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## Fatter and Fitter? Is there an inverse relationship between BMI and complications in the non-diabetic population following lung resection?

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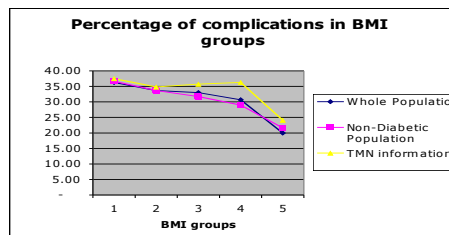
### Methods

A database of consecutive thoracic cases from 2001 to 2007 was analyzed. Records for lung resections with BMI, diabetic history, postoperative complications, mortality and ITU readmission, were assembled. They were grouped into 5 BMI groups, I (<19.5), II (19.5-24.9), III (25-29.9), IV (30-34.9), V (>35). All records were analyzed for trends across the BMI groups with presence and number of complications, ITU readmission and mortality as endpoints. Complications were again looked at with the diabetic population removed. Records with incomplete TMN information,  $N \geq 2$  or  $M > 0$  were removed with the remaining tested for complications.

They were then grouped into Stages 0-III and the distribution measured.

### Results

1951 records. Percentage of complications showed a downward trend with increasing BMI.  $\chi^2$  test gave a p of 0.24. ITU re-admission (p 0.94), mortality (p 0.95). There was a negative correlation co-efficient of -0.34 between number of complications and BMI. Removing the diabetic population also gave a downward trend (p 0.343). Using the TMN exclusion criteria left 1390 records, complications gave a p of 0.68. The spread of stages was unequal with BMI groups III and IV having a significantly greater proportion of Stage II than Stage I,  $p < 0.00001$ . Our results showed a decreasing trend but failed to reach statistical significance. With this data the obesity paradox cannot be said to exist in this population.



### Discussion

Some studies looking at heart failure and PCA found improved mortality and morbidity with increasing BMI. **1** Is this obesity paradox a real phenomenon? There are a number of theories as to why it may not be. Are we seeing the deleterious effects of cachexia and/or recent weight loss rather than salutatory effects of obesity? Smokers are thought to generally have a lower BMI. Consequences of excess body weight on mortality are delayed and may not be seen in the short term. Are the obese treated more aggressively with pro-active management? **2** Whatever the answer, those with increased BMI seem not to be at risk of increased complications.

### References

1. Gruberg et al (2002) The impact of obesity on the short-term and long-term outcomes after percutaneous coronary intervention: the obesity paradox? *J Am Coll Cardiol* **39**:578-584
2. Steinberg BA et al (2007) Medical therapies and invasive treatments for coronary artery disease by body mass: the "obesity paradox" in the Get with the Guidelines database. *Am J Cardiol* **100** (9) : 1331-5

## An audit of post-cardiac surgery gastrointestinal haemorrhages and their relationship with anti-platelet & anticoagulant therapies

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Gastrointestinal (GI) complications post-cardiac surgery, although uncommon, often have devastating results on patient morbidity and mortality [1]. Due to the significant stress response and tissue injury caused by cardiac surgery, and with increased use of multimodal anti-platelet & anticoagulant therapies, the risk of post operative GI haemorrhages (GIH) cannot be underestimated.

### Methods

We reviewed 120 consecutive surgical patient casenotes, known to have had post-operative GIH, from our audit database between 04/2000 & 10/2007. A classification of the severity of haemorrhage (minor, major & life-threatening) [2] was used.

### Results

The recorded annual incidences of GIH showed an increase of >25% in 2005 & 2006. 80% occurred within the first 14 postoperative days. 75% were either “major or life-threatening”. The predominant anti-platelet & anticoagulant therapies implicated were aspirin 80%, low molecular weight heparin (LMWH) 59%, clopidogrel 43% and warfarin 26%, with the most common combination being “triple therapy” (aspirin, LMWH & clopidogrel) at 33%. This combination showed a markedly increased prevalence during 2005 & 2006 coinciding with the change from subcutaneous to LMW heparin.

**Table 1**

Age (mean)	History of PUD	M:F	TOE	Mortality	Annual Risk	Gastro Protection
45-85y (71y)	16%	2.4:1	25%	13%	1.1%	40%

### Discussion

From our results it was evident that there was an increased incidence of GIH during the years of 2005 and 2006 which coincided with increased use of “triple therapy” anticoagulant/anti-platelet agents. Recommendations: 1) prophylactic proton pump inhibitors (omeprazole 40mg OD) for 14 days starting on the last pre operative day ; 2) early nasogastric coating feeds in patients ventilated for >18 hours post-operatively. We found no way to accurately predict which patients are most at risk of post operative GIH, however, our results suggested that using gastro protective agents reduced the likelihood of major or life threatening GIH. Other considerations were to routinely test patients for aspirin and clopidogrel resistance and H.pylori but these have a significant financial implication.

### References

- 1 Perugini, Orr, Porter, Dumas and Maini *Gastrointestinal complications following cardiac surgery* Archives of Surgery Vol. 132 No.4, 1997 : .338-452.
- 2 Boucher, Pharand, Skidmore *A critical appraisal of the CURE trial: role of clopidogrel in non-ST-segment elevation acute coronary syndromes* Can J Clin Pharmacol Vol 11 (1) spring 2004: e156-e167.

## Cardiac output monitoring devices – what do the practitioners think?

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Measuring cardiac output is of paramount importance in the management of critically ill patients in the intensive care unit and of 'high risk' surgical patients in the operating room [1]. Alternatives to the thermodilution method of cardiac output measurement, using a pulmonary artery catheter (PAC) are now available and include oesophageal Doppler, lithium dilution cardiac output (LiDCO) and pulse-induced contour cardiac output (PiCCO) studies. The evaluation of these cardiac output monitoring devices has proved difficult since agreement between them is not as unequivocally complete to be uniformly convincing. This is evidenced by the varied and inconsistent adoption of the newer methods by clinicians [1, 2, 3]. We surveyed anaesthetists to determine the perceived qualities of each device and what device is preferred in a series of clinical scenarios.

### Methods

Consultant and registrar level anaesthetists were surveyed via an online questionnaire.

### Results

Eighty-five responses (sixty-seven completed) were recorded on a database. Oesophageal Doppler monitoring is the most frequently used device in both ITU and surgical patients, where as Pulse Contour Analysis was the most infrequently used.

**Table 1** The perceived advantages and disadvantages of each device on average within the surveyed population of anaesthetists.

<b>Pulmonary Artery Catheter</b>		<b>Oesophageal Doppler</b>		<b>Pulse Contour Analysis</b>	
<u>Advantages</u>	<u>Disadvantages</u>	<u>Advantages</u>	<u>Disadvantages</u>	<u>Advantages</u>	<u>Disadvantages</u>
Accuracy	Invasiveness	Continuity of measurement	Accuracy	Accuracy	None
Continuity of measurement	Complication rate	Availability of appropriate training	Reliability	Continuity of measurement	
Availability of appropriate training		Ease of use	Patient tolerance	Availability of appropriate training	
Ease of use		Familiarity		Ease of use	
Reliability		Invasiveness		Reliability	
Patient tolerance		Complication rate		Patient tolerance	
Familiarity				Familiarity	
				Invasiveness	
				Complication rate	

Although the majority of respondents listed all of the features of Pulse Contour Analysis as advantageous, a significant proportion listed availability of appropriate training and familiarity as disadvantages. Clinical scenario 1 synopsis: 23 year old RTA victim with a fractured pelvis, ARDS and anuria. Preferred device: Oesophageal Doppler. Clinical scenario 2 synopsis: 67 year old with a history of angina has angina, heart failure, a perforated bowel and sepsis. Preferred device: Oesophageal Doppler. Clinical scenario 3: 61 year old undergoing a GA for an elective hip replacement has mild mitral regurgitation. Preferred device: None.

### Discussion

This survey suggests the invasiveness and complication rates of PACs lend favour to Oesophageal Dopplers as devices for cardiac output monitoring within these clinical scenarios. The recent introduction of Pulse Contour Analysis methods can account for their relative unpopularity; however it seems that

those anaesthetists that do utilise them consider them to be favourable in most aspects. Indeed perceived advantages include accuracy, ease of use, invasiveness, and complication rates, all of which are perceived disadvantages of PACs and Oesophageal Dopplers. This survey suggests that with greater familiarity and more accessible training PCAs can become the device of choice.

## References

- 1 Berton C, Cholley B. *Equipment review: New techniques for cardiac output measurement – oesophageal Doppler, Fick principle using carbon dioxide, and pulse contour analysis* Critical Care 2002; 6: 216-21.
- 2 Chaney JC, Derdak S. *Minimally invasive hemodynamic monitoring for the intensivist: current and emerging technology* Critical Care Medicine 2002; 30: 2338-45.
- 3 Vincent JL, De Backer D. *Cardiac output measurement: is least invasive always the best?* Critical Care Medicine 2002; 30: 2380-2.

## A survey of TOE practice in cardiac centres across the UK

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The last 11 years has seen a considerable expansion in perioperative transoesophageal echocardiography (TOE). A previous survey looked at TOE practice in the UK [1]. We conducted a survey to inform us on the latest national standards regarding operator qualifications, and equipment availability. This information will facilitate the setting of local standards and optimisation of resources, to ensure the delivery of a high quality perioperative TOE service in our centre.

