

# **NASGBI ASM Free Papers 2014**

### <u>A pilot study to assess if delayed cerebral ischaemia following subarachnoid haemorrhage affects</u> interhemispheric variation measured using bilateral Bispectral Index monitoring (BiBIS)

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#### Background:

Delayed Cerebral Ischaemia (DCI or vasospasm) affects up to 40% of patients following subarachnoid haemorrhage (SAH). Bispectral index monitoring can detect some types of cerebral ischaemia.<sup>1</sup> We used bilateral Bispectral Index (BiBIS) monitoring to ascertain if a left to right (L-R) interhemispheric difference (BiBISd) was greater in patients with DCI following SAH.

#### <u>Methods</u>

Ethical approval was obtained to apply BiBIS to patients following admission with acute SAH. Monitoring was removed if a patient could not tolerate it and was replaced if it became disconnected. Neurological observations and haemodynamic parameters were collected. Hourly averaging of downloaded data was carried out, with a difference of 10% in BiBISd [(L-R) / L x 100] regarded as significant.<sup>2</sup> Data are reported as mean (SD) or median (range) as appropriate.

#### <u>Results</u>

Twenty five patients were recruited over a 12 month period. Five patients were excluded since data was not complete. Patients were monitored for 8 (3-22) days representing 162 (54-504) hours of monitoring. Complete data were available for 89 (7-311) hours.

For the period of complete data recordings, overall BiBISd was > 10% for 31% of the time, with an absolute BiBISd of 7 (5) over this period.

In the 7 patients with DCI, BiBISd was > 10% for 36% of the recorded time (absolute BiBISd = 5) vs 27% of recorded time in patients with no DCI (absolute BiBISd = 8). (P < 0.001, Fisher's exact).

#### Discussion

In this observational pilot study in neurocritical care patients, BiBISd is greater than 10% for a larger proportion of monitored time in patients with DCI. This cohort of patients also demonstated interhemispheric BIS variation more frequently than in previously published work in anaesthetised patients. (2) Further work is warranted to investigate if this overall finding is of clinical significance or can be used to predict or diagnose DCI.

- Harclerode Z, Andrzejowski J, Coley S and Dyde R. Bispectral index detects intraoperative cerebral ischaemia during balloon assisted cerebral aneurysm coiling. F1000Research 2014, 2:225 (doi: 10.12688/f1000research.2-225.v2)
- Smith M, Wiles M, Andrzejowski J. Interhemispheric EEG variability measured using a bilateral Bispectral Index (BIS) sensor. J Neurosurg Anesthesiol 2012; 24: 244.

## Evaluation of the management of patients undergoing cerebral angiography at risk of Contrast Induced Nephropathy

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#### Introduction

Contrast induced nephropathy (CIN) is an important cause of acute renal impairment. Contrast is used during cerebral angiography procedures for subarachnoid haemorrhage, arteriovenous malformations (AVM) and venous stenting. Patients at risk of CIN should be identified preoperatively. Risk factors include pre-existing renal impairment, age over 70 years, congestive cardiac failure, diabetes mellitus, metformin and administration of nephrotoxic drugs. We wished to check we were identifying and managing the patients at risk of CIN appropriately.

#### <u>Methods</u>

We conducted a retrospective review of patients undergoing cerebral angiography for subarachnoid haemorrhage, AVM and venous stenting over a five month period at Addenbrookes Hospital. Estimated GFR was calculated by the abbreviated MDRD equation. We excluded patients under 18 years.

#### <u>Results</u>

We reviewed 69 cases with a mean age of 50 years (range 19-87). All patients had a preoperative creatinine recorded. Preoperative renal function is shown in table 1.

Twenty patients had only a preoperative creatinine recorded of which 14 (70%) had one or more risk factors for CIN. The patient CKD 3 was pre-hydrated and the patient with CKD 4 was given Visipaque, a less nephrotoxic contrast agent. Using Wilcoxon pairs, we demonstrated a statistically significant difference between the preoperative and postoperative e-GFR (86 vs. 78). (P = 0.002).

#### **Conclusion**

There was a statistically significant reduction in e-GFR post contrast administration. All patients with risk factors for CIN should have a postoperative creatinine recorded. Patients presenting for interventional radiological procedures with significant risk factors for developing CIN should have adequate precautions pre and intraoperatively to minimise the risk including pre-hydration and use of appropriate contrast agents.

- Standards for intravascular contrast agent administration to adult patients (second edition).
  London: Royal College of Radiologists, 2010
- Morcos SK. Prevention of contrast media toxicity the story so far. Clin Radiol 2004; 59: 381 389.
- Morcos SK. Prevention of contrast media toxicity following angiographic procedures. J Vasc Interv Radiol 2005; 16: 13 – 23.

Preoperative Renal Function	Number of patients (%)	
Normal	31 (45)	
CKD 2	36 (52)	
CKD 3	1 (1)	
CKD 4	1 (1)	

Table 1. Preoperative renal function

## Validation of the infraorbital positioning of a bispectral index sensor in patients undergoing intracranial neurosurgery.

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#### Introduction

Bispectral index (BIS) monitoring using a frontal sensor is commonly used as a depth of anaesthesia monitor for neurosurgical cases. There are occasions, however, when the sensor position is impractical, e.g. bicoronal incisions. A previous study in extracranial surgery showed acceptable BIS readings from an infraorbital sensor position.<sup>1</sup>

#### **Methods**

Formal ethical approval was deemed unnecessary, but the study was registered with the local governance committee. Eight patients undergoing intracranial neurosurgical procedures using intravenous anaesthesia with BIS monitoring were studied. After synchronisation of two BIS modules, two sensors were applied; one to the standard forehead position [BISnorm] and one to the infraorbital site [BISinf]. Data were downloaded after completion of surgery and analysed using SigmaStat software. A Kolmogorov–Smirnov test was used to test for normality of data, with comparisons done using R-squared coeffecient, Bland-Altman plot and Wilcoxon matched pairs analysis.

#### <u>Results</u>

In total 1979 paired BIS readings were analysed, each representing 60 s of mean BIS values. Kolmogorov–Smirnov testing showed the data to not be normally distributed.

Median (IQR) BISnorm and BISinf were 31 (25-42) and 31 (26-42) respectively (p=0.001).

Bland-Altman analysis showed a mean difference of -0.5 (95% CI -15 to 14) (Fig. 1). Overall only 49% of BlSinf values were within 10% of the BlSnorm value, although 84% and 61% of BlSinf readings were within 10 and 5 BlS units of the BlSnorm values respectively.

Scatter plot analysis revealed a R-squared coefficient of 0.675.

#### **Conclusion**

The infraorbital positioning of a BIS sensor results in highly variable BIS values that correlate moderately well with the readings from a standard forehead array. The output from this sensor arrangement should be interpreted with caution in patients undergoing intracranial surgery in whom the standard sensor position cannot be used.

 Nelson P, Nelson JA, Chen AJ & Kofke WA. An Alternative Position for the BIS-Vista Montage in Frontal Approach Neurosurgical Cases. J Neurosurg Anesthesiol 2013; 25: 135-142.



Figure 1. Bland Altman analysis. Differences between the BIS values obtained using the forehead (BISnorm) and the infraorbtial (BISinf) sensor position plotted against the mean BIS value of the two readings. The solid line represents the mean difference; the broken lines represent the 95% limits of agreement.

## <u>Changes in Resting State Functional Connectivity under Anaesthesia and Sedation: Prospective</u> <u>Observational Study</u>

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#### Introduction

Anaesthetic agents causes reversible abolition of the conscious perception and the mechanism of anaesthetic action is poorly understood. Advances in brain imaging have allowed us a peek into this enigma. The brain can be thought of as possessing multiple networks, where group of regions interact with each other to process sensory, motor or cognitive tasks. Increased activity within the defined brain regions (network) increases the blood flow in these regions. Increased flow can be tracked through BOLD-fMRI (blood-oxygen level dependant-functional MRI) scans. The default mode network(DMN) is seen at rest, and is related to self-awareness. Observing the effect of general anaesthesia (GA) on the DMN will show how intrinsic brain activity is altered, and insight into the mechanisms of GA. Study aim is to determine the effect of GA on the functional connectivity with the DMN.

#### **Methods**

After REB approval, patients requiring a GA for MRI are consented for an additional 5 minutes of scanning under 1 MAC sevoflurane. Spontaneous blood oxygen level-dependent fluctuations are measured, and a seed-voxel analysis of the PCC (posterior cingulate cortex) was done to identify the DMN and changes therein. These findings are compared to a control of non-anaesthetised subjects previously investigated.

#### **Results**

Six study subjects were compared to eight controls, averaged in standard-space. Under 1 MAC sevoflurane anaesthesia, with a nonparametric Wilcoxon rank sum test (p<0.002), there was a trend of decreased activity within the DMN of anaesthetised subjects as compared to controls. Mean % fluctuations in MRI signal within the chosen PCC seed-voxel given by regression over the DMN mask for each subject was:.082, .231, .392, .5.

#### **Conclusions**

Preliminary results show decreased activity within the DMN under GA. This suggests that the DMN plays a role in awareness. Our study shows that at clinically significant dose of GA, correlates of consciousness may still be active.

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- Greicius MD, Kiviniemi V, Tervonen O et al. Persistent default-mode network connectivity during light sedation. Hum Brain Mapp 2008;29:839–847.
- 3. Peltier SJ, Kerssens C, Hamann SB, Sebel PS, Byas-Smith M, Hu X. Functional connectivity changes with concentration of sevoflurane anesthesia. Neuroreport 2005; 16: 285–288.



Figure 1: Aggregate image of study subjects showing persistence of DMN

### <u>The timing of acute endovascular treatment and neurological outcome in poor grade aneurysmal</u> <u>subarachnoid haemorrhage (aSAH) patients</u>

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#### Introduction

The NCEPOD report, 'Managing the Flow,' recommended that patients with acute good grade aneurysmal subarachnoid haemorrhage (aSAH) have their aneurysms secured within 48 hours of ictus, but the timing for poor grade aSAH remains unclear.<sup>1</sup> The aim of this study was to investigate the proportion of our acute poor grade aSAH (World Federation of Neurosurgeons (WFNS) grade 4 or 5) patients who underwent successful endovascular detachable coil embolisation (DCE) within 48 hours of ictus, establish the reasons for delayed treatment (> 48 h) and determine whether this impacted on outcome.

#### **Methods**

We identified all patients with grade 4-5 acute aSAH who had their aneurysms successfully secured between January 2008 and July 2013 from the unit database. Notes were then reviewed for demographic data, treatment timing, and reason for delay, complications and outcome at 6 months using a dichotomised Modified Rankin Score (MRS) and Glasgow Outcome Scale (GOS). Dichotomised outcome (good vs poor outcome) in patients undergoing early (< 48 hours) and delayed (> 48 hours) treatment was compared using a Fisher-exact test.

#### <u>Results</u>

Seventy-one patients with acute poor grade aSAH were successfully treated with endovascular DCE during this period and 53 (75%) received treatment within 48 hours. 45% of patients with early treatment had a good outcome compared to 22% of those treated after 48 h (p = 0.05). The reasons for the delayed treatment in 18 (25%) patients were medically unfit (2 [11%]), admitted at weekends (6 [33%]) and delayed transfers (10 [56%]). Table 1 summarises the results.

#### **Conclusion**

The majority of acute poor grade aSAH patients admitted to our ITU are treated within 48 hours. The main reasons for delayed treatment were 'delayed transfer' into the neurosurgical centre and inability to treat patients on certain weekends. Our data suggest that delayed treatment of poor grade aSAH may be associated with poor outcome, and should be investigated further in a large, prospective multicentre study.

 National Confidential Enquiry into Perioperative Outcome & Death. Managing the Flow? A review of the care received by patients who were diagnosed with an aneurysmal subarachnoid haemorrhage. London: National Confidential Enquiry into Perioperative Outcome & Death, 2013.

