



# **NASGBI ASM Abstracts 2015**

## **HIF expression following isolated blast brain injury**

J.E. Risdall MB BS MA(Cantab) MA (Lond) FFARCSI; A.J. Carter PhD MSB CBiol; D.K. Menon MD PhD FRCP FRCA FFICM FMedSci. *University Department of Anaesthetics, Addenbrooke's Hospital, Cambridge, UK.*

### Introduction

Blast brain injury (BBI) has risen to prominence in recent military conflicts and terrorist incidents, and may represent a specific form of primary brain injury [1]. Hypoxia inducible factor-1 $\alpha$  (HIF) is a transcriptional activator of genes, implicated in cerebral oedema formation in cerebral ischemic/reperfusion injury and controlled cortical impact models, but its role in BBI is not well defined.

### Methods

The study was Ethically Reviewed and performed under the Animals (Scientific Procedures) Act 1986. Rats, terminally anaesthetised with isoflurane, (n=14) were exposed to a cranial blast wave using a bench-top blast wave generator [2]. 14 control animals were handled identically but not exposed to blast. All animals were killed after 8 hours and the brains extracted. 18 brains (9 blast, 9 controls) were examined histologically for tissue damage and HIF expression. The remaining 10 were divided for HIF extraction, Western Blot quantification, and assessment of inflammatory mediators, reported separately[3].

### Results

At 8 hours, there was no histological evidence of tissue damage. HIF was variably expressed following blast, predominantly in the middle section of the ipsilateral cortex. Dual staining revealed co-localisation of HIF and Neu-N suggesting HIF expression/accumulation in neuronal nuclei. Occasional non-neuronal cells also stained positive for HIF. HIF was detectable by Western blot in both groups with greater expression in the blast-exposed animals, but this was not statistically significant. By contrast analysis of the same brain tissue showed significant blast-induced elevation of several inflammatory mediators [3].

### Conclusions

These results show a trend suggestive of increased HIF expression in the cortex in BBI, although the signal was weaker than that of inflammatory mediators. Eight hours exposure to isoflurane, known to induce HIF, may have influenced this.

1. Risdall JE, Menon DK. Traumatic Brain Injury. *Phil. Trans. R. Soc. B* 2011;366:241-250.
2. Guy RJ, Kirkman E, Watkins PE et al. Physiologic Responses to Primary Blast. *J Trauma: Injury, Infection, and Critical Care* 1998;45:983-987
3. Risdall JE, Carter AJ, Kirkman E, Watts SA, Taylor C, Menon DK. Endothelial activation and chemoattractant expression are early processes in isolated blast brain injury. *Neuromol Med* 2014;16:606-19.

## **Management of patients with spinal cord injury: an integrated care pathway**

C. Fiandeiro MBChB FRCA DA; N. Gibson MBBS BSc; G. Giannitopoulos MBBS; A. Zoumprouli MD. *St George's University Hospital, London, UK.*

### Introduction

Spinal Cord Injuries (SCI) can affect any age group, but is more prevalent in young males. Spinal Research UK reports that a 1000 people sustain spinal cord injury each year in UK and Ireland. St George's is a trauma centre in South West London, with a dedicated Neuro Intensive Care Unit. We audited our management of spinal cord injury patients and our compliance to national guidelines and ATLS protocols. Our audit in 2013 showed that despite patients being admitted to the correct destination, both 4 hour and 24 hour targets were not achieved. In order to improve our service we included teaching on management of Spinal Cord Injury as part of our NICU induction and implemented an Integrated Care Pathway (ICP).

### Methods

An ICP booklet for Spinal Cord Injuries at T8 & above was followed by the multidisciplinary teams from admission and completed daily for the first 7 days on NICU. A structured proforma was used to collect data over an eight month period between March 2014 and October 2014, looking at 4 hours and 24 hours intervals. We identified 13 patients.

### Results

Data were available for 9 patients (69% completion rate). Our SCI pathway showed a substantial improvement in management at both 4 hours and 24 hours after admission. Table 1 shows our re-audit results as compared to our initial audit in 2013, at 4 hours and 24 hours. The improved documentation of actions undertaken and clear communication, has improved the care given to our SCI patients.

### Conclusions

The Integrated Care Pathway has clearly improved the continuity of care delivered to these patients, the goal directed documentation has ensured communication between the members of the team. It was supported by all members of the MDT. We will aim to re-audit in a year to ensure the on-going awareness and it's use. This pathway has also highlighted which other areas we can improve on (ie.ASIA scoring).

Table 1. Comparing initial audit (n=15) and re-audit (n=9), guidelines suggest targets to be achieved within a certain period of time.

Percentage of patients meeting admission targets	Initial Audit target at 4hours	Re-Audit target at 4hours	Initial Audit target at 24hours	Re-audit target at 24hours
Arterial line inserted	33%	89%		
Target MAP documented	40%	78%		
NGT Inserted	0%	89%	46%	100%
VTE Prophylaxis	27%	100%	46%	100%
Urinary catheter Inserted	54%	100%		
Anal tone documented	54%	33%		
Spinal Clearance			66%	100%
Secondary survey			40%	66%
Bowel care Protocol			74%	89%

## **Is it cost effective to treat poor grade subarachnoid haemorrhage? Single centre cost per QALY by grade**

C. Hamilton MBChB FRCA; C. Spencer MBChB FRCA FFICM EDIC; J. Tate BSc(Hons); N. Pickstock MBChB FRCA; N. Gurusinghe MBBS FRCSEd. *Royal Preston Hospital, Preston, UK.*

### Introduction

Acute aneurysmal subarachnoid haemorrhage (aSAH) can be a severely debilitating or fatal condition. In our hospital, the zeitgeist predicted a futile outlook for poor grade SAH patients. We sought to review our management and outcomes of SAH patients and estimate the cost of their inpatient stay.

### Methods

The severity, timings and complications of all SAH patients presenting acutely in the year 2013 were recorded including Glasgow outcome scores (GOS) at discharge and follow-up. We interrogated the ICNARC database and combined the datasets to obtain the length of stay for each level of care for each patient. The cost per level of care was estimated using a costing analysis previously conducted in our hospital in this patient group. The treatment costs were estimated using the coiling service line reporting cost for that year. The individualised life expectancies were estimated by age using those reported in Rivero-Arias et al. [1] The quality of life adjusted years (QALY) were then calculated from the GOS using a conversion factor from Aoki et al. [2]

### Results

Data was collected on 111 patients. 105 patients were analysed at discharge and 98 patients attended followup. we excluded patients with incomplete data. The total estimated cost was £17439.80 per person. The cost per QALY at follow up is summarised in the table below.

### Conclusions

The cost per QALY for admission and treatment of all grades of aSAH fell well below the threshold used by NICE to determine the cost-effectiveness of an intervention. Our estimation includes the majority of the inpatient financial burden; other radiological and neurosurgical interventions were not included. These may only represent a small portion of the long term economic burden of rehabilitation, loss of earnings and social care costs. Based on our analysis of inpatient costs and exceptionally good outcomes in some poor grade patients, we cannot recommend withholding aSAH treatment on WFNS grade alone.

1. Rivero-Arias et al. Burden of disease and costs of aneurysmal subarachnoid haemorrhage (aSAH) in the United Kingdom. Cost Effectiveness and Resource Allocation 2010, 8:6
2. Aoki N et al. Management of unruptured intra- cranial aneurysm in Japan: a Markovian decision analysis with utility measurements based on the Glasgow Outcome Scale. Med Decis Making. 1998; 18: 357–364.

Table 1.

WFNS Grade	Patients	Patients with Outcome Data	GOS 1 (Death)	GOS 3	GOS 4	GOS 5	Average Age	Total QALYs Saved	Cost per QALY (£)
5*	18	16	6	6	2	2	54.2	85.3	6038.1
5	25	23	13	6	2	2	55.6	85.3	6260.8
4*	9	8	4	0	0	4	64.6	57.6	3308.4
4	11	10	6	0	0	4	63.6	57.6	3369.1
3	5	5	1	1	1	2	62.8	51.6	1443.9
2	19	19	0	3	4	12	54.2	324.8	1076.1
1	48	42	1	2	3	37	53.9	820.8	678.3
<b>Total</b>	<b>108</b>	<b>99</b>	<b>21</b>	<b>12</b>	<b>10</b>	<b>57</b>	<b>55.4</b>	<b>1483.0</b>	<b>1166.4</b>

## **Postoperative nausea and vomiting after craniotomy; are we doing enough?**

C. Fiandeiro MBChB FRCA DA; J. Dinsmore MBBS FRCA, DA. *St George's University Hospitals, London, UK.*

### Introduction

Postoperative nausea and vomiting (PONV) following craniotomy can occur in up to 54% of patients and may affect surgical outcome. [1] There are well-established patient and anaesthesia related risk factors but the contribution of the type of surgery is debated. We currently have no antiemetic guidelines for craniotomy patients but seemed to perform well with a snapshot survey reporting an incidence of only 30%. We wanted to establish the true incidence and evaluate potential risk factors.

### Methods

The incidence of PONV after craniotomy was audited in 100 patients having elective craniotomy, over a 10-month period. Both supra- and infratentorial craniotomies were included. A questionnaire was completed by the anaesthetist intraoperatively and patients were followed by the authors. A simplified Apfel score was calculated for each patient to compare predicted to the observed incidence of vomiting. [2]

### Results

We obtained completed questionnaires from 100 patients (49 males: 51 females), mean age 53 yrs (17 - 80 yrs). The overall incidence of PONV and some risk factors are shown in table 1. The incidence of PONV was particularly high in those undergoing infratentorial surgery and was higher in females than males. There did not appear to be an association with age, the use of TIVA or awake craniotomy. The incidence of PONV was higher than would be expected by the simplified Apfel score (43%).

### Conclusions

Patients undergoing craniotomy should be identified as high-risk for PONV. The multiple confounding variables contributing to PONV made data analysis very difficult. However our incidence of PONV is similar to other studies. As expected, it is a particular problem for females and those undergoing infratentorial surgery. However despite all our patients receiving dexamethasone and an intraoperative anti-emetic, 28% still had PONV at 48hrs. We plan to introduce antiemetic guidelines for these patients and re-audit their effect once established. [3]



1. Latz B, Mordhorst C, Kerz T et al. Postoperative nausea and vomiting in patients after craniotomy: incidence and risk-factors. J Neurosurg 2011;114:491-496.
2. Apfel CC, Heidrich FM, Rao-Jukar S et al. Evidence based analysis of risk factors for postoperative nausea and vomiting. Br J Anaesthesia 2012;109:742-753.
3. Gan TJ, Diemunsch P, Habib AS et al. Consensus guidelines for the management of postoperative nausea and vomiting. Anesth Analg 2014;118:85-113.

