

Coronary Artery Bypass Surgery in the Awake Patient

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Introduction: Thoracic Epidural Anaesthesia (TEA) in cardiac surgery has been shown to offer numerous benefits (1,2). We describe our initial experience of awake CABG, the first as far as we are aware, in the UK, although others abroad have reported their experience (3).

Methods: Eleven patients underwent minimally invasive direct CABG (MIDCAB) surgery using TEA only. There were no selection restrictions. A standard anaesthetic technique was used, comprising insertion of a 16G Touhy needle into the epidural space at T2-3 using the 'hanging drop' method. A solution of equal volumes of bupivacaine 0.5% and lignocaine 2% with added sodium bicarbonate and fentanyl 2mcg/ml was used. An initial bolus of 10 mls of this mixture was used, with additional increments of 5mls until a sensory block to T2-7 was achieved. After the first six patients, the technique was modified with 10-15mls of 2% Lignocaine + bicarbonate adrenaline and 2mg Diamorphine. In addition surgical infiltration of the ipsilateral phrenic nerve was done as soon as possible once the thorax was opened. In all patients surgical access was through an incision at the 4th left intercostal space, using a rib cage lifting technique. The left anterior descending artery was revascularised using the pedicled left internal mammary conduit. A foot-plate stabiliser was used to immobilise the heart. Postoperative analgesia was maintained with an epidural infusion of bupivacaine 0.1% with fentanyl 2mcg/ml.

Results: Seven patients successfully underwent the procedure using epidural anaesthesia alone. Of these patients two had severe respiratory impairment and one was a brittle asthmatic. Four patients were converted to general anaesthesia with a laryngeal mask and controlled ventilation: two because of inadequate analgesia and two due to respiratory distress. Of the latter two, one patient could not tolerate the open pneumothorax and the other the discomfort of diaphragmatic irritation. None developed a Horner's syndrome. All the patients in whom this technique was used, reported a high level of satisfaction. All patients had effective analgesia postoperatively. Six of the patients were discharged home by day 3. The average duration of hospital stay was shorter than we would expect for routine MIDCAB surgery.

Discussion: 'Awake' cardiac surgery is a relatively novel concept in the UK. However our experience shows its feasibility in our establishment, where the use of epidurals during cardiac surgery is not uncommon. The relative benefit of this technique will need further experience and study.

References:

1. Kirino K, Friberg P, Grzegorzczak A, Milocco I, Rickstein S, Lundin S: Thoracic epidural anaesthesia during coronary artery bypass surgery: effects on cardiac sympathetic activity, myocardial blood flow and metabolism, and central haemodynamics. *Anesth Analg* 1994; **79**:1075-81.
2. Scott N, Turfrey D, Ray D et al: A prospective randomised study of the potential benefits of thoracic epidural anaesthesia and analgesia in patients undergoing coronary artery bypass grafting. *Anesth Analg* 2001; **93**: 528-35.
3. Karagoz HY, Kurtoglu M, Bakkaloglu B, Sonmez B, Cetintas T, Bayazit K: Coronary artery bypass grafting in the awake patient: three years experience in a 137 patients. *J Thorac Cardiovasc Surg.* 2003; **125**:1401-4.

Biphasic Internal Defibrillation in Cardiac Surgery – Audit of Energy Levels

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Introduction: We have recently replaced our 30-year-old cardiac theatre defibrillators with biphasic machines and whilst different energy levels are recommended for adult external defibrillation ¹, there appear to be no guidelines for the internal energy levels required in cardiac surgery. Therefore as part of the introduction process we set out to establish what energy levels were actually required to cardiovert patients from ventricular fibrillation (VF) during the rewarm phase of standard cardioplegia-induced asystolic hypothermic CPB.

Materials and Methods: We used the Heartstart XL biphasic defibrillator / monitor (Philips Medical, Andover, USA), a manual / AED defibrillator capable of delivering energies between 2 and 200J. It produces a biphasic truncated exponential (BTE) waveform similar to that seen in implantable defibrillators. A data-set was collected for patients requiring defibrillation for VF during rewarm which included details of LV function, cross-clamp time, CPB-run temperature, minimum and maximum energy levels delivered, and total number of shocks. Shocks were delivered in an escalating sequence commencing at 5 Joules (5, 7, 10J).