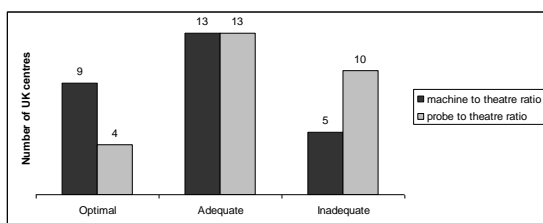
### Methods

In November 2007 we performed a web based survey to create a snapshot of current TOE practice across UK cardiac centres. The questionnaire consisted of questions regarding the specialty, training and accreditation of TOE practitioners, and the adequacy of available equipment in each centre. The link to the questionnaire was sent by e mail to the respective ACTA linkman. The responses were collected from the SurveyMonkey.com website and analyzed.

### Results

Out of 45 centres 27 responded (61%). In the UK 93% of TOE operators are anaesthetists. In 5 of 27 centres all the operators have a TOE exam, while in 15 of 27 centres  $> \frac{1}{2}$  hold an exam qualification. In only 1 centre all the operators are accredited, while  $> \frac{1}{2}$  have accreditation in 7 out of 27 centres. For the purpose of analysis machine to theatre and probe to theatre ratio was defined as optimal (1 machine/theatre & 1 probe per theatre + 1 extra probe), adequate (1 machine per 2 theatres & 1 probe per 2 theatre) and inadequate (1 machine per 3 or  $>$  theatres & 1 probe per 2 or  $>$  theatres). Fig 1

**Fig 1** Machine and probe availability in UK centers



### Discussion

Over the last 6 years TOE has been embraced by the cardiac anaesthetic community. Anaesthetists now make up 93% of perioperative TOE operators, compared to 53% in 2001. The 2001 survey noted that only 11% of operators were formally qualified. To improve training and qualification, the Association of Cardiothoracic Anaesthetists and British society of Echocardiography produced a syllabus and accreditation program in Adult TOE in 2003. Currently 15 (55%) UK centres have  $> \frac{1}{2}$  of the TOE practitioners holding an exam qualification. Accreditation uptake has been slower. Our survey has shown that most UK centres have adequate TOE equipment.

### References

1. Harvey NJ, Swanevelde JLC. The state of intra-operative Transoesophageal echocardiography in the British Isles: Survey Results. Poster Abstract, ACTA Spring Meeting Cambridge 2001

## **Tissue oxygen saturation during anaesthesia and cardiac surgery and its association with ICU outcome**

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Near Infra-Red Spectroscopy is a novel method for rapid and non-invasive assessment of tissue oxygen saturation (StO<sub>2</sub>). An association between StO<sub>2</sub> and oxygen delivery has been demonstrated during shock, trauma and resuscitation. We sought to explore StO<sub>2</sub> during anaesthesia and surgery and its association with outcome.

### **Methods**

74 adult patients undergoing first-time, elective, single procedure cardiac surgery requiring cardiopulmonary bypass (CPB) were studied. StO<sub>2</sub> was measured from the thenar eminence (Inspectra Tissue Spectrometer Model 325, Hutchinson Technology Inc, USA) through anaesthesia, surgery and intensive care unit (ICU) care for a maximum of 24 hours. Clinical details and haemodynamic variables (blood pressure and heart rate) were prospectively collected. Outcome was defined as duration of ventilation and of ICU stay.

### **Results**

StO<sub>2</sub> rose from baseline during induction of anaesthesia (81.70 to 88.52,  $p < 0.001$ ). This rise was 5.70 lower in those patients suffering haemodynamic change requiring treatment ( $p = 0.0055$ ). StO<sub>2</sub> then fell during surgery (mean 78.89) with a significant change in minimum StO<sub>2</sub> during CPB (75.88 to 68.16  $p < 0.0001$ ). During this time, StO<sub>2</sub> was associated with CPB temperature (every one point increase in temperature was associated with a 1.14 increase in StO<sub>2</sub>,  $p < 0.001$ ) and CPB flow rate (every one point increase in flow rate was associated with a 2.39 increase in StO<sub>2</sub>,  $p = 0.02$ ), and inversely with FiO<sub>2</sub> (every one point increase in FiO<sub>2</sub> was associated with a 1.95 decrease in StO<sub>2</sub>,  $p = 0.04$ ). Minimum StO<sub>2</sub> during surgery was also associated with pre-operative Hb (correlation coefficient 0.22,  $p = 0.054$ ) but not minimum intra-op Hb (correlation coefficient 0.001,  $p = 0.84$ ). There was no association between any StO<sub>2</sub> measure and length of ventilation or length of stay on ICU. Using a StO<sub>2</sub> cut-off of 75 for the mean during surgery, there was a trend for StO<sub>2</sub>  $< 75$  to be associated with longer CPB duration (105.0 v 86.7,  $p = 0.22$ ) and longer ventilation time (8.2 v 6.2,  $p = 0.06$ ) than those with StO<sub>2</sub>  $> 75$ .

### **Discussion**

We have shown that StO<sub>2</sub> is easily and non-invasively measured in cardiac surgical patients. StO<sub>2</sub> increased as CPB temperature rose, an effect perhaps attributable to muscle bed vasodilatation. Similarly, the rise in StO<sub>2</sub> with increased CPB flow may reflect increased oxygen delivery. The fall in StO<sub>2</sub> with rise in FiO<sub>2</sub> is harder to explain, but may reflect a confounding effect, with clinical variables associated with lower StO<sub>2</sub> themselves triggering an increase in FiO<sub>2</sub> as an intervention. Such hypotheses are worthy of further interrogation. Our data also support expanded studies relating StO<sub>2</sub> to CPB duration.

### **Acknowledgement**

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## Analysis of compliance rate with 6- hours and 24-hours Sepsis Care Bundles in ICU

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**Introduction and Objectives:** The mortality rate associated with severe sepsis remains high. Compliance with the Severe Sepsis Care Bundles introduced by the Surviving Sepsis Campaign (SSC) has been shown to improve the mortality rate related to severe sepsis<sup>1, 2 & 3</sup>.

The primary objective of our audit was to determine the compliance rate for 6-hours and 24-hours sepsis care bundles. The secondary objective was to assess the compliance rate for completion of sepsis screening and management protocols used in our unit.

**Method:** This was a prospective observational audit conducted over a period of three months between December 2006 to February 2007. Cases of severe sepsis in the ICU were identified and the medical notes, nursing charts, sepsis screening and management protocol sheets were used to collect the data. We used Severe Sepsis Care Bundles published in the Institute for Healthcare Improvement website<sup>2</sup>. We modified some of the elements to suit our unit policies. A 'Yes' score was given if the intervention had been implemented or considered. A 'No' score was given otherwise. We calculated the compliance rate for each of the interventions and for overall 6-hrs and 24-hrs sepsis care bundles. We also looked at the compliance rate for completing the Severe Sepsis Screening and Management protocol sheets used in our ICU. **Compliance** was assessed as an 'all or none' basis, i.e a severe sepsis case was said to be compliant with the care bundle if all the elements of the bundle were achieved within the specified time frame.

**Results:** We identified 20 cases of severe sepsis. The commonest source of sepsis was pneumonia (50%) Within the 6- hours Sepsis bundle group, lactate was measured in 18 cases and blood cultures were taken before antibiotics in 19 cases. In 16 cases, SVO2 (Central venous oxygen saturation) was measured and kept >70%. All the cases received appropriate antibiotics and fluid challenges to keep MAP >65mmhg. All the elements of the 6-hrs sepsis care bundle were completed in 14 cases with an overall compliance rate of 70% (14/20).

18 cases qualified for the 24-hrs sepsis care bundle. Within this group, the short synacthen test was considered in 15 cases. The blood glucose control ( levels 4-10 mmolL<sup>-1</sup>) and the low tidal volume ventilation(to keep plateau pressure < 30cm H2O) strategies were followed in all the cases. Activated Protein C was considered in only 6 cases and was appropriate in 2 cases. All the elements of the 24-hrs sepsis care bundle were achieved in 10 cases with an overall compliance rate of 55% (10/18).

The sepsis screening and management protocol sheets were completed in 50% (10/20) of the cases

**Discussion:** F. Gao and et al showed a compliance rate of 52% and 30% with 6 hrs and 24 hrs sepsis care bundles respectively. A Castellanos-Ortega and et al showed a better compliance rate for 6 hours bundle compared to 24 hours sepsis bundle. In both these studies, the mortality rate was higher in the non compliant groups.<sup>1,2</sup> Our compliance rate for 6-hours and 24 hours sepsis care bundle was 70% and 55% respectively. The poor compliance rate for Activated Protein C intervention, significantly reduced the overall compliance rate for 24 hour sepsis bundle care.

We made following simple recommendations to improve our performance in future.

1. Make sure sepsis screening and management protocol sheet is present in the admission pack
2. Clearly document the time of onset of sepsis and time of achieving each element of severe sepsis bundle.
3. Perform Short Synacthen Test in all septic patients needing inotropes or vasopressors.
4. Send central venous blood sample for SVO2 measurement and Blood culture as soon as the central venous catheter is placed.
5. Staff education with audit results and their feedback

**Conclusion:** We achieved higher compliance rate with the 6-hours sepsis care bundle in our unit when compared to other studies. However, with the education of the medical and nursing staff using our audit results and by proper documentation of sepsis screening and management protocols, we should be able to achieve a higher compliance rate overall. After this audit we have made some simple recommendations to the ICU. We plan to complete the audit cycle after instituting these measures to look for improvement in the compliance rate.