Table 1. Incidence of postoperative nausea and vomiting (PONV) in patients undergoing craniotomy

<b>PONV</b>	<b>Incidence &lt; 24hrs</b>	<b>Incidence &gt; 24 hrs</b>
<b>All patients</b>	Nausea 51% Vomiting 31%	Nausea 23% Vomiting 16%
<b>Supratentorial craniotomy</b>	Nausea 43% Vomiting 25%	Nausea 16% Vomiting 9%
<b>Infratentorial craniotomy</b>	Nausea 79% Vomiting 53%	Nausea 57% Vomiting 35%
<b>PONV in Males : Females</b>	Males : Females 41% : 59%	Males : Females 19% : 36%

## **Determining pregnancy status before neurosurgery: familiarisation with standard checks sustains improvement in patient's safety over five years**

E. Hoogenboom MD FMH FRCA; C. Moss BM MRCP FRCA; A. Pearce FRCA; S.R. Wilson FRCA FFICM.

*National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust*

### Introduction

Surgery in pregnant women is linked to increased risk of miscarriage, congenital malformations, and low birth weight. Pregnancy prompts a change of surgical, radiological and/or anaesthetic management (1). NICE guidelines (2) advise testing, when the date of last menstrual period (LMP) is uncertain or when the history cannot exclude pregnancy. The NPSA (3) recommends checking and recording the pregnancy status in the immediate perioperative period. Practice improvement in our department was achieved by staff education and training, empowering patients through posters and booklets and the availability of bedside testing. The introduction in 2010 of a mandatory check, in our version of the World Health Organisation (WHO) perioperative checklist, significantly improved documentation. A repeat audit was carried out to confirm sustainability of the achieved results.

### Methods

A three cycles audit of pregnancy status documentation (patients' history, known LMP or negative pregnancy test result). Case notes of women aged 16 to 55 years, undergoing surgery under general anaesthetic were reviewed in 2009, 2010, 2011, and 2014. X-ray use was noted.

### Results

Results are summarised in Table 1. Patients included in the 4 audits were 104, 28, 51, and 50. The mode age group was 41 to 50 years. Women undergoing neurosurgery with an unknown pregnancy status steadily decreased: from 82% in 2009 to 8% in 2014.

### Conclusions

Documentation of pregnancy status in the perioperative period has continued to improve. We attribute this to staff being more familiar with the document and efforts to increase compliance with the WHO checklist, which is under continuous scrutiny. As the LMP/history may be unreliable, we intend to introduce routine pregnancy testing (with consent) for all women aged 16-55 years, facilitated by

guidance from a decisional flowchart. This will improve patient's safety and minimize the risks of operating in the presence of unknown pregnancy.

1. Reitman E, Flood P Anaesthetic considerations for non-obstetric surgery during pregnancy, BJA 2011 Dec;107 Suppl 1:i72-8
2. National Institute for Health and Clinical Excellence guidelines on preoperative testing CG3 2013, <http://www.nice.org.uk/guidance/cg3/chapter/1-recommendations> [NICE website], accessed 03/03/2015
3. National Patient' Safety Agency (NPSA) Rapid Response Report NPSA/2010/RRR011 <http://www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=73883&type=full&servicetype=Attachment> [NPSA website], accessed 03/03/2015

Table 1: Documentation of pregnancy status or LMP in the preassessment clinic, anaesthetic chart and WHO form and interventions implemented between each audit cycles

Documentation of pregnancy status or last menstrual period	2009		2010		2011		2014
Preassessment clinic	85%	Staff Training, Patients Empowerment	92%	Introduction of new WHO checklist	100%	Increased compliance with WHO checklist use	100%
Anaesthetic chart	0%		14%		20%		4%
WHO form	N/A		N/A		66%		92%
% of women with unknown pregnancy status undergoing surgery	82%		71%		12%		8%
% of women with unknown pregnancy status exposed to x-ray	70%		55%		16%		0%

## **Audit of neuropathic pain in adult tethered cord syndrome patients undergoing surgical untethering procedure**

H.C. Butterfield MB ChB FRCA FFICM; P.K. Ganty MBBS DA FCARSCI FRCA ; P Kilfoyle MD Pharm PgDip.  
*The Walton Centre NHS Foundation Trust, Liverpool, UK.*

### Introduction

Adults with Tethered Cord Syndrome (TCS) present for neurosurgical intervention at our institution and require multidisciplinary team management. This population were observed to develop new or worsening neuropathic (NP) pain in the post operative period. Our audit looked at the incidence of this and recommendations are made to improve the pain management in this cohort. A procedure specific approach to pain relief, modified to the needs of individual patients is now recommended.(1) Chronic pain can develop if pain is not treated effectively at the time of surgery.(2)

### Methods

38 patients who underwent untethering procedures over a 2 year period for a single neurosurgeon were identified. Data collected included patient age, gender, pre- and perioperative analgesic use and the incidence of new or worsened NP pain in recovery or the ward. Prompting questions from the Doleur Neuropathique 4 (DN4) questionnaire were used to diagnose NP pain.

### Results

Average patient age is 44 years and 65% were female. 3 of the 38 patients had NP pain in recovery. 17 of the 38 patients had NP pain on the ward. Of these 17 patients only 5 were taking gabapentionds preoperatively. All 17 were referred to the Chronic Pain Team postoperatively for management. Some had prolonged hospital stays.

### Conclusion

We identified a patient population that requires improved pain management. New or worsened NP pain occurs in up to 45% of this patient population. Recommendations to improve the quality of care for this population include:

1. A surgery specific analgesic regime to be added to the hospitals EPMA (electronic prescribing medicines administration) system.(3) This regime commences gabapentionoid naïve patients on Pregabalin 300mg on the night before surgery and 300mg 8 hourly for the next 5 days. It has protocols

for the use of ketamine, lidocaine and magnesium in addition. Information about pain relief to be added to the current patient information leaflet.

1. White P, Kehlet H. Improving post-operative pain management. *Anesthesiology* 2010;112(1):220-225
2. Niraj G, Rowbotham J. Persistent post operative pain: where are we now? *Br J Anaesth* 2011;107(1):25-29
3. Gritsemko, Karina et al. Multimodal therapy in perioperative analgesia. *Best Practice & Research Clinical Anaesthesiology* 2014;28 (1):59-79

## **Association of serum calcium and presence of vasospasm in patients following aneurysmal subarachnoid haemorrhage**

A. Bhattacharjee MBBS FCARCSI; H. Chamarette MBBS FRCA; A.M.V. Luoma MBChB FRCA. *National Hospital for Neurology & Neurosurgery, UCLH NHS Foundation Trust, London, UK.*

### Introduction

Subarachnoid haemorrhage (SAH) accounts for 6% of stroke affecting 6-12 per 100000 people per year [1]. Delayed cerebral ischaemia due to clinically symptomatic vasospasm affects a third of patients [2]. Nimodipine, a calcium antagonist, is currently the main drug used to reduce vasospasm & improve outcome [3]. It stabilises voltage gated L-type calcium (Ca) channels in their inactive form, inhibiting Ca influx into vascular smooth muscle, thereby preventing vasospasm. We hypothesised that high serum [Ca] at presentation may increase risk of vasospasm.

### Methods

Retrospective electronic case-note review of all patients admitted to our Critical Care Unit with SAH in 2014. Data collected: demographics, WFNS grade of SAH, admission serum Ca & adjusted (adj) Ca, incidence of vasospasm. Vasospasm identified from transcranial doppler studies & cerebral angiography.

### Results

- 102 patients identified, 99 had complete data sets
- WFNS Grade SAH: I = 65%, II=6.7%, III = 8.3%, IV=20%
- Mean [SD] patient age: 54.4 [13.4] years. 64% female
- Incidence of vasospasm 44.4%
- No significant difference between serum [Ca] / adj [Ca] across different grades of SAH
- Vasospasm associated with increased serum Ca [mean 2.231mmol/L (sd 0.163) vs 2.158mmol/L (sd 0.156)] [p=0.029] on presentation [figure 1], but not adj [Ca]

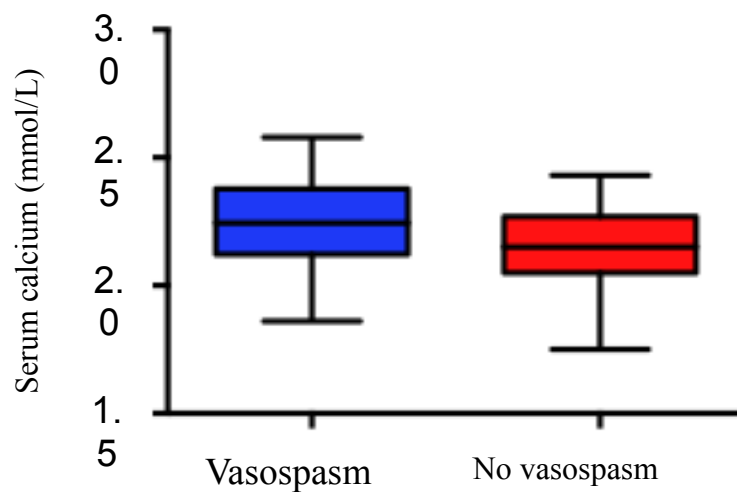
### Conclusion

Although our patient number is small, we demonstrated an association between serum [Ca] & vasospasm. There was no difference across grades of SAH. Intracellular or CSF [Ca] level may be more influential in vasospasm due to possible vascular & blood brain barrier injury following SAH, but this is

difficult to measure. Our findings suggest serum [Ca] at presentation could be utilised as a biomarker to predict risk of vasospasm, & may account for the efficacy of nimodipine.

1. Smith M. Intensive care management of patients with subarachnoid haemorrhage. *Curr Opin Anaesthesiol* 2007; 20:4007; DOI:10.1097/ACO.0b013e3282efa686
2. Brilstra EH et al. Rebleeding, secondary ischemia and timing of operation in patients with subarachnoid hemorrhage. *Neurology* 2000; 55:1656-60
3. DorhoutMees S et al. Calcium antagonists for aneurysmal subarachnoid haemorrhage. *Cochrane Database of Systematic Reviews* 2007; Issue 3. Art. No: CD000277. DOI: 10.1002/14651858

Figure 1: Serum calcium on presentation and the presence or absence of vasospasm in acute subarachnoid haemorrhage (SAH)



**The cardiovascular effects of adrenaline-containing local anaesthetic infiltration into the nasal mucosa of patients undergoing endoscopic trans-sphenoidal pituitary surgery: a prospective observational study.**

M.D. Wiles<sup>1</sup> BMedSci MMedSci (ClinEd) BMBS MRCP FRCA FFICM; M. Sanders<sup>2</sup>; J.C.

Andrzejowski<sup>1</sup> MBChB FRCA FFICM. 1. *Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK*, 2. *University of Sheffield Medical School, Sheffield, UK*.

Introduction

Local anaesthetic (LA) containing adrenaline is often infiltrated into nasal mucosa prior to trans-sphenoidal pituitary surgery (TPS) to decrease blood loss. In patients undergoing sinus surgery this has been shown to produce a marked decrease in mean arterial pressure (MAP) 90 seconds after infiltration [1-2], although this effect has never been studied using continuous cardiac output measurement.

