch closure of ostium in the pulmonary artery, left internal mammary artery bypass to the left coronary system).

Post cardiopulmonary bypass TOE showed:

1. Repaired MV with trace to mild mitral regurgitation.
2. Absent flow from pulmonary artery to the left coronary artery.
3. Good flow in the left main coronary artery.

Weaning from cardiopulmonary bypass was achieved on minimum inotropic support.

The post-operative course was uneventful.

## P-120

### Non-invasive ventilation (NIV) during endoscopic lung volume reduction

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**Introduction:** Respiratory rehabilitation and lung volume reduction surgery (LVRS) are the main therapies for end-stage emphysema. Endobronchial valve placement in selected areas is an alternative to LVRS. We present the anaesthetic and ventilatory management of a patient with sleep apnoea and end-stage emphysema scheduled for endoscopic lung volume reduction.

**Case Report:** A 60-year-old man with a BMI of 30 kg/m<sup>2</sup>, end-stage emphysema, FEV<sub>1</sub> of 34% of predicted, sleep apnoea, ischaemic heart disease on NYHA III, was treated with beta-adrenergics, anticholinergics, theophylline, inhaled steroids, calcium-channel blockers, aspirin and nasal CPAP. The patient was recruited for a multicentre clinical trial on endoscopic lung volume

reduction and admitted to a respiratory intensive care unit. Monitoring included: ECG, pulse oximetry, respiratory rate and invasive blood pressure. The procedure was performed under a continuous infusion of remifentanyl (0.01 µg kg<sup>-1</sup> min<sup>-1</sup>) and propofol (2 mg kg<sup>-1</sup> h<sup>-1</sup>). Non-invasive ventilation (NIV) was through a special nasofacial mask with a valve for fibrebronchoscope inlet. Pressure support of 10 cmH<sub>2</sub>O, PEEP 4 cmH<sub>2</sub>O and FiO<sub>2</sub> 0.4 was applied. Two one-way valves were inserted bronchoscopically, one in the left upper lobe and the other in the lingula. Spontaneous breathing (15–24 breath min), oxygen saturation (92–97%) and haemodynamics (SBP 95–105 mmHg) were measured during the fifty-minutes procedure. The patient awoke 5–6 min later without discomfort. An episode of bronchospasm 24 hours later was resolved with i.v. steroids. Radiographic signs of volume reduction were observed at discharge.

**Discussion:** Low-doses of remifentanyl and propofol allowed spontaneous breathing and the use of NIV, avoiding endotracheal intubation. Bronchoscopic endobronchial valve placement was safely performed in this patient with poor cardiopulmonary function.

#### Reference:

- 1 Decramer M. Treatment of chronic respiratory failure: lung volume reduction surgery versus rehabilitation. *Eur Respir J Suppl* 2003; **47**: 47s–56s. Review.

## P-121

### Brucella endocarditis of the aortic valve

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**Introduction:** Brucella endocarditis is a rare complication of brucella infection (<2%) but has a high mortality rate. Heart failure is the leading reason for death. Brucella organisms may be implanted on a valve with a congenital abnormality or which has been damaged by rheumatic fever. The infection predominantly involves the aortic valve. Brucellosis, though common worldwide, predominates in the Mediterranean and Middle East regions. This report suggests that the combination of valve replacement and antibiotic therapy produces successful results in the treatment of brucella endocarditis.

**Case Report:** A 25-year-old man with a history of rheumatic fever underwent aortic valve replacement in 2003. He was hospitalized three years later with shortness of breath, cough, and weakness. On admission, abundant petechiae could be seen on his abdomen and both ankles. His blood pressure was 149/30 mmHg and pulse rate was 97 beats/minute. His cardiac physical examination revealed a diastolic cardiac murmur at the left sternal border and aortic area. The electrocardiogram was normal, but the chest roentgenogram showed an enlarged left ventricle. The diagnosis of brucella endocarditis was based on clinical features, high brucella serologic titres and positive blood cultures. An echocardiogram showed a large vegetation shifting to and fro from the outflow tract of the left ventricle and into the aorta, indicating possible acute infective endocarditis with valve vegetations and aortic insufficiency.

