

## Meeting abstracts

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### **Illusions and 'delusions' in cardiac surgical patients after prolonged intensive care unit stay**

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**Introduction:** A follow up after discharge from intensive care unit (ICU) [1] revealed that vivid 'dreams' occur in 32% of patients. Although it is questionable whether these are dreams in the true sense, there is no doubting their impact on the sufferer, as has been described by anecdotal and published accounts [2]. Aetiological factors are unknown. We undertook a study of a relatively homogeneous population who had undergone cardiac surgery in order to identify the incidence of 'dreams', to identify possibly causative factors and to inquire into the ongoing effects the 'dreams' have had.

**Patients and methods:** Following Institutional Ethical Committee approval, and consent from each patient's general practitioner, we performed a retrospective, questionnaire-based study. Included in the study were all patients still living who had stayed 4 days or longer on the ICU after cardiac surgery. Patients were excluded if their general practitioner objected.

The questionnaire was a modification of that used by Jones *et al* [1] and inquired into dreams, memories for normal events on ICU (eg endotracheal suction), and subsequent flashbacks and panic attacks. Demographic and clinical details were obtained from the medical records of all those who replied. The population was split into dreamers (D) – if they could describe one or more of dreams, nightmares, travelling and persecution – and nondreamers (ND). The groups were analyzed by stepwise logistic regression and  $\chi^2$  testing where appropriate.

**Results:** Of 423 eligible patients, 240 were still alive and contactable. Replies were received from 161 (response rate 67%). The duration of stay on the ICU ranged from 4 to 64 days. Dreams were recounted in 77 patients (48%). These varied from vivid stories (29%) to severe persecutory beliefs (19%),

60% of which involved members of staff. The mean number of 'normal' events remembered in the ICU was significantly higher in group D ( $P < 0.001$ ). Sepsis and midazolam usage were more common in group D (odds ratios 3.6, 95% confidence interval 1.7–7.3 for sepsis; odds ratio 2.9, 95% confidence interval 1.3–6.2 for midazolam). The development of new neurological signs while in the ICU protected against dreams (odds ratio 0.3, 95% confidence interval 0.1–0.7). Flashbacks and episodes of panic after discharge from ICU were more common in group D ( $P < 0.001$ ).

**Discussion:** ICU patients have been shown not to enter rapid eye movement (dream) sleep, but 'dreams' are common. Unlike true dreams, the patients studied here could recall their experiences from years previously in minute detail. Although many of the 'dreams' could be interpreted as being a distortion of reality (an illusion), some bore no bearing on real events (a hallucination). It appears that, with time and adequate explanation, all patients had insight into their experiences, unlike in psychoses.

**Conclusion:** Illusions and hallucinations are common after prolonged recovery in an ICU after cardiac surgery, are more frequent among patients receiving midazolam and in those who are septic, and are associated with flashbacks and episodes of panic. In those with less memory for their stay in ICU, illusions are rare.

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## Perioperative melatonin secretion in patients undergoing coronary artery bypass graft surgery: a pilot study

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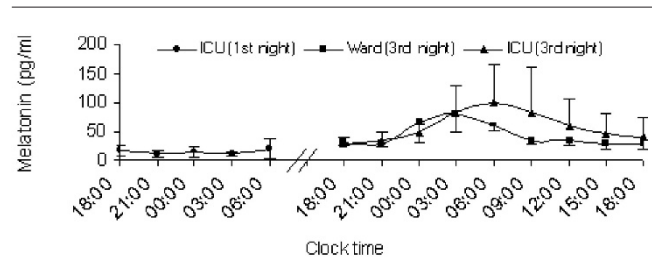
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**Introduction:** Melatonin, a neurohormone, plays important roles in adjusting the 'biological clock', and is an important mediator in many normal physiological functions [1]. Melatonin disturbances have been linked to neuropsychological dysfunction and postoperative delirium [2]. However, there have been no reports on postoperative melatonin levels to date. The aim of the present study was to observe perioperative melatonin secretion in patients undergoing coronary artery bypass graft surgery.