Method

After ethical approval and consent, 11 patients undergoing TPS were recruited. A LiDCOrapid (LiDCO, Cambridge, UK) CO monitor was connected to a radial arterial line and a standard propofol/remifentanyl anaesthetic titrated to a BIS 40 to 55 given. Cardiovascular indices were monitored for 30 s prior to, and 5 min following the administration of nasal LA (4 mls 4% articaine with 1:200,000 adrenaline; Septanest, Septodont, Maidstone, UK). Data analyses were done using SigmaStat (v3.11, Systat Software, San Jose, California). Data were not normally distributed and are expressed as median (range) with Friedman repeated measures analysis of variance with a post hoc Tukey test.

Results

Two patients were excluded as data could not be downloaded, leaving nine for analysis. Mean (SD) age was 56.9 (17.6) years, with five being male. A significant drop in MAP [defined a priori as >20% from baseline) was seen in five patients; the CVS parameters of these patients were indexed (baseline assigned as 1) and analysed. The drop in MAP [24.6% (21.1 to 30.1)] occurred 116 s (40 to 154) after infiltration. Change in CVS indices 120 s after LA were as follows: SVR 0.860 (0.752 to 0.953); MAP 0.934 (0.897 to 0.986); HR 1.045 (1.013 to 1.093); SV 1.032 (0.964 to 1.146); and CO 1.076 (0.980 to 1.193) [P<0.05 for all compared to baseline] (Fig. 1).

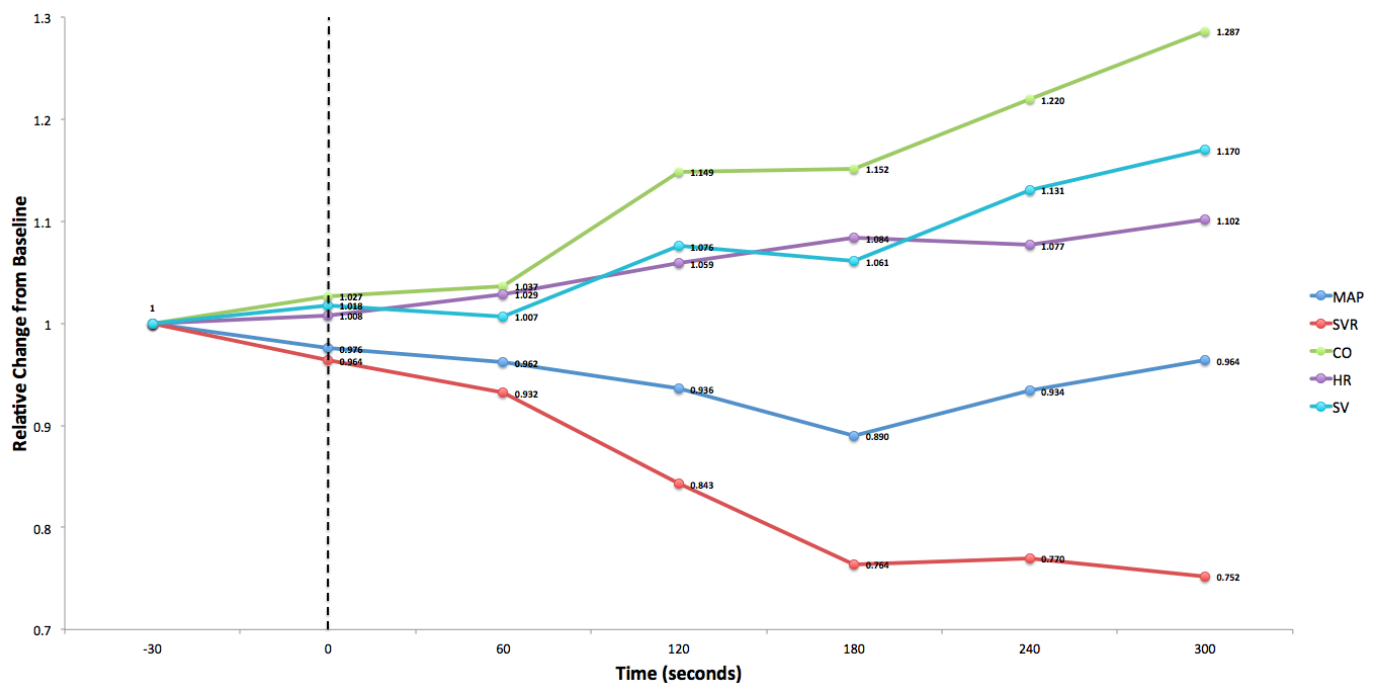


## Conclusion

Nasal infiltration of adrenaline containing LA in patients having TPS results in a >20% decrease in MAP in over 50% of cases. Our data suggest this is due to a fall in SVR, possibly due to adrenaline-mediated  $\beta_2$  vasodilatation.

1. Yang JJ, Li WY, Jil Q, et al. Local anesthesia for functional endoscopic sinus surgery employing small volumes of epinephrine-containing solutions of lidocaine produces profound hypotension. *Acta Anaesthesiol Scand*. 2005;49:1471-6.
2. Yang JJ, Zheng J, Liu HJ, et al. Epinephrine infiltration on nasal field causes significant hemodynamic changes: Hypotension episode monitored by impedance-cardiography under general anesthesia. *J Pharm Pharm Sci*. 2006; 9:190–197.

Figure 1. Mean relative change in mean arterial pressure, systemic vascular resistance, cardiac output, heart rate and stroke volume from baseline over a 300 second period after infiltration of adrenaline containing local anaesthetic into the nasal mucosa, represented by the vertical dashed line. MAP, mean arterial pressure; SVR, systemic vascular resistance; CO, cardiac output; HR, heart rate; SV, stroke volume.



## **The management of pyrexia in acute brain injuries on the neuro critical care unit**

M. Braganza BMedSci BMBS FRCA; N. Ahmed MBChB FRCA; L Borrill ADNS BSc (Hons) MSc (CC); J.C.

Andrzejowski MBChB FRCA FFICM; M.D. Wiles BMedSci, MMedSci (ClinEd), BM BS, MRCP, FRCA, FFICM.

*Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK.*

### Introduction

Pyrexia (temperature  $>37.5^{\circ}\text{C}$ ) in the presence of acute brain injury is associated with worsened neurological outcomes [1]. Management of pyrexia should therefore be a priority in Critical Care [2]. We set out to appraise the current incidence of pyrexia on our Neuro Critical Care Unit (NCCU), as recommended by the RCOA audit recipe compendium [3].

### Methods

Retrospective temperature data were collected from the electronic patient record system (Metavision, iMDsoft, MA, USA). All level 3 patients with an acute brain injury admitted to NCCU between April 2014 & January 2015 were included. Temperature at admission and subsequent hourly temperatures for the first 72 hours were analysed. Methods employed to manage pyrexia were also recorded. All data are mean (SD) or number (proportion).

### Results

Forty-five patients were identified (60% male, age 46 (15) years) which generated data for 3240 patient hours. Temperature on admission to NCCU was  $36.6 (0.5)^{\circ}\text{C}$ . 92% of patients developed a pyrexia within 9 (10) hours from admission. Average time with a pyrexia of  $>37.5^{\circ}\text{C}$  was 22 (16) hours per patient (Table 1). 22% of patients had no documented cooling, whilst 68% received passive cooling (e.g. fan). 26% were actively cooled with a Blanketrol (CSZ Medical, USA) at 10 (12) hours after onset of pyrexia. Paracetamol was used in 93% of patients. Antibiotics were started in 77% of patients after 21(20) hours.

### Conclusions

The majority of acute brain injured patients have pyrexia within the first 72 hours of admission. Early antibiotic use was insufficient to prevent this. Earlier and more aggressive use of active cooling techniques needs to be employed to limit pyrexia and optimise outcomes.

1. Suehiro E et al. Survey of brain temperature management in patients with traumatic brain injury in the Japan neurotrauma data bank. *Journal of Neurotrauma* 2014; 31(4): 315-20
2. Thorston Steiner et al. European Stroke Organisation Guidelines for the Management of Intracranial Aneurysm and Subarachnoid Haemorrhage. *Cerebrovasc Disease* 2013; 35: 93-112
3. Royal College of Anaesthetists Audit Recipe Book (3rd edition 2012).  
[www.rcoa.ac.uk/system/files/CSQ-ARB-2012\\_1.pdf](http://www.rcoa.ac.uk/system/files/CSQ-ARB-2012_1.pdf)

Table 1. Temperature data and cooling methods of cohort. Data are mean (SD) or number (proportion).

Time with temperature > 37.5°C (h)	Number of patients (%)	Temperature over 72 hours Mean (SD) °C	Type of cooling	
			Passive	Blanketrol
0	4 (8)	36.4 (0.9)	0 (0)	0 (0)
1-6	7 (16)	36.8 (0.6)	1 (14)	1 (14)
7-12	9 (20)	37.1 (0.3)	4 (44)	3 (33)
13-24	6 (13)	37.2 (0.5)	5 (83)	1 (17)
25-48	16 (36)	37.4 (0.2)	11 (69)	5 (31)
>48	3 (7)	37.8 (0.2)	3 (100)	0 (0)

## **Grade 1 subarachnoid haemorrhage, central venous pressure line insertion and Intensive Care Unit bed usage - are we getting it right?**

K. Miller MBChB BMedSci (Hons) FRCA; N.Huggins MBChB FFARCSI FRCA. *Univeristy Hospitals Birmingham NHS Trust, Birmingham, UK.*

### Introduction

All Subarachnoid Haemorrhage (SAH) patients are admitted to the Intensive Care Unit (ICU) post coiling. Clinical implementation of a 2007 audit required insertion of a Central Venous Pressure (CVP) line and admission to ICU. This audit addressed whether Grade 1 SAH patients required a CVP line and hence an ITU bed post coiling.

### Methods

A retrospective analysis of all neuroradiology patients over an 18 month period from June 2012 to December 2013. Confirmed and potential SAH patients were identified using the computerised patient record and classified according to the World Federation of Neurosurgical Societies [1]. The paper notes of patients with a confirmed or suspected Grade 1 SAH were analysed.

### Results

420 neuroradiology cases were identified and from these there were 158 confirmed or potential SAH patients. 78 sets of notes were analysed for patients with a confirmed grade 1 SAH or where the grade was not clear. 56 patients were identified as having a grade 1 SAH; 40 patients (71.4%) had a CVP line inserted prior to ICU with a further 5 patients having a CVP line inserted on the ICU. 47 lines were inserted in 45 patients. 16 patients had Noradrenaline administered and 1 had a CVP line inserted for Noradrenaline but the blood pressure stabilised without administration. 35.5% of SAH grade 1 patients required Noradrenaline during their ICU stay and of these 93.8% commenced Noradrenaline within 24 hours of arrival on ICU. 62.5% of patients stayed on ICU for 2 days or less and this increased to 70.5% when the length of stay until medically fit was the end point. 5 patients required readmission, 3 for Noradrenaline administration.