Results: Data from 21 episodes of VF during rewarm following routine CABG and / or valve surgery were audited. All but one reverted after 3 or fewer shocks (the final patient required Amiodarrone 300mg and a 4th 10J shock to cardiovert and was excluded from further analysis). There was no obvious correlation between number of shocks / absolute energy delivery, type of surgery, cross-clamp time or CPB temperature, although all of the patients who failed to convert at 5J had some degree of LV impairment. However just over 50% of this sub-group still successfully cardioverted with a single 5J shock. These results are summarised below:

No of shocks	1 (5J)	2 (5,7J)	3 (5,7,10 J)
No of episodes – good LV	9	0	0
No of episodes – impaired LV	6	2	3
No of episodes – total	15	2	3

Summary and Conclusions: Our limited data would suggest that lower energy levels are required to cardiovert VF during the rewarming phase of hypothermic cardioplegic cardiac arrest in cardiac surgery using the Philips BTE defibrillator in contrast to the 10-20J previously required with our old monophasic machine. We would therefore suggest that internal defibrillation for VF during rewarm be commenced at 5J and escalated as necessary. Further work is required to identify whether internal cardioversion can be successfully carried out using even lower energies and whether experience with the Philips BTE defibrillator can be extrapolated to other biphasic machines.

References: [1] Cummins RO, Hazinski MF, Kerber RE, et al: Low-energy biphasic defibrillation: evidence-based review applied to emergency cardiovascular care guidelines. *Circulation* 1998, 97: 1654-1667

A prospective audit of haemofiltration post cardiac surgery

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Introduction Renal failure is a significant cause of morbidity and mortality following cardiac surgery. Reported incidence varies. However, a recent report [1] suggests that it has declined. Mortality rates still remain high with a reported ICU mortality of 53.8% [1]. For the purpose of this audit we defined renal failure as the need for post-operative haemofiltration (HF). We looked at the incidence of HF following cardiac surgery and subsequent mortality rates.

Methods Data were prospectively collected for a period of one year on all patients who were haemofiltered (HF) in the intensive care unit (ICU) post cardiac surgery. Data were subject to chi-square statistical analysis.

Results

	No. of cases	HF	%HF	HF died	% mortality HF
Cabg on cpb	525	19	3.6	7	36.8
Cabg off cpb	245	5	2.0	1	20
Cabg + valve	95	6	6.3	2	33.3
single AVR	64	7	10.9	5	71.4
single MVR	30	3	10.0	1	33.3
Other	89	10	11.2	5	50
Total	1048	50	4.8	21	42

Discussion The overall incidence of HF post cardiac surgery was 4.8% with a marked increase for both mitral and aortic valve operations (10 and 10.9% respectively) as well as other combined complex procedures (11.2%) which were significantly higher than the overall incidence ($p=0.001$). The incidence was lower for coronary artery bypass grafting with a lower incidence for off bypass (2%) than on bypass surgery (3.6%), although this difference was not significant ($p=0.2$). The overall mortality rate following HF was 42%. Mortality rates after HF were not significantly different for the various types of cardiac surgery ($p=0.5$).

Conclusion The aetiology of renal failure following cardiac surgery is a complex interaction of risk factors. Pre-operative renal impairment, perioperative hypoperfusion, age and prolonged procedures have all been implicated [2]. The incidence appears to be markedly increased in valvular surgery. The subsequent mortality of patients requiring HF following cardiac surgery remains high.

References

1. Ostermann ME, Taube D, Morgan CJ, Evans TW. **ARF following CPB: a changing picture.** Int Care Med, 2000 **26**(5):565-71
2. Suen WS, Mok CK, Chiu SW et al. **Risk factors for the development of ARF requiring dialysis in patients undergoing cardiac surgery.** Angiology, 1998 **49**(10):789-800

Audit of glycaemic control of patients undergoing major cardiac surgery

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Improved glycaemic control in diabetic patients undergoing major surgery has been shown to improve perioperative morbidity and mortality [1]. Uncontrolled hyperglycaemia increases the risk of death after myocardial infarction in patients with or without diabetes [2]. Tighter glucose control using insulin infusions improves outcome in diabetics and non-diabetics [3].

We audited intraoperative glycaemic control of 961 patients undergoing major cardiac surgery over a one-year period. Seven consultant anaesthetists were asked what their blood glucose (BG) threshold was for starting insulin in theatre during CPB. Based on the available evidence we chose a blood glucose level of 8 mmol.l⁻¹ as a maximum acceptable level.

Results: Anaesthetist's intention to start insulin was different between diabetic and non-diabetic patients with a lower threshold to start insulin in diabetic patients (Table 1). Only one out of seven anaesthetists considered a blood glucose of greater than 8 mmol.l⁻¹ as the trigger point for insulin infusion in non-diabetics and three out of seven accepted this trigger in diabetics. From our electronic database we found blood glucose of > 8 mmol.l⁻¹ in 412 (43%) patients (Table 2). Of these patients only 24% had an insulin infusion started.

Conclusion: Our audit has shown that intraoperative glycaemic control can be improved. Consultant anaesthetists varied widely in their opinion of best practice, and these opinions were often not implemented. The data was presented at an internal audit meeting and a protocol has been introduced to ensure tighter glucose control. An insulin infusion is started on all patients if the blood glucose > 8 mmol.l⁻¹ regardless of whether they are diabetic or not. Tight control, between 4.5-8 mmol.l⁻¹, is maintained in theatre and cardiac ICU and a more conventional approach of keeping blood glucose <10 mmol.l⁻¹ is adopted as soon as the patient is discharged to the ward.