Table 1: Summary of patient demographics, grade of aSAH, risk factors, and complications, according to early and delayed treatment timing.

	Treatment within 48 hours	Treatment after 48 hours
Mean age(range) (years)	58 (35-82)	60 (24-86)
Female to Male ratio	40 (75%) : 13 (25%)	13 (72%) : 5 (28%)
Grade IV	31 (58%)	9 (50%)
Grade V	22 (42%)	9 (50%)
Risk factor: smoking	9 (17%)	4 (22%)
Vasospasm	18 (34%)	5 (28%)
Hydrocephalus	35 (66%)	8 (44%)
Outcome: Good	24 (45%)	4 (22%)
Outcome: Poor (deaths)	29 (55%) (16)	14 (78%) (9)

#### Nutritional Deficits and Feeding Tolerance on the Neuro ICU

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#### Introduction

Early provision of enteral nutrition in critically ill patients is associated with improved outcomes, such as more ventilator-free days and reduced length of ICU stay. Significant energy deficits have been found to occur in 55-60% of ICU patients due to interruptions in feeding.<sup>1</sup> Though standardised bowel care practices have been shown to improve feeding tolerance in critically ill patients,<sup>2</sup> there are often no strategies to compensate for loss of feeding time if enteral nutrition is withheld for other reasons.<sup>3</sup>

#### **Methods**

A prospective analysis of adult patients admitted to the neuro ICU during a 3 month period was undertaken. For the first 7 days of admission cumulative calorie and protein deficits were recorded along with number of hours feeding was withheld, reasons for feeding interruptions and whether practices were compliant with bowel care guidelines.

#### <u>Results</u>

Thirty patients (53% male, mean age 58 years) were included in the audit. Mean duration of feeding interruptions was 45.5 hours per patient during the first 7 days of admission with mean energy and protein deficits of 6854 kcal and 243 g respectively. In patients where bowel care guidelines were followed, 100% had a bowel movement by day 5 and 15% experienced upper GI complications compared with 10% and 58% respectively in the non-compliant group (Fig. 1).

#### **Conclusion**

Enteral feeding can be withheld for prolonged periods of time in the neuro ICU leading to cumulative energy deficits that are above cut-off values associated with increased complications. Compliance with bowel care guidelines improves gastrointestinal tolerance however strategies are needed to compensate for loss of feeding time for other investigations and procedures. A new volume-based feeding approach will be trialled on the unit to help reduce nutritional deficits.

- Berger MM, Pritchard C. Best timing for energy provision during critical illness. Crit Care, 2012; 16: 215.
- 2. Mostafa SM, Bhandari S, Ritchie G, et al. Constipation and its implications in the critically ill patient. Br J Anaes, 2003; 91: 815-819.
- Heyland DK, Cahill NE, Dhaliwal R, et al. Enhanced protein-energy provision via the enteral route in critically ill patients: A single center feasibility trial of the PEP uP protocol. Crit Care, 2010; 14:R78.



FIGURE 1. Bar graph showing incidence of GI complications in relation to compliance with local bowel care guidelines

## Sustained elevation in bispectral index following ketamine adminstration during total intravenous anaesthesia for spinal surgery

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#### Introduction

Ketamine is increasingly being administered to patients undergoing spinal surgery in an attempt to decrease the incidence of acute and chronic pain. Ketamine is known to affect bispectral index (BIS) in anaesthetised patients.<sup>1-3</sup> Previous studies have disagreed about the magnitude and onset of this BIS change and have not reported the duration of effect.

#### <u>Methods</u>

The project was registered as a service evaluation. All patients received a propofol/remifentanil based anaesthetic for spinal surgery. Once stable surgical and anaesthetic conditions were achieved, and peripheral nerve stimulation showed no residual neuromuscular blockade, a ketamine bolus (0.5mg kg<sup>-1</sup>) was given. BIS data were downloaded for analysis.

#### <u>Results</u>

Data were collected from 10 cases. Two showed no discernable change in BIS following ketamine and in one, the baseline BIS was too variable to allow analysis. Results from the seven remaining cases are reported as either mean (SD) or median (range). Mean BIS value over the 10 min baseline period prior to ketamine, was 42 (3). The median time for the BIS to rise to a value 10% above baseline and to reach its maximum value was 4 (2-11) and 13 (9-17) min. The maximum BIS value during the observation period was 62 (54-72). This equates to a rise of 44% (37-53) above baseline (Fig.1). The median duration of increase in BIS was 50 (43-78) min. There were no significant changes in the haemodynamics or level of surgical stimulation in patients during data recording. The duration of BIS rise might have been longer in three of the patients, however anaesthesia was discontinued before BIS returned to baseline.

#### **Conclusions**

The increase in BIS induced by a ketamine bolus of (0.5mg kg<sup>-1</sup>) can occur as early as two minutes or be delayed for up to 11 minutes after drug administration. Anaesthetists should be aware of the wide variety in onset of provoked BIS change and potentially prolonged duration of effect when administering a ketamine bolus.

- Hans P, Dewandre PY, Brichant JF. Comparative effects of Ketamine on Bispectral Index and spectral entropy of electroencephalogram under sevoflurane anaesthesia. Br J Anaes 2005; 94: 336-40
- Vereecke HE, Struys MM, Mortier EP. A comparison of bispectral index and ARX-derived auditory evoked potential index in measuring the clinical interaction between ketamine and propofol anaesthesia. Anaesthesia 2003; 58: 957-61.
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#### **Outcomes after Traumatic Brain Injury - Service Evaluation**

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#### Introduction

Traumatic brain injury (TBI) remains a leading cause of mortality and morbidity worldwide,<sup>1</sup> but significant improvements in TBI patient outcomes continue to be seen.<sup>2</sup> In 2005-2008, a service evaluation was conducted assessing the outcome of patients admitted to the Wessex neurointensive care unit (NICU) after TBI. Since then, Southampton General Hospital opened a helipad in November 2011 and became a major trauma centre (MTC) in April 2012. We conducted a second service evaluation to see whether there have been any changes in patients' profile or outcome.

#### **Methods**

Patients admitted with TBI to the NICU between August 2012 and August 2013 were included. For survivors, structured interviews were conducted via telephone to obtain 6 month and 12 month scores based on the Extended Glasgow Outcome Scale (GOSE). Further patient profile information was obtained from patient notes.

#### **Results**

One-hundred and thirty-one patients (70% male) were identified. Since 2005 there has been little change in gender, duration of stay, injury mechanism and initial Glasgow Coma Score. The most common mechanisms of injury continue to be falls (42%) and road traffic collisions (39%). However, the age of patients has increased (p<0.001). The median age in 2012-13 is 50, compared to 35 in 2005-08. There are more patients aged over 66 years (7.6% in 2005-08 vs 19.1% in 2012-13), with more deaths occurring in this age group (Fig. 1). Otherwise, GOSE scores remain comparable to 2005-08. Compared to 2005-08, there are also fewer admissions in which alcohol was involved (p<0.001).

#### **Conclusion**

The Wessex NICU has treated an increased proportion of older patients with TBI and has observed less alcohol involvement. This study evaluated the efficacy of treatment for this changing patient profile and

allowed patients to express their feelings about recovery. More resources are needed to continue this work and evaluate whether these changes are sustained.

- 1. Maas AI, Stochetti N, Bullock R. Moderate and severe traumatic brain injury in adults. Lancet Neurol 2008;7:728-41.
- 2. Greve MR, Zink BJ. Pathophysiology of traumatic brain injury. Mt Sinai J Med 2009;76:97-104.



FIGURE 1: Clustered-stacked bar chart showing ages of patients and their 6-month outcome data in 2005-2008 compared to 2012-2013.

#### The accuracy of clinical identification of correct lumbar level for surgery: potential use for ultrasound

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#### Introduction

The local practice used to identify the correct level in lumbar surgery is clinical examination followed by x-ray confirmation of the marking needle. There has been recent interest in the use of ultrasound (US) in central neuraxial blocks.<sup>1</sup> This method has the potential to be translated to neurosurgery.

#### **Methods**

This was a two-part audit; the first part examined the accuracy of the current practice of using anatomical landmarks. The second part involved repeating the audit to examine the accuracy of level identification using US followed by radiographic confirmation. Patients under 18 years of age or undergoing revision surgery were excluded.

#### <u>Results</u>

We included 28 patients in the first part and 16 in the second part. The mean ages were 55 and 52 years and the mean body mass indices (BMI) were 30 kg m<sup>-2</sup> and 29 kg m<sup>-2</sup> respectively. The most frequent operative level was the L4/5 disc space (50%). Initial identification of the intended vertebral level by anatomical landmarks was incorrect in 16 patients (57%). This resulted in repositioning of the marking needle and repeat radiograph prior to skin incision. In the 16 patients where ultrasound was used to identify the level followed by radiographic confirmation, correct initial identification was confirmed in all.

#### **Conclusion**

The initial identification of the intended operative vertebral level was often incorrect using anatomical landmarks. Previous studies have shown similar results.<sup>2</sup> Inaccuracy leads to the use of repeated radiological imaging. Although the radiation exposure for patients is brief, it nevertheless has the potential to cause harm. The cumulative dose may be significant to staff. Shared hospital resources (e.g.

image intensifier, radiographers) may be required elsewhere. We showed that initial identification with ultrasound helps reduce inaccuracy although further research would be required before radiographs can be replaced altogether.

- 1. Chin KJ, Karmakar MK, Peng P. Ultrasonography of the adult thoracic and lumbar spine for central neuraxial blockade. Anesthesiology 2011; 114: 1459-85.
- 2. Lee AJ, JS Ranasinghe, Chehade JM et al. Ultrasound assessment of the vertebral level of the intercristal line in pregnancy. Anesth Analg2011; 113: 559–64



# **NASGBI ASM Posters 2014**

#### An Audit of the use of Stress Ulcer Prophylaxis in Neurotrauma Intensive Care

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#### Introduction

Studies have reported evidence of mucosal damage within 24 hours of admittance in 75-100% of patients.<sup>1-2</sup> This damage can be associated with a significant bleeding risk and therefore, certain patients require prophylaxis. However, the use of stress ulcer prophylaxis (SUP), in particular proton pump inhibitors (PPI), are associated with increased risk for Clostridium difficle infection and nosocomial pneumonia.<sup>3</sup>

We audited compliance in the neurotrauma critical care unit with Trust critical care guidelines for the use of SUP.

#### **Methods**

The audit was registered and data was collected from September to December 2013 on 6 random days. The trust guidelines on indication for use of stress ulcer prophylaxis are given in Figure 1. The standards set were 90% of the patients should be on SUP when indicated, 0% of patients should be on SUP when not indicated.

#### **Results**

A total of 114 patients were analysed, of which 55 (48%) were on SUP. PPIs were used in 89% and the rest H2 receptor antagonists. The most common reason for SUP use was because it was their routine medication with other indications displayed in Figure 1. Five patients had an indication for SUP but were not on it. Comparing the results to the standards set, 91% of patients where on SUP where indicated and 20 % were on SUP where 'not' indicated.

#### **Conclusion**

We were good at putting the patients on SUP where indicated but were not good at withdrawing the SUP when not indicated. A high proportion of patients were on SUP exposing them to the associated nosocomial risks. This audit raises two questions: firstly, which patients on "high dose" steroids need to

be on SUP, what is the evidence for it and what is practice in other neurosurgical centres? Second, should we routinely continue PPIs in all patients who have been taking them as regular medication during their inpatient stay or should we tailor use to the individual's risk factors?

- Grube RR, May DB. Stress ulcer prophylaxis in hospitalised patients not in intensive care units. Am J Health Syst Pharm 2007;64:1396-00.
- 2. American Society of Health-System Pharmacists Commission on Therapeutics. ASHP therapeutic guidelines on stress ulcer prophylaxis. Am J Health Syst Pharm 1999; 56:347-79.
- MacLaren R, Reynolds PM, Allen RR. Histamine-2 Receptor Antagonists vs Proton Pump Inhibitors on Gastrointestinal Tract Hemorrhage and Infectious Complications in the Intensive Care Unit. JAMA Intern Med. 2014; 74:564-74.