The development of peripheral emboli and acute renal failure, along with the echocardiographic information regarding aortic valve vegetations, prompted us to do an emergency aortic valve replacement.

Anaesthesia was induced with 10 µg/kg<sup>-1</sup> fentanyl, 0.1–0.2 mg kg<sup>-1</sup> etomidate and 0.15 mg kg<sup>-1</sup> cisatracurium and maintained with isoflurane 1% and 0.15 µg kg<sup>-1</sup> min<sup>-1</sup> fentanyl. Arterial, central venous and pulmonary artery pressures were monitored continuously.

Surgery was performed under standard hypothermic cardiopulmonary bypass. After the aortic root was incised, a large accumulation of vegetation was found. The excised valve showed an acute inflammatory infiltrate with mucopolysaccharide and granulomatous formations. After an uneventful recovery, the patient was discharged on a regimen of doxycycline (200 mg/day), rifampicin\* (600 mg/day) and levofloxacin (250 mg/day) for 6 weeks.

We conclude that when a diagnosis is made of acute valve regurgitation secondary to acute infective endocarditis and brucella, valve replacement surgery should be performed immediately. Combined antibiotic and surgical treatment is the best approach for treating brucella prosthetic valve endocarditis as the mortality rate is less than for medical treatment alone and infection of the new prosthesis that has been placed is low.

## P122

### Placement of a double-lumen intubation tube with the assistance of fiberoptic bronchoscope in a patient with tracheoesophageal fistula after an operation of esophageal stent

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**Case Report:** A 68-year-old male patient presented to the emergency service with dysphagia. In a local hospital, three months previously, he had been diagnosed as having an oesophageal carcinoma. In that hospital an oesophageal stent [1] had been inserted and then chemoembolization had been performed. He was now suspected of having a tracheoesophageal fistula.

Bronchoscopy was performed to confirm the diagnosis of tracheoesophageal fistula. First the fiberoptic bronchoscope was inserted into a left-sided double-lumen endobronchial tube. After anaesthetic induction, the left-sided double-lumen tube with fiberoptic bronchoscope, was moved forward slowly. The fistula was seen at 8 cm beyond the vocal chords. The oesophageal stent, seen by bronchoscopy, divided the trachea into two at the site of the fistula. The bronchoscope was advanced to the left main bronchus carefully, on the tracheal side related to the stent. The double-lumen tube was then slid over the bronchoscope into to the left main bronchus. Then the cuffs of bronchial and tracheal were inflated. Confirmation of the endobronchial tube placement was made by auscultation.

With the patient in the left lateral position, right thoracotomy was performed and left single lung ventilation used. The oesophagus was explored. Oesophageal and tracheal defects, approximately 2 cm in length, were seen 3 cm above the azygos vein. The oesophageal stent was removed and the tracheal defect repaired.

Thirty-five cm of the thoracic oesophagus was resected as far as the hiatus. The hiatus was freed and bleeding controlled. The patient was moved to the supine position and laparotomy performed.

The double-lumen endobronchial tube was then changed to a normal single lumen tube using the fiberoptic bronchoscope. The patient was transferred to ICU. He was extubated one day after the operation.

**Discussion:** In patients who have a tracheoesophageal fistula, there is a risk that an endotracheal tube may pass through the fistula and into the oesophagus by mistake if a fiberoptic bronchoscope is not used. We conclude that these patients should be intubated with the assistance of a fiberoptic bronchoscope to avoid inadvertent oesophageal intubation through the fistula and damage to the oesophagus and trachea.

#### Reference:

- 1 Kozarek R, Raltz S, Brugge WR, et al. Prospective multicenter trial of esophageal Z-stent placement for malignant dysphagia and tracheoesophageal fistula. *Gastrointest Endosc* 1996, **44**: 562–567.

## P-123

### Retrospective assessment of perioperative treatment of newborns having the arterial switch operation (ASO) for transposition of the great arteries (TGA)

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**Introduction:** Transposition of the great arteries (TGA) exists as 10% of congenital heart diseases. Without cardiac surgical intervention babies born with TGA are at very high risk of sudden death [1]. The goal of the study was to analyse the perioperative period of newborns treated by arterial switch operation (ASO).