**References:** 1.F Gao, T Melody, D F Daniels et al: The impact of compliance with 6-hour and 24-hour sepsis bundles on hospital mortality in patients with severe sepsis: a prospective observational study, *Critical Care* 2005, 9:R764-R770

2. A Castellanos-Ortega, B Suberviola, A González-Castro, C Gonzalez, A Ruiz, J Teja and F Ortiz: Impact of sepsis care bundles on hospital mortality in 135 consecutive patients with septic shock, *Critical Care* 2007, 11(Suppl 2):P70

3. A Castellanos Ortega, B Suberviola, A Vallejo, A González-Castro, A Ruiz, MA Ballesteros, FJ Llorca and F Ortíz-Melón, Compliance with the sepsis care resuscitation bundles is associated with decreased mortality in patients with septic shock, *Critical Care* 2008,12(Suppl 2):P414

## Audit of a Perioperative Transoesophageal Echocardiography Service facilitates the purchasing of new equipment

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A recent publication highlighted the importance of delivering a high quality perioperative echocardiography service, through a continuous quality improvement (CQI) program [1]. Despite the existence of a perioperative transoesophageal echocardiography (TOE) service in our cardiac centre for the last 5 years, we felt our practice and resources to be below suggested standards.

### Methods

We conducted a 1 year retrospective audit. Our centre has 1 TOE machine with a paper logbook attached. Using the logbook we identified and analysed the cases in which TOE resulted in a change to the planned surgical intervention. Employing a US model [2], the cost-benefit was calculated for patients in whom significant morbidity or reoperation would have been prevented, to yield an average saving per patient.

### Results

A total of 242 cases (68% of all the cases archived on the machine), were recorded in the paper logbook. Out of these 242 cases, 33 resulted in a change to the planned surgical intervention based on the TOE findings. We considered 11 of these 33 changes to be significant. With current overheads, we showed a saving of £399 per patient receiving an intraoperative TOE. To ascertain if there would still be a saving in the event of purchasing a 2nd TOE machine, we recalculated the expenditure, and estimated that the saving would be £292 per patient. **Table 1**

**Table 1** Cost analysis steps display cost savings per patient with 1 machine (current) and with the purchase of a 2nd machine (estimated).

Steps in cost analysis	Current	Estimated
Yearly cost of providing TOE service	£28,050	£65,984
TOE cost per patient	£92	£199
TOE cost for all patients in analysis	£32,652	£70,586
Number of significant interventions	11	11
Saving made by changed operations	£141,148	£103,214
Cost saving per patient having a TOE	£399	£292

### Discussion

Purchasing new equipment to implement a CQI program can be limited by budget constraints. Our audit identified 11 cases where the change to the planned surgical intervention was significant enough to postulate that reoperation or significant morbidity was prevented.

We showed poor compliance in completing the paper logbook and it can therefore be argued that some cases benefiting from perioperative TOE were unidentified, and even greater savings are possible.

### References

1 Kisso J, Byrd B, Geiser E, et al. Recommendations for continuous quality improvement in echocardiography. *JASE* 1995; **8**: S1-28

2 Fanshawe M, Ellis C, Habib S, et al. A retrospective analysis of the cost and benefits related to alterations in cardiac surgery from routine intraoperative transoesophageal echocardiography. *Anesth Analg* 2002; **95**:824-7

## A retrospective cohort study of median ICU length of stay and incidence of haemofiltration as a function of number of nights on mechanical ventilation

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We conducted a retrospective cohort study of all patients admitted to the cardiothoracic intensive care unit using data collected from the Patients Analysis Tracking Software (PATS) database. We quantified the characteristics which may be dependent on the sedation regimen used during periods of mechanical ventilation (MV). Studies have shown reduced time to extubation and ICU length of stay (LOS) when comparing standard sedation regimens with remifentanyl based regimens [1]. These differences are even greater in the presence of haemofiltration (CVVHF).

### Methods

The data was collected from the PATS database for all ventilated patients between 1.12.05 and 30.11.07. Patients with a tracheostomy were excluded. The patients were divided into two groups: ventilated patients without readmission or reintubation (group I) and ventilated patients who were reintubated and readmitted to the ICU (group II).

### Results

The population consisted of 1493 males (71.6%) with a mean age of 63.4yrs (median 66, range 17 – 96) and 593 females (28.4%) with a mean age of 63.1 yrs (median 68, range 17 -91)

Nights of MV	Group I median ICU LOS (days)	Group II median ICU LOS (days)	CVVHF %	Number of patients
1	1	7.5	5	2089
2	3	8	19	367
3	4.5	8	36	111
4	6	9	44	66
5	6.5	10	43	42
6	10	10.5	47	34
7	0	14	57	23
8	0	14	50	22
9	0	17	33	18
10	11.5	18.5	29	17
11	0	21	23	13
>11	13	21	27	11

### Discussion

Most patients were extubated after one night of ventilation. The median length of stay in ICU was markedly longer in group II. The peak of haemofiltration is at 7 days of ventilation. For the greatest clinical impact and cost effectiveness, we conclude that the optimal time for using remifentanyl based sedation would be after 3 days of mechanical ventilation. This may enable earlier extubation, discharge and better patient outcome with increased ICU capacity and potential for greater clinical activity

### Reference

1 Breen D, Karabinis A, Malbrain M, et al.

*Decreased duration of mechanical ventilation when comparing analgesia-based sedation using remifentanyl with standard hypnotic-based sedation for up to 10 days in ten intensive care patients: a randomised trial* Crit Care. 2005 Jun;9(3):R200-10

## A comparison between the Bloomsbury sedation score and the Richmond Agitation-Sedation Score in adult cardiothoracic critical care patients

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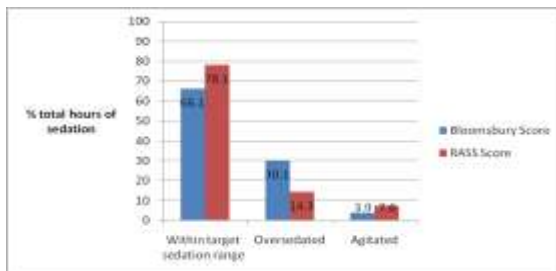
For the assessment of ICU sedation, several scoring systems have been introduced into clinical practice, but the differentiation between deeper sedation levels remains poor. Few of the available sedation scales have been validated. The aim of this prospective cohort study was to test and compare our current sedation score (Bloomsbury score) with the Richmond Agitation-Sedation Score (RASS).

### Methods

For 7 consecutive 24 hour periods all ICU patients were scored with the Bloomsbury and RASS every hour by two different nurse with 15 minutes interval. Patients receiving neuromuscular blocking agents were excluded. The clinical data including age, gender, total hours spent at each level of sedation, the use of mechanical ventilation, time of extubation, dosage and route of administration of the sedatives and analgesic drugs were also recorded.

### Results

Based on each score there is a target range for optimal sedation. Outside this range patients will be either agitated or over sedated. The figure below shows the proportion of hours spent within these categories having been assessed using the Bloomsbury and RASS scores



### Discussion

The majority of patients received sedation within the target range; (66.1% Vs 78.1%). Outside of this range over sedation was more common than agitation but the proportions varied widely depending on which score was used (30.1% Bloomsbury Vs 14.3% RASS). Agitation appeared to be more common when using the RASS score.

We conclude that a validated sedation score such as the RASS score is more discriminating between levels of sedation than the Bloomsbury score. This is because RASS offers broader discrimination in the commonly used mild to moderate sedation range. It is more objective and avoids overlapping between sedation ranges. This may be important when making comparisons between different sedation regimens, titrating sedative medications and possibly the length of stay in ICU.

### Reference

1. Wesley E, Ely et al. Monitoring Sedation Status Over Time in ICU Patients Reliability and Validity of the Richmond Agitation-Sedation Scale (RASS) JAMA : 2003 : 289 : 2983-2991.

## Were all measures taken to prevent blood transfusion on bypass?

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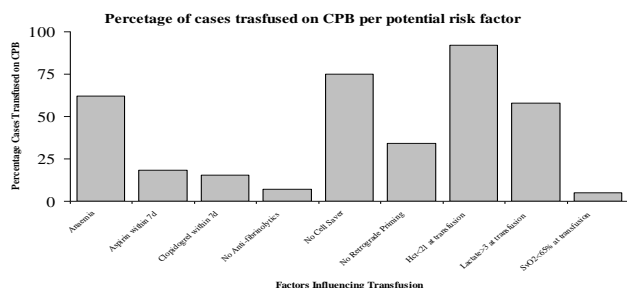
The transfusion of red blood cells during cardiopulmonary bypass (CPB) for coronary artery grafting has been shown to double the likelihood of low output cardiac failure postoperatively (defined as requiring 2+ inotropes or an intra-aortic balloon pump at 48 hrs post op) [1]. Strategies have been described to minimise requirement for blood transfusion on CPB based on several possible causative factors [2]. This study investigates all cases in our establishment throughout 2007 in which a blood transfusion on bypass was required, and asks whether all measures possible were taken to prevent transfusion.

### Methods

Cases were identified from cardiac and perfusion databases. Several non-modifiable factors such as age, female gender, low body surface area and high co-morbidity were not further analysed. We identified whether available strategies to minimise transfusion were being implemented. These included pre-operative recognition of anaemia (Haematocrit (Hct), Male <39%, Female <36%), withdrawal of anti-platelet therapy for a minimum of 7 days. Intra-operative use of anti-fibrinolytic therapy, cell saver, retrograde priming of CPB circuit, and an appropriate blood transfusion trigger (Hct<21%, SvO<sub>2</sub><65%, Lactate>3 mmol/L) were also analysed.