Figure 1: Indications for the use of SUP in critical care

\* INR > 1.5, PT > 18, APTT > 60, Platelet count < 50,000 % Nor-adrenaline > 0.2 mcg/kg/min \* Prednisolone > 60 mg / day <sup>€</sup> NG asps > 60 ml/hour

## Are We On Target? A Review of Local Compliance With Nationally Set Targets For The Management of Traumatic Brain Injury

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#### Introduction

Traumatic brain injury (TBI) is the leading cause of death and disability in young adults in the developed world.<sup>1</sup> Whilst primary injury cannot be altered, targeted management to prevent secondary brain injury has led to a decline in mortality.<sup>1</sup> National guidelines recommend that a computerised tomography (CT) scan is performed within 1 hour of identifying a patient with a significant head injury.<sup>2</sup> The initial management of patients with TBI should maintain a cerebral perfusion pressure (CPP) of > 60 mmHg and a PaCO<sub>2</sub> of 4.5- 5 kPa<sup>-1</sup> in order to reduce the risk of secondary injury.

#### **Methods**

Retrospective audit of the last 20 adult patients with severe TBI requiring intracranial pressure (ICP) monitoring. Patients were identified using the intensive care unit (ICU) database. Case notes were reviewed to identify basic demographics and audit what physiological targets had been documented and the timing of initial CT scan.

#### <u>Results</u>

Fourteen male and 6 female patients were admitted (median age (range) 46.5 (17–79) years). Median time to CT scan was 65.5 minutes. On admission to ICU, 90% patients had a target for CPP or mean arterial pressure (MAP) documented. All patients with a CPP target had a value of > 60 mmHg recorded. 70% of patients had a target PaCO<sub>2</sub> documented; these ranged from 4-5 kPa. Targets for PaO<sub>2</sub>, ICP and general nursing instructions were also audited.

#### **Conclusions**

We have demonstrated that we do not consistently document targets and that these targets are not always in agreement with current 'best practice'. Documentation was better for CPP/MAP than for PaCO<sub>2</sub> both in terms of the number of patients who had a target documented and also the appropriateness of the target. One possible explanation for this is the previous recommendation that PaCO<sub>2</sub> be maintained lower and that the change has not been fully recognised by staff. This audit has driven some quality improvement work and the development of a 'neuro bundle' for use within our unit.

- Dinsmore J. Traumatic brain injury: an evidence-based review of management. Contin Educ Anaesth Crit Care Pain 2013; 13: 189-195
- National Institute for Clinical Health and Excellence. Head Injury Triage, assessment, investigation and early management of head injury in children, young people and adults. London: National Institute for Health and Clinical Excellence; January 2014. NICE Clinical Guideline 176

#### Single Centre Retrospective Review of Peripartum Admissions to a Specialist Neurointensive Care Unit

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#### Introduction

The CEMACE report of 2006-7 highlighted neurological conditions as the second highest cause of indirect maternal deaths in the UK.<sup>1</sup>Therefore we decided to review peripartum admissions to our tertiary neurointensive care unit over a 4-year period from 2010-2013 and compare them to the ICNARC report of 2007,<sup>2</sup> which summarised the number, and nature of obstetric admissions to ITU in the UK.

#### <u>Methods</u>

Data were collected retrospectively on patients admitted to the neurointensive care unit who were currently pregnant (CP) or recently pregnant (RP) within 42 days of delivery. Patient demographics, diagnosis, comorbidities, length of stay, neurosurgical or radiological intervention, organ support and maternal and fetal outcome were recorded.

#### <u>Results</u>

Results are shown in table 1. Three (13.6%) patients were hypertensive (1 pregnancy induced, 2 primary hypertension) and 2 (9.1%) known epileptic. Four (18.1%) patients had venous sinus thrombosis, 3 (13.6%) eclampsia, 3 mass lesions, 2 (9.5%) posterior reversible encephalopathy syndrome, 2 following cardiac arrest during LSCS, 2 neurovascular anomalies, 2 Guillain Barre and 2 pseudoseizures. Three admissions followed home birth. Four received inotropes and 6 antihypertensives. Nine required neurosurgical intervention and 1 neuroradiological. Twelve (54.5%) patients made a full neurological recovery, 3 had residual cranial nerve palsy, 3 motor deficit. One baby died and there was one termination of pregnancy.

#### **Conclusions**

Peripartum neurological complications cause significant morbidity and mortality. Any loss of life or function is a tragedy with far reaching consequences. However, as shown in the ICNARC report and our

case series, specialist care allows for a full range of intervention and management to achieve better outcomes than would be expected for similar age and severity matched controls.

- Centre for Maternal and Child Enquiries (CMACE). Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006–08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG 2011;118:1–203.
- Intensive care national audit and research centre (ICNARC) Female admissions (aged 16-50 years) to adult, general critical care units in England, Wales and Northern Ireland, reported as 'currently pregnant' or 'recently pregnant'. Available at: http://www.oaa-anaes.ac.uk/assets/\_managed/editor/File/Reports/ICNARC\_obs\_report\_Oct2009.pdf

	Obstetric NITU	Unplanned NITU	ICNARC reference
	admissions	admissions	(all obstetric ITU admissions)
Total	22 (1.1%)	1925	513
Average Age/years (SD)	CP – 30.6 (7.3)	54.5	CP – 29.2 (6.4)
	RP – 33.4 (6.6)		RP – 30.9 (6.3)
Length of stay/days	6.2 (mean)	4.9 (mean)	CP - 1.9 (median)
	4 (median)		RP – 1.1 (median)
Proportion level 3	59.1% (13)	63.3% (1219)	100%
Currently pregnant (CP)	50% (11)		18.5% (95)
Recently pregnant (RP)	50% (11)		81.5% (418)
Mean APACHE score	10	10.9	12
Mortality	4.5% (1)	12.90%	2%

#### Table 1: Summary of Results

#### The impact of a novel algorithm for the spinal management of sedated and ventilated trauma patients

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#### Introduction

Spinal injury occurs in approximately 10% of all major trauma cases.<sup>1</sup> In 2012 we designed and implemented a spinal management algorithm (Fig. 1) for sedated and ventilated trauma patients admitted to The Wessex Neurosciences Intensive Care Unit. Here we present the initial review of the impact of our algorithm. We performed an audit of the quality of documentation prior to and following the introduction of the form, including an assessment of compliance with its completion. A staff survey was also conducted to assess its effectiveness.

#### **Methods**

A retrospective case note review of sedated and ventilated trauma patients admitted to the Neuro ICU over a nine month period (May 2012 to February 2013) was undertaken. This period covered the introduction of the spinal management algorithm (end of June 2012). The patients' notes were examined for clear documentation of a spinal management plan. Where the new form was present, its completion was assessed. The staff survey involved a paper questionnaire given to doctors, physiotherapists and nursing staff who had been present on the unit prior to, and following the introduction of the form.

#### <u>Results</u>

The notes of 48 patients were reviewed. The form was present in 31 out of 34 cases following its introduction. In all 31 cases the front side had been fully completed, providing a clear management plan for use of collar, whether the patient could be sat up and how the patient should be turned (100% compliance). In the 17 cases with no form present in the notes, there was clear documentation about: use of cervical collar in 13 cases; whether the patient could be sat up in 11 cases; and the type of patient turn required in 11 cases. All 19 staff surveyed responded that the form had improved clarity of the spinal management plan, with 18 indicating an improvement in consistency of management between shifts.

#### **Conclusion**

Use of a printed algorithm can improve the documentation, clarity and consistency of spinal management.

 Hasler RM, Exadaktylos AK, Bouamra O et al. Epidemiology and predictors of spinal injury in adult major trauma patients: European cohort study. European Spine Journal 2011; 20: 2174-2180.



FIGURE 1. Spinal management algorithm (front page)

#### Improving critical care bed usage after major spinal surgery

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#### Introduction

Patients undergoing spinal surgery may be managed postoperatively as level 1 ward patients or as level 1 or 2 patients in a critical care area for monitoring, respiratory and cardiovascular support. Admission is planned by the anaesthetist on the basis of preoperative assessment, comorbidities, functional status (frailty score), the type and the extent of planned surgery. However, patient selection is an inexact process, and improved strategies are the focus of ongoing research.<sup>1</sup> In order to determine whether our patient selection is optimal, we audited the organ supports provided postoperatively. Critical care beds have high demand, and unnecessary occupancy contributes to avoidable cancellation of future cases.

#### **Methods**

A retrospective analysis of data for patients admitted during the first six months of 2012, identified from electronic records (Metavision). Data were collected from electronic records, operation notes and anaesthetic charts. Unplanned admissions and readmissions were excluded.

#### <u>Results</u>

Four of the twenty-five patients required vasopressors, greater than 35% oxygen or CPAP. No patient required analgesia that couldn't be provided on the ward. All four patients were over seventy years of age, and ASA 3, but not unified by any other data.

#### **Conclusion**

We had anticipated that most patients would have required organ support or clinical care that couldn't have been provided on the spinal surgical ward, however, this was not demonstrated. This suggests that many patients could be cared for on the spinal surgical wards immediately postoperatively or after a period of extended recovery. Thus, there may be potential to improve the efficiency of critical care bed usage.

However, the small sample and retrospective data collection limit the conclusions that can be drawn. We plan to prospectively audit a larger cohort to re-examine our conclusions and identify variables that may be used to predict which patients require critical care admission.

1. Rhodes A, Cecconi M. Can surgical outcomes be prevented by postoperative admission to critical care? Critical Care 2013; 17:110.

			Critical care	Highest level of	Vasopressor
Age ASA		Operation	stay (days)	Respiratory support	infusion
76 3	2	L3/4 and L4/5	1	CDAD	No
	5	Decompression.	Ţ	CrAr	NO
76 3	2	Instrumented fusion	1	High flow oxygen	No
	5	T12 - pelvis.	Ţ	nigh now oxygen	NO
75	4	L5 Decompression.	2	Low flow oxygen	Yes
		Revision			
76	3	instrumented fusion	1	Low flow oxygen	Yes
		T12-pelvis.			

Table 1. Patients who received postoperative organ support

#### Documentation Of Emergency Intubation Procedures Outside Of The Anaesthetic Room

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#### **Introduction**

A number of reports and expert bodies have highlighted that poor care within the 'golden hour' after acute brain injury may adversely affect neurological outcome. The standard of care is described in guidelines produced by the Association of Anaesthetists of Great Britain and Ireland.<sup>1</sup> Part of the provision of this care requires the keeping of clear, accurate and legible records.<sup>2</sup> Here we report on our audit on the standard of documentation of the acute management of intubated patients admitted to our tertiary referral neurosciences intensive care unit.

#### **Methods**

This was a prospective review of the medical records of all intubated patients admitted to our critical care unit over a four-month period.

#### <u>Results</u>

Sixty-five sets of patient notes were assessed. 54% of intubations took place in an intensive care unit, 41% in an emergency department (referring or local hospital) and 5% on a ward. The majority of intubations (56) were performed by anaesthetists. 20% of operators recorded the monitoring used. There was variable documentation on the components of the rapid sequence induction (RSI) (e.g. use of cricoid pressure, preoxygenation, airway soiling and grade of laryngoscopy). Only 85% of operators documented the drugs used and as such it was not always clear that efforts to obtund the laryngeal response to intubation were made. Only 15% of cases had any transfer documentation or observations documented post intubation.