### Conclusions

Noradrenaline was required by 35.5% of patients with 93.7% commencing it within 24 hours of admission. This audit reinforces the requirement of CVP insertion and ICU admission post-coiling for

Grade 1 SAH patients as per current local guidelines. Delayed discharge once medically fit needs to be addressed.

1. Teasdale G et al. A universal subarachnoid hemorrhage scale: report of a committee of the World Federation of Neurosurgical Societies. J Neurol Neurosurg Psychiatry. 1988 Nov; 51(11);1457

Table 1. Length of stay.

Days until discharged	Number of patients (total 56)	Percentage	Days until medically fit (total 51)	Percentage
1	24	42.9	34	66.7
2	11	19.6	2	3.9
3	9	16.1	7	13.7
4	1	1.8	0	
5	2	3.6	0	
8	1	1.8	1	2
12	1	1.8	0	
15 or more	7	12.5	7	13.7

## **Reducing blood volumes sampled on Neurosciences ICU**

A. Heavyside MB ChB DipIMC RCS(Ed); A. Brookes MB BS MBioch; J. Hell MB BS FRCA FFICM; M. Cordingly MB BS BSc(Hons) MRCP FRCA. *Wessex Neurological Centre, University Hospital Southampton NHS Foundation Trust, Southampton, UK.*

### Introduction

Anaemia seems to be associated with poorer outcomes on Neurosciences ICU (NICU).[1] Studies in ICU populations have found that up to 41 ml blood/patient/day may be sampled.[2] This can have a significant cumulative effect on haemoglobin concentration. Reducing the blood volume sampled could slow this fall in haemoglobin concentration, decreasing anaemia and potentially the need for transfusion, with its associated complications.[1,3]

### Method

The blood volume sampled from each level 3 NICU patient (n=15) was calculated over 3 separate, 24 hour periods. This was done by

1. Assuming each patient had 1 set of standard blood tests/day and that vacutainers have standard sample volumes, the volume/patient/day was calculated.
2. The number of ABGs/patient/day was recorded and a mean and SD calculated.
3. The volume of blood left over in each ABG syringe (n=126) was measured

A multidisciplinary approach to reducing this volume was then introduced; involving medical hardware suppliers, the hospital laboratory, and NICU staff. Smaller sample vacutainers and blood gas syringes were introduced, at no increased cost, which did not compromise the accuracy or speed of automated analysers. Data collection was repeated following these interventions. A four day data collection window was used to ensure a similar number of ABG samples (n=137). Student's t test was used to compare variables.

### Results

The mean blood volume sampled prior to, and following, our interventions is shown in table 1. Assuming an average number of tests/patient, the volume sampled/patient/day was reduced from around 19ml to 9ml. The most significant reductions were demonstrated by using lower volume blood gas syringes, reducing blood drawn by a mean of 0.9ml/sample ( $p = <0.0001$ ).

## Conclusion

A roughly 50% reduction in blood volume sampled/patient/day was achieved on our NICU with a simple change in sampling technique. This may slow the onset of anaemia and reduce transfusion requirement.

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3. Marik PE, Corwin HL. Efficacy of red blood cell transfusion in the critically ill: a systematic review of the literature. Crit Care Med 2008; 36(9):2667-74.

Table 1. Mean blood volumes sampled from Neurosciences ICU patients before and after the study interventions

Tests	Mean number of blood samples/patient/day	Mean blood volume sampled/patient before intervention		Mean blood volume sampled/patient after intervention		Reduction in daily blood volume sampled/patient ml/day
		ml/test	ml/day	ml/test	ml/day	
Blood gases	7	1.2	8.4	0.3	2.1	6.3
Full blood count	1	3	3	2	2	1
Biochemistry	1	5	5	2.8	2.8	2.2
Coagulation	1	2.7	2.7	1.8	1.8	0.9
DAILY TOTALS			19.1		8.7	10.4

## **Carotid artery stenting risks and anaesthetic techniques: a single centre experience**

D. Mayhew MBBS BSc (Hons) FRCA; J. Lynes MBChB BSc (Med Sci) FRCA; *The Walton Centre for Neurology and Neurosurgery, Liverpool, UK.*

### Introduction

Carotid artery stenting (CAS) is a radiologically guided procedure for patients with symptomatic carotid stenosis. [1,2] Risks are small but there exist no formal standards against which practice can be assessed. [3] The Walton Centre uses primarily noninvasive anaesthetic techniques but recognises the need for consensus around safe levels of intervention to prevent complications. We wish to establish our rate of complication following elective CAS to compare our incidences with existing literature, ensure we accurately present risk to patients and inform critical care bed planning.

### Methods

Cases from 2009 to 2014 were identified from clinical coding, and data extracted regarding anaesthetic technique, vagolytic drug use and the incidence of post-procedural complications. Complications to be screened for were identified from European Society of Cardiology data.<sup>3</sup>

### Results

Thirty-six procedures were carried out in the 5 year period. Four were emergencies undertaken during cerebral aneurysm coiling and four cases followed trauma. All emergent cases underwent general anaesthesia. Twenty-eight elective procedures were undertaken for carotid occlusive disease; 17 under local anaesthesia. Vagolytics were used in 43% of these cases; 71% in the local anaesthesia subgroup. Regimes varied between atropine and glycopyrronium. In the elective cohort one patient suffered acute in-stent thrombosis following a procedure under local anaesthesia, requiring immediate balloon angioplasty under general anaesthetic; giving a 3.4% complication rate. This is within the data specified by the European Society of Cardiology.

### Conclusions

Carotid artery stenting is a safe technique which provides an therapeutic alternative to endarterectomy for symptomatic carotid stenosis. Extended recovery techniques may be safe post procedure, as complications are rare and typically identified within the first 30 minutes. This may enable more efficient use of critical care facilities.



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2. Yadav, J. S. et al. Protected carotid-artery stenting versus endarterectomy in high-risk patients. *N. Engl. J. Med.* 2004;351:1493–501.
3. Castriota F, Cremonesi A, T. L. Carotid Artery Stenting Complications. *Eur. Soc. Cardiol. E-Journal* 2010;8:17. Accessed March 3, 2015.

## **Cardiovascular dysfunction and its consequences in aneurysmal subarachnoid haemorrhage admissions to neurocritical care**

M.A.G. Suliman BMedSci(Hons) BMBS DTM&H MRCP; S. Bhandari MBBS MD; R. Sainsbury MBChB; R. Asher MSc; A. Chandran MBBS MRCS FRCR; P. Nair MBBS DA FRCA FFICM. *Horsley Intensive Care Unit, The Walton Centre NHS Foundation Trust, Liverpool, UK.*

### Introduction

Aneurysmal subarachnoid haemorrhage (aSAH) carries significant morbidity and mortality. Previous studies indicated worse outcomes amongst patients who develop cardiovascular dysfunction (CVD). Our study aimed to explore this, and to highlight whether there was a 'high risk group' for developing CVD who may benefit from future targeted therapy.

### Methods

We retrospectively reviewed the casenotes of 100 coiled aSAH admissions to neurocritical care. Our primary outcome of interest was CVD, with secondary outcomes being ITU length of stay (LOS), survival, and modified rankin scale (MRS) at hospital discharge. Risk factors of interest were age, gender, GCS and WFNS score on admission, Fisher grade, aneurysmal location, speed of coiling, day (weekday vs weekend) and time (in or out of hours) of presentation. Univariate and multivariable statistical models were conducted to analyse the data.

### Results

A total of 83 patients were included in this study; of those 17 (20%) died. 36 (43%) had CVD and 11 (13%) patients had CVD requiring 2 or more inotropes to offset the haemodynamic instability. 32 (47%) had an unfavourable MRS ( $>1$ ). The median ITU LOS was 5 days (range: 0-56). Univariate analysis showed that GCS was significantly associated with all five outcomes; WFNS was significantly associated with all but MRS; and Fisher grade was significantly associated with survival and ITU LOS. CVD was found to be associated with both ITU LOS and survival. WFNS remained significant for CVD when conducting multivariable analysis; GCS and CVD remained significant for ITU LOS.

### Conclusion

Our study indicated that the development of CVD adversely affected survival and prolonged ITU LOS. Furthermore, patients presenting with poor GCS and WFNS scores were more likely to develop CVD (see

table 1). Screening for CVD (ECG, enzymes, echocardiography) and early goal-directed therapy, with particular emphasis on this high risk group, may improve their overall outcomes.

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3. Wartenberg KE. Critical care of poor-grade subarachnoid hemorrhage. Curr Opin Crit Care. 2011;Apr 17(2):85-93

		<b>Cardiovascular dysfunction</b>		p-value
		No	Yes	
<b>Gender:</b>	N	47 (57%)	36 (43%)	0.788
	Female	30 (64%)	24 (67%)	
	Male	17 (36%)	12 (33%)	
<b>Age:</b>		54.9 (12.6)	58.3 (12.1)	0.227
<b>Aneurysm location:</b>	Anterior	22 (47%)	15 (42%)	0.890
	Posterior	18 (38%)	14 (39%)	
	Other	4 (9%)	5 (14%)	
	Missing	3 (6%)	2 (6%)	
<b>GCS:</b>	N	46	36	<0.001
	Median	15	14	
	IQR	(15-15)	(8.5-15)	
<b>WFNS:</b>	Good (1-3)	43 (91%)	21 (58%)	<0.001
	Poor (4-5)	3 (6%)	15 (42%)	
	Missing	1 (2%)	0	
<b>Fisher Grade:</b>	N	47	36	0.057
	Median	4	4	
	IQR	(3-4)	(4-4)	
<b>Coiling speed:</b>	N	44	29	0.558
	Median	25.5	27.5	
	IQR	(19.3-45.6)	(20.5-90.2)	
<b>Day of presentation:</b>	Weekday	32 (68%)	25 (69%)	0.895
	Weekend	15 (32%)	11 (31%)	
<b>Time of presentation:</b>	In hours	19 (40%)	20 (56%)	0.171
	Out of hours	28 (60%)	16 (44%)	

## **Effect of tranexamic acid on intra-operative blood loss and transfusion requirements in patients undergoing excision of intracranial meningioma**

B. Hooda<sup>1</sup> MD DM; R.S. Chouhan<sup>2</sup> MD; G.P. Rath<sup>2</sup> MD DM. *1. Department of Anaesthesiology, Army College of Medical Sciences, New Delhi, India and 2. Department of Neuroanaesthesiology and Critical Care, All India Institute of Medical Sciences, New Delhi, India.*

### Introduction

Surgical excision of meningiomas is often complicated by significant blood loss requiring allogenic blood transfusion with its attendant risks. Tranexamic acid is well recognized as a modality to reduce perioperative blood loss in a variety of surgical procedures. However, its blood conservation effect remains uncertain in intracranial surgery.

### Methods

Sixty adult patients undergoing surgical excision of intracranial meningioma were randomized to receive 20 mg/kg of tranexamic acid followed by 1 mg/kg/h infusion (tranexamic acid group) or equivalent amount of isotonic saline (placebo group) throughout the duration of surgery. Primary outcome was to evaluate the effect of tranexamic acid on intra-operative blood loss and transfusion requirements. Its effect on quality of surgical haemostasis, peri-operative complications, length of hospital stay and neurological outcome was also studied.