### Results

71 of 928 cases were transfused on CPB in 2007. The percentages of these cases with the possible risk factors are graphically displayed below.



### Discussion

Transfusion on CPB increases incidence of low output cardiac failure [1]. It would appear that most transfusions in this series were triggered by a low haematocrit and high lactate. Preoperative anaemia and low utilization of cell saving equipment may be implicated in the requirement for blood transfusion on CPB in this population. Further investigation is required.

### References

- 1 Surgenor S, Defoe G, Fillinger M, *et al.* Intraoperative red cell transfusion during coronary artery bypass graft surgery increases the risk of postoperative low-output heart failure. *Circulation* 2006; **114**: 1-43-48
- 2 Ferraris V, Spiess B, *et al.* Perioperative blood transfusion and blood conservation in cardiac surgery: The Society of Thoracic Surgeons and The Society of Cardiovascular Anesthesiologists Clinical Practice Guideline. *Ann Thoracic Surg* 2007; **83**: S27-86

## **A simple measure to reduce the incidence of Heparin Induced Thrombocytopenia (HIT) in cardiac intensive care patients – a retrospective observational analysis**

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### **Method**

An observed difference in the incidence of HIT on cardiac ICU prompted a retrospective search of cardiac intensive care HIT positive patients. All patients with a diagnosis of HIT who tested antibody positive on an enzyme linked immunosorbent assay (ELISA) for the HIT antibody between 30 January 2006 and 22 March 2007 were identified (group 1). Patients who were HIT+ve between 23 March 2007 and 23 March 2008 (group 2) were also identified following the removal of heparin from pressure transducer flush. The numbers were compared to see if the observed difference was statistically significant.

### **Results**

21 out of the 884 patients identified in group 1 were HIT antibody +ve on an ELISA for the HIT antibody (HPIA). 8 out of the 802 patients in group 2 were HPIA +ve. This occurred following removal of heparin from pressure transducer flush systems in both theatres and cardiac ICU. It is statistically significant with a  $P < 0.03$  using a Chi squared test. Eleven patients out of the twenty nine, from both groups, who were HPIA+ve died before leaving hospital

### **Discussion**

HIT is an immune mediated drug reaction associated with heparin administration, leading to a reduced platelet count. It is life threatening resulting in arterial and venous thromboses. HIT should be considered if the platelet count falls by 50% or more or falls below the laboratory normal range[1]. HIT incidence in the general population is around 3%. The pathophysiology involves development of IgG antibodies that recognize the platelet factor 4/heparin complex. These antibodies bind complexes resulting in platelet aggregation and thrombus formation.

The incidence of HIT on our cardiac unit was 2.6% prior to March 2007 in line with the national incidence. In the year following the removal of heparin from pressure transducer flush systems, our HIT incidence fell to 1%. This action along with use of the British Society of Haematology guidelines 2006[1] for estimation of pretest probability (the 4 Ts) happened simultaneously and both may have contributed to the decreased recorded HIT+ve incidence. Reducing HIT not only prevents this life and limb threatening complication but has simple cost advantages by using saline only flush systems (500ml saline £0.40 vs 500ml heparinised saline £3.88) and potentially reduces the number of long stay cardiac intensive care patients with a less easily quantified cost saving[2].

### **Acknowledgements**

Department of Haematology, University Hospital of Wales  
Dr. Judith Hall, Head of Academic Dept, Dept Anaesthesia, UHW

### **References**

- 1 Keeling D, et al *The management of heparin induced thrombocytopenia British Society of Haematology* 2006; **133** 259-269
- 2 Gettings E M et al *Outcome of post op critically ill patients with HIT Critical Care* 2006; **10**

## **Survival outcomes from cardiac surgery in patients aged eighty and over**

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### **Methods**

Data were extracted from the Patient Analysis and Tracking system (PATS) used at Bristol Royal Infirmary Cardiac Surgical Unit between April 1996 and April 2007. Minimum duration for follow up was 2 years.

### **Results**

Of 10,548 cardiac surgical operations, 273 (2.6%) were carried out in patients aged 80 years or older (mean 82.0 years), prior to April 1<sup>st</sup> 2005. 141 (51.6%) had elective surgery, 109 patients (39.9%) underwent coronary artery bypass grafting, 89 patients (32.6%) underwent valve replacement only and 75 patients (27.5%) underwent other or combined procedures.

In hospital mortality for patients aged eighty and over for coronary artery bypass grafting was 1.8%, for valve surgery 11.2% and combined procedures 13.3%.

Actuarial survival, irrespective of procedure, for patients aged eighty and over was 92.3% compared to 97.3% for the rest of the adult dataset at 30 days, 88.6% compared to 95.8% at 6 months, 87.5% compared to 95.1% at 1 year and 82.4% compared to 93.4% at 2 years.

### **Discussion**

Previous studies have shown that elderly patients can regain an adequate quality of life and become physically autonomous again after cardiac surgery [1]. The present study shows that for patients aged eighty years and over there is a higher perioperative risk only for certain cardiac surgical procedures. When compared to younger patient groups the mortality in the patients aged eighty and over is greater at 30 days, 6 months, 1 year and 2 years.

### **References**

- 1 Chocron S, Rude N, Dussaucy A, Lepledge A, Clement F, Alwan K, Viel J-F, Etievent J-P. Quality of Life after Open-heart Surgery in Patients over 75 Years Old. *Age and Ageing* 1996; **25**: 8-11.

## **Use and diagnostic value of intraoperative transoesophageal echocardiography in cardiac surgery**

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Transoesophageal echocardiography (TOE) is well established in the armamentarium of cardiac anaesthesia. Despite its popularity and guidelines, the utility and impact of TOE on peri-operative management remain to be clarified.

### **Methods**

We prospectively collected data from 109 consecutive patients undergoing cardiac surgery in our institution and investigated whether TOE was being performed in accordance with contemporary best practice guidelines and assessed the impact of examination findings on intraoperative surgical and anaesthetic decision making.

### **Results**

Complete TOE examinations were performed in 69 patients (63%). All patients with a category I indication [1] and half of patients with category II underwent assessment. TOE was not used in remaining 39 patients undergoing isolated first-time surgical revascularisation and 1 patient having aortic valve replacement in whom the supervising anaesthetist did not consider it necessary. Where TOE was performed, previously undiagnosed findings were detected in 13 patients (19%). Anaesthetic management was influenced in 33 patients (48%), equally distributed between category I and II indications and prompted adjustments to drug strategy and fluid therapy. Surgical strategy was influenced in 9 patients (13%), 8 of whom had category I indications.

### **Discussion**

Intraoperative TOE is being used appropriately in our unit. Findings influenced anaesthetic and surgical decision-making in 48% and 13% of patients respectively. This was of most value in weaning patients with impaired left ventricular function from cardiopulmonary bypass and assessing valvular anatomy and function following surgical repair.

### **References**

1 Cheitlin MD, Armstrong WF, Aurigemma GP et al. *ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines* Circulation 2003 Sep 2;108(9):1146-62

## Haemofiltration practices on a cardiac surgical intensive care unit

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### Introduction

Acute renal failure is a well recognised complication of cardiac surgery<sup>1</sup>. Continuous haemofiltration is a highly effective system for replacement of renal function and early and intense treatment is associated with improved outcome.<sup>2</sup> It is recommended that the dose of ultrafiltration is prescribed according to patient bodyweight and should be at least 35 mL h<sup>-1</sup> kg<sup>-1</sup>.<sup>3</sup> Adequacy of renal replacement therapy can be assessed using Kt/V,<sup>4</sup> a dimensionless ratio, that can be thought of as a multiple of the volume of plasma cleared of urea divided by its volume of distribution. A Kt/V of 1.2 should be regarded as the minimum dose to be delivered.<sup>5</sup> We audited our practice to determine whether these targets were being met.

### Method

We retrospectively reviewed the notes of all patients that underwent cardiac surgery at our institution between March and June 2007 and identified those that required post-operative renal replacement therapy. The ideal dose of haemofiltration was calculated using patient weight based on the recommended 35 mL h<sup>-1</sup> kg and the prescribed dose was established from prescription charts and standard machine settings. The actual dose of haemofiltration delivered was determined from nursing observation charts. Ideal, prescribed and delivered Kt/V was calculated using the formula  $[1440 \times (\text{ideal exchange rate}/60)]/[1000 \times (\text{body weight} \times 0.58)]$ .