#### **Conclusion**

Our observational study demonstrates a varied standard of documentation throughout our catchment area. Whilst management may comply with national standards, this is not reflected in the documentation. Possible reasons for this include: time-pressure; out-of-hours working; and relatively junior trainees performing the procedures. Our data has supported the introduction of the following potential improvements:

- 1. An RSI 'shadow board' and checklist
- 2. An RSI sticker, which brings documentation to the national standard.
  - Association of Anaesthetists of Great Britain and Ireland. Recommendations for the Safe Trransfer of Patients with Brain Injury. 2006. Available at : http://www.aagbi.org/sites/default/files/braininjury.pdf. Accessed March 1, 2014.
  - Association of Anaesthetists of Great Britain and Ireland and the Royal College of Anaesthetists Joint Committee on Good Practice. Good Practice. A guide for departments of anaesthesia, critical care and pain management. Third edition, 2006. Available at : http://www.rcoa.ac.uk/system/files/CSQ-GoodPractice2006.pdf. Accessed March 1, 2014

## Introducing Pre-emptive Analgesia: Optimising Management of Perioperative Pain Following Spinal Surgery

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#### Introduction

With an ageing population, spinal surgery is increasingly common. Patients often report severe and poorly managed postoperative pain. The Royal College of Anaesthetists state patients should only experience mild pain during recovery from anaesthesia. An audit of perioperative pain in spinal surgery in 2011 revealed high pain scores, falling far short of this standard.

#### Method:

A prospective re-audit of perioperative pain management for spinal surgery was performed in 2013. The prospective nature enabled differentiation between neuropathic and somatic pain. In addition, preemptive analgesia was launched, and baseline preoperative pain scores were recorded and compared to postoperative scores. Postoperative pain scores were assessed in theatre recovery and 12 hours postoperatively on the ward. Pain scores, intraoperative and postoperative analgesia, and intravenous morphine requirements were all compared with data from 2011.

#### **Results**

Patients reported less postoperative pain, verified by lower intravenous morphine requirements postoperatively (6.6 vs. 10.2 mg). Moderate to severe neuropathic pain disappeared with surgery, suggesting the reduction in pain scores was unrelated to classification of pain. Pain scores on discharge from theatre recovery fell by 18%. This remained true at 12 hours. However, 50% of patients still experienced moderate to severe pain. All patients were prescribed pre-emptive analgesia, though a third did not receive any. Documentation regarding local anaesthetic use was often ambiguous.

#### **Conclusion**

Altering the perioperative pain regimen and using pre-emptive analgesia reduced pain scores. Whether this led to any change in clinical outcomes is unknown. Too many patients still experience moderate to severe pain, persisting on discharge to the ward. Further scope should involve multidisciplinary implementation of an analgesic regimen, with pre-emptive analgesia, increased intraoperative morphine and local anaesthetic use.

## 1<sup>st</sup> cycle standards

	Group A	Group B
% in >mild pain on PACU admission	68%	50%
% in >mild pain on PACU discharge	26%	8%
% >mild pain on ward - Somatic - Neuropathic	38% (not specific)	25% 0

#### Cranioplasty After Decompressive Craniectomy: Complications

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#### Introduction

Decompressive craniectomy (DC) is used to treat refractory raised intracranial pressure (ICP). In infarction it is has been shown to reduce mortality and improve functional outcome.<sup>1</sup> In traumatic brain injury (TBI), the benefit is unproven. The DECRA trial showed that despite lowering ICP, there was no improvement in mortality and a worse neurological outcome at 6 months.<sup>2</sup> Following a DC, cranial reconstruction (cranioplasty) is required. The complications following this are not well reported but are thought to be high. This audit aimed to review the rate of complications in our neurosurgical unit

#### <u>Methods</u>

Using data coding, all cranioplasties between 2008-2012 were selected. Primary tumour resections, eyebrow craniotomies and patients < 16 years old were excluded. The final cases were DC for TBI, MCA syndrome and postoperative craniotomy complications. The following data were obtained using retrospective notes analysis:

- Patient demographics
- Reason for DC
- Type of craniectomy and cranioplasty
- Time between craniectomy and cranioplasty
- Major complications
- Location of postoperative care
- Reoperation requirement

#### <u>Results</u>

Thirty-eight titanium cranioplasties were performed: 78.9% for TBI; 15.8% for infarction; and 5.3% for craniotomy complications. Of these, 23.6% had complications <72hours, 21% had complications >72 hours. The early complications were oedema or bleeding and the late complications infective. The reoperation rate was 34.2%. Postoperatively 32% of patients required critical care input.

#### **Conclusion**

The majority of cranioplasties are performed for trauma related DC. The procedure has an overall complication rate of 44.6%, a re-operation rate of 34.2% and a mortality rate of 2.6%. A literature review suggests this is a high – the limited data available suggests complications range from 24-36.5%. Cranioplasty results in significant cerebral physiological changes and complications and the insertion of a prosthetic flap is associated with a high infective risk.

- National Institute for Health and Clinical Excellence Guideline CG38. Stroke Diagnosis and initial management of acute stroke and transient ischaemic attack. London: National Institute for Health and Clinical Excellence, 2008.
- 2. Cooper J, Rosenfeld JV, Murray L et al. Decompressive craniectomy in diffuse traumatic brain injury. New Engl J Med 2011; 364:1493-1502.
#### An Audit of Compliance with NCEPOD Managing the Flow? Standards Relevant to Neurocritical Care.

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#### Introduction

The NCEPOD "Managing the Flow?" review<sup>1</sup> into the diagnosis and management of aneurysmal subarachnoid haemorrhage (aSAH) in the UK made recommendations to improve the care of these patients. All aSAH patients managed in our tertiary care facility have multidisciplinary input and spend time in critical care so we audited critical care compliance with these recommendations.

#### <u>Methods</u>

Three key process standards relevant to critical care were identified. These were administration of nimodipine within 24 hours of admission, definitive neurovascular intervention (coiling or clipping) within 48 hours and the consideration of organ donation as part of end of life care. Admissions between 1st January and 31st December 2012 were identified from the ICU Wardwatcher and neurovascular databases. Data were obtained on presenting WFNS grade and functional outcome scores. Patient level data were obtained from the electronic patient record.

#### <u>Results</u>

One-hundred and twenty-eight patients were admitted with an aSAH. Ninety-two were WFNS grade I-III, 36 were WFNS grade IV-V. 98.5% received nimodipine within 24 hours of ictus. 91% of all patients underwent definitive neurovascular intervention and 96% of WFNS grade I-III within the first 48h, 91% by coil embolisation. Three were treated within 60 hours. Of the remainder, 7 were WFNS grade V and managed conservatively or died before 48h. Nineteen patients died in critical care, 11 were diagnosed brain dead and 7 underwent withdrawal of life sustaining treatment. Family were approached for all potential donors (n=16) and 8 proceeded to organ donation. Functional outcomes at hospital discharge are displayed (Fig. 1)

#### **Conclusion**

We are complying with the NCEPOD recommendations relevant to critical care. Functional outcomes of our WFNS grade IV patients warrant review as they appear worse than those published<sup>1</sup> but are of

uncertain significance due to small sample size. We will continue to audit these key process measures, in particular time to treatment.

 National Confidential Enquiry into Perioperative Outcome & Death. Managing the Flow? A review of the care received by patients who were diagnosed with an aneurysmal subarachnoid haemorrhage. London: National Confidential Enquiry into Perioperative Outcome & Death, 2013.



# Anaesthetic Techniques For Elective Craniotomies: A Review Of Practice & Documentation At Queen's Regional Neurosciences Centre

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#### Introduction

Anaesthetic practice for elective craniotomies varies within our trust and between neurosurgical centres. Our aim was to identify techniques currently practiced within our trust and review the standard of documentation.

#### **Methods**

We retrospectively reviewed the medical records of patients who underwent elective craniotomies during a 12 month period (May 2012 to April 2013) at Queen's regional neurosciences centre.

#### **Results**

One-hundred and nine medical records were reviewed (57% male) from 169 cases identified (16 excluded as did not meet entry criteria, 44 medical records not available). Ninety-seven (89%) patients had general anaesthesia. The remaining either had an awake craniotomy or a combined awake and general anaesthetic technique. There were 19 different lead anaesthetists. This was a consultant in 96% of cases.

Of the patients undergoing general anaesthesia, 63% received total intravenous anaesthesia (TIVA), 35% received a volatile anaesthesia with a remifentanil infusion & 2% received volatile anaesthesia alone. Table 1 demonstrates the different TIVA regimens used. Nine (17%) patients undergoing TIVA with at least one target controlled infusion (TCI) had a weight documented on the anaesthetic chart, preassessment chart or theatre care plan. Of the patient receiving volatile anaesthesia, 20% did not have the agent recorded.

#### **Conclusion**

Total intravenous anaesthesia is the most common method for administering general anaesthesia for elective craniotomies at our centre. A notable proportion of anaesthetic records had incomplete

documentation. The majority of target-controlled infusions were administered without documented weight and height measurements suggesting they were estimated for TCI pump programming. The results of this review will be presented at the departmental clinical governance meeting to highlight standards of documentation. In addition they have prompted a review of preoperative assessment practice and led to a survey of anaesthetists regarding TIVA.

Table 1. Breakdown of total intravenous anaesthesia regimens (TCI, target-controlled infusion)

Percentage of patients
65
14
8
5
8

# Perioperative Analgesia For Elective Craniotomies: A Review Of Practice At Queen's Regional Neurosciences Centre

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#### Introduction

Management of perioperative pain following craniotomy varies between anaesthetists and departments.<sup>1</sup> Since a review of practice in our centre in 2007 non-steroidal anti-inflammatory drug (NSAID) use in this group of patients has become increasingly controversial.<sup>2</sup> Our aim was to review current practices in our centre.

# <u>Methods</u>

We retrospectively analysed medical records for patients who underwent elective craniotomies during a 12 month period (May 2012 to April 2013). Medical records were reviewed for analgesic administration and prescriptions upto 24 hours postoperatively.

#### <u>Results</u>

One-hundred and nine medical records were reviewed (57% male, 23% on preoperative analgesics) from 169 cases identified (16 excluded as did not meet entry criteria, 44 medical records not available). Analgesic administration intraoperatively and in recovery was compared with 2007 data (Table 1). In 2013, 37.5% patients experienced pain in recovery compared with 33% in 2007. Morphine prescription for postoperative ward analgesia increased between 2007 & 2013 from 25% to 59%.

#### **Conclusion**

Since the 2007 review there has been increased intraoperative paracetomol and morphine administration. Postoperative morphine prescription also increased. Perioperative codeine and NSAID use has fallen reflecting current concern regarding their use. Despite this, a similar percentage of patients reported pain in the recovery room in 2007 and 2013.

Improvement in perioperative pain management may be achieved by increased intraoperative opioid administration, although this may be limited by the need for rapid postoperative neurological

assessment. Regular opioid prescription for the first 24 hours postoperatively may be beneficial. Novel analgesic methods like regional scalp blocks and dexometomedine should be evaluated. Further audit cycles should quantitatively assess the pain experienced.

- 1. Kotak D, Cheserem B, Solth A. A survey of post-craniotomy analgesia in British neurosurgical centres: time for perceptions and prescribing to change? Br J NeuroSurg 2009;29:538-42.
- 2. Kelly P, Janssens M, Ross J, Horn E. Controversy of non-steriodal anti-inflammatory drugs and intracranial surgery: et nos inducas in tentationem? Br J Anaesth 2011;107:302-305.

Table 1: Intraoperative and recovery analgesia administration for elective craniotomies, comparing 2007and 2013 data

Analgesia Administered	Intraopera	tive (% of patients)	Recovery (% of patients	
Audit Year	2007	2013	2007	2013
Paracetamol	18	86	22	2
Remifentanil	100	97	-	-
Fentanyl	14	8	0	3
Morphine (iv)	50	73	27	33
Morphine (im)	0	3	-	-
Codeine	36	5	5	2
Diclofenac	0	0	5	0
Ketamine	0	5	-	-

# Escalation of care in patients admitted to a Neurosurgical and Spinal Postoperative care Unit – a retrospective analysis

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#### **Introduction**

Our Neurosurgical and Spinal Postoperative care Unit (NSPU) opened in 2010 to care for elective and emergency patients with a patent airway not requiring invasive monitoring.<sup>1</sup> Between opening and June 2013 there were 1 839 admissions. We investigated patients whose care was escalated to critical care.