**Patients and methods:** After local ethics committee approval and informed consent, 11 male patients aged between 60 and 78 years, who were scheduled for elective coronary artery bypass graft surgery under hypothermic cardiopulmonary bypass, were enrolled in the study. All patients received the same anaesthesia regimen, which is used routinely at Papworth Hospital. Blood samples for measurements of melatonin were taken during the day of surgery at specific time points and every 3 h on postoperative days 2 and 3. Plasma concentrations of melatonin were measured using a radioimmunoassay method.

**Results:** During surgery melatonin levels were below the minimum sensitivity level in most patients, but low levels, without circadian variation, were measured during the first postoperative night in some patients ( $n = 7$ ; Fig. 1). Circadian secretion was observed on the third postoperative night, irrespective of whether the patient was on the ward ( $n = 6$ ) or in the intensive care unit (ICU;  $n = 3$ ; Fig. 1). However, the peak

**Figure 1**



Plasma melatonin concentrations.

level of melatonin was observed 3 h later in patients who remained in the ICU (Fig. 1).

**Conclusion:** Melatonin secretion is impaired during cardiac surgery and in the immediate postoperative period. However, a circadian rhythm is present from postoperative day 2. The clinical implication of this observation has to be evaluated further.

**Acknowledgement:** X Guo is sponsored by the Royal Society Fellowship.

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## Retrograde autologous priming of the cardiopulmonary bypass circuit – effective and safe blood conservation

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**Introduction:** Many patients require a blood transfusion after cardiac surgery. Dilution of the patient's blood with the pump prime may contribute to this need. Retrograde autologous priming (RAP) of the cardiopulmonary bypass (CPB) circuit reduces CPB prime volume, and hence haemodilution [1]. The purpose of the present study was to compare RAP of the CPB circuit with normal priming in reducing both the percentage of patients requiring homologous blood and the volume of blood transfused. The incidence of complications was noted.

**Patients and methods:** After ethics approval and informed consent, 84 patients undergoing primary coronary artery surgery were recruited. Patients were randomized into control and RAP groups. Acute normovolaemic haemodilution (ANH) was performed as appropriate, aiming for a minimum haematocrit during CPB of 20%. The incidence of perioperative myocardial infarction was monitored by troponin T concentrations and new electrocardiographic changes. Haematocrit

below 18% while on CPB and below 24% during the postoperative period were used as triggers for blood transfusion. All data were analyzed using the appropriate statistical tests;  $P < 0.05$  was considered statistically significant.

**Results:** The groups were matched for age, weight, New York Heart Association classification and preoperative haematological data. There was a significant difference in homologous blood transfusion between the two groups. The percentage of patients receiving homologous blood was 47.5% in the control group versus 20.0% in the RAP group ( $P = 0.009$ ). The mean volume of homologous blood transfused was 296.7 ml in the control group versus 81.9 ml in the RAP group. Table 1 shows various parameters and their significance between these two groups.

**Discussion:** The present results indicate that reducing the CPB prime and haemodilution by means of RAP of the CPB

**Table 1**

Variables measured	Control	RAP	P
ANH donation (ml)	446.4	628.3	0.015
RAP volume removed (ml)	–	788.8	–
Oxygenator reservoir volume at 30 min (ml)	1133.8	640.0	<0.001
Preoperative haematocrit (%)	43.1	43.0	NS
Haematocrit on CPB (%)	23.8	24.6	NS
Haematocrit on admission to the ICU (%)	27.0	28.8	0.040
Haematocrit at discharge (%)	31.7	33.5	0.030
Homologous blood transfusion (%)	47.5	20	0.009
Homologous blood transfusion per patient (ml)	296.7	81.9	0.003
Postoperative troponin T >1 µg/l (%)	10	12.5	NS
Q-wave myocardial infarction (%)	2.5	2.5	NS

ICU, intensive care unit; NS, not significant.

circuit is a safe and effective means of reducing homologous blood transfusion. We found no significant adverse effects.