Table 1

Threshold for insulin	Non-diabetics	Diabetics
>8 mmol.l ⁻¹	1/7 (14%)	3/7 (43%)
>10 mmol.l ⁻¹	4/7 (57%)	4/7 (57%)
>12 mmol.l ⁻¹	2/7 (29%)	0/7

Table2

Actual BG where insulin was started	Non-diabetics	Diabetics
<8 mmol.l ⁻¹	23%	39%
8-10 mmol.l ⁻¹	17%	25%
10->12 mmol.l ⁻¹	35%	18%
>12 mmol.l ⁻¹	25%	18%

References: 1. Risum O, Abdelnoor M, Svennevig JL et al. Diabetes mellitus and morbidity and mortality risks after coronary artery bypass surgery. *Scand J Thorac Cardiovasc Surg* 1996;**30**: 71-5. 2. Capes SE, Hunt D, Malmberg, Gerstein HC. Stress hyperglycaemia and increased risk of death after myocardial infarction in patients with and without diabetes: a systematic overview. *The Lancet* 2000; **355**: 773-8. 3. Van Den Berghe G, Wouters P, Weekers F et al. Intensive Insulin therapy in Critically Ill patients. *N Engl J Med* 2001; **345**: 1359-67.

POSTOPERATIVE METABOLIC ACIDOSIS FOLLOWING CARDIAC SURGERY

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Introduction: Following cardiac surgery involving cardiopulmonary bypass (CPB) all patients, to varying degrees, develop a metabolic acidosis. At the end of CPB, we have found the change in strong ion difference (SID) rather than lactaemia influences this acidosis.(1) In the early postoperative period, lactaemia may play a more important role in the development of metabolic acidosis.(2) The aim of this study was to investigate the causes of metabolic acidosis after cardiac surgery.

Methods: Patients scheduled for elective cardiac surgery were recruited. Details of patient and operative characteristics were collected. Arterial blood samples were taken before induction of anaesthesia and six hours after surgery. Samples were analysed for blood gas measurements and electrolytes. SID was then calculated.

Results: Forty six patients were had complete data sets and were included in the study. Changes in concentrations from baseline to six hours postoperatively were calculated. Change variables, patient and operative characteristics and the amounts of intravenous fluids administered that correlated significantly ($p < 0.05$) with change in hydrogen ion concentration were identified. Only change in phosphate concentration and sex were significantly correlated with change in hydrogen ion concentration. These variables were then entered into a multiple regression model ($r^2 = 64\%$, $p < 0.001$) having first corrected the variance for change in arterial carbon dioxide tension to remove the respiratory component of acidosis. Only patient sex remained in the model ($\beta = 0.22$, $p = 0.02$) to explain change variance in the metabolic component of hydrogen ion concentration six hours postoperatively.

Discussion: The lack of influence of changes in lactate concentration is in agreement with our findings at the end of CPB.(1) In contrast to our previous findings, changes in SID did not affect the metabolic acidosis that occurs six hours after heart surgery. These negative findings should be interpreted with caution as the study size was not sufficient to detect small effect sizes. The association between sex and metabolic acidosis requires further investigation to establish its clinical importance. .

References: 1. LG Cormack, CV Collinson and RP Alston. **Metabolic acidosis and cardiopulmonary bypass: hypoperfusion or iatrogenic?** Critical Care 2002 6(Suppl 2):2 2. Ryan, T, Balding, J, McGovern, EM, et al. **Lactic acidosis after cardiac surgery is associated with polymorphisms in tumor necrosis factor and interleukin 10 genes** Ann Thorac Surg 2002;73:1905-1909

DYSAESTHESIA FOLLOWING CARDIAC SURGERY

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Introduction Chronic pain is a common complication of cardiac surgery and is associated with dysaesthesia.(1,2) Dysaesthesia in the early postoperative period might therefore predict chronic pain. However, the incidence and extent of acute dysaesthesia have not been quantified and the aim of this study was to do so.

Methods On the second postoperative day, acute pain was measured using a categorical verbal rating scale. Hypoaesthesia, hypoalgesia, hyperalgesia and allodynia were mapped out by pinprick and cotton wool brushing, traced onto paper of a known weight then was cut out and weighed to determine the area of dysaesthesia.