### Results

Over this three month period 20 patients required renal replacement therapy; 14 male and 6 female with mean age of 67 years. The average pre-operative creatinine was 135 and one patient had pre-existing end stage renal failure. Patients on average required haemofiltration for 3.8 days and mean ITU and hospital stay were 5.6 and 9.2 days respectively. In 8 patients it was possible to calculate the mean time from decision to undertake haemofiltration to its commencement as 187 minutes (range 45 to 540 minutes). Mean weight was 75 kg hence the ideal exchange rate, based on a rate of 35 mL h<sup>-1</sup> kg<sup>-1</sup> was 2625 mL h<sup>-1</sup>. None of the 20 patients had haemofiltration individually prescribed to them based on their weight. All were dialysed using a standard regimen of 2000mL hourly exchanges, giving a mean dose of 26.7 mL h<sup>-1</sup> kg<sup>-1</sup>. The dose of haemofiltration actually delivered could only be calculated in 15 out of 20 patients because of lack of documentation. However on day 1 patients received haemofiltration for two thirds of available hours resulting in a delivered dose of 16 mL h<sup>-1</sup> kg<sup>-1</sup>. On day 2 patients on average received 21 hours of haemofiltration resulting in a delivered dose of 23.4 mL h<sup>-1</sup> kg<sup>-1</sup> and on day 3 16.5 hours hence a delivered dose of 18.4 mL h<sup>-1</sup> kg<sup>-1</sup>. On day 1 the ideal, prescribed and delivered Kt/V's were 1.4, 1.1 and 1.04 respectively, on day 2 1.36, 1.06 and 0.88 and on day 3 1.35, 1.05 and 0.67.

### Discussion

This study demonstrates that failure to prescribe renal replacement therapy on an individual basis together with periods spent not being haemofiltered lead to patients receiving a dose less than the recommended 35 mL h<sup>-1</sup> kg<sup>-1</sup>. One reason for this is that our standard regimen is sufficient only for patients weighing less than 65kg. Other reasons include interruption of haemofiltration as a result of difficulties with venous access, coagulation of the filter and requirement for investigations and treatment. Consequently, the mean Kt/V we attained was less than the recommended 1.2, indicating an inadequacy of renal replacement therapy. We plan to repeat this audit following implementation of guidelines to improve prescription and documentation of haemofiltration and determine whether this improves practice and outcome.

### References

- 1 Endre ZH. Post cardiac surgical acute renal failure in the 1990s. *Aust NZ J Med.* 1995;25:278–2
- 2 Bent P, Tan HK, Bellomo R, Buckmaster J, Doolan L, Hart G, Silvester W, Gutteridge G, Matalanis G, Raman J, Rosalion A, Buxton BF. Early and intensive continuous haemofiltration for severe renal failure after cardiac surgery. *Ann Thorac Surg.* 2001;71:832–837
- 3 [Ronco C, Bellomo R, Homel P, Brendolan A, Dan M, Piccinni P, La Greca G](#) *Lancet.* 2000 Jul 1;356(9223):26-30.
- 4 Gotch FA, Sargent JA. A mechanistic analysis of the National Cooperative Dialysis Study (NCDS) *Kidney Int.* 1985;28(3):526-34.
- 5 Renal Association Clinical Practice Guidelines, 2006 Update.

## **Experience of Percutaneous Aortic Valve Replacement at King's College Hospital, London**

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Many patients with severe symptomatic aortic stenosis have multiple co-morbidities, making them high-risk candidates for surgical valve replacement. Medical management is poor and restenosis inevitable with balloon valvuloplasty. We report on our early experience with 25 patients in a European multicentre, nonrandomised trial of transapical and retrograde transfemoral percutaneous catheter based valve replacements.

### *Methods*

Patients with symptomatic aortic stenosis unfit for conventional surgery were selected using EUROSCORE and Society of Thoracic Surgeons risk calculator scores. Those with aorto-femoral disease were allocated to the transapical group. Procedures were performed by a team of cardiothoracic surgeons, cardiologists and anaesthetists. A cardiopulmonary bypass circuit was on site for emergency use. Anaesthetic management for both groups was a general anaesthetic with sevoflurane and remifentanyl with a single lumen endotracheal tube. All patients had central, arterial and pulmonary artery pressure monitoring. Target blood pressure was maintained with IV fluid and vasopressors. Temporary rapid pacing reduced cardiac motion and blood flow across the valve during prosthesis deployment. The balloon-mounted valve was positioned with a guiding catheter within the aortic annulus using fluoroscopy, aortography and transoesophageal echo images. Ventilation was temporarily discontinued for valve deployment. Activated clotting time was maintained >250s. Patients were extubated post procedure in cardiothoracic recovery.

### *Results*

To date, 17 patients have undergone transapical and 8 patients transfemoral valve placement. Two patients needed defibrillation. One patient required emergency surgery on bypass. There were 3 access complications and one patient required a significant operative transfusion (>3units). No perioperative strokes or myocardial infarctions occurred. In a group of elderly patients, with significant medical co-morbidities there were no direct anaesthetic complications.

### **Discussion**

Significant potential advantages of one technique over the other may become apparent with greater numbers. In both groups there is a trend towards shorter procedure times and reduced time to extubation. We are currently unable to publish details on short-term outcome and 30 day mortality as the trial is ongoing.

### **References**

1. Webb JG, *et al.* Percutaneous Aortic Valve Implantation Retrograde From the Femoral Artery. *Circulation.* 2006; 113:842-850
2. Walther T, *et al.* Transapical Minimally Invasive Aortic Valve Implantation. *Circulation.* 2007;116:I-240 – I-245

## **Staged surgical management of hypoplastic left heart syndrome: Outcome from a single institution 1996-2008**

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Hypoplastic Left Heart Syndrome (HLHS) is a constellation of anatomical abnormalities involving some or all of the structures between the left atrium and upper descending aorta, with the key features being underdevelopment or atresia. Without surgery 95% of patients with HLHS die in the neonatal period, and there is no long term survival. Palliation of HLHS usually involves a 3-stage process, typified by the Norwood (Stage I), then bi-directional Glenn shunt (Stage II) followed by completion Fontan (Stage III) procedures.

### **Methods**

We have maintained a database of all patients operated on between the start of our HLHS program in April 1996 through until April 2008. The results presented here come from chart review of all patients who had operative repair for a primary diagnosis of HLHS during this time.

### **Results**

During the 144 months of the program 43 patients underwent a modified Norwood procedure (Stage I) for HLHS at a median age of 6 days (range 2-38 days). There were 40 right modified Blaulock-Taussig shunts and 3 right ventricle to pulmonary artery (Sano modification) shunts performed. 22 of these infants are still alive (overall survival 51%) with a median period of survival of 6.1 years (range 1.7 – 11.3 years). 32 infants were alive at 30 days of age (74%), giving an early mortality of 26%. There were 6 deaths beyond 30 days but prior to Stage II palliation; survival to Stage II was 60%.

26 patients underwent Stage II palliation at a median age of 4.7 months (range 18 days – 16.3 months). 4 of these patients died (2 within 30 days), giving a second stage survival of 85%.

13 patients have undergone Stage III at a median age of 4.3 years (range 3.0 – 7.7 years). All 13 have survived, giving a third stage survival of 100%. There is an intention to treat the 9 remaining patients who are at the second to third interstage.

No patients have undergone orthotopic heart transplantation.

### **Discussion**

We believe that our data represents a success in the management of infants with this very challenging lesion over the last 12 years. Survival rates at our institution are comparable to contemporaneous studies, including much larger series [1]. Lessons learned in the peri-operative management of HLHS have been applicable to other aspects of paediatric cardiac care, and strengthened our unit as a result.

### **References**

1 McGuirk SP, Griselli M, Stumper OF, et al. Staged surgical management of hypoplastic left heart syndrome: a single institution 12 year experience. *Heart* 2006; **92**: 364-370.

## Re- survey of Neuraxial Analgesia in Adult Cardiac Surgery in the United Kingdom

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Neuraxial anaesthesia (NA), both thoracic epidural (TEA) and Spinal Anaesthesia (SA) has been used in cardiac surgery for over 15 years and can facilitate early extubation and provide superior analgesia<sup>[1]</sup>. We previously conducted a postal survey of current practice of NA in patients undergoing cardiac surgery in the United Kingdom in 2001. Since that time randomised controlled trials have demonstrated that TEA has multiple benefits including a reduction in arrhythmias and improvement in pulmonary function<sup>[2]</sup>. Conversely the first case reports of cardiac surgery associated epidural haematoma have been published<sup>[3]</sup>. We undertook a resurvey in 2006 to assess whether there had been a change in practice.

### Methods

UK Consultant cardiac anaesthetists were identified from the ACTA database and confirmed with all institutions conducting cardiac surgery. A questionnaire regarding practice was sent to them. Non responders were followed up by directly by telephone either with the consultant or the unit. Data were analysed using Microsoft Excel<sup>TM</sup>.

### Results

A total of 348 Consultants were identified of which 251 responded (72% response rate). 41 (16%) of the respondents practice regional analgesia at least occasionally for cardiac surgery. This has increased from 27 of the 280 anaesthetists. Four respondents reported knowledge of complications related to spinal or epidural analgesia in cardiac surgery. Two of these were total spinal anaesthesia and two were continuing radiculopathy. There were no reported epidural haematomas. None of the respondents in our previous survey had reported personal experience or knowledge of complications. The survey explored the management of bleeding at the insertion site. 56% (n=19) of respondents would postpone surgery if blood was obtained down the epidural needle. This is similar to our previous survey where over 60% would postpone surgery if blood was obtained down the epidural needle.

### Conclusion

No epidural haematomas were reported in our survey; the risk of haematoma formation in patients requiring systemic heparinisation has yet to be quantified and may be as high as 1: 2400<sup>[4]</sup>. We have shown a small increase in the number of Consultant cardiac anaesthetists who perform NA since our original survey in 2001 – from 27 to 41. This suggests that their benefits for both low risk<sup>[2]</sup> and selected patients(eg obesity) are available to more patients. A UK or Europe-wide register may be useful in assessing the technique more comprehensively.