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**Diabetes mellitus and morbidity and mortality risks after cardiac surgery**

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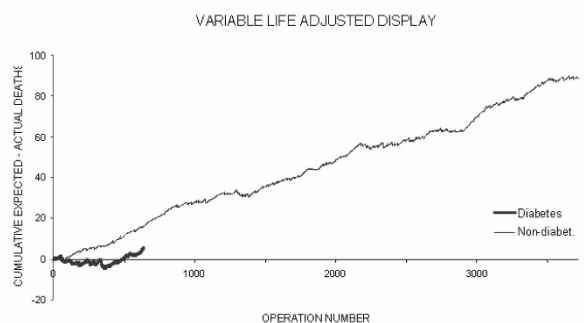
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**Introduction:** We analyzed a database of 4367 patients (3519 male, 848 female) who underwent isolated coronary artery bypass graft (CABG) surgery at St George’s Hospital between 1991 and 1998. We sought to identify pre-existing risk factors and postoperative complications among diabetic patients as opposed to nondiabetic patients that might explain the previously observed higher mortality among diabetic patients [1].

**Methods:** Fourteen preoperative risk factors and nine postoperative outcome measures were analyzed by appropriate statistical tests, depending on whether the data were continuous or categorical.

**Results:** There were no significant differences between diabetic and nondiabetic persons with regard to age; New York Heart Association classification of heart failure; requirement for preoperative intra-aortic balloon pumping; left ventricular ejection fraction; incidence of myocardial infarction or requirement for percutaneous transluminal coronary angioplasty during the 30 days before surgery; or one-, two- or three-vessel disease or total cross-clamp time. However, time spent on cardiopulmonary bypass was longer in the diabetic group: 81.2 min versus 78.6 min in the nondiabetic group (two-tailed  $P < 0.03$ ). There were significant differences in pre-existing risk factors in diabetic persons versus nondiabetic persons: mean body mass index (27.3 kg/m<sup>2</sup> versus 26.6 kg/m<sup>2</sup>, respectively;  $P < 0.00001$ ,

**Figure**



unstable angina ( $n = 251$  versus  $n = 1244$ , respectively;  $P < 0.004$ ), hypertension ( $n = 302$  versus  $n = 1278$ , respectively;  $P < 0.000001$ ) and renal failure requiring dialysis ( $n = 5$  versus  $n = 8$ , respectively;  $P < 0.01$ ). These differences were reflected in a higher mean Parsonnet score (5.65 for diabetic persons versus 5.48 for nondiabetic persons; two-tailed  $P < 0.0052$ ).

In-hospital mortality was significantly higher in the diabetic group ( $n = 31$  [4.83%]) than in the nondiabetic group ( $n = 115$

[3.09%];  $P < 0.02$ ), a difference of 1.74%. In addition the diabetic group required a longer mean intensive care unit stay (2.06 days versus 1.76 days in the nondiabetic group; two-tailed  $P < 0.0001$ ). Diabetic persons were at increased risk for requiring postoperative haemofiltration ( $P < 0.001$ ), resuturing ( $P < 0.04$ ), and post-CABG laparotomy ( $P < 0.002$ ). There were no differences in requirement for postoperative intra-aortic balloon pumping, re-sternotomy rate, incidence of cerebrovascular accident, or requirement for tracheostomy.

## A survey of blood transfusion practice in UK cardiac surgery units

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**Introduction:** Blood is expensive and carries risks. The theoretical risk of variant Creutzfeldt–Jakob disease and the consequent introduction of leucodepletion by UK blood services has significantly increased the cost of blood to the National Health Service. This is with a probable increase in demand because of waiting lists and no concurrent increase in donations. Cardiac surgery is a major user of blood. The use of guidelines and blood conservation techniques such as perioperative cell salvage may result in a reduction in blood use [1]. We do not have guidelines in our unit and have reviewed our blood use over the past 3 years. In the absence of good evidence from which to construct guidelines, we have surveyed UK cardiac surgery units on blood use and the presence of audit and guidelines in order to form an overview of current practice.