# <u>Methods</u>

A ward register was used to identity patients transferred to critical care. We used a retrospective notes review to identify factors that predicted the need for escalation: age; gender; ASA score; urgency (elective vs emergency); speciality; admission diagnosis and procedure; comorbidities; reason for escalation; and outcome.

#### **Results**

Twenty-nine patients were transferred to critical care, but only 24 notes were available. In one case care was not escalated; in the remaining 23 care was escalated to HDU 10, HDU and then ICU 3, and ICU 10. Mean age was 57 (range 18-75) years, 15 were females, the median ASA score was 3 (range 2-4) and nine patients were smokers. The majority of cases were emergencies (19).

Primary diagnosis, reason for escalation and co-morbidities are reported in Table 1. Commonest reasons for escalation were neurological (70%) and respiratory (26%). Commonest comorbidities were cardiovascular (70%) and respiratory (35%). Twelve patients were discharged for rehabilitation, six were discharged home, four died and one was discharged for palliative care.

# **Conclusion**

The overall rate of escalation of care was low (approximately 1.5%). Two cases were potentially predictable; one had community-acquired pneumonia and the other had been discharged from HDU within 24 h of major surgery with massive blood loss (failed discharge). The commonest diagnosis was

SAH and vasospasm. In a previous local evaluation, 16% of patients undergoing emergency coiling for aneurysmal SAH required escalation from a neurosurgical ward to critical care.<sup>2</sup> Our current lower rate probably reflects NSPU providing more intense nursing care than a neurosurgical ward.

- 1. Pritchard C, Radcliffe J. General principles of postoperative neurosurgical care. Anaesth Intensive Care Med 2011;12:233-9.
- Wiles M, McGann C, Hancock S. Evaluation of the requirements for Critical Care in patients undergoing emergency endovascular coiling for intracerebral aneurysms. J Neurosurg Anesthesiol 2011;23:284-5.

Primary intervention	Reason for escalation				Como	rbidity	
	CVS	RS	CNS	CVS	RS	Metabolic	Other
SAH (NXR) n=12	1	2	2 9 (vasospasm)		4	2	1
Neurosurgery n=8 (craniotomy 2; biopsy 2; EVD 2; AVM 1; posterior fossa 1)		1	7 (CNS bleed 4, ventriculitis 1, seizures 1, persistent low GCS 1)	8	3	2	3
Spinal surgery n=3		3		3	1	1	

SAH, subarachnoid haemorrhage; NXR, interventional neuroradiology; CVS, cardiovascular system; RS, respiratory system; CNS, central nervous system; EVD, external ventricular drain; AVM, arteriovenous malformation; GCS, Glasgow Coma Scale.

# <u>A retrospective review on current practices on haemodynamic management of patients undergoing</u> <u>angioplasty for cerebral vasospasm in our centre</u>

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#### Introduction

Cerebral vasospasm is a common and devastating complication after subarachnoid haemorrhage (SAH).<sup>1</sup> Guidelines for treatment recommend hypertension with euvolemia.<sup>2</sup> Endovascular therapy with cerebral angioplasty and administration of intra-arterial vasodilators is indicated in patients who fail medical treatment.<sup>3</sup> Study aim was to review the haemodynamic management and anaesthetic care of patients undergoing endovascular therapy for cerebral vasospasm in our institution.

#### **Methods**

Medical records of all patients who underwent endovascular therapy for cerebral vasospasm between April 2006 and September 2012 were reviewed retrospectively. Patients with clinical vasospasm were treated by inducing hypertension to systolic pressures of 140 to 170 mmHg. Endovascular treatment was performed if there was no clinical improvement. Data were collected on blood pressure measurements, anaesthetic management, duration and complications of hypertensive therapy and outcome. The differences in the pre- and post angioplasty systolic blood pressure were statistically analysed.

#### **Results**

Forty-five patients had 47 endovascular interventions with balloon angioplasty for proximal vessel spasm and 16 patients had additional intra-arterial injection of a vasodilator agent. Vasospasm onset was 7 days (range 2-15) after SAH. The post angioplasty systolic blood pressure was higher than pre (163  $\pm$  24 (100-210) vs 178  $\pm$ 18 (140–220) mmHg (p < 0.001). Prior to endovascular treatment 68.9% of patients required vasopressors, but post angioplasty 93.3% required them. Norepinephrine was the most commonly used. Angioplasty was successful in reversing the cerebral vasospasm. 80% of patients were discharged from hospital.

#### **Conclusion**

Cerebral vasospasm affects multiple vessels in the same patient. Despite endovascular therapy being a successful intervention for proximal vessel spasm, most patients still required induced hypertension with higher levels post angioplasty compared to pre angioplasty.

- 1. Alaraj A, Charbel FT, Amin Hanjani S. Peri-operative measures for treatment and prevention of cerebral vasospasm following subarachnoid hemorrhage. Neurol Res 2009;31:651-659.
- Connolly ES, Rabinstein AA, Carhuapoma JR et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage: A guideline for the healthcare professionals from the American Heart Association/ American Stroke Association. Stroke 2012;1-5.
- Priebe HJ. Aneurysmal subarachnoid haemorrhage and the anaesthetist. Br J Anaes 2007; 99:102-118.

		Number of patients
Total (n)		44
Age (Mean +/- SD)		51 +/- 9.67
Gender (M: F)		11: 33
Coil: Clipping		27: 17
Vasospasm severity	Mild	4
	Moderate	13
	Severe	15
	Complete narowing	12
Vasospasm Location	Anterior circulation	30
	Posterior circulation	5
	Both	9

#### Anaesthesia for cranioplasty: 78 cases of just "filling a hole?"

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#### Introduction

Cranioplasty is an elective procedure commonly undertaken by neurosurgeons to repair skull defects after decompressive craniectomies. After an unexpected death following such surgery, a retrospective review of the cranioplasties was performed to determine current practice. Aspects of pre-, intra- and postoperative anaesthetic care were analysed to potentially improve and standardise the service provided.

#### <u>Methods</u>

A retrospective notes review of cranioplasties was performed. Indication for craniectomy, time to cranioplasty, as well as aspects of perioperative and postoperative management and complications were recorded.

#### <u>Results</u>

Seventy-eight patients identified to have undergone cranioplasty surgery from January 2011-August 2013. The main indications for craniectomy were trauma (30%), infection (29%) and intracranial haemorrhage (29%). The average time to cranioplasty was 291 days and 50% of cases were admitted on the day of surgery. 76% of cases were ASA Grade 1-2 and the remainder ASA 3. Anaesthetic technique was 77% TIVA, 21% volatile. 87% of cases reported no intraoperative complications, 7% had a difficult intubation with a 5% rate of haemorrhage and one seizure. 100% of patients received antibiotics intraoperatively and 68% postoperatively. 75% of patients went to an HDU setting following surgery. The rate of postoperative complications was 33%. 14% Infection/wound breakdown, 9% seizure cases, 8% haemorrhage. 9% of cases required reoperation due to infection, 6% for adjustment of cranioplasty and 2.5% for haemorrhage. Locally the death rate was 1.3%, which was comparable with published figures.<sup>1</sup> The average time to discharge following cranioplasty was 5.8 days.

#### **Conclusion**

The incidence of our local postoperative complication rate is in keeping with published data,<sup>2</sup> and demonstrates that cranioplasty surgery is not a low-risk procedure. The anaesthetic perioperative care should therefore reflect this potentially with the development of standards and guidelines

- 1. Broughton E, Pobereskin L, Whitfield PC. Seven years of cranioplasty in a regional neurosurgical centre. Br J Neurosurg 2014; 28:34-9
- Chang V, Hartzfeld P, Langlois M, et al. Outcomes of cranial repair after craniectomy. J Neurosurg 2010;112:1120-4.

#### **Re-audit on Management of Thromboprophylaxis in Neurosurgical Patients**

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#### Introduction

Deep vein thrombosis (DVT) is a common, often occult complication following major surgery despite specific prophylaxis recommendations. The incidence of symptomatic DVT is between 2.3-6% but was found to be around 20-35% when assessed using contrast venography in neurosurgical patients without any prophylaxis.<sup>1</sup> Pharmacological thromboprophylaxis is a trade-off between the benefit of reducing venous thromboembolism (VTE) and bleeding risk especially in neurosurgery. An initial audit in 2010 at our hospital showed poor compliance with pharmacological VTE prophylaxis in neurosurgical patients. A VTE assessment has now been made mandatory when a patient is admitted onto our electronic Prescribing Information and Communication System (PICS). Hence the re-audit.

#### <u>Methods</u>

Snapshot data collected on two days. Patients identified from PICS. Type of surgery, postoperative day, mechanical and pharmacological VTE prophylaxis, with review of notes and a patient visit to assess their mobility where necessary.

#### <u>Results</u>

Data from 145 patients were collected and evaluated. 100% of patients had mechanical prophylaxis. In 106 patients (73.1%) low-molecular weight heparin (LMWH) prophylaxis was prescribed. In seven of these patients LMWH was paused at the time of the audit. We looked for contraindications to LMWH in those patients in whom it was not prescribed. In total we could not identify a justifiable cause in 17 patients (11.7%). Subgroup analysis showed that LMWH was prescribed in 54 (81%) patients in cranial group, 13 (62%) patients in cranial trauma group and 39 (62%) patients in spinal group. Significant improvement in prescribing LMWH was made from 2010 (46% in 2010 vs 73.1% in 2013).

#### **Discussion**

We are still far from achieving 100% pharmacological VTE prophylaxis. PICS has now been modified to make a mandatory proposal for LMWH (where recommended by VTE assessment) which does not allow any other prescribing activity until LMWH is either deleted or authorised.

 Payen JF, Faillot T, Audibert G, et al. Thromboprophylaxis in neurosurgery and head trauma. Ann Fr Anesth Reanim. 2005; 24: 921-7.



#### A reaudit of the incidence of hypertension in recovery following major neurosurgery

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#### **Introduction**

Postoperative hypertension is associated with increased risk of complications following intracranial surgery.<sup>1</sup> An audit of patients in 2005 showed that 43% had a systolic blood pressure (SBP) >20% baseline in recovery after craniotomy.<sup>2</sup> Following changes in analgesic administration, we re-audited postoperative hypertension in this patient group.

#### **Methods**

Our audit department gave us permission to assess all patients undergoing intracranial or spinal cord surgery over a 6 week period. Patients were anaesthetised using a propofol/remifentanil TIVA technique. We recorded perioperative analgesia, blood pressure & any interventions for post op BP control. Recovery SBP was compared to preoperative values.

#### **Results**

Forty-eight patients were included for 51 consecutive surgical procedures [44% male patients, mean age 51.8 years, (range 21-77)]. Two patients who were normotensive preoperatively, required intraoperative beta blockade to treat hypertension. Neither had postoperative hypertension or complications. Overall perioperative analgesic administration is shown in table 1.

Eight patients (16%) were hypertensive in recovery. One was on treatment for hypertension preoperatively (similar to 2005 cohort). Four of these patients received antihypertensive treatment in recovery.

#### **Conclusion**

The incidence of hypertension in recovery has decreased from 43% to 17% since 2005. This may be due to the increased use of longer acting opiates (e.g. morphine) instead of routine codeine at the end of surgery.

However, as only four of the patients with hypertension in recovery received treatment/timely intervention for postoperative hypertension this remains a concern in our unit. We plan to address this problem with better guidance for the recovery staff before re-auditing.

- 1. Basali A, Mascha EJ, Kalfas I, Schubert A. Relation between perioperative hypertension and intracranial hemorrhage after craniotomy. Anaesthesiology 2000;93:48-54.
- Hartog A, Andrzejowski J. Audit of Post-Operative Blood Pressure Control in Patients Having Major Intra-Cranial Surgery. Journal of Neurosurg Anaesth 2005:17;161.