### Results

The two groups were comparable in terms of demographics, preoperative laboratory parameters and tumour characteristics (location and size). Intraoperative variables in terms of amount of infused fluids, duration of surgery and anaesthesia were also comparable in the two groups. However, the amount of blood loss was significantly less in the tranexamic acid group compared to placebo group (830.4 ml in Group T vs 1124.5ml in Group P;  $p = 0.03$ ). (Table 1)

There was a trend towards lesser transfusion requirement in the tranexamic acid group; even though it did not reach statistical significance. Additionally, patients in Group T significantly fared better on a 5-grade surgical haemostasis scale ( $p = 0.007$ ). However, there was no difference with regards to extent of tumour removal, perioperative complications, length of hospital stay or neurologic outcome between the two groups.

### Conclusion

Use of tranexamic acid significantly reduced blood loss by 27% in patients undergoing elective craniotomy for excision of meningiomas.

Table 1: Comparison of intra-operative blood loss and transfusion requirement in the two groups.†: Data given as Geometric mean (Min, max) of patients unless specified.\*: Data given as number (%). PRBC; packed red blood cells

Parameter	Group T (n=30)	Group P (n=30)	Difference (95% CI)	P value
Blood loss (ml)	830.4 (684,1008.2)	1124.5 (912.6,1385.5)	1.3 (1.1,1.8)	<b>0.03</b>
Intra-operative PRBC transfusion				
No of patients transfused*	13 (43.3)	17 (56.7)		
Volume (ml)	554.0 (382.0, 803.5)	645.0 (498.7, 834.2)	1.2 (0.8, 1.8)	0.46

## **Decompressive hemicraniectomy for cerebral oedema in extensive hemispheric infarction: experience of a tertiary referral centre**

T. Thomas MB BS BSc(Hons) FRCA FFICM; H. Madder MB BS FANZCA; I. Reckless BSc MB BS MBA FRCP; J. Kennedy MB ChB MSc MRCP. *Neurosciences Intensive Care Unit, John Radcliffe Hospital, Headley Way, Headington, OX3 9DU, Oxford, Oxfordshire, UK.*

### Introduction

The National Institute of Clinical Health and Care Excellence (NICE) advocates decompressive hemicraniectomy (DH) in selected patients to treat brain swelling secondary to a middle cerebral artery (MCA) territory infarction, where there is clinical evidence of mass effect and imaging indicates extensive infarction(1). There is no published outcome data from randomized controlled trials (RCTs) for patients receiving this intervention in the United Kingdom (UK).

### Methods

We analysed outcome data for patients admitted to the Neurosciences Intensive Care Unit (NICU) between 2008 and 2013 who had undergone DH for the management of extensive MCA territory infarction. All patients fulfilled the NICE criteria for eligibility for consideration of DH. Median age was 49 years old (range 31-55).

### Results

Twenty four patients were admitted to the NICU for neurological observation following extensive MCA territory infarction with the intention of receiving a DH in the event of neurological deterioration. Of these, 23 proceeded to DH. One patient did not receive a DH because their neurological condition remained stable. Ten patients had a left MCA and 13 had a right MCA territory infarct. Twenty one patients were discharged from the NICU (9% NICU mortality), and 20 patients survived to hospital discharge (13% hospital mortality). The average NICU length of stay (LOS) was 4 days and mean hospital LOS was 14 days.

### Conclusions

Decompressive hemicraniectomy can be a life-saving procedure following an extensive MCA infarct. Our data compares favourably with post-operative outcomes reported in recently completed European

RCTs(2), and demonstrates the successful implementation of a high-risk procedure into the management of stroke patients in the UK.

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## **Effect of dexmedetomidine on cerebral autoregulation and carbon dioxide reactivity during sevoflurane anaesthesia**

S. Banik MD; G.P. Rath MD DM; H. Prabhakar MD; P. K. Bithal MD. *Department of Neuroanaesthesiology, All India Institute of Medical Sciences, New Delhi, India.*

### Introduction

The effect of dexmedetomidine (Dex) as anaesthetic adjuvant on cerebral autoregulation has not been well studied.

### Methods

25 consecutive ASA I patients between 18-60 years undergoing lumbar spine surgery were randomised to two groups. Group D (n=13, M:F= 6:7) received infusion of Dex 1mcg/kg bolus over 10 minute followed by 0.5mcg/kg/hr maintenance, while Group C (control, n=12, M:F=6:6) received infusion of 0.9% Normal Saline at similar rates. General anaesthesia was induced after loading dose completion with Fentanyl 2mcg/kg, propofol 1-2mg/kg and vecuronium 0.1mg/kg. Anaesthesia was maintained with O<sub>2</sub>: N<sub>2</sub>O=1:1 and sevoflurane (0-4%) at FGF of 2 litres/minute.

After 5 minutes of constant BIS value 40-50 and normocapnia, the right middle cerebral artery (MCA) was insonated with Transcranial Doppler (TCD) probe. Transient hyperaemic response (THR) test was performed by compressing the right common carotid for 5-7 seconds. Patient was hyperventilated to test CO<sub>2</sub> reactivity. Hemodynamics, PaCO<sub>2</sub>, SpO<sub>2</sub>, MCA<sub>FAV</sub>, BIS, MAC were recorded before and after hyperventilation. Surgery was subsequently performed and infusion continued until 10 minutes before skin closure. Time to recovery, time to extubation, Aldrete score, emergence agitation were recorded.

### Results

Patient demographics and durations of surgery and anaesthesia were well matched between the two groups. THR ratio (1.27±0.11 Group D, 1.24±0.04 Group C, p 0.46), Compression ratio (47.78±15.67 Group D, 52.55±9.25 Group C, p 0.36), CO<sub>2</sub> reactivity (87.44±2.48 Group D, 87.98±1.43 Group C, p 0.52), were comparable between the two groups, as were MAP, SpO<sub>2</sub>, MAC, BIS, MCA<sub>FAV</sub>, times to recovery, and extubation, and Aldrete scores. Fentanyl used in Group D (147.69±13.62) was significantly lower than Group C (304.16±66.39, p 0.001).



### Conclusion

Dex maintains intact dynamic cerebral autoregulation, as measured by THR test, and CO<sub>2</sub> reactivity, when used as anaesthetic adjuvant in patients undergoing lumbar spine surgery.

## **Chronic subdural haematoma and timely access to theatre: an audit**

A. James BM BS FRCA; P. Veale BSc(Hons) MBBS FRCA; N. Weston MB ChB. *Nottingham University Hospitals NHS Trust, Nottingham, UK.*

### Introduction

Patients presenting with chronic subdural haematoma are often elderly with significant pre-existing systemic disease [1]. An evaluation of care provided for this challenging population at our institution identified delay to surgery as an area that could be improved upon. We drew an analogy with those admitted with proximal femoral fractures where timely access to theatre is the subject of national guidelines [2]. We put forward an audit criterion at our Trust – that surgery for chronic subdural haematoma should take place within 24 hours of the decision to operate, with a proposed standard of 100%. A service improvement project was undertaken focused upon emergency theatre utilisation and staff education. Following this an audit was conducted against the criterion and standard.

### Methods

The theatre management database was searched to identify all operations for chronic subdural haematoma between July 2013 and June 2014. The interval between the operation being booked and the start of surgery was then extracted. Comparison was made with the original service evaluation data from August 2010 to July 2011.

### Results

131 operations were identified. The date and time at which the operation was booked were recorded for 79 (60.3%) of these cases. In 76 of these 79 cases the operation took place within 24 hours of being booked – representing a performance of 96.2%. By comparison the performance achieved against this criterion in the original service evaluation was 81.2%.

### Conclusions

Attainment against the audit standard has increased significantly but still falls below our target. We believe that improved prioritisation of these patients and additional emergency theatre capacity throughout the Trust have been key components in achieving the increase in performance to date.

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## **The acromegalic airway: is it truly difficult? A five year retrospective audit of airway management of acromegalics**

M. Bassett MBChB MRCP FRCA; S. Tomlinson MBChB FRCA. *Salford Royal NHS Foundation Trust, Salford, UK.*

### Introduction

Acromegaly is a multisystem disease caused by excess production of growth hormone. It is traditionally believed that acromegaly is a risk for airway difficulty<sup>(1)</sup>. We conducted a 5 year retrospective audit of acromegalics undergoing anaesthesia looking for difficulties in ventilation and intubation.

### Methods

We identified every acromegalic undergoing pituitary surgery at our hospital in the last 5 years. 44 cases were reviewed. We interrogated every anaesthetic chart for information on the airway assessment, the ability to bag-mask ventilate, the laryngoscopy view, aids used and whether any critical incidents occurred.

### Results

Of the 44 cases, 9 had a Mallampatti score of 3 or 4. Bag-mask ventilation was achieved in 40 cases; 4 were not recorded. There were 6 grade 3 views on laryngoscopy and no grade 4 views. Only simple adjuncts were needed to aid intubation.

### Conclusions

Studies have shown significant rates of airway difficulty in acromegalics<sup>(2,3)</sup>. Our audit would indicate rates of serious airway difficulties far lower than these studies. In 5 years of cases at our hospital there were no difficulties in mask ventilation or intubation that could not be overcome with simple adjuncts. Limitations to our audit include that we were unable to confirm the severity of the acromegalic features in these patients. Indeed, they are being treated earlier so features causing airway difficulty might be less prevalent than previously. It was not a controlled study and a consultant anaesthetist performed every case, our results may have been different if these patients were seen by trainees.

We are reassured that these patients were managed simply and without incident and believe that this should be possible in non-specialist centres too. The increasing use of indirect laryngoscopy should only serve to make the management of the “acromegalic airway” less intimidating.

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## **Hyperglycemia is a frequent event for patients on a neurosurgical ward**

S. Heaney MBChB BSc(Hons) PhD FRCA; K. Kelly MBChB MD MRCP(UK) FRCA DICM. *Department of Clinical Neuroscience, Western General Hospital, Edinburgh, UK.*

### Introduction

Hyperglycaemia is associated with increased mortality and morbidity in a variety of disease processes of relevance to neuroanaesthesia including subarachnoid haemorrhage, ischemic stroke, spinal cord injury and traumatic brain injury (1). The surgical stress response, pre-existing diabetes and exogenous steroids commonly used in neurosurgery are known to raise blood sugar levels (2). NHS Diabetes recommends an upper blood glucose limit of 12mmol/L for all patients undergoing surgery during their hospital stay (3). Our aim was to better understand the incidence of clinically relevant hyperglycaemia (>12mmol/L) within our neurosurgical unit.

### Methods

A retrospective analysis was conducted on all capillary blood glucose (CBG) readings taken over a 14 day period on the two neurosurgical wards (including a 4 bedded HDU) at the Western General Hospital in Edinburgh. All CBG testing was conducted according to ward protocols by nursing staff using an Accu-Check Inform II meter (Roche).