1. Chaney M. *Intrathecal and Epidural Anaesthesia and Analgesia in Cardiac Surgery* *Anesth Analg* 2006;**102**:45-64
2. Scott NB, Turfrey DJ, Ray DA, et al *A prospective randomized study of the potential benefits of thoracic epidural anesthesia and analgesia in patients undergoing coronary artery bypass grafting* *Anesth. Analg.* 2001;**93**:528-35.
3. Rosen D, Hawkinbery D, Rosen R et al. *An Epidural Haematoma in an adolescent after Cardiac Surgery.* *Anesth Analg* 2004;**98**:966-9
4. Hemmerling T, Carli F. Editorial II: *Thoracic epidural anesthesia for cardiac surgery : are we missing point?* *British Journal of Anaesthesia* 2008;**100** (1): 3-5.

## Temporary epicardial pacing wire usage in Off-Pump Coronary Artery Bypass (OPCAB) surgery

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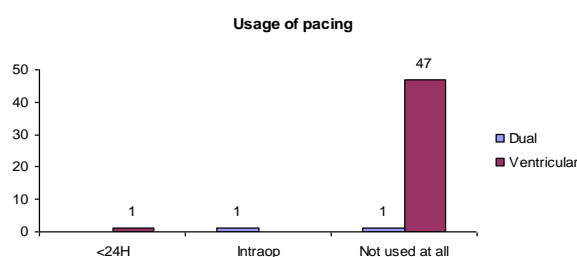
Temporary epicardial pacing wires are commonly used in cardiac surgery. In many centres prophylactic epicardial pacing wires are routinely inserted in all patients. Complications although rare, can be serious including bleeding, tamponade, arrhythmias, injury to grafts, etc. It has been suggested that OPCAB may be associated with a reduced requirement for pacing and routine insertion of pacing wire is unnecessary [1].

### Methods

Data was collected prospectively from fifty patients who underwent OPCAB surgery. Patient's age, preoperative rhythm, type of pacing wires (single or dual chamber) and usage, indication of use, delay in removal of pacing wires and any complications were recorded.

### Results

Of the 50 patients, 48 had single chamber (ventricular) wires and 2 had dual chamber pacing wires. In all but one, the epicardial pacing wires were inserted prophylactically after completion of the grafts. In one of them dual chamber pacing wires were inserted and used intraoperatively for sinus bradycardia.



Removal of pacing wires (if not required) after 3 days is our normal practice. After this it was considered as delayed removal. In 10 patients there was at least 24 hours delay (48 hours in 3 and 72 hours in 1) in removal. There were no complications at removal in any except one wherein the pacing wire snapped and tip was left behind.

### Discussion

Temporary epicardial pacing wire insertion in cardiac surgery is a common practice at the University Hospital of Wales. Because of the higher risk of rhythm disturbances following valvular heart surgery it is commonly used in all such patients. After this observational study however, in patients with no risk factors for rhythm disturbances who are undergoing OPCAB surgery, we have stopped routine insertion of pacing wires in every patient. This will be re-audited in future.

### References

1. Puskas JD et al. Is routine use of temporary epicardial pacing wires necessary after either OPCAB or conventional CABG/CPB? *Heart Surgery Forum* 2003; 6:E103–E106

## Usefulness of routine lung function tests prior to cardiac surgery

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Pulmonary dysfunction is a common postoperative complication following cardiac surgery. To identify patients at increased risk of developing postoperative pulmonary complications our department has been routinely performing limited lung function tests on all patients undergoing cardiac surgery. This involved spirometry assessment of forced expiratory volume in one second (FEV<sub>1</sub>), forced vital capacity (FVC) and peak expiratory flow rate (PEFR). This practice was reviewed to determine its usefulness in predicting post operative pulmonary dysfunction.

### Method

Over a period of six months data was prospectively collected from 68 consecutive patients undergoing coronary artery bypass grafts with or without valvular surgery. Data collected included demographics, preoperative operative and postoperative blood gases, CPB time, extubation time and duration of ITU stay. All patients were prospectively followed up during their hospital stay.

### Results

Of the 68 patients, 14 (Group A) required continuous positive airway pressure (CPAP) in the postoperative period and the rest (Group B) did not require any respiratory support after extubation.

Values are median [interquartile range]

### Discussion

	Group (n=14)	A	Group (n=54)	B	p
Age (years)	66 [61-73]		65 [58-71]		0.52
Preop Hb (g/dl)	13.5 14.1	[13.3-	13.7 14.3]	[13.2-	0.81
BMI (kg/m <sup>2</sup> )	26 [22-34]		26 [23-29]		0.64
Hx of lung dis. %	0		10		0.71
Smokers %	57		83		0.08
FEV <sub>1</sub> (L/s)	2.18 2.78]	[1.76-	2.42 3.0]	[1.85-	0.49
%FEV <sub>1</sub> pred	80 [71-99]		83 [64-97]		0.95
FVC (L)	3.05 3.83]	[2.35-	2.88 3.42]	[2.26-	0.69
% FVC pred	86 [76-91]		79 [68-95]		0.35
CPB time (min)	123 [98-151]		111 [89-151]		0.49
Ext. time (hours)	15 [7-21]		7 [6-13]		0.02
ITU days	1 [1-2.5]		1 [1-1]		0.03

The value of routine lung function tests before cardiac surgery has been looked before [1]. Most of the cardiac patients have pulmonary impairment secondary to cardiac disease and one of the major determinants of post operative respiratory dysfunction in this group of patients is poor cardiac function. Our audit showed that there is no benefit in routine preoperative lung function tests in all cardiac surgical patients. We have introduced a preoperative screening tool to risk stratify patients undergoing cardiac surgery and the usefulness of this tool will be tested in future.

### Reference

1. Bando K, Sun K, Binford RS, et al. Determinations of long duration of endotracheal intubation after cardiac operations. *Ann Thorac Surg* 1997; **63**:

## TOE in off-pump apicoaortic conduit surgery

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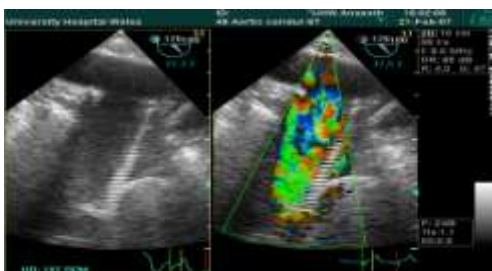
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Placement of a valved apicoaortic conduit (AAC) between left ventricular apex and descending aorta through a lateral thoracotomy has been reported as an alternative to redo sternotomy in patients with aortic stenosis (AS) and previous cardiac surgery<sup>1</sup>. We report two such cases and the the important role of transoesophageal echo (TOE) in this procedure.

### Cases

A 48 year old male with history of two previous cardiac surgeries presented with severe AS. Significant coronary artery disease precluded conventional myocardial preservation using cardioplegia and an apico-aortic conduit was placed on a beating heart through a left lateral thoracotomy. Femoral vein and artery were cannulated as a standby to proceed onto cardiopulmonary bypass in an emergency. TOE guided placement of venous cannula. TOE also aided in the correct placement of the ventricular and descending aortic components of the conduit and also demonstrated adequate flow through the conduit on completion of the procedure. The second patient was a 81 year old male who had a previous CABG and presented with severe AS. A sternotomy was deemed risky due to the substernal location of the previous grafts on imaging. The patient underwent placement of an AAC and TOE was again used to similar effects in this case.

**Figure 1** TOE images showing apico-aortic conduit



### Discussion

TOE is reported to influence surgical decision making in 7% cases<sup>2</sup>. AAC placement is a technically demanding procedure where TOE can aid the surgeon in the correct placement of the ventricular component directed away from the septum and the aortic component in an atheroma free area of the descending aorta. Demonstration of adequate flow across the AAC using Colour flow Doppler reassures the surgeon about the functionality of the conduit and helps ensure an optimal outcome for the patient.

### References

- 1 Vassiliades TA. Off-pump apicoaortic conduit insertion for high- risk patients with aortic stenosis. *European Journal of Cardiothoracic Surgery* 2003; **23**: 156-158
- 2 Eltzschig HK, Rosenberger P, Loffler M, Fox JA, Aranki SF and Shernan SK. Impact of Intraoperative Transesophageal Echocardiography on Surgical Decisions in 12,566 patients undergoing cardiac surgery. *The Annals of Thoracic Surgery* 2008; **85**: 845-852

## **Modified thromboelastography and perioperative blood transfusion for coronary artery bypass surgery following recent aspirin and clopidogrel: an observational study**

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Aspirin and clopidogrel therapy confers protection against myocardial infarction [1], but increases perioperative bleeding in surgical patients. PlateletMapping TEG can be used to monitor therapy [2] and has been suggested as a predictor of postoperative bleeding.

### **Methods**

Patients presenting for coronary artery bypass surgery (CABG) with a history of recent aspirin or clopidogrel were included. Platelet responsiveness to adenosine diphosphate (ADP) and arachidonic acid (AA) was measured by modified TEG maximum amplitude (MA) at induction of anaesthesia. Platelet inhibition by either drug was calculated by comparison with standard TEG MA(%). Blood product transfusion and chest drain loss in the first 24 hours was recorded. Red cell transfusion was given to maintain a haemoglobin of 8.0g/dl, platelets were transfused according to clinical discretion.