		Intra-op Codeine	Intra-op Morphine	Total
	Number of patients (% of total)	32 (65%)	17 (35%)	49
2004/5	Hypertensive in PACU (% of total)	14 (29%)	7 (14%)	21 (43%)
	Number of patients (% of total)	0 (0%)	30 (59%)	51
2012	Hypertensive in PACU (% of total)	N/A	7 (14%)	8 (16%)

# <u>A retrospective audit of the management of patients with a spinal cord injury over a thirty month</u> period and the implementation of an Integrated care pathway

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# Introduction

To retrospectively audit the initial management of patients with a spinal cord injury admitted over a thirty month period at intervals of 4 hours, 24 hours and 7 days.

# <u>Methods</u>

A structured proforma was designed based upon the national guidelines for Spinal cord injury and ATLS guidelines.<sup>1-2</sup> Thirty-three patients were identified with a spinal cord injury between June 2011 and December 2013. Notes were reviewed retrospectively and audited against local and national guidelines.

# <u>Results</u>

Case notes were available for 21 of the 33 patients, a 64% completion rate. Within 4 hours of admission, 24% of patients had an arterial line inserted and 28% of patients had a target mean arterial pressure (MAP) documented. No patient had a NG tube inserted and VTE thromboprophylaxis was documented in only 19%. Confirmation of anal tone was carried out in only 38% of patients.

Within 24 hours of admission, 67% of patients had a NG in situ and VTE thromboprophylaxis was documented in 43% of patients. Only 9% had ASIA scoring within 24 hours. Spinal clearance was documented in 71% of patients.

Over the next seven days, only 28% had further ASIA assessment scoring. All patients were referred to a spinal cord injury unit within seven days.

# **Conclusion**

This audit highlights that the current management of SCI is not in complete accordance with national guidelines with both 4 hour and 24 hour targets not being achieved. Unawareness of the requirement for regular ASIA scoring is highlighted with only 9% of patients having ASIA scoring within 24 hours. We

are also undertaking a survey of doctors and the preliminary results have shown that the majority lack awareness or understanding of ASIA scoring. Our findings have led to the design and implementation of a care pathway that covers the first 7 days of care for patients admitted with a spinal cord injury at T8 level or above. Additionally we have included ASIA score training during induction.

- Meeting the Needs of People with Spinal Cord Injury in Planning for Trauma. National Spinal Cord Injury Strategy Board, approved in May 2010
- 2. Advanced trauma life support, 8th edition, the evidence for change. J Trauma. 2008;64:1638-50.

# Airway management in the face of traumatic cervical spine injury: evaluation of a major trauma centre experience

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#### Introduction

Airway management in patients with cervical spine injury is complicated by the risk of secondary neurological injury. Secondary injury occurs in 2-10% of patients following cervical injury and all airway manoeuvres cause spine movement.<sup>1</sup> Fibreoptic intubation might be expected to limit this risk but it was unclear to what extent we provide this in our unit.

#### <u>Methods</u>

Patients presenting to our major trauma centre with spinal injuries over a one year period (January-December 2013) were identified from our trauma network database. The subset in whom a cervical injury had been sustained was selected and case records reviewed to examine patient airway management and where applicable timing of surgery to stabilise the cervical spine. The project was registered with the hospital patient safety unit.

# <u>Results</u>

Of 240 patients presenting with spinal injuries, 90 (37.5%) sustained cervical injury (23.3% isolated cervical spine injury; 37.8% with associated head injury; 36.7% with other spine injury). Those patients intubated on arrival (prehospital, emergency department or critical care) amounted to 37 (41.1%). A further 34 (37.8%) patients underwent surgery and were intubated in theatre. 31 (34.4%) underwent spinal surgery with a mean delay to operation of 66.8h. Most patients received a modified rapid sequence induction with manual inline stabilisation. Fibreoptic intubation was only considered in those patients intubated in theatres by anaesthetists.

# **Conclusion**

Despite the development of a specialist major trauma centre there is no accepted standard for airway management in patients with cervical trauma in our institution. Initial treatment rightly focuses on oxygenation and control of ventilation and is limited by the impracticality of fibreoptic intubation in the

field. Further analysis is necessary to determine whether a proportion of patients intubated by nonanaesthetists would benefit from fibreoptic intubation by a skilled airway technician.

1. Crosby ET. Airway management in adults after cervical spine trauma. Anesthesiology 2006;104:1293-318.

# Massive airway haemorrhage - the sting in the tail following a case of postoperative macroglossia

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# Introduction

Postoperative macroglossia is a well described complication after neurosurgery. We present a unique case of secondary life threatening airway haemorrhage. The aetiology and implications for practice are considered.

# Case History

A 32 year old man presented for excision of a parasagittal AVM. Orotracheal intubation was easy and a throat pack was used. Surgery lasted 9 hours with the patient positioned supine with neck flexion. Airway obstruction occurred immediately on extubation. Direct laryngoscopy revealed an enlarged tongue with a Grade 4 view. Reintubation was achieved using an Aintree catheter with fibreoptic scope via a LMA. The macroglossia progressed over the next 72 hours and a tracheostomy was performed. Apparent resolution occurred gradually over 3 weeks. Prior to decannulation he suddenly developed profuse oral bleeding. Examination under anaesthesia revealed a midline strip of necrosis from the tongue tip to base involving the lingual artery. After haemostasis, the necrotic tissue was resected and the healthy sides approximated. The rest of his recovery was uneventful.

# **Discussion**

Features common to previous cases include: (Fig. 1)<sup>1-3</sup>

- Mechanical venous obstruction
- Long operative duration
- Progressive swelling after the end of surgery
- Protracted clinical course

The suspected mechanism is that venous obstruction results in tongue ischaemia with subsequent reperfusion injury at the end of surgery.<sup>3</sup> This explains the rapid progression after the end of surgery and

protracted duration typically described. Postoperative macroglossia is rare but an appreciation of the likely mechanism may help in the prevention, early recognition and management of cases that do occur. We suggest:

- Vigilance at extubation in at risk cases:
  - o Long duration
  - Potential venous obstruction eg neck flexion, throat pack
- Early tracheostomy:
  - In anticipation of a protracted course
  - To reduce ongoing tongue pressure injury
- Be wary of tongue necrosis
- 1. Moore JK, Chaudhri S, Moore AP, Easton J. Macroglossia and posterior fossa disease. Anaesthesia 1988;43:382-5.
- 2. Kawaguchi M, Sakamoto T, Ohnishi H, Karasawa J. Pharyngeal packs can cause massive swelling of the tongue after neurosurgical procedures. Anesthesiology 1995;2:434-5.
- Lam AM, Vavilala MS. Macroglossia: Compartment syndrome of the tonge? Anaesthesiology 2000;6:1832-5.

SOURCE	AGE (years)	POSITION	OPERATIVE DURATION (hours)	OROPHARYNGEAL FOREIGN BODIES	MACROGLOSSIA DURATION (days)	DEBRIDEMENT PERFORMED?	COMMENTS
Moore <sup>1</sup>	27	Park bench with neck flexion	14	Throat pack	14	No	
Moore <sup>1</sup>	32	Park bench with ?neck flexion	12	Thro at pack	14	No	
Moore <sup>1</sup>	24	Park bench with marked neck flexion	12	Throat pack	13	No	
Kawaguchi <sup>2</sup>	28	Supine with neck neutral	11	Large throat pack	>20	Yes	Patient had tracheostomy – no orotracheal tube. Authors attribute macroglossia to pharyngeal packs.
Lam <sup>3</sup>	2	Sitting	6	Oropharyngeal airway	Died day 4	No	
Lam <sup>3</sup>	30	Sitting with "maximum flexion"	12	Unknown	Died day 24	No	
Lam <sup>3</sup>	56	Supine with neck flexion	8	Unknown	21	No	Unilateral macroglossia/necrosis in this case.
Lam <sup>3</sup>	44	Prone with head rotation and neck flexion	9	Oesophageal stethoscope and 8mm temp probe	10	No	Severe swelling for 10 days. Ongoing problems 1 year later.
Lam <sup>3</sup>	17	Sitting with neck flexion	8	Transesophageal echo probe	14	No	

Figure 1. Summary of previous case reports

#### An unusual cause of a difficult laryngoscopy

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#### Introduction

A 21-year-old man was referred to our institution from a nearby district general hospital. The patient had been allegedly attacked with a claw hammer, leaving the hammer embedded in his skull.

#### Case history

The referral from the emergency department stated that the patient was compliant with a GCS of 14 (E4 V4 M6), and therefore he was transferred without undergoing tracheal intubation and without an anaesthetic escort. On arrival it was noted that the handle of the hammer passed down in front of his face and mouth (Fig. 1a & 1b), making it impossible to achieve a good seal with a facemask or to access the mouth for direct laryngoscopy and tracheal intubation.

At this point the patient's GCS was 13 (E3 V4 M6) and he was calm and cooperative, although smelling strongly of alcohol. The decision was taken to perform an awake nasal fibreoptic intubation as, this was thought to be the safest and most reliable method of securing his airway without disturbing the position of the hammer and whilst minimising the risk of aspiration.

The procedure was carried out using target controlled remifentanil for sedation and topical anaesthesia (cophenylcaine to nose and 4% lignocaine to pharyngeal/tracheal tissues by "spray as you go"). This was straightforward and well tolerated and once the airway was secured (Fig 1c) anaesthesia was induced with propofol. Surgery proceeded uneventfully and the patient was successfully awoken immediately postoperatively without neurological deficit.

#### **Discussion**

The position of the hammer made direct laryngoscopy difficult if not impossible. Although this airway challenge occurred without warning, in hindsight the scout images from the CT brain (Fig 1d) did suggest

that the handle of the hammer was likely to impede access to the patient's mouth. This case should serve as a reminder that even when in the context of an unusual and attention grabbing injury, adequate airway assessment is essential prior to undertaking a interhospital transfer.



# <u>Primary diagnosis of metastatic non-small cell lung cancer with spinal cord compression in the third</u> <u>trimester of pregnancy</u>

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#### Introduction

Spinal cord compression due to undiagnosed metastatic malignancy in a pregnant woman is rare. We present the case of a parturient diagnosed with spinal metastases in the third trimester of pregnancy and a review of the literature.

#### Case History

A 32 -year-old pregnant woman of 30 weeks gestation attended the emergency department with a fourday history of bilateral lower leg weakness and acute urinary retention. MRI spine showed a metastatic lesion in the dorsal spine at T11-12 causing spinal cord compression. A CT scan showed right lower lobe adenocarcinoma with liver metastases and widespread skeletal involvement. An emergency caesarean section was performed under general anaesthetic. The following day, she underwent urgent complex spinal surgery for tumour debunking, spinal decompression and T9-L1 pedicure screw fixation. A histological diagnosis of metastatic non-small cell papillary lung carcinoma was made and chemotherapy commenced postoperatively.

# **Discussion**

To the best of our knowledge, we are presenting the first documented primary diagnosis of a pregnant woman at 30 weeks gestation with metastatic non-small cell lung carcinoma and spinal cord compression.

A literature search has revealed two similar cases: a 19-year-old pregnant woman presenting with paraplegia due to spinal metastases secondary to osteosarcoma;<sup>1</sup> and, a 19-year-old pregnant woman diagnosed with Wilms' tumour and spinal cord compression.<sup>2</sup> In the first case, an urgent decompressive laminectomy for spinal cord compression was performed under general anaesthesia during pregnancy. In the second case, the patient refused induction of labour until fetal viability could be maintained. Chemotherapy was given for spinal cord compression until 28 weeks gestation when caesarean section

was performed. After delivery the tumour bed and paraspinal metastases were irradiated. We have highlighted the complexities of managing metastatic spinal cord compression.