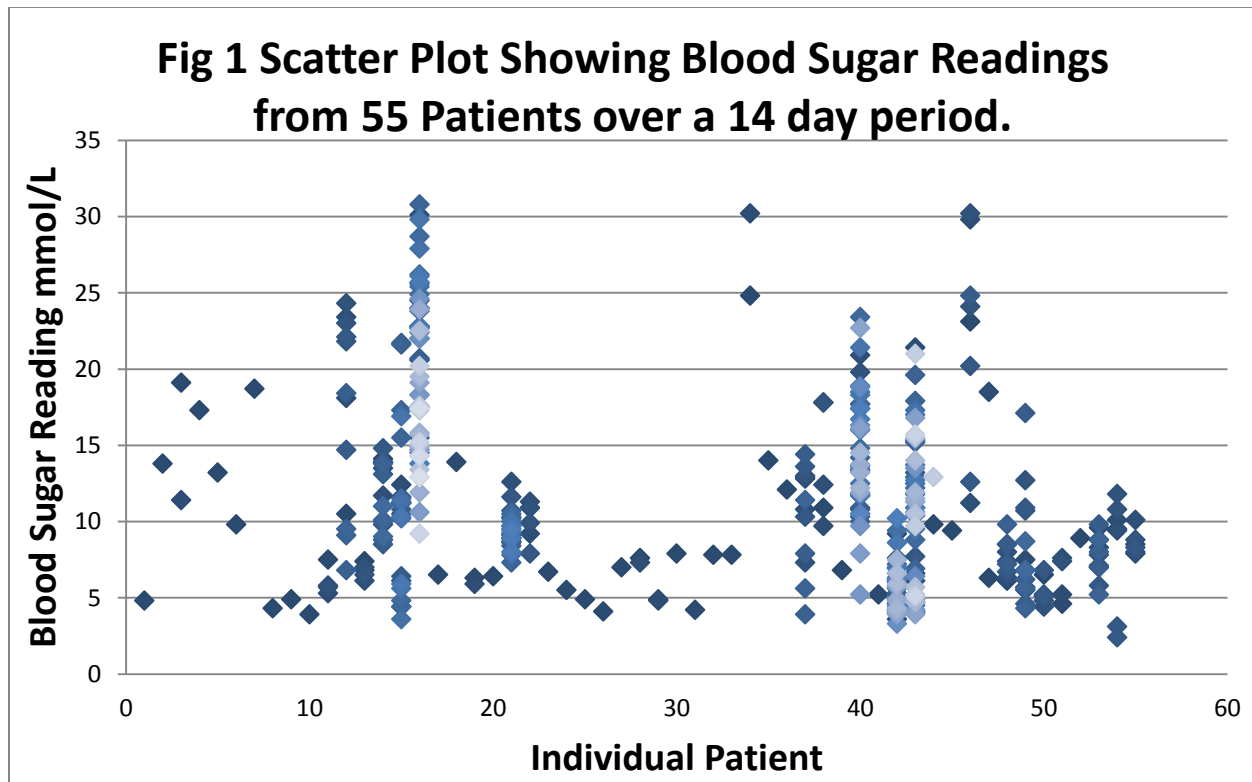
### Results

55 patient data sets were identified, please see Fig1. The frequency of CBG testing per patient during the 14 day period ranged from 1 to 51 readings. 21 of the 51 patients had one or more blood glucose readings > 12mmol/L and 7 of the 51 had one or more blood glucose readings > 20mmol/L. 7 patients experienced prolonged periods of hyperglycaemia lasting greater than a day.

### Conclusions

Hyperglycaemia (>12mmol/L) is a frequent occurrence within the peri-operative period of our neurosurgical patients. A significant minority of our patients are experiencing severe hyperglycaemia (>20mmol/L). In many instances the hyperglycaemia is prolonged and does not seem to be being addressed adequately. More generally, our results suggest that neurosurgical units should investigate the glycaemic control of their patients as there may be significant room for improvement.

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## **Valproic acid-meropenem interaction and the effect on plasma VPA levels in patients on meropenem: a retrospective study**

S. Kulkarni MBBS MD FRCA EDIC; J. Sebastian BSc MBBS MRCP FRCA. *Department of Anaesthesia, Salford Royal Foundation Trust, Salford, UK.*

### Introduction

To evaluate the effect of drug interaction between the carbapenem antibiotic - meropenem and the anti-epileptic drug valproic acid (VPA) in patients with seizures.

### Methods

The effect of the concomitant use of VPA and meropenem were evaluated in a retrospective manner in 20 patients at Salford Royal NHS Foundation Trust. Patients receiving VPA of 1-2g/day and meropenem of 6g/day concomitantly were included in this retrospective audit. Only those patients who had plasma VPA levels measured pre-meropenem treatment, during meropenem treatment, 1-7 days after discontinuation of meropenem were included in the audit. The data post 7 days was not available in most patients and hence were not included.

### Results

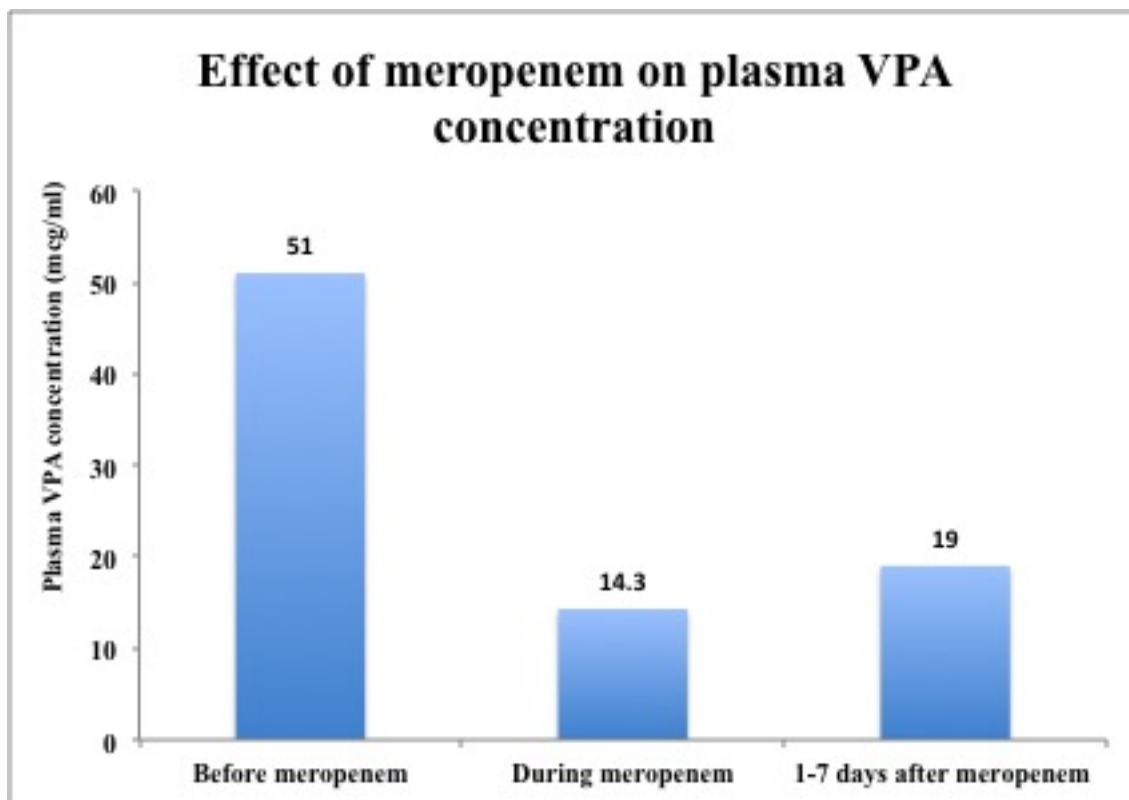
Regardless of the daily dose, a decrease in VPA plasma concentration to sub-therapeutic dose was observed in all patients following meropenem administration. The decrease was to the extent of 70% during Meropenem therapy (Figure 1). During meropenem treatment and/ after 7 days of discontinuation of meropenem, plasma VPA concentration was not higher than 20µg/ml (Optimal target plasma VPA concentration 50-100 µg/ml). Two episodes of seizures were recorded in the notes during this period needing introduction of another anti-epileptic agent.

### Conclusion

An interaction between VPA and meropenem when administered simultaneously has been shown according to various studies. Plasma levels of VPA were lowered initially upon meropenem administration. As the therapeutic effect of VPA is concentration dependent, when meropenem treatment is imperative, substitution of meropenem with an antiepileptic drug could prove beneficial. If the adjuvant therapy of VPA and meropenem is necessary, close monitoring and dose adjustment of VPA is essential to avoid development of seizures.



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## **Anaesthetic implications of 5 ALA dye and intraoperative MRI for high-grade glioma resection**

A. Bhatia MD PDCC; H. Sapra DA FNA; K. Singh MS Mch; A.N. Jha MS FRCS; Dr Y. Mehta MD DNB FRCA.  
Medanta, The Medicity, Gurgaon, Haryana, India.

### Introduction

5-aminolevulinic acid fluorescence-guided glioma resection is a rapidly growing, novel approach to improve the extent of tumor resection. Intraoperative tumor fluorescence provided by the chemical compound 5-ALA assists surgeons in identifying the true tumor margin during resection of glial neoplasms, consequently increasing the extent of the resection.(1) However, use of ALA dye along with intraoperative MRI can be quite challenging for the anaesthesist because of its side effects and interaction with anesthetic agents, limited knowledge of its effects and also the need to maintain dim lighting in operation theatre to avoid photosensitivity.

### Methods

This retrospective observational comparative study was conducted including patients with high grade glioma who underwent tumor resection in our centre from January 2012 to December 2014. Patients who underwent high grade glioma resection surgery following ALA dye administration were included- Group A. These patients were compared with same number of age and sex matched patients who were operated for high grade glioma but were not administered ALA dye-Group B. Hemodynamic monitoring was initiated just before the dye was administered in group A and at preinduction in Group B before anesthesia. Thereafter heart rate and blood pressure was recorded  $\frac{1}{2}$  hrly till the end of surgery. Intraoperative usage of vasopressors for maintaining blood pressure was also noted.

### Results

A total of 90 patients were included ;45 in each group. The study found significantly increased intraoperative use of vasopressors in Group A (p=0.038). The duration of surgery was significantly longer in Group A (p=0.00).

### Conclusion

ALA dye usage for neurosurgery can result in significant hypotension requiring increased intraoperative use of vasopressors. As more centres start using this novel technique, it is imperative for the anaesthesist to understand its side effects and interaction with anesthetic agents.