Results Fifty patients undergoing sternotomy were examined: 38 coronary artery bypass graft (CABG), nine heart valve and three combined surgery. Dysaesthesia was found in 54% of patients. Multivariate regression analysis ($r^2 = 0.33$, $p < 0.001$) found the area of dysaesthesia to be associated with CABG surgery ($\beta = 0.33$) and the severity of acute total body pain ($\beta = 0.29$). Left sided dysaesthesia was associated with CABG surgery ($\beta = 0.33$) and right sided dysaesthesia ($\beta = 0.30$) ($r^2 = 0.26$, $p < 0.001$). Right side dysaesthesia was associated with use of right pleural drain (CHAUX retractor) ($\beta = 0.32$) and left sided dysaesthesia ($\beta = 0.42$) ($r^2 = 0.46$, $p < 0.001$).

Discussion Dysaesthesia is associated with CABG surgery and its' extent may be influenced by surgical technique. The association with the severity of acute pain may indicate neuropathic pain that is unrelieved by conventional analgesia. Further study is required to determine whether acute dysaesthesia predicts chronic pain.

References

1. Eisenberg E, Pultorak Y, Pud D, and Bar-El Y. **Prevalence and characteristics of post coronary artery bypass graft surgery pain (PCP)**. Pain 2001;**92**:11-17.
2. Kalso E, Mennander S, Tasmuth T, Nilsson E. **Chronic post-sternotomy pain**. Acta Anaesthesiologica Scandinavica 2001;**45**:935-9

Parasternal block in patients undergoing off-pump coronary artery bypass surgery: a pilot study.

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Introduction:

Beating heart cardiac surgery (OPCAB), which was originally described in the 1960's, is being enthusiastically revisited by cardiac surgeons. A full midline sternotomy is the most common approach because it allows the standard techniques of internal mammary harvesting, permits excellent access to all coronary vessels and is the least painful¹. Pain control in this group of patients is often achieved through the use of systemic opioids, but may also benefit from the adjunction of a regional technique or even a combination of both. In this study, we aimed to evaluate the efficacy of a parasternal block to our routine pain control protocol, in those patients undergoing OPCAB surgery.

Methods: After LREC approval and informed consent, 20 patients were recruited in this placebo controlled, double blind, single centre, randomised study. All subjects received a standardised anaesthetic, and were operated on by the same surgeon. At the time of chest closure 0.5 ml/kg of a solution containing either bupivacaine 0.5% (n=10) or placebo (n=10) was administered in each intercostal space, at the level of the chondrocostal cartilage. All patients received paracetamol (1g qds) and a morphine infusion (patient controlled –1mg/ml–1mg bolus–5min interval) as per our normal care protocols. A unique investigator recorded pain at rest and effort, at regular intervals (Visual Analogue Scale), as well as opioid consumption, nausea and vomiting (N&V) and peak flow (PF). Between groups comparisons were made using Fisher's exact test for categories and either the Mann Whitney test or Student's T test for interval data. The Friedman test was used to assess changes over time, and adjustment for multiple comparison were applied

Result: Morphine use, pain, N&V and PF changed significantly overtime and none of the subjects, in either group, required opioid analgesia beyond the 4th postoperative day. There was no significant difference in postoperative pain scores, morphine consumption, incidence of N&V and PF measurements between the 2 groups during their hospital stay. However pain was significantly higher at the follow up visit in the group allocated to bupivacaine (p=0.02).

Conclusion: In this pilot study, the adjunction of parasternal blocks to our conventional opioid-based postoperative analgesic regimen did not alter postoperative pain scores, morphine consumption and incidence of nausea and vomiting. Increased level of pain 6 weeks postoperatively in the group receiving bupivacaine warrants further investigation.

References:

1. Scheld H, Schmid C: **Cardiac surgery without the use of cardiopulmonary bypass: the challenges.** Current Opinion in Anaesthesiology 1998, **11**, 5 – 8

Cardiopulmonary bypass modifies anaesthetic depth as measured by Bispectral Index

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Introduction The end-tidal concentration of isoflurane required to maintain a constant Bispectral Index (BIS) value after cardiopulmonary bypass (CPB) may be less than that required before CPB [1]. We sought to confirm this finding.

Methods We studied 20 adult patients undergoing cardiac surgery with CPB. Premedication of oral diazepam 10 mg, plus intramuscular morphine 10 mg and prochlorperazine 12.5 mg, was given 90 min before induction of anaesthesia. Anaesthesia was induced with 0.5-1.0 mg.kg⁻¹ of propofol, then maintained with isoflurane throughout the procedure. Fentanyl was infused using a Graseby 3400 syringe driver controlled by STANPUMP [2], to maintain an effect site concentration of 3ng.ml⁻¹ using Shafer's pharmacokinetic model. The P_aCO₂ was maintained between 4.5 and 5.5 kPa and α -stat blood gas management was used on CPB. The isoflurane concentration was titrated to maintain the Bispectral Index (Aspect, A-2000) at 45 throughout surgery. BIS, nasopharyngeal temperature and end-tidal isoflurane concentrations were recorded on four occasions (before sternotomy, after sternotomy, at normothermia before the end of CPB, after weaning from CPB) at one-minute intervals and the mean value calculated. The same pair of isoflurane vaporizers were used throughout the study and the end-tidal isoflurane concentration was measured using the same anaesthetic gas module (SMART, Marquette-Hellige). Blood pressure was maintained within acceptable values using phentolamine 0.5-1.0 mg and phenylephrine 50-100 μ g. Heart rate was controlled where necessary using esmolol 0.5-1.0 mg.kg⁻¹ or glycopyrrolate 0.6-1.2 mg.