**Method:** The assessment was performed from January to November 2006 on the group of 14 newborns who had the arterial switch (ASO) operation within the first 14 days of life. The method used in this research was a retrospective analysis of perioperative data of 14 newborns with TGA.

**Results:** The newborn, mean age 5.4 days (3–13), assessed as ASA scale 4, underwent the ASO procedure. Half of them had a Rashkind septostomy in the first 2 days of life. Before the operations all received continuous intravenous infusion of prostaglandin E1 0.025 µg kg<sup>-1</sup> min<sup>-1</sup>. In all patients intravenous anaesthesia was conducted with fentanyl, vecuronium and midazolam in standard doses. At the end of extracorporeal circulation (ECC) patients typically received infusions of nitroprusside, dopamine and dobutamine, but 28% needed adrenaline and half of them noradrenaline and milrinone. Infusions were successfully stopped on 4.7 (1–20) postoperative days. During the operation the recorded mean times were: anaesthesia 300.4 min (280–400), ECC 163.6 min (145–190) and arterial clamping 76.8 min (60–105). Postoperatively the following complications were observed: pneumonia (57.1%), low cardiac output (57.1%), arrhythmias (14.3%), severe sepsis (7.1%) and one death. The length of stay (LOS) in the postoperative intensive ward was 11.8 days (4–33).

**Discussion:** The arterial switch operation (ASO) for transposition of the great arteries seems to have a good prognosis for survival, except for postoperative complications reported by other authors [2] (heart failure, arrhythmias, sudden death).

#### References:

- 1 Raja SG, Shauq A, Kaarne M. Outcomes after arterial switch operation for simple transposition. *Asian Cardiovasc Thorac Ann* 2005; **13**(2): 190–198. Review.

- 2 Bartoloni G, Bianca S, Patane L, et al. Pathology of coronary narrowing after arterial switch operation: autopsy findings in two patients who died within 3 months of surgical treatment and review of the literature. *Cardiovasc Pathol* 2006; **15**(1): 49–54.

## P-124

### The combination of psoas compartment, sciatic nerve and T12-L1 paravertebral blocks for femoropopliteal bypass surgery in a high risk patient

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**Introduction:** Generally femoropopliteal bypass surgery is performed under general or spinal anaesthesia. But when patients have severe medical illnesses that contribute to a substantial incidence of perioperative complications, the choice of anaesthesia becomes more important. An ideal anaesthetic technique would provide good analgesia and have few complications associated with its use, including minimal haemodynamic instability, and provide an adequate surgical environment.

**Case Report:** An 86-year-old male was scheduled for femoropopliteal bypass surgery. He had severe heart failure, nephropathy due to hypertension and severe chronic obstructive lung disease. He was also under medical treatment for a thoraco-abdominal aorta aneurysm. The anaesthesia technique that we performed was the combination of psoas compartment block, sciatic nerve block and T12-L1 paravertebral block. After placing an intravenous catheter and monitoring, the patient was turned to the lateral position (Sim's position), with the operation site uppermost. Psoas block was performed using the technique of Winnie [1]. The sciatic nerve was blocked using the classical posterior approach (Labat technique) [2]. T12-L1 paravertebral block was performed using the technique described by Moore [3]. 60 mL of local anaesthetic solution (0.33% bupivacaine with 1/200,000 epinephrine) was divided for psoas block (30 mL), sciatic nerve block (20 mL) and paravertebral block (10 mL). It provided adequate surgical anaesthesia. Vital signs were stable during an uneventful operation lasted 120 min. No complications were recorded. The patient was transferred to the ward after 60 min observation in the post-anaesthesia care unit.

**Discussion:** This case showed that the regional anaesthetic technique described above provided adequate anaesthesia for femoropopliteal bypass, intraoperative haemodynamic stability and an acceptable postoperative course for a patient known to have multiple risk factors.

#### References:

- 1 Winnie AP, Ramamurthy S, Durrani Z, et al. Plexus blocks for lower extremity surgery. *Anesthesiology Review* 1974; 11–16.
- 2 Labat G. Labat's Regional Anesthesia: Its techniques and clinical applications. 4th ed. St Louis, MO: Warren H Green, 1985.
- 3 Moore D. Regional block. A handbook for use in the clinical practice of medicine and surgery. 4th ed. Springfield, IL: Charles C Thomas, 1965.