**Method:** Glasgow Royal Infirmary data were analyzed on the basis of percentage of unnecessary transfusions performed. An unnecessary transfusion was defined as having occurred in patients with a discharge haemoglobin of  $\geq 11$  g/dl transfused one unit of blood or with a discharge haemoglobin of  $\geq 12$  g/dl transfused two or more units. The questionnaire was sent, in the form of an electronic document, to 41 cardiac units. Only paediatric units were then excluded. Units were also requested to supply data sets on 20 first time coronary artery bypass grafts (CABGs). This was the number thought to be achievable by most units.

**Results:** At the Glasgow Royal Infirmary, by fiscal year from April 1996 to March 1999, 79, 81 and 80% of all cardiac surgery patients received blood and 26, 22 and 26% of those transfused received unnecessary units of blood. The response to the questionnaire was 43.6% (17 out of 39) of units; 31% (12 out of 39) supplied data sets. Twelve out of 17 units have blood transfusion guidelines; these were sometimes followed in

**Conclusion:** There is a significantly greater postoperative morbidity and mortality among diabetic patients undergoing CABG surgery when compared with nondiabetic patients.

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seven and usually followed in five units. Eight out of 17 units have audit, and three of these felt that this had resulted in a reduction in blood use. Seven out of 17 hospitals have guidelines but do not have ongoing audit. The percentage of CABGs transfused ranged between 20 and 95%. Units agreed that there was no evidence on which to base transfusion triggers, but most units accept haemoglobin above 8–9 g/dl during and after intensive care unit treatment. In the data sets, there was no significant difference between units in age, weight and height of patients. For haemoglobin at admission and discharge, there were significant differences between units ( $P = 0.0001$  and  $P = 0.00004$ , respectively, by analysis of variance). The average haemoglobin at admission ranged between 12.4 and 14.8 g/dl, and at discharge it ranged between 9.8 and 11.4 g/dl. Combining the 11 groups for which discharge haemoglobin was supplied (ie 220 patients), 52% of all patients received blood, of whom 25% received unnecessary (as defined above) units of blood.

**Conclusions:** Transfusion practice at the Glasgow Royal Infirmary needs to be improved. Despite Health Department guidance [1], there is a wide range in transfusion practices among cardiac surgery units in the UK. Blood transfusion appears to be excessive in some units. An important number of transfusions may be unnecessary. Identifying unnecessary transfusions performed may be a useful index of transfusion practice. Identification of how units achieve low transfusion rates and model guidelines by the Association of Cardiothoracic Anaesthetists may be helpful to units in which transfusion is excessive.

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## Monitoring cardiac output in beating heart coronary artery bypass graft surgery: use of pulse contour cardiac output

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**Introduction:** Coronary artery bypass grafting is the gold standard for myocardial revascularization. Coronary revasculariza-

tion with the heart beating avoids cardiopulmonary bypass and its complications, but requires active participation by the

anaesthetist to manipulate the cardiovascular physiology and maintain haemodynamic stability. The present study evaluates the pulse contour cardiac output (PiCCO) monitor in measuring haemodynamic changes during off-pump coronary artery bypass graft (CABG) surgery.

**Methods:** Patients ( $n=9$ ) undergoing beating heart surgery were anaesthetized in theatre with invasive blood pressure monitoring. The right internal jugular vein was cannulated using the Seldinger technique, and a quadruple lumen catheter was inserted using aseptic technique. A thermodilution arterial catheter (PULSIOCATH, Pulsion Medical Systems AG, München, Germany) was inserted into the right femoral artery. The Octopus® III Tissue Stabilization System (Medtronic Inc, Minneapolis, MN, USA) was used to stabilize the heart during grafting. Measurements of haemodynamic parameters were made at several time points.