Results Data were obtained from 14 men and 6 women with a mean age of 67 yr (range 49-78) and are presented as mean values with 95% confidence intervals.

	ET Isoflurane (%)	BIS	Temp (°C)
Before Sternotomy	0.74 (0.60-0.89) *#	44.9 (42.9-46.9)	35.5
After Sternotomy	0.84 (0.67-1.02) ^\$	44.2 (42.3-46.1)	35.5
Rewarming	0.45 (0.38-0.52) *^	43.5 (42.2-44.7)	36.9
After CPB	0.59 (0.51-0.67) # \$	45.4 (44.0-46.7)	36.7

P=0.026, *^\$ P<0.001

Discussion The mean isoflurane concentration was significantly lower post-CPB than pre-CPB. This may be the result of changes in blood solubility of isoflurane or the pharmacokinetics of fentanyl during CPB, or factors related to CPB itself.

Reference: 1. Lundell JC, Scuderi PE, Butterworth JF. Less isoflurane is required *after* than *before* cardiopulmonary bypass to maintain a constant Bispectral Index value. J Cardiothorac Vasc Anesth, 2001; 15: 551-4.

1. Online at <http://pkpd.icon.palo-alto.med.va.gov> (accessed October 2002)

A prospective audit of haemofiltration post cardiac surgery

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Introduction Renal failure is a significant cause of morbidity and mortality following cardiac surgery. Reported incidence varies. However, a recent report [1] suggests that it has declined. Mortality rates still remain high with a reported ICU mortality of 53.8% [1]. For the purpose of this audit we defined renal failure as the need for post-operative haemofiltration (HF). We looked at the incidence of HF following cardiac surgery and subsequent mortality rates.

Methods Data were prospectively collected for a period of one year on all patients who were haemofiltered (HF) in the intensive care unit (ICU) post cardiac surgery. Data were subject to chi-square statistical analysis.

Results

	No. of cases	HF	%HF	HF died	% mortality HF
Cabg on cpb	525	19	3.6	7	36.8
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Discussion The overall incidence of HF post cardiac surgery was 4.8% with a marked increase for both mitral and aortic valve operations (10 and 10.9% respectively) as well as other combined complex procedures (11.2%) which were significantly higher than the overall incidence ($p=0.001$). The incidence was lower for coronary artery bypass grafting with a lower incidence for off bypass (2%) than on bypass surgery (3.6%), although this difference was not significant ($p=0.2$). The overall mortality rate following HF was 42%. Mortality rates after HF were not significantly different for the various types of cardiac surgery ($p=0.5$).

Conclusion The aetiology of renal failure following cardiac surgery is a complex interaction of risk factors. Pre-operative renal impairment, perioperative hypoperfusion, age and prolonged procedures have all been implicated [2]. The incidence appears to be markedly increased in valvular surgery. The subsequent mortality of patients requiring HF following cardiac surgery remains high.

References

1. Ostermann ME, Taube D, Morgan CJ, Evans TW. **ARF following CPB: a changing picture.** Int Care Med, 2000 **26**(5):565-71
2. Suen WS, Mok CK, Chiu SW et al. **Risk factors for the development of ARF requiring dialysis in patients undergoing cardiac surgery.** Angiology, 1998 **49**(10):789-800

The effect of preoperative hydration on outcome after Cardiac Surgery

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Introduction: The risk of renal impairment after cardiac surgery is dependant on a number of factors including pre-operative renal function. Impaired pre-operative renal function increases the risk of post-operative renal impairment, the need for renal replacement therapy, length of stay and risk of death. Factors that either improve pre-operative function or reduce the peri-operative impairment may positively impact.

Methods: A retrospective audit of 400 consecutive cardiac surgical cases. Patients with pre-operative impaired renal function (defined as serum creatinine > 1.4mg/dL [1]) were analysed. One surgeon routinely re-hydrated this group (group H) with IV fluid and oral fluids following a previous similar audit. The other surgeons did not re-hydrate routinely (group D). Data on demographics, renal function and outcome was compared with that from a similarly selected group from the other surgeons within our unit.

Results: 48 patients were identified in group D and 17 in group H. There were no differences in age, weight, pre-operative creatinine, and calculated pre-operative creatinine clearance (CrCl). The two groups were similar for operative procedures, diabetes, and cardiac function.

The results are summarised in the table. Data was analysed using either Student's t-test or Chi squared test.