- 1. Jones BP, Milliken BC, Penning DH. Anesthesia for cesarean section in a patient with paraplegia resulting from tumour metastases to spinal cord. Can J Anaesth. 2000; 47: 1122-28.
- Corapcioglu F, Dillioglugil O, Sarper N, et al. Spinal cord compression and lung metastasis of Wilms' tumor in a pregnant adolescent. Urology. 2004; 64: 807-10.

# Erroneous Bispectral Index values associated with the presence of Periodic Lateralised Epileptiform Discharges (PLEDs)

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#### Introduction

We report a case in which Periodic Lateralised Epileptiform Discharges (PLEDs) in the unprocessed electroencephalogram (EEG) of a patient with acute encephalitis were associated with the display of an erroneously high BIS value.

# Case History

A 67-year-old male presented acutely with seizures. Initial bloods, CT and lumbar puncture (LP) were normal. Antiepileptic and antimicrobial therapy including acyclovir were started. Subsequent status epilepticus necessitated tracheal intubation and bilateral BIS monitoring was instituted. A repeat LP was positive for herpes virus. Sedation was stopped after three days but the patient remained comatose.

Periodic high-amplitude spikes against electrical silence were noted on the raw EEG BIS display. Rises in the BIS from near zero to values above 70 were inconsistent with the clinical picture (Fig. 1). A formal EEG showed PLEDs in all montages suggestive of severe cerebral dysfunction. A week later, the patient remained comatose despite treatment and died shortly after ventilatory support was withdrawn. PLEDs continued to be observed during withdrawal.

# **Discussion**

PLEDs are patterns of abnormal EEG activity indicative of severe cerebral pathology and associated with poor outcome independent of aetiology. Persistence of PLEDs on formal EEG monitoring during the process of death has been reported.<sup>1</sup>

PLEDs have not been previously described in the context of BIS monitoring. This case demonstrates BIS detecting a EEG anomaly, yet incorporating this into the processed index to produce an erroneous value. Whilst clinicians would rarely act on a BIS value in isolation, this case illustrates the utility of the raw EEG

waveforms that can be obtained from the BIS monitor; in our situation prompting a formal EEG evaluation.

 Fishman O, Legatt A. PLEDs following control of seizures and at the end of life. Clin EEG Neurosci 2010 41:11



FIGURE 1 - PLEDs (highlighted) in raw EEG waveform with erroneously high Bispectral Index of 74

#### Anaesthetic Management of Intra-arterial Thrombectomy for Acute Ischaemic Stroke

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#### Introduction

Stroke is the third leading cause of death and the leading cause of disability in Europe with significant socioeconomic implications. Endovascular approaches to the treatment of large cerebral artery occlusion such as intra-arterial thrombectomy (IAT) provide an alternative method for early recanalisation and potentially improves outcome. Patients presenting for such interventions are a heterogeneous group ranging from alert and oriented to comatose. In line with the pathogenesis of stroke, they may have multiple co morbidities, which present challenges for appropriate selection of anaesthetic technique. As part of a NHS multidisciplinary group we were asked to produce consensus guidelines for safe and effective anaesthetic management of patients presenting for IAT.<sup>1</sup>

#### **Methods**

A literature search was conducted to review current best evidence for anaesthetic management of IAT including choice of local, sedation or general anaesthesia (GA), anaesthetic agent, haemodynamic parameters and timing of procedure.

#### <u>Results</u>

A number of studies report an association between GA and poor outcome. An association between hypotension and poor outcome was also found. Time from stroke onset to successful reperfusion appears to be an important factor. All studies were retrospective.

#### **Conclusions**

It is difficult to know if GA is independently associated with worse outcome as these patients often have worse baseline neurological status, procedural complications may necessitate conversion to GA and GA may in itself result in delays. Current evidence suggests that GA should not be used routinely without clear indications.<sup>2</sup> Haemodynamic management must be an important focus of care. We have developed suggested standards of care and a protocol for the safe and effective anaesthetic management of IAT

(Fig. 1). Due to limited data most recommendations are based on expert opinion.<sup>3</sup> Controlled, randomised studies are needed.

- NHS Improvement: Intra-arterial interventions in acute stroke consensus statements. Available at: www.basp.ac.uk/LinkClick.aspx?fileticket=bR3g05gU9YQ%3D
- John N, Mitchell P, Dowling R et al. Is general anaesthesia preferable to conscious sedation in the treatment of acute ischaemic stroke with intra-arterial mechanical thrombectomy? A review of the literature. Neuroradiology 2013;55: 93-100
- Society of Neuroscience in Anesthesiology and Critical Care Expert Consensus Statement: Anaesthetic Management of Endovascular Treatment of Acute Ischaemic Stroke. Available at: http://pubs.societyhq.com/SNACC-StrokeConcensusStatement/



Figure 1: Intra-arterial Mechanical Thrombectomy Protocol

#### Patient preparation and intraoperative comfort during awake craniotomy

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#### Introduction

Awake craniotomy for eloquently-located tumours has been performed in Belfast since February 2012. Intraoperative assessment is conducted by neuro-speech therapist (NST) or neurophysiotherapist (NP). Surgery on awake patients has unique challenges. Anonymous written questionnaires were distributed to assess patient preparation and intraoperative comfort during awake craniotomy.

#### <u>Methods</u>

Ethical approval unnecessary as per ethics committee. Draft questionnaires were distributed to three patients as pilot questionnaires. Final version produced in conjunction with NST and Stroke Association guidance.<sup>1</sup> Twenty-four questionnaires were distributed (20 posted, 4 in hospital) and returned via addressed envelope with no patient identifiers. Excluded patients: pilot 3; advanced illness 2; deceased 1; and address unavailable 4. Median time from operation to questionnaire 243 days, range 2-722.

#### <u>Results</u>

Nineteen questionnaires were returned, 79.2% response. Table 1 shows percentage indicating preparation by surgeon, anaesthetist and NST as 'good/very good'. Six patients had NP assessment (not presented). Intraoperative symptoms/emotions affected patients 'some/a lot/very much': headache 15.8%; pain elsewhere 10.5%; dry mouth 21.1%; difficulty breathing 5.3%; nausea 0%; cold 15.8%; hot 0%; needing to pass water 0%; difficulty concentrating 26.3%; and fear 15.8%. Confidence in team members was 'quite a lot/very much': surgeon 94.7%; theatre nurses 94.7%; anaesthetist 100%; NST 100%; and NP 83.3%. Seven patients expressed gratitude and one surprise at 'seeing the operation on TV'.

#### **Conclusions**

Preoperative language errors may reduce patient professed understanding of information since NST rated highly in all aspects. To supplement understanding a DVD explaining the procedure and patient-

information leaflet are being developed. The theatre tour was popular and should continue. Avoidance of dry mouth, maintaining normothermia and analgesia may improve intraoperative concentration.

 Herbert R, Haw C, Bown C, Gregory E, Brumfitt S. Accessible Information Guidelines [Stroke Association website] July 2012. Available at: http://www.stroke.org.uk/resourcesheet/accessible-information-guidelines. Accessed 1 December 2013.

Table 1. Percentage of patients indicating that aspects of preoperative preparation for awake craniotomy were 'good' or 'very good'.

Pre-operative preparation by:							
Surgeon:	% patients stating 'good/very good'	Anaesthetist:	% patients stating 'good/very good'	NST^:	% patients stating 'good/very good'		
Explanation of need for the operation	89.5	Explanation of asleep-awake- asleep	89.5	Explanation of why NST involved	100		
Explanation of reason for being awake	100	Tour of theatre*	93.3	Explanation of intraoperative speech assessment	100		
Amount of information	89.5	Amount of information	84.2	Amount of information	100		
Time to ask questions	83.3	Time to ask questions	78.9	Time to ask questions	100		
Patient understanding of the information	77.8	Patient understanding of the information	68.4	Patient understanding of the information	84.6		

NST = neuro-speech therapist; \*15/19 patients had a tour of theatre; ^13/19 patients had pre/intraoperative NST assessment.

# Implementation of on-going simulation-based education and training in the medical management of the head-injured patient for general intensive care staff - a pilot study

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#### Introduction

High-fidelity simulation training can engage groups of staff who deal infrequently with certain conditions. In our institution, care of the head-injured patient was identified by general intensive care staff as an area in which they lacked confidence. We designed and implemented a proposal to address this learning need involving such simulation, which has been shown to enhance knowledge retention through experiential learning.<sup>1</sup>

# <u>Methods</u>

During the pilot session, held in a simulation suite, a group of mixed health care professionals participated in simulated scenarios addressing common aspects of the medical management of a head-injured patient. Before and after the study day, participants returned questionnaires concerning their attitudes to the day, the perceived effect of the experience on their learning needs, and other variables relating to human factors. Respondents used a Likert-type scale for all surveyed measures ranging from 1(strongly disagree) to 5(strongly agree). In addition, space was allowed for free-text responses.

# <u>Results</u>

The initial course was attended by a cohort of 10. Global improvements were reported in all pre-defined learning objectives (Table 1). Free-text comments were positive and constructive in nature, and used to further refine future courses.

#### **Conclusions**

Our results confirmed to us that the learning objectives had been met by the scenario design. 'Buy-in' by senior staff has led to the running of a number of weekly sessions using the same scenario, but with an 'in-situ' approach - a simulation technique held in the actual workplace of the delegates. This has been shown to further enhance team training, and can expose system-based latent risks to patient safety.<sup>2</sup> We continue to collect data and hope that our efforts contribute to an improvement in clinical

outcomes.<sup>3</sup> Our eventual aim is for senior staff to continue the project, cascading training to meet the needs of their learners.

- 1. Olympio MD. Simulation saves lives. ASA Newsl 2001;65: 15-19
- Gardner AK, Ahmed RA, George RL, et al. In Situ Simulation to Assess Workplace Attitudes and Effectiveness in a New Facility. Sim Healthcare 2013;8:351-358
- Merchant D. Does High-Fidelity Simulation Improve Clinical Outcomes? J Nurses Staff Dev 2012;28:1(E1-E8)

NeuroSIM for General Intensive Care Staff - Course Date 20/09/13								
Questions relating to Learning Objectives	4understand the concepts of raised ICP	Understand ICP monitoring equipment			🛔 am familiar with using the STH ICP protocol	Aknow how the C-spine is cleared safely		
Total Score	46	44	43	45	43	41	44	44
Total Responses	10	10	10	10	10	10	10	10
Mean Score	4.6	4.4	4.3	4.5	4.3	4.1	4.4	4.4
Mean change from pre-course answers	1.27	1.62	1.3	1.28	1.41	0.66	0.62	1.07
As % improvement	25.4%	32.4%	26.0%	26.0%	28.0%	13.2%	12.4%	22.0%

TABLE 1 – Improvement in learning objective scores from pre-course to post-course (self-reported Likert scores have been summed)

# NICE Guidance - Depth of Anaesthesia Monitors: A Survey to Assess Impact on Daily Practice amongst Neuroanaesthetists

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# Introduction

Following the publication of NICE Diagnostics Guidance DG6 in November 2012<sup>1</sup> the use of electroencephalography(EEG)-based depth of anaesthesia (DoA) monitors is recommended as an option during certain types of general anaesthesia. This survey was designed to assess the impact of the guidance on everyday practice amongst neuroanaesthetists in the UK.

# <u>Methods</u>

A link to an online survey was sent to all members of the NASGBI. Questions focussed on access, training and usage including frequency, anaesthetic technique and patient type when using these systems.

# <u>Results</u>

One-hundred and fifty-six responses were received (93% from consultants) representing 31 neuroscience centres. Of these, 133 (85%) had access to monitoring systems.

Bispectral Index Monitoring (BIS) was the most commonly available (70%) along with E-Entropy (8%) and other referential EEG (2%). 18% cited no availability of any monitoring system. Training had been received in 65% this most commonly being colleague led.