### **Results**

18 patients on recent aspirin and 13 patients on recent aspirin and clopidogrel were included. Mean 24 hour drain loss was 693mls (range 200-1780mls). Mean blood product transfusion was 2.47 units (range 0-9 units). Transfusion requirement decreased with decreased platelet inhibition to ADP. Transfusion rate was poorly related to inhibition due to aspirin. Chest drain loss was unrelated to inhibition due to either drug. Recovery of platelet responsiveness following cessation of either drug was highly variable between patients. Those who had omitted antiplatelet therapy for three days showed a range of inhibition from 49.8-92.0% to ADP activation and 38.5-79.0% to AA activation.

### **Discussion**

Due to the many factors that contribute to bleeding following cardiac surgery, transfusion is difficult to predict from preoperative platelet function alone. However, transfusion appears less likely following CABG when platelet inhibition due to APD antagonists has recovered after cessation of clopidogrel. In contrast, platelet recovery after cessation of aspirin did not appear to predict bleeding or transfusion requirement. The variable platelet function seen in the first week after cessation of both drugs may reflect differences in recovery, drug responsiveness or innate platelet function. Larger studies are needed to establish whether modified TEG can be used to predict or guide transfusion in the context of recent antiplatelet therapy.

### **References**

1. Bliden KP, DiChiara J, Tantry US et al. *Increased risk in patients with high platelet aggregation receiving chronic clopidogrel therapy undergoing percutaneous coronary intervention: is the current antiplatelet therapy adequate?* J Am Coll Cardiol. 2007 Feb13;**49**(6):657-66.
2. Agarwal S, Coakley M, Reddy K et al. *Quantifying the effect of antiplatelet therapy: a comparison of the platelet function analyser (PFA-100) and modified Thromboelastography (mTEG) with light transmission platelet aggregometry.* Anesthesiology 2006 Oct;**105**(4):676-83.

# Quality and outcome data from a point of care database for an intraoperative echocardiography service for mitral valve repair

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## Methods

When we set up our intra-operative transoesophageal echocardiography (IOTOE) service, we also created a point of care database to assess the quality of our studies and to enable study of its utility in relation to cardiac surgical outcomes. To this effect we identified the first 50 patients on the database undergoing planned mitral valve repair. We then retrieved all available pre-operative, intra-operative and post-operative echocardiography data.

## Results

Seven patient datasets were rejected due to inadequate information leaving 43 datasets to analyse. Pre-operative studies (cardiology echo lab): 31 (72%) assigned a grade and 25 (58%) assigned a mechanism of mitral regurgitation (MR). Pre-bypass studies (IOTOE): 38 (88%) assigned a grade and 42 (98%) assigned a mechanism of MR. Comparison: 27 datasets (63%) were available where a grade and 25 (58%) a mechanism were assigned both from the echolab and IOTOE; 22 (81%) of these studies were in agreement on the grade and 19 (76%) were in agreement on the mechanism. 40 (93%) post bypass studies (IOTOE), 39 (88%) post-operative studies and 23 (53%) late post-operative studies assigned a grade of MR. 34 (79%) patient datasets were assigned a grade of MR in both the post-bypass and post-operative studies – of these 100% were in agreement. 23 (53%) of late post operative patients were available with an MR grade, only 1 study differed from post-bypass. This study was graded as mild MR post-bypass but graded severe at late post-operative follow up.

Regarding surgical outcome, 47 mitral valve repairs were planned and all of which were successfully achieved without need for prosthetic replacement. The mitral regurgitation was by a variety of mechanisms and a variety of repair techniques were used. One patient needed an annuloplasty revision during the same theatre session due to systolic anterior motion. A number of additional procedures were performed at the time as shown in table 1.

**Table 1**

14	Coronary artery bypass
5	Aortic valve replacement
4	Tricuspid valve replacement
2	Atrial septal defect repair
1	Myectomy

## Discussion

IOTOE was more efficient at assigning a grade and had a much better utility at assigning a mechanism to MR. We further conclude that the convergence of IOTOE with pre and post operative studies validates the accuracy and utility of our IOTOE service.

## Acknowledgement

Mr Graham Leech for assistance with database design

## References

1 Gillinov AM, Cosgrove DM, Blackstone EH et al. Durability of mitral valve repair for degenerative disease. *J Thorac Cardiovasc Surg* 1998; **116**: 734-43

## **Endovascular Stenting of Disease of the Descending Thoracic Aorta. Is the Promise Fulfilled and Anaesthetic Management**

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Lesions of the thoracic descending aorta have a high mortality and morbidity if treated with open surgery. Interventional endovascular stenting is associated with lower mortality and morbidity [2] and has become standard treatment for suitable patients in our institution. There may be particular anaesthetic issues for this patients.[1]

### **Methods**

The case notes of the first 33 patients undergoing thoracic aortic stenting at the Bristol Royal Infirmary(BRI), performed from 2002-2008 were reviewed.

### **Results**

Of the 33 patients the diagnoses were 11 dissections, 10 aneurysms, 2 false aneurysms, 7 aortic traumas and 3 others. General anaesthesia was performed in all cases. At the time of stent deployment no specific hypotensive interventions were required. Of the two major intraoperative complications there were one fatal aortic rupture and one intrapulmonary bleed from an aortobronchial fistula. 14 patients were extubated immediately following the procedure. The median ICU and hospital stay were 2 days (1 to 29 days) and 7 days (1 to 30 days), respectively. Four patients died in hospital. The reported mortality to date was 27% (9 of 33) patients.

### **Discussion**

Our experience indicates that survival is better than conventional management, but the mortality is still high. Cost savings from decreased length of stay are offset by stent cost at \$10K each. No specific hypotensive techniques at stent deployment were required.

### **References**

[1] Baril DT, Kahn RA, Ellozy SH, Carroccio A, Marin ML. *Endovascular Abdominal Aortic Aneurysm Repair: Emerging Developments and Anaesthetic Considerations* Journal of Cardiothoracic and Vascular Anaesthesia 2007 **21(5)**: 730-42

[2] Swee W, Dake MD. *Endovascular Management of Endovascular Dissections* Circulation 2008 **117**: 1460-73

## The use of the Confusion Assessment Method (CAM-ICU) to assess delirium in post-operative cardiac surgery patients

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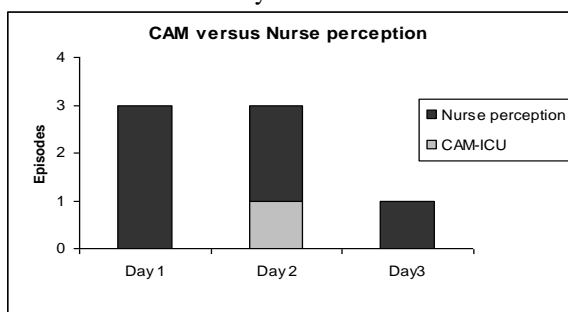
Delirium in intensive care patients has been shown to prolong duration of mechanical ventilation and is associated with an increased mortality [1]. The CAM-ICU has been developed and validated as a simple bedside screening tool for delirium in the general intensive care (ICU) population. Delirium equates to a positive CAM-ICU score, and this can be subdivided into the hypermanic variant which describes the agitated, aggressive patient, and the hypomanic variant that is calm, but still incapable of organised mental thought. The latter subtype often goes unrecognised, but has a similarly worse prognosis. Cardiac surgical patients have a high incidence of post operative delirium. This audit aims to assess the utility of the CAM-ICU in post-operative cardiac surgery patients in our ICU patients.

### Methods

We prospectively collected data from patients undergoing cardiac surgery in our unit. They were screened for delirium using the CAM-ICU for 3 days post-operatively. CAM-ICU scores were documented, and if positive it was noted whether the patient was hyper- or hypomanic. The nursing assessment of patient mental state was also recorded.

### Results

We surveyed 28 patients of whom 3 were excluded because their poor understanding of English prevented accurate evaluation. Of the remaining 25 patients, 5 (20%) had a positive CAM-ICU score at some point during the assessment period. Of the 5 patients who had a positive score, only 1 was correctly identified as confused by the nurse at the bedside.



### Discussion

This study shows that the CAM-ICU score can be used to screen for delirium in cardiac surgery ICU patients. The CAM-ICU tool picked up four additional confused patients that would have been otherwise missed. All were hypomanic, and although not as easy to detect as the hypermanic group, still have worse outcomes. We intend to introduce this simple tool to increase detection of delirium with a view to facilitating early and appropriate treatment.

### References

1 Ely EW, Shintani A, Truman B et al. Delirium as a predictor of mortality in mechanically ventilated patients in the intensive care unit. JAMA 2004; **14**:1753-1762

## **Audit Of Fast-Track Cardiac Surgery At St George's Hospital**

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Fast-track (FT) cardiac surgery has proven to be safe and cost effective and has already been adopted in many centres [1]. We undertook an audit on FT cardiac surgery at St George's Hospital (SGH) to establish the safety of our current service and to review the reasons for patients failing FT in order to optimise our system which ultimately reduces cancellations due to lack of Cardio-Thoracic Intensive Care Unit (CTICU) beds.

### **Methods:**

This audit was a review of patients' charts for a period from January to August 2007. Our definition of FT is extubation in the recovery area 2-4 hours post surgery and transfer to 1:2 nursing care on the same day with avoidance of CTICU admission. Inclusion criteria for FT are: Euroscore < 9, age < 75 years, first-time operation, the type of operation: coronary artery bypass graft (CABG), atrial septum defect closure, aortic valve replacement (AVR) with or without CABG and minimally invasive direct coronary artery bypass, body mass index (BMI) < 30, creatinine < 150 mmol/l, ejection fraction > 40%, no recent myocardial infarction (MI) and normal lung function. Potential FT patients are identified by recovery staff and suitability confirmed with an anaesthetist. FT charts are completed by nursing staff in the recovery area.