	Group H (mean, sd) N=17	Group D (mean, sd) N=48	P value
Age	70.4	68.8	0.531
Weight	73.9	78.6	0.252
Pre-op Creatinine (mg/dL)	1.61	1.68	0.491
Pre-op CrCl (mls/min)	45.0	47.8	0.533
Post-op Peak Creatinine	1.89	2.41	0.037
Post-op renal dysfunction	4	24	0.073
Need for renal replacement	1	8	0.118
ICU Length of stay (days)	2.7	5.4	0.132
Hospital Length of stay (days)	10.1	15.1	0.046
Mortality	1	7	0.348

Conclusion: Re-hydrating patients with impaired renal function appears to ameliorate some of the post-operative deterioration in renal function and the subsequent stay on ICU and in the hospital. This probably reflects a benefit of avoiding peri-operative dehydration and impaired end organ perfusion. This may well have a benefit on mortality although numbers are too small to demonstrate this.

References: 1. Mangano CM, Diamondstone LS, Ramsay JG, Aggarwal A, Herskowitz A, Mangano DT. Renal dysfunction after myocardial revascularisation: Risk factors, adverse outcomes , and hospital resource utilization. *Annals Int Med* 1998, 128(3):194-203

Audit of renal outcomes after cardiac surgery

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Introduction: Renal dysfunction is a well-recognised complication after cardiac surgery and is influenced by a number of factors including pre-operative renal dysfunction. Post-operative renal dysfunction has implications for mortality, morbidity, length of stay in ICU, the hospital as well as financial cost. This audit aimed to define the incidence of pre and post-operative renal dysfunction in the cardiac surgical population at our institution.

Methods: We examined the cardiac surgical database for the records for all cardiac surgical patients in a 6-month period from Jan-Jun 2003. Demographic variables, the pre-operative, peak post-operative serum creatinine and estimated pre-operative creatinine clearance (CrCl) calculated using the Cockcroft-Gault equation was recorded for each patient. The need for renal replacement, length of stay in ICU, post-operative stay and mortality were also recorded. Pre and post-operative renal dysfunction was defined according to the criteria defined by Mangano et al[1].

Results: Records from 449 patients were examined. The results are summarized in the table below.

	All patients	Pre-op Creat. >1.4 mg/dL	Pre-op Cr Cl < 60 mls/min
Number	449	70 (15.6%)	139 (30.9%)
Mean Age (yrs)	62.8	68.1	72.8
Mean Weight (Kg)	78.2	78.8	69
Gender (%M:%F)	75:25	83:17	64:36
Mean pre-op Cr Cl (mls/min)	75.4	45.6	46.1
Mean pre-op Creatinine (mg/dL)	1.18	2.06	1.55
Mean peak Creatinine (mg/dL)	1.46	2.62	2.01
Post op Renal dysfunction (%)	12.7	40	27.3
Post-op CVVH (%)	3.6	12.9	8.6
Post-op non CVVH dysfunction (%)	9.1	27.1	18.7
Mean ICU LOS (days)	2.4	4.7	3.7
Mean Hospital LOS (days)	10	13.5	12.2
Mortality (%)	3.3	11.4	7.9

Discussion: The incidence of renal dysfunction is similar to that published from other centres[1][2]. Pre-operative renal impairment predisposes to post operative dysfunction, the need for renal replacement and longer ICU and hospital stays.

References:

1. Mangano CM, Diamondstone LS, Ramsay JG, Aggarwal A, Herskowitz A, Mangano DT. **Renal dysfunction after myocardial revascularisation: Risk factors, adverse outcomes, and hospital resource utilization.** *Annals Int Med* 1998, **128(3)**:194-203
2. Garwood S, Swamidoss C, Davis E, Samson L, Hines R. **A case series of low-dose fenoldopam in seventy cardiac surgical patients at increased risk of renal dysfunction.** *J Cardiothorac Vasc Anesth* 2003, 17 (1):17-21

Comparison of recovery from neuromuscular blockade after pancuronium with and without magnesium sulphate in cardiac surgery patients

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Introduction Pancuronium, commonly used during anaesthesia for cardiac surgery, may predispose patients to an increased risk of postoperative morbidity due to residual neuromuscular blockade (NMB) [1]. Magnesium sulphate may be used intraoperatively and has been known to potentiate NMB [2]. It is unknown what effect the combined use of magnesium sulphate and pancuronium has in cardiac surgery patients undergoing cardiopulmonary bypass (CPB) in terms of duration of action of neuromuscular blockade. We aimed to investigate this further.