**Results:** A decrease in systolic blood pressure was found, and differed according to the coronary territory being grafted. The percentage changes from baseline were as follows: left anterior descending (LAD;  $-14.77\% \pm 28.4\%$ ), circumflex marginal (CM;  $-24.28\% \pm 26.1\%$ ) and right coronary artery (RCA;  $-15.17\% \pm 21.3\%$ ). There was a mean percentage decrease in cardiac index when the CM ( $-7.15\% \pm 22.59\%$ ) was being grafted, compared with the other two arteries: LAD

( $10.78\% \pm 37.9\%$ ) and RCA ( $7.49\% \pm 27.5\%$ ). There were also reductions in stroke volume during the procedure: LAD ( $-5.11\% \pm 21\%$ ), CM ( $-21.42\% \pm 8.14\%$ ) and RCA ( $-8.06\% \pm 20.63\%$ ). The systemic vascular resistance index was reduced during revascularization: LAD ( $-20.22\% \pm 27.1\%$ ), CM ( $-20.95\% \pm 18.41\%$ ) and RCA ( $-13.16\% \pm 27.5\%$ ).

**Conclusion:** Cardiovascular monitoring may be difficult during off-pump CABG surgery. Manipulation of the heart results in a change in the cardiac axis, and therefore precordial electrocardiogram. ST-segment analysis may be unreliable. Central venous pressure and pulmonary artery pressure may be elevated because of myocardial displacement, as opposed to decreased ventricular compliance. The PiCCO uses transpulmonary thermodilution and arterial pulse contour for measurement of stroke volume, continuous cardiac output, systemic vascular resistance, intrathoracic blood volume and extravascular lung water. The present results correspond to those of other groups using pulmonary artery floatation catheters [1] for monitoring cardiac output during off-pump CABG surgery. The PiCCO monitor offers a less invasive method of continuous haemodynamic monitoring during beating heart surgery.

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**Deliberate bridging to transplantation in the paediatric age group: initial UK results**

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**Introduction:** In the paediatric age group in the UK, there is an excess of donor organs over recipients. There are still deaths

while waiting for transplantation. In an effort to extend the survival of children with dilated cardiomyopathy, we have

**Table 1**

**Patient characteristics, treatment details, complications and outcomes**

Patient	Age (years)	Weight (kg)	Blood group	ICU stay (days)	Duration of assist (days)	Vent. size	Transplant	Complications	Outcome
1	5	14	O+	5	3.5	25	No	Air embolus/bleeding	Death
2	6.5	27	O+	34	8	25	Yes	Bleeding/ventricle change/acute renal failure/complete heart block	Survive
3	2.5	12	B+	29	8	25	Yes	Ventricular clot	Survive
4	1.5	9.2	O-	31	3	25	Yes	Colonic perforation/neuro/fungal sepsis/acute rejection	Death
5	13.6	53.3	O+	6	6	60	Yes	Bleeding/tamponade/re-exploration	Survive
6	11	24.4	A+	11.5	10	25	Yes	Bleeding/tamponade/jaundice/acute renal failure and PD	Survive
7	1.8	11.7	O-	8	8	25	No	Neuro/bleeding/tamponade/seizures	Death
8	17.1	75	O+	11	11	60	No	Neuro/bleeding/tamponade/acute renal failure/multiorgan failure	Death

PD, peritoneal dialysis; neuro, neurological injury.

employed a paracorporeal ventricular assist device (Medos HIA Assist, Medos, Stolberg, Germany) in patients who we felt were dying. We report our results here.

**Method:** We considered children who were admitted to our intensive care units (ICUs) with a diagnosis of dilated cardiomyopathy of such severity that they were ventilated. If listed for transplantation, they were considered for a mechanical assist device. Our threshold for this was the scenario detailed above, with the addition of incipient renal

failure and escalation in the doses of the inotropes being used.

**Results:** The results are presented in Table 1.

**Conclusion:** A bridge to transplantation is feasible. There are complications and 50% mortality. The criteria for support in this group need to be defined better. The benefit of such a costly programme alongside a transplant programme remains to be established.