50% of respondants did not routinely consider using these monitors mainly due to lack of equipment but also due to confidence in present practice and a mistrust of the technology and evidence base (Table 1). Several stated that they were awaiting the results of NAP5<sup>2</sup> prior to reevaluating practice.

Of those who do consider usage, TIVA, previous awareness and poor pre-existing cardiovascular function were the main indications with 14% using monitors on a weekly basis, 7% on a daily basis and 49% rarely. 12% did report a change in practice following the NICE guidance; 74% however, did not and 14% declined to answer.

#### **Conclusions**

NICE guidance has not led to a change of daily practice for the majority of neuroanaesthetists. Financial constraints and pressure on existing equipment appear to be the main factor. This may change following the results of NAP5 and subsequent revision of guidance. Many are sceptical of the existing technology and would welcome a consistent and reliable monitor.

- 1. National Institute for Health and Care Excellence. Depth of anaesthesia monitors (E-Entropy, BIS and Narcotrend). DG6. London: National Institute for Health and Care Excellence, 2012.
- NAP5: Accidental Awareness during General Anaesthesia in the United Kingdom (National Audit Projects web site). February 19<sup>th</sup>, 2014. Available at: http://www.nationalauditprojects.org.uk/NAP5\_home

# Table 1.

Why do you not use any DoA monitoring systems ? A summary of responses.

	Respondants
	(Number)
None readily available/not enough equipment	36
Cost precludes use	5
Not convinced by evidence/need consistent accurate monitor	16
Don't feel it adds any benefit to patient management	10
Not necessary/caseload not applicable	8
Confident in own practice	7
Difficult to use for certain procedures	4
Don't understand the technology	1
Use raw EEG	1
# Experience in Transfer of Ventilated Patients with Traumatic Brain Injury and Implementation of a <u>new Transfer Checklist</u>

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## Introduction

The quality of transfer of ventilated patients with traumatic brain injury to a neurosciences centre may have a significant impact on patient outcome.<sup>1</sup> Previous local audit identified suboptimal care in a proportion of these patients. Consequently, we aimed to assess the transfer experience amongst trainee anaesthetists in our region.

## **Methods**

We conducted a survey of all anaesthetic trainees attending a regional scientific meeting, using a realtime electronic data capture system via handheld devices. We incorporated questions on the grade of training, number of previous transfers (including paediatric time critical transfers), level of transfer training received and the nature of any critical incidents encountered.

#### <u>Results</u>

Sixty trainees from CT1 to ST7 level completed the survey. Fifty-one trainees (85%) had performed interhospitals transfers, with 31 (52%) having undertaken more than 10 separate transfers and 13 (22%) having performed a paediatric time critical transfer. Forty individuals (67%) had no formal transfer training but the majority of trainees felt adequately prepared (67% overall; 100% from ST4 level and above). Eighteen anaesthetists (30%) reported experiencing a critical incident in transfer, the most common being airway and oxygenation problems (7), cardiovascular instability (5) and monitoring failure (4).

# **Conclusions**

Our survey highlights the significant transfer exposure of junior anaesthetists and the substantial critical incident rate on the background of varied experience and level of training. We have designed a simple pre-transfer checklist in order to improve the quality of transfer of head injured patients. This has been

introduced into all hospitals within our region through our trainee-led research collaboration, SHARC. We are now benchmarking the use of this checklist against a number of quality indicators recorded on arrival of patients at our tertiary neurosciences unit.<sup>2</sup>

- The Association of Anaesthetists of Great Britain and Ireland. Recommendations for the Safe Transfer of Patients with Brain Injury. AAGBI guidelines, May 2006. Available at: http://www.aagbi.org/sites/default/files/braininjury.pdf. Accessed Feb 13, 2014.
- SHARC. Quality of Transfer in Patients with Severe Traumatic Brain Injury. Available at: http://www.sharcgroup.org.uk/projects/project-3-quality-of-transfer-in-patients-with-severetraumatic-brain-injury. Accessed Feb 13, 2014.

# For your eyes only: A survey investigating the practices of neuroanaesthetists in the Great Britain and Ireland with regards eye protection in patients undergoing a general anaesthetic for neurosurgery

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# Introduction

All patients undergoing a general anaesthetic (GA) require some form of eye protection to reduce risk of eye damage. A recent literature review of eye protection has shown that there is no significant advantage with taping the eyes vs. applying lubricants vs. both.<sup>1</sup> We therefore surveyed neuroanaesthetists in the UK to see what the variation in practice was, which tape and lubricants were used (if any), whether practices change with differing procedures/positions and the whether the reporter has ever been directly involved in a case of eye damage following a GA.

# <u>Methods</u>

An online questionnaire was sent out to all members of the NASGBI. Questions relating to the subject of patient positioning, eye protection and incidence of eye damage were asked. Data were analysed using SurveyGalaxy software, exporting the data into Microsoft Word and Powerpoint.

# <u>Results</u>

One-hundred and seventy-six responses were received from 32 institutions. Nearly 90% of these were from consultants. 24% (36/150 respondents) across 16 trusts reported having an eye protection policy in place at their hospital for supine/lateral surgery and 23.3% for prone surgery. The majority of respondents use either individual tape and/or Gauze pads and/or a large adhesive dressing covering both eyes and cheeks. The most common tape used was Micropore (41.7%).

In the past 12 months, only 13% of those who answered had been directly involved in one or more patients with eye damage. Only 4% of respondents reported having been directly involved in cases of permanent eye damage in the last 5 years.

# **Conclusions**

Eye damage during neurosurgical procedures does happen, with over 10% of respondents being directly involved in such cases in the previous twelve months. Over 75% are either not aware or do not have departmental policies in place to prevent such complications. Practice of eye protection is varied, with no definite advantage being proven of any method other than taping the eyes.

 Grixti A, Sadri M, Watts MT. Corneal Protection during General Anesthesia for Nonocular Surgery. Ocul Surf. 2013;11:109-118.

#### A national survey of the use of spinal cord monitoring

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#### Introduction

Neurophysiological intraoperative monitoring (IOM) assesses the functional integrity of neural structures to increase safety and reduce morbidity. Techniques include EMG and evoked potentials (EP): somatosensory (SSEP) and motor-evoked (MEP). The use of IOM has reduced the incidence of motor deficit in scoliosis surgery and is now considered a standard of care.<sup>1</sup> However the spinal cord is at risk whenever corrective forces are applied to the spinal column or the canal is surgically invaded. Complex spine surgery is also increasing. The use of IOM has implications for anaesthetists, as anaesthetic management may need to be modified.<sup>2,3</sup> We wanted to investigate availability of IOM, indications for use and anaesthetic techniques used.

#### <u>Methods</u>

An on-line survey was distributed to all Consultant Neuroanaesthetists in the UK who were members of the NASGBI. The responses were analysed by survey galaxy software.

#### <u>Results</u>

We had 124 replies from 30 of 34 adult neurosurgical units. Results are summarised in table 1.

#### **Conclusions**

The use of IOM varies widely, largely driven by surgical preference. Most units have access to IOM and regard it as an important tool to reduce morbidity. However only 60% of anaesthetists use IOM and 15% did not know what was available in their unit. Some felt that it was just a surgical tool but successful use requires understanding and involvement by all; EPs are sensitive to hypotension and most anaesthetics interfere with signal acquisition. Neurophysiologists often request TIVA but many felt this decision should be the anaesthetists. Remifentanil was used in 80% of cases but volatile agents in 14% for SSEPs and 7% for MEPs. Despite claims that standardisation reduces complications only 40% of units had guidelines for these cases. As numbers of complex procedures increase, IOM may improve outcome. If

used, preoperative discussion between all involved is essential. As the use of IOM increases anaesthetists should be included in training programmes.

- Nuwer MR, Emerson, RG, Galloway G et al. Evidence-Based Guideline Update: Intraoperative Spinal Monitoring with Somatosensory and Transcranial Electrical Motor Evoked Potentials. J Clin Neurophysiol 2012; 29: 101-8.
- Raw DA, Beattie JA, Hunter JM. Anaesthesia for Spinal Surgery in Adults. Br J Anaesth 2003; 91: 886-904.
- 3. Moberg D, Galloway SG. Neurophysiology. In: Matta BF, Menon DK, Smith M eds. Core Topics in Neuroanaesthesia and Neurointensive Care. Cambridge University Press, 2011: 101-117

# Table 1. Summary of Responses.

Intraoperative monitoring (IOM), Electromyography (EMG), Somatosensory evoked potentials (SSEP), Motor evoked potentials (MEP).

Is equipment for IOM available in your hospital?						
Yes		80%				
No		15%				
Don't know		5%				
What types of IOM are available in your hospital for spinal surgery?						
EMG		62%				
SSEP		90%				
MEP		72%				
Don't know		15%				
Do you ever use IOM for spinal surgery?						
Yes		65%				
No		20%				
No answer		15%				
Who usually carries out the monitoring?						
Neurophysiologist		80%				
Surgeon		8%				
Neurologist		2%				
Other		10%				
Which of the following types of surgery do you usually use monitoring for?						
Scoliosis surgery		45%				
Spinal cord tumours		65%				
Cervical / thoracic instrumentation		40%				
Lumbar instrumentation		12%				
Don't monitor/ No answer		14%				
Do you have agreed anaesthetic guidelines for use during IOM?						
Yes		40%				
No		35%				
No answer		25%				
What anaesthetic agents do you use when you are performing IOM?						
		Nitrous			Muscle	
5140	Volatiles	oxide	Propofol	Remifentanil	relaxants	Suggamadex
EMG	11.4%	1.4%	58.6%	64.3%	12.9%	0.0%
SSEP	14.3%	1.4%	/1.4%	80.0%	20.0%	0.0%
MEP	7.1%	1.4%	77.1%	81.4%	17.1%	0.0%
What is the main reason you use spinal cord monitoring?						
Decreased perioperative morbidity		50%				
Surgical preference		24%				
Medicolegal reasons		4%				
Other answers		22%				

#### Anaesthesia for cranioplasty: a local and national view

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#### Introduction

Cranioplasty is an elective procedure undertaken by neurosurgeons to repair skull defects after decompressive craniectomies. Opinions differ as to the seriousness of this procedure. Previous work has shown that the overall rate of complications following cranioplasty is greater than other cranial procedures.<sup>1</sup> Establishing the perioperative practice of UK neuroanaesthetists would help guide the future management of these patients.

#### **Methods**

We initially carried out a retrospective notes review of 78 cranioplasties performed in our centre. Following this we undertook a national survey of cranioplasty practice in the UK. Members of the Neuroanaesthesia Society of Great Britain and Ireland were asked to complete a survey on perioperative management and complications.

#### <u>Results</u>

We had a response from 39% (134) of NASGBI members. 90% of these were consultant anaesthetists and 90% had anaesthetized for cranioplasty surgery within 2 years. Anaesthetic technique most commonly employed was volatile compared with TIVA locally, and in 50% the operator was a consultant neurosurgeon. Postoperatively, 28% of respondents routinely sent cranioplasty patients to a HDU, compared to 75% locally. 28% of respondents had to re-anaesthetise a cranioplasty patient for a complication the most common being wound infection (18%), followed by haemorrhage. Locally our return to theatre rate was 33%, with individual numbers comparable to the national figures. Locally the death rate was 1.3%, which was comparable with published figures.<sup>2</sup>

#### **Conclusions**

Following craniectomy, cranioplasty is often seen as a low risk procedure. However the complication rate and the view of the surveyed anaesthetists demonstrate that it is often underrated surgery with the

potential for unknown risks. Comments from the survey focused on the grade of the operating surgeon. A combined anaesthetic and surgical approach would aid the development of management standards for a procedure that is not without risk.

- Chang V, Hartzfeld P, Langlois M et al. Outcomes of cranial repair after craniectomy. J Neurosurg 2010;112:1120-4.
- 2. Broughton E, Pobereskin L, Whitfield PC. Seven years of cranioplasty in a regional neurosurgical centre. Br J Neurosurg 2013; 28:34.39.