## P-125

### Anaesthesia for percutaneous pulmonary valve replacement in adults: report of 3 cases

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**Introduction:** Percutaneous pulmonary valve implantation (PPVR) has been described to be a reliable innovative option for the adult patient population [1].

Despite the relative non-invasiveness of the procedure, adults with congenital heart disease remain a true challenge for the anaesthesiologist who has to provide safe general anaesthesia in a relatively “unfriendly” environment such as the Cardiology Lab. Between July and December 2006 three adults underwent PPVR at our institution.

**Case reports:** In all cases a Melody™ trans-catheter pulmonary valve was implanted. Patients' characteristics are described in Table 1.

**Table 1.**

	Patient 1	Patient 2	Patient 3
Age/Gender	41/F	46/M	26/M
Congenital pathology	Bicuspid AV	Tet. of Fallot	Bicuspid AV
Previous heart ops.	1	2	2
Pulmonary Valve	Stenosis	Stenosis	Stenosis
RVSP (mmHg)	88	106	59
Coexisting disease	Previous TIA	Haemodialysis	None

After cannulation of right or left radial artery and insertion of a large bore peripheral line, induction of anaesthesia was accomplished with midazolam

0.02 mg/kg, fentanyl 0.25 µg/kg, rocuronium 0.5 mg/kg and propofol titrated to loss of consciousness. An 8F sheath introducer was inserted into the right or left internal jugular vein after intubation. For maintenance of anaesthesia sevoflurane at a MAC between 0.7 to 1 was used.

**Results:** The first patient of our series developed haemoptysis after deployment of the valve and required urgent bronchoscopy and prophylactic insertion of a right chest tube. She was then transferred to the Intensive Care Unit and extubated 24 h after the procedure. Patients 2 and 3 were successfully extubated at the end of the procedure.

**Conclusion:** From our initial experience we conclude that a cardiac surgery-like anaesthesia monitoring and line insertion is mandatory. Understanding of possible complications and effective communication with the cardiology team are the keys for safe intra-operative management.

**Reference:**

- 1 Nordmeyer J, Coats L, Bonhoeffer P. Current experience with percutaneous pulmonary valve implantation. *Semin Thorac Cardiovasc Surg* 2006; **18**(2): 122–125.

## P-126

### Postoperative TOE diagnosis of inferior vena cava stenosis after elective mitral valve replacement

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**Introduction:** Elective cardiac surgery in patients with mitral valve disease and normal left ventricle function is usually uneventful. We present an unusual perioperative complication after an otherwise uncomplicated mitral valve replacement.

**Case Report:** A 64-year-old female with episodes of shortness of breath and NIDDM presented for elective mitral valve replacement. Preoperative transoesophageal echocardiography (TOE) after induction of anaesthesia, showed: severe mitral regurgitation, LVEF > 60% and mildly dilated left atrium.

The surgical procedure was uneventful, the mitral valve was replaced with a mechanical prosthesis, a complete TOE was repeated after cardiopulmonary bypass without any unusual findings.

During the first two hours after admission to the Intensive Care Unit the patient developed:

1. Low cardiac output syndrome
2. Haemodynamic features of hypovolaemia
3. Metabolic acidosis
4. Lactic acidosis
5. Elevated liver enzymes

Urgent TOE was then performed showing:

1. Hyperkinetic, hypovolaemic left ventricle
2. Severe inferior vena cava stenosis at the junction to the right atrium

The patient was urgently transferred to the operating room where a patch-repair of the inferior vena cava under deep hypothermic circulatory arrest was carried out. The patient was discharged home 10 days after surgery.

**Discussion:** Haemodynamic instability is a category I indication for performing a TOE exam [1]. Our report fully supports this suggestion. Early identification of the pathology with the use of TOE enabled prompt and effective treatment.

**Reference:**

- 1 Cheitlin MD, Armstrong WF, Aurigemma GP, et al. ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography. *J Am Coll Cardiol* 2003; **42**: 954–970.

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