Method Patients between 18 and 80 years undergoing elective valvular or coronary artery bypass grafting were considered eligible. Subjects received a standardised general anaesthetic either receiving pancuronium alone or in combination with magnesium sulphate 5g prior to CPB. Postoperatively, an acceleromyograph (TOF-WATCH[®], Organon Teknika) was used to measure the train of four (TOF) at 15-minute intervals. TOF data were obtained until the TOF ratio was greater than 0.8 on two separate occasions. The total recovery time, time in CICU and magnesium plasma levels post-CPB were recorded. Statistical analysis was performed using SPSS 11.0 for MS Windows.

Results Demographic patient data of the two groups were comparable. The duration of neuromuscular blockade and plasma magnesium levels are shown in Table 1. The total length of duration of neuromuscular blockade was significantly longer in the magnesium and pancuronium group than the pancuronium only group ($p < 0.005$). The time in CICU was also significantly extended in the magnesium and pancuronium group ($p < 0.05$). Measured plasma magnesium level also is significantly different between the groups ($p = 0.000$).

Table 1 Values are mean (SD)

	Pancuronium and magnesium group	Pancuronium group	P value
Magnesium level (mmol/l)	2.36 (± 0.23)	1.56 (± 0.31)	P=0.000
Total recovery time (mins)	555.0 (± 115.3)	402.5 (± 73.3)	P=0.002
Time in CICU (mins)	288.0 (± 139.7)	160.5 (± 60.0)	P=0.021

Conclusion The duration of neuromuscular blockade by pancuronium is extended by the co-administration of magnesium sulphate in patients undergoing CPB.

References: 1 Van Oldenbeek C, Knowles P, Harper NJN. Residual neuromuscular block caused by pancuronium after cardiac surgery. *Br J Anaes* 1999; 83: 338-9. 2 Fuchs-Buder T, Wilder-Smith OH, Borgeat A, Tassonyi E. Interaction of magnesium sulphate with vecuronium-induced neuromuscular block. *Br J Anaes* 1995; 74:405-409.

Cerebral oxygen saturation (rSO₂) monitoring during aortic arch surgery

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Introduction: Brain damage is a frequent complication for patients who have aortic arch operations. Deep hypothermic circulatory arrest is used alone or combined with partial cerebral perfusion techniques for brain protection. We report a case where rSO₂ monitoring alerted us to two periods of cerebral hypoxia which if left undetected and untreated would almost certainly have caused brain damage. Case Report: A 63-year-old female Jehovah's witness underwent repair of a large chronic aortic aneurysm. To estimate the state of regional cerebral oxygenation (rSO₂) a near-infrared spectroscopy monitor was used (INVOS Somanetics, Troy, MI, USA). The right subclavian artery was prepared with a Gortex graft as the arterial cannulation site. It enabled perfusion into the aorta until the innominate artery was clamped and then partial cerebral perfusion via the right carotid during hypothermic arrest. The patient was cooled to 18°C on cardiopulmonary bypass (CPB). The operation involved aortic valve and root replacement together with ascending, arch and descending aortic replacement with an "elephant trunk" procedure. During the operation we encountered two periods of decreasing regional cerebral oxygenation.

Period A) After initiation of CPB the right radial artery pressure rose to a mean of 108 mmHg and the femoral artery pressure fell to 36 mmHg. At the same time both rSO₂ values declined to 27% (left) and 27% (right) respectively. After informing the surgeon about the problem a kink at the subclavian Gortex graft was discovered. After fixing, cerebral oxygenation returned to 51% and 44% respectively.

Period B) After crossclamping the innominate artery there was another decline of both rSO₂ values to 28% (left) and 38% (right) despite mean radial artery pressure of 60mmHg. Since the flow rate of the subclavian cannulation site was reduced from 4.01 l/min to 0.88 l/min after crossclamping we suspected a deranged cerebral autoregulation with insufficient blood flow to the brain via the right carotid and poor cross flow to the left hemisphere. After increasing the flow rate to 1.76 L/min the cerebral oxygenation values went back to 51% and 56% rSO₂ respectively.

Discussion: Cerebral desaturation often occurs because mean arterial pressure has fallen below the lower limit of cerebral autoregulation which is impaired during hypothermia. There are only a limited number of monitors available to guide the management of adequate brain perfusion during extensive aortic arch replacement. The Somanetics Invos cerebral oximetry monitor does not depend on a pulsatile signal, provides a valuable trend of cerebral oxygenation and can warn of hypoxia at an early stage hopefully before irreversible brain damage [1,2]. At the end of surgery the haemoglobin was 8.5 g/dL (no blood products had been given) and the patient made a complete recovery. Cerebral oximetry in this case enabled us to detect inadequate cerebral blood flow at an early stage and take appropriate action.

References: 1. Higami T, Kozawa S, Asada T, et al. Retrograde cerebral perfusion versus selective cerebral perfusion as evaluated by cerebral oxygen saturation during aortic arch reconstruction. *Ann Thorac Surg* 1999, 67:1091-6. 2. Janelle GM, Mnookin S, Gravenstein N, Martin TD, Urdaneta F. Unilateral cerebral oxygen desaturation during emergent repair of a DeBakey type 2 aortic dissection: Potential aversion of a major catastrophe. *Anesthesiology* 2002, 96:1263-5.