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Impact of the combination of 5-aminolevulinic acid-induced fluorescence with intraoperative  
magnetic resonance imaging-guided surgery for glioma. World Neurosurg.2011 Jul-Aug;76(1-  
2):120-7

## **Determination of preoperative anxiety in neurosurgical patients: a prospective, observational study**

J. Whitaker<sup>1</sup> MBChB FRCA; M. Sanders<sup>2</sup>; C. Hirst<sup>1</sup> MBChB FRCA; M. Braganza<sup>1</sup> BMedSci BMBS FRCA; J.C. Andrzejowski<sup>1</sup> MBChB FRCA FFICM; M.D. Wiles<sup>1</sup> BMedSci MMedSci (ClinEd) BMBS MRCP FRCA FFICM. 1. *Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK*, 2. *University of Sheffield Medical School, Sheffield, UK*.

### Introduction

Preoperative anxiety is common but there has been little work focusing on neurosurgical patients. A Canadian neurosurgical study showed the incidence of preoperative anxiety was 89%, with 55% having high levels of anxiety. [1] We aimed to determine the incidence and severity of preoperative anxiety in a UK neurosurgical cohort.

### Methods

Fifty elective neurosurgical patients were asked to complete an Amsterdam Preoperative Anxiety and Information Scale (APAIS); this scores anxiety level (out of 10) and knowledge requirement (out of 5) for both surgery and anaesthesia. A shortened six-point form of the State-Trait Anxiety Inventory (STAI) was also used, scoring anxiety out of 24. Demographic data were also collected. Data analyses were performed using SigmaStat (v 3.1, Systat Software, San Jose, California). Anxiety data were not normally distributed and are expressed as median (IQR) with a Mann-Whitney Rank Sum test used for comparison.

### Results

The age (SD) of our population was 54.7 (15.6) years with other demographic data shown in Table 1. The incidence of anxiety was 80% [APAIS 8 (5.25 to 11) and STAI 12.5 (9 to 16)]. 36% of patients had high levels of anxiety (defined as APAIS  $\geq 10$ ). [2] APAIS scores were found to be higher for the surgery than the anaesthetic both in terms of anxiety [5 (3 to 6) vs. 3 (2 to 5);  $P=0.007$ ]] and the need for information [3 (2 to 5) vs. 2 (1 to 4);  $P=0.039$ ]. Gender, cranial vs. extracranial surgery and the presence of malignancy had no effect upon anxiety levels (Table 1).

### Conclusions

We found a high incidence of anxiety in neurosurgical patients. Surgical aspects of care appear to contribute more to anxiety than anaesthetic factors. Preoperative anxiety has been associated with adverse consequences, including increased anaesthetic and analgesic requirements and overall dissatisfaction with care. [3] The provision of more information preoperatively regarding the surgical aspects of treatment may help reduce anxiety levels.

1. Perks A, Chakravarti S, Manninen P. Preoperative anxiety in neurosurgical patients. J Neurosurg Anesthesiol. 2009; 21:127-30.
2. Moerman N, van Dam FSAM, Muller MJ, et al. Amsterdam Preoperative Anxiety and Information Scale Study. Anesth Analg. 1996; 82:445–451.
3. Williams JGI, Jones JR. Psychophysiological responses to anesthesia and operation. JAMA 1968; 203:415-417.

Table 1. Anxiety scores in relation to patient and surgical factors. APAIS, Amsterdam Preoperative Anxiety and Information Scale; IQR, interquartile range. Data are number (proportion) or median (IQR).

		n (%)	Median (IQR) APAIS score	P value
Gender	Male	26 (52)	8 (5.25 to 10)	0.58
	Female	24 (48)	9 (5.75 to 11.25)	
Operation Site	Cranial	16 (32)	9 (5 to 11.25)	0.89
	Extracranial	34 (68)	8 (6 to 10.75)	
Pathology	Cancer	9 (18)	9 (9 to 12)	0.19
	No Cancer	36 (72)	8 (5 to 10.25)	
	Patient Unsure	5 (10)		

## **Antihypertensive use and systolic blood pressure in patients undergoing anterior cervical discectomy**

J.H. Palmer BSc MBChB FRCA; M. Woodhouse. *Salford Royal NHS Foundation Trust, Salford, UK.*

### Introduction

Animal studies have established similarities between autoregulation in the brain and spinal cord [1]. A human study in acute cervical cord injury has linked increased cord perfusion pressure with improved limb motor score [2]. It is unknown whether cord compression caused by disc prolapse affects autoregulation of cord blood flow.

### Methods

A retrospective casenote study to investigate whether spinal cord compression caused by disc protrusion leads to autoregulatory increase in systemic blood pressure to maintain perfusion. 259 patients listed for anterior cervical discectomy and fusion (ACDF) in 2012; myelopathies were compared to radiculopathies (controls). Exclusion criteria: emergency surgery, incomplete data. Main outcome measures: Anti-hypertensive use, systolic blood pressure at preoperative assessment.

### Results

35% of myelopathies were using antihypertensive agents compared to 22% of controls (radiculopathies) ( $p = 0.02$ ). Mean [SD] of systolic blood pressures of radiculopathies was 127.74 [14.975] mmHg compared with 133.26 [18.22] in myelopathies ( $p = 0.008$ ). Logistic regression showed the only factor associated with hypertension and antihypertensive use was age but use of antihypertensives in both groups of patients (27.8%) was almost double the average for England [3] (15.2%)  $p = 0.013$

### Conclusions

Chronic spinal cord compression does not in itself lead to an autoregulatory increase in systemic blood pressure but age matched prospective studies are required to confirm or refute this. There is an association between antihypertensive use and/or systolic blood pressure and myelopathy but age accounts for it. The very high rates of antihypertensive use in both groups cannot be fully explained. Further prospective studies with age matched normal control subjects as well as investigation of changes in blood pressure after successful surgical correction of myelopathy are needed.

1. Hickey R, Albin MS, Bunegin L, Gelineau J. Autoregulation of spinal cord blood flow: is the cord a microcosm of the brain? *Stroke* 1986; 17: 1183-1189
2. Guha A, Tator CH, Rochon J. Spinal cord blood flow and systemic blood pressure after experimental spinal cord injury in rats. *Stroke*. 1989; 20:372-377
3. Joint Health Surveys Unit. Health Survey for England (2013). Adult trend tables. [www.ic.nhs.uk](http://www.ic.nhs.uk) (accessed June 2014).

## **Better NEWS for neuro patients?**

E. Hoogenboom MD FRCA FMH; S. Fairley; M. Newton MB BS FRCA. *National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, UK.*

### Introduction

The Irish Health Service Executive in 2011(1) and the Royal College of Physicians in 2012 (2) developed and advocated the use of a National Early Warning Score (NEWS); this provides a consistent format for recording patients' observations and facilitates the early detection of, and timely response to, deteriorating patients. NEWS is explicitly not recommended in children or pregnant women, but no reference is made to patients with an intracranial injury. Professor Teasdale (3) warned of the risk of using NEWS in this population, because the Glasgow Coma Scale (GCS) and other important neurological parameters are not included. A modified neurological NEWS, was introduced in our trust in Spring 2014. We have surveyed the introduction of NEWS in other neuromedical and neurosurgical centres in the UK and Ireland.

### Methods

An online questionnaire was distributed in Summer 2014 (via Survey Galaxy) to 39 centres of neuroanaesthesia in Great Britain and Ireland via NASGBI linkmen, enquiring about their use of NEWS and any modifications made to include neurological parameters.

### Results

25 (64%) centres of neuroanaesthesia completed the questionnaire. Two thirds of respondents were unaware of Professor Teasdale's concerns. NEWS had been introduced in half of the responding centres; The majority modified NEWS, to include neuroscience specific parameters (GCS, limb power, pupil size, urine output, seizure activity, vital capacity and paediatric parameters). Where NEWS hadn't been introduced, an adequate system was reported to be already in place and/or NEWS was considered unsuitable for the centre. Most respondents favoured the introduction of a standardized neuroscience early warning score (EWS) with guidance from NASGBI (see Figure 1).

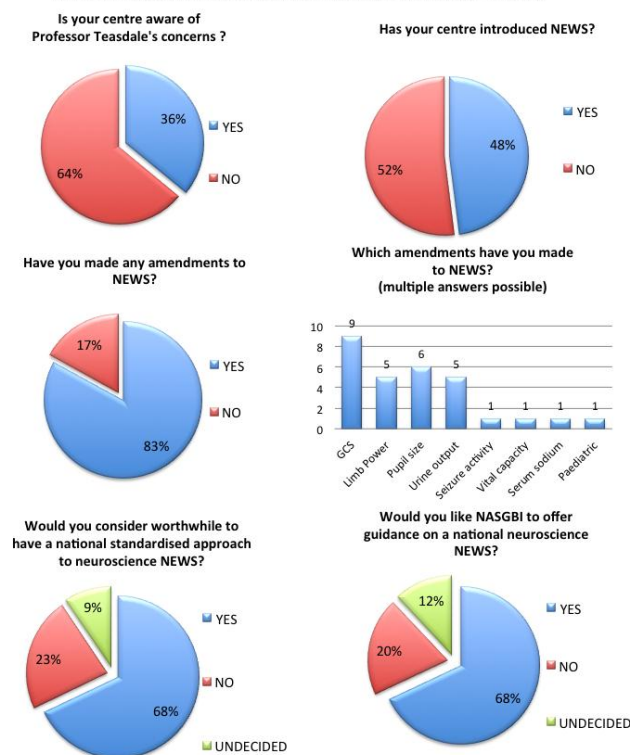
### Conclusion



A nationally standardized approach to a neuroscience EWS in conjunction with NEWS should be developed. Advice and expertise from centres who have successfully implemented a neurological version of NEWS and NASGBI guidance would be welcome.

1. Guiding Framework and Policy for the National Early Warning Score System to Recognise and Respond to Clinical Deterioration [Ireland Health Services website]  
<http://www.hse.ie/eng/about/Who/ONMSD/practicedevelopment/MEWS/ewsframework.pdf>  
(accessed 03/03/2015)
2. Royal College of Physicians. National Early Warning Score (NEWS): Standardising the assessment of acute illness severity in the NHS. Report of a working party. London: RCP, 2012 [Royal College of Physicians website], <https://www.rcplondon.ac.uk/sites/default/files/documents/national-early-warning-score-standardising-assessment-acute-illness-severity-nhs.pdf> (accessed 03/03/2015)
3. Teasdale G M, National early warning score (NEWS) is not suitable for all patients, British Medical Journal, 2012; 345:e5875

**Fig. 1 Survey on the introduction of National Early Warning Score (NEWS) in neurosurgical centres in Great Britain and Ireland**



## **Complications related to sitting position during paediatric neurosurgery**

G.P. Rath MD DM; P. Gupta MD DM; H. Prabhakar MD; P.K. Bithal MD. *All India Institute of Medical Sciences (AIIMS), New Delhi, India.*

### Introduction

Sitting position is preferred during posterior fossa surgery as it allows better anatomical orientation and provides a clear surgical field with improved blood and CSF drainage. However, its use has recently been declined owing to the propensity to life-threatening complications. We retrospectively reviewed the perioperative complications in children who underwent neurosurgery in sitting position.