### **Results:**

176 patients were entered into the FT pathway in the 8 months period. 130 out of 176 patients (74%) were successfully FT. Failed FT included 35 out of 138 CABGs (21%), 8 out of 33 AVRs (32%) and 2 out of 7 AVR & CABGs (40%). Reasons for failure were: inability to extubate 2 hours before transfer to the ward and pain (14 patients, 30%), bleeding (8 patients, 17%) and lack of FT nurses or beds (8 patients, 17%). 19 patients were attempted for FT despite not fitting FT criteria due to increased age, increased BMI, recent MI and impaired ventricular function. 12 of these patients (63%) were successfully FT. None of the FT patients discharged from recovery to the ward required admission to CTICU.

### *Discussion*

FT is safely undertaken at SGH. However there was a considerable number of patients (26%) who failed to FT. Failure to FT appears to be associated with type of surgery. CABGs had the lowest rate of failed FT, followed by AVR and CABG & AVR. Our charts were not indicative of differences between on and off pump CABGs. In order to reduce FT failure, providing more effective analgesia, shorter time to extubation and better haemostasis should be considered. The failure rate could be further reduced if sufficient FT nurses and beds were available. This audit also showed that 2/3 of patients not meeting our FT criteria were successfully fast tracked. Therefore our local FT criteria could be reviewed and broadened.

### *References*

Cheng DC. Fast-track cardiac surgery: economic implications in postoperative care. *J Cardiothorac Vasc Anesth* 1998 ; **12**:72-9.

# Is the routine use of mechanical cell salvage for off-pump coronary artery bypass graft (CABG) surgery clinically valuable?

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The value of mechanical red cell salvage for conventional on-pump coronary artery bypass grafting (CABG) surgery to reduce blood loss and transfusion is well established.[1] However, cell salvage may not be as clinically valuable in off-pump CABG (OPCAB) surgery as it is associated with lower peri-operative blood loss and transfusion compared to on-pump CABG. The aim of this audit was to compare the transfusion outcomes of patients undergoing on-pump CABG and OPCAB in our unit.

## Methods

We performed a prospective observational study of all patients who underwent elective on- and off-pump CABG surgery from 10<sup>th</sup> March to 25<sup>th</sup> April 2008. The primary outcome measurements were volume of autologous transfusion, haemoglobin concentrations (Hb) (before autologous transfusion, at intensive care unit (ICU) admission and 12 hours post-admission) and total chest drainage and volume of allogenic transfusion at 12 hours. The volume of autologous transfusion was used as an estimate of intraoperative blood loss.

## Results

Forty patients underwent on-pump CABG surgery and 31 patients OPCAB. Patient and operative characteristics were similar. Results are summarized in table 1.

**Table 1.**

Variable	On-pump (n=40)	Off-pump (n=31)	p
Autologous transfusion (mL)	822	552	<0.001
Pre-transfusion Hb (g/L)	98	109	1
Hb at ICU admission (g/L)	111	112	0.007
Hb at 12 hr post-ICU (g/L)	96	104	0.475
Blood drained at 12 hr (mL)	574	677	0.008
Allogenic transfusion (units)	0.82	0.23	0.261
			0.029

## Discussion

OPCAB surgery was associated with less blood loss and transfusion compared to on-pump CABG surgery in our unit. Our audit suggests that cell salvage may be of less clinical value in OPCAB surgery. However, a randomized controlled trial is required to establish whether or not mechanical cell salvage is clinically and economically valuable in OPCAB surgery.

## References

1 Carless PA, Henry DA, Moxey AJ et al. *Cell salvage for minimising perioperative allogeneic blood transfusion*. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD001888. DOI: 10.1002/14651858.CD001888.pub2.

## Complex re-do cardiac surgery in a patient with severe factor XII deficiency

M. Bretland and R.A. Kumar

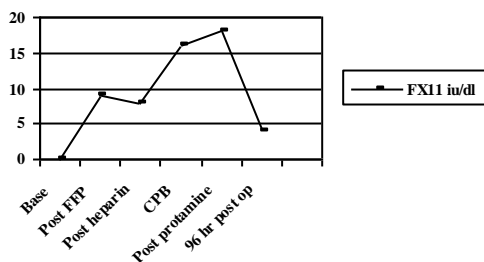
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Factor XII deficiency is an inherited disorder of the intrinsic blood coagulation pathway. Though it manifests as a prolongation of the activated partial thromboplastin time (APTT) and activated clotting time (ACT) due to reduced contact activation, it is not associated with an increased risk of bleeding in vivo. Difficulties will arise however when such a patient requires manipulation and monitoring of their coagulation status as in the case of cardiopulmonary bypass (CPB).

### Case

A 71yr old male with no history suggestive of any bleeding disorder had an APTT of 178.8s on pre-operative assessment for redo coronary artery bypass grafting (CABG) and aortic valve replacement (AVR), with possible mitral valve repair. Factor XII levels were consistent with homozygous factor XII deficiency –baseline of <1.0 iu/dl as against a normal of 50-200 iu/dl. 2 units FFP were transfused following induction of anaesthesia and 2 units were added to the CPB prime as a source of factor XII. This corrected the ACT from a baseline of 470s to 171s prior to anticoagulation with heparin for CPB. Post heparin ACT was 624s. ACT and factor XII level were monitored throughout the operative period. The patient underwent CABG, AVR and mitral annuloplasty with a CPB time of 122 min. Postoperative stay and recovery were uneventful. Figure 1 demonstrates the stability of factor XII levels during and beyond the bypass period following the administration of FFP.

**Figure 1** Perioperative variation in Factor XII level



### Discussion

The use of FFP to provide factor XII for patients with severe factor XII deficiency undergoing CPB has been previously described [1]. A prolonged baseline ACT can potentially mask falling levels of heparin activity during CPB in these patients. Correcting this artefactual abnormality before CPB by using FFP can avoid this. However, the masking effect can still occur if the transfused factor XII level is simultaneously reduced during prolonged CPB runs. We have for the first time demonstrated that the level of factor XII from transfused FFP remains stable during the operative period on CPB.

### References

- 1 Veronesi R, Maurelli M, Bianchi T, et al. Mitral valve repair and cardiac transplantation in a patient with Factor XII Deficiency. *Journal of Cardiothoracic and Vascular Anesthesia* 2005; **19**: 419-420

## Prolonged Stay after Cardiac Surgery: A Predictable Problem?

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Prolonged length of stay (over 48 hours) in the Intensive Care Unit (ITU) following cardiac surgery is associated with increased morbidity and mortality (1) and if unexpected, can impact on theatre list planning. The incidence varies but may be as high as 27% (1,2). The pre-operative morbidity and type of operation are associated with length of stay. We carried out this audit to ascertain the post-operative course of our cardiac surgical patients, whether longer stay may be predicted and subsequent last minute cancellations reduced.

### Methods

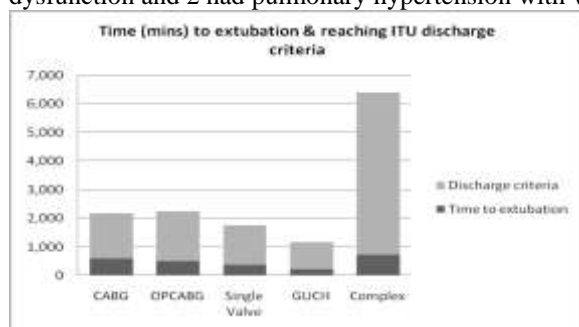
Consecutive elective cardiac surgical admissions to our ITU were prospectively audited. Data regarding the nature of surgery and pre-operative morbidity was collected. Standardised ITU discharge criteria were agreed. Time from admission to extubation and also time from extubation to attainment of ITU discharge criteria were recorded.

### Results

50 patients were included. Twenty seven were coronary artery bypass grafts (CABG); of which 5 were off-pump (OPCABG), 8 were single valves, 5 were grown-up congenital heart disease (GUCH) and the remainder were complex procedures (CABG/valve or mixed valve).

Mean length of ventilation post-surgery was 529 mins. This was shorter in the GUCH group and longer in the complex group (224 and 674 mins). No patients required re-intubation. Time to reach ITU discharge criteria was disproportionately longer in the complex group compared to the overall average (5667 versus 2148 mins).

Only 12% of patients needed to stay over 48 hours. Of the ten patients that took longest to meet discharge criteria, all displayed pre-operative morbidity. Five had poor ventricular function, 3 had pre-existing renal dysfunction and 2 had pulmonary hypertension with worsening respiratory failure.



### Discussion

Our data suggests it is not the delay in extubating complex surgical patients that delays discharge, it is the post-operative problems that follow. Prolonged ITU stay may be predicted by the presence of pre-operative morbidity and surgical complexity. Better understanding of these factors will allow rational planning of daily theatre lists.

### Reference

- 1 Heimrath OP, Buth KJ, Legare JF. Long-term outcomes in patients requiring stays more than 48 hours in the intensive care unit following coronary bypass surgery. *J Crit Care* 2007; 22(2): 153-158
- 2 Atoui R, Ma F, Morin JF: Risk factors for prolonged stay in the Intensive care unit and on the ward after cardiac surgery. *J Card Surg* 2008;23(2): 99-106