An audit of blood loss and blood transfusion in patients undergoing CABG after Clopidogrel and Aspirin administration.

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OBJECTIVES : Platelet dysfunction is a common cause of bleeding after coronary artery bypass graft (CABG) surgery. This audit explores the effects of Clopidogrel and Aspirin on bleeding complications after CABG surgery.

DESIGN : Prospective observational audit of 91 patients undergoing “on pump” CABG surgery.

METHODS : We audited 91 consecutive patients who underwent CABG during a 7 week period (July- Aug 2003) at the London Chest Hospital. Patients undergoing concomitant valvular surgery were excluded (n=2). The study population included both patients who had previous cardiac surgery, and patients undergoing emergency procedures. The 89 patients included were sub-divided into those that were exposed to Clopidogrel therapy within 7 days of surgery (n= 2), both Aspirin and Clopidogrel (n= 12), Aspirin alone (n= 65) and those not exposed to either (n= 10). The groups were comparable in age, gender, body weight and baseline haematocrit.

RESULTS : Unexpectedly, the Clopidogrel and Aspirin group had a lower mean chest drain output at 24 hours post CABG than both the Aspirin alone and No-Clopidogrel-No-Aspirin groups (*694.4 mls vs. 831.9 mls vs. 726 mls*), although these differences were not statistically significant.

Both the Clopidogrel-with-Aspirin and the Aspirin-only groups received blood products more frequently when compared to the No-Clopidogrel-No-Aspirin group and also the mean number of units transfused per patient was greater . Consistent with the highest mean blood loss, the Aspirin group was transfused more PRBC units than the Clopidogrel and Aspirin group and No Clopidogrel and No Aspirin groups (*1.67 U vs. 1.0 U vs. 0.6 U*) Again, these differences were not significant. Overall, the frequency and amount of blood product transfusion in those who were not on Aspirin or Clopidogrel preoperatively was lower than for the those receiving Clopidogrel and/or Aspirin.

CONCLUSION : Our audit suggested that continuing to administer Clopidogrel (and Aspirin) in the 7 days prior to CABG surgery is associated with higher postoperative bleeding and morbidity. However, this increased bleeding tendency did not appear to result in a clinically significant increased blood loss or requirement for allogenic blood product transfusion.

PAIN SISTERS- DOES THEIR PRESENCE ON THE WARDS IMPROVE PATIENT SAFETY?

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Introduction

- The LTHT is the largest trust in the NHS. There are only 4 acute pain sisters who cannot visit every clinical area; their primary role is education and to visit specific wards on a daily basis
- These wards are General Surgery (GS), Vascular & Orthopaedics but not Cardio-

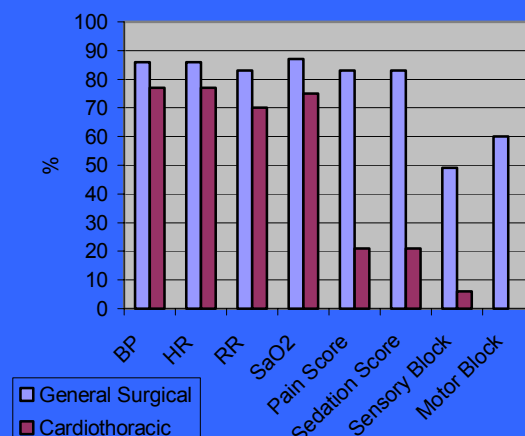
Methods

- Data was collected prospectively on patients with epidural or paravertebral blockade in the two separate clinical areas -general surgical (GS) wards and cardio-thoracic (CT) wards
- Nursing Staff and Anaesthetists involved in patient care were unaware of the audit
Data was collected to assess how closely the advice in the Acute Pain Guidelines

Results

- 20 patients records (10 on each ward- GS and CT) were reviewed assessing the frequency of clinical observations, management of unsuccessful regional blockade and the assessment of efficacy
- The routine observations (BP, HR, RR and SpO₂) were recorded most of the time with only slight differences between the wards, whereas the more specialised observations revealed large differences (see graph)
- Regional block was effective (according to staff and patients) in both groups (CT 7/10 GS 8/10)
- Of the 'problems' encountered CT 5/7 GS 8/8 were managed appropriately
- Fishers exact testing shows a statistical difference between the groups for the frequency of

% of recommended number of observations performed on patients with epidural or paravertebral blockade



Conclusions

- Clear differences were seen in the frequency of observations between the wards
- There was little difference in efficacy or in the management of problems encountered
- Regular observations are more likely to identify adverse effects and prevent critical incidents
- These results indicate there may be an improved patient care on wards with Pain Sister