### Methods

Medical records of 97 children (<18yrs) who underwent neurosurgery in sitting position over a period of 12 yrs, were analysed. Data pertaining to perioperative course were collected which included demographics, haemodynamic changes, various complications, duration of ICU stay and hospital stay, and neurological status at discharge. Statistical analysis was done by Chi-square and Mann-Whitney test and a p-value <0.05 was considered as significant.

### Results

Median age of these children was 12yrs (Range 3-18yrs). Haemodynamic instability was observed in 12 (12.3%) children. A total of 38 episodes of venous air embolism (VAE) were encountered in 21 (21.6%) children; nine experienced multiple episodes. VAE was associated with hypotension in five (23.8%) and desaturation in four (19.1%) children. Six children presented with postoperative tension pneumocephalus; three were managed with twist drill burr-hole evacuation. Brainstem handling was the most common indication (42.5%) for postoperative ventilation. The duration of ICU and hospital stays were comparable between children who experienced VAE and those who did not ( $p>0.05$ ). Neurological status at discharge was also comparable between these two groups ( $p=0.83$ ).

### Conclusions

This study observed a lesser incidence of VAE and associated complications. Tension pneumocephalus was managed successfully without any adverse outcome. Hence, we believe, with meticulous anaesthetic and surgical techniques, sitting position can safely be practiced in children undergoing neurosurgery.

1. Leonard IE, Cunningham AJ. The sitting position in neurosurgery—not yet obsolete! Br J Anaesth 2002; 88: 1-3
2. Harrison EA, Mackersie A, Ewan MC, Facer E. The sitting position for neurosurgery in children: a review of 16 year's experience. Br J Anaesth 2002; 88: 12-17
3. Rath GP, Bithal PK, Chaturvedi A, Dash HH. Complications related to positioning in posterior fossa craniectomy. J Clin Neurosci 2007; 14: 520-5

## **A survey of the management of cardiac arrest in neurosurgery**

A. Ladele FRCA; J. Ralph FRCA; R. Francis FRCA. *Queen Elizabeth University Hospital NHS Foundation Trust, Birmingham, UK.*

### Introduction

Cardiac arrest during neurosurgery is infrequent. It poses challenging constraints requiring effective application of crew resource with concurrent treatment of underlying mechanism (1). Until recent, there was no guideline for its management. Thus, we conducted a survey to identify the learning needs and awareness of the cardiac arrest in neurosurgery algorithm (2) in order to facilitate implementation of the guidelines in our establishment.

### Method

We conducted a paper questionnaire survey in October 2014. We targeted all members of staff working in neuro theatres within our establishment. We asked for the locations of the nearest defibrillator to neuro theatres and staff's specific role during a cardiopulmonary event. We asked what sequence of actions staff would undertake when commencing CPR if the patient was supine, in pins, prone, lateral, seated or recumbent positions; and if the type of proning implement effected the commencement of chest compressions. We recorded staff demographics, sex, role, grade & specialty.

### Results

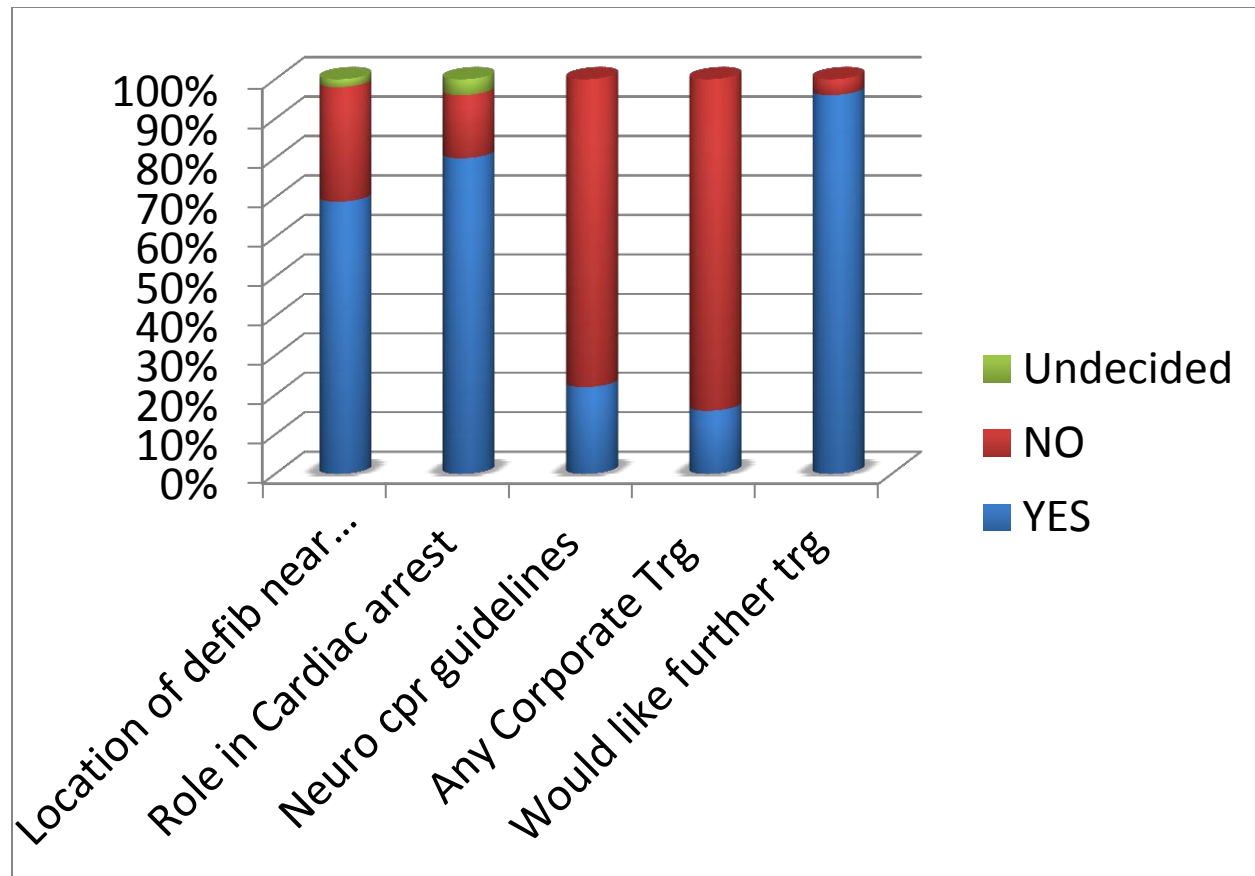
We received 45 responses during the period. 80% could identify a role during a cardiac arrest. 69% could locate the defibrillator nearest their theatre. Figure 1. 76% would immediately commence chest compressions in supine patients. In patients with pins, 45% would remove the pins before chest compressions. In the prone, lateral, seated/recumbent positions, majority would change position before chest compressions (74%, 93%, 83% respectively). 16% had undertaken some training/CPD in managing cardiac arrest/neuro emergencies and 22% were aware of the NASGBI guidelines. Majority of the staff were keen for further team training.

### Conclusion

Our results showed that there was a degree of uncertainty in managing cardiopulmonary arrest/emergencies during neurosurgery. We identified the need for regular neuro theatre team training. Thus, we aimed to implement the new guidelines via presentations, posters & simulation.

1. Chowdhury T, Petropolis A, Cappellani RB. Cardiac emergencies in neurosurgical patients. BMRI Vol 2015, Article ID 751320. Available from: Hindawi Publishing Corporation. Open Access October 1, 2014.

2. Working group of the resus council UK, NASGBI, SBNS. Management of Cardiac Arrest during neurosurgery in adults. Guidelines for healthcare providers. Aug 2014, 1-24.



## **Current practice of pre-operative risk assessment in neurosurgery**

S. Bapat, MB ChB; A. Val Luoma MB ChB. *National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, UK.*

### Introduction

Intra-cranial & spinal surgery is associated with significant morbidity (23.6% & 11.2%) [1]. Fully informed consent, shared-decision making & optimal peri-operative care is essential to ensure excellent surgical outcome. Formal pre-operative surgical risk assessment is key, multiple models exist [2] with P-possum suggested by the Royal College of Anaesthetists [RCOA] for high-risk cases [3]. Evidence exists to support use of formal pre-operative risk assessment in non-cardiac surgery but little published on best-practice for neurosurgery. The aim was to establish current practice in pre-operative risk assessment at UK Neurosciences centres.

### Methods

National peer-reviewed structured electronic survey on current practice of pre-operative risk assessment conducted through NASGBI in 2014. Trainees excluded.

### Results

- 46% response rate. 85% of neurosurgical units offer pre-operative assessment [PAC] for elective admissions; 58% nurse-led
- 19% of neuroanaesthetists perform formal risk assessment, 56% for both elective & emergency patients. P-possum used most frequently [Table 1]
- 33% always discuss results with surgical team but formal MDT discussion is rare [2%]
- 60% always discuss results with patient, responsibility lying with both surgeon & anaesthetist or neuroanaesthetist in PAC in 1/3
- Risk data used to plan post-operative care [84%] & gain informed consent for anaesthesia [72%] & surgery [49%]

### Conclusions

Our survey is the first of its kind in the UK for neurosciences. Formal risk assessment & MDT discussion is not routine & usually prompted by perceived risk or ASA grade. Neurosurgery has a high risk of morbidity [1]. Formal MDT pre-operative risk assessment should be considered essential for these

patients. Data on appropriate tools & factors increasing surgical risk is poor [2]. Further work is required to establish best practice in neurosurgery to ensure patients are appropriately consented, improve standards of care & support surgical outcome data.

1. Rolston JD, Han SJ, Lau CY, Berger MS, Parsa AT. Frequency and predictors of complications in neurosurgical surgery: national trends from 2006 to 2011. J Neurosurgery 2013; 120:736-45.
2. Reponen E, Tuominen H, Korja M. Evidence for the use of preoperative risk assessment scores in elective cranial neurosurgery: A systematic review of the literature. Anesth Analg 2014;119:420-32.
3. Norris A, Mole A, Hutchinson A,, de Beer T. Guidelines for the provision of anaesthetic services .[RCOA, web site]. Jaunary 2015. Available at [http://www.rcoa.ac.uk/system/files/GPAS-2015-FULL\\_2.pdf](http://www.rcoa.ac.uk/system/files/GPAS-2015-FULL_2.pdf). Accessed on March 1, 2015.

Table 1.

	Frequency
Formal risk score: <ul style="list-style-type: none"> <li>• Possum or variant</li> <li>• Surgical risk score</li> <li>• Lee revised cardiac risk index</li> <li>• ACS risk Calculator</li> <li>• Other</li> </ul>	33% 15% 15% 8% 7%
Biochemical markers for risk assessment: <ul style="list-style-type: none"> <li>• eGFR</li> <li>• Brain natriuretic peptide</li> <li>• CRP</li> <li>• Other</li> </ul>	56% 5% 13% 3%
Pre-operative investigations to facilitate pre-operative risk assessment: <ul style="list-style-type: none"> <li>• CPEX testing</li> <li>• Echocardiography</li> <li>• Cardiac stress testing</li> <li>• Other</li> </ul>	18% 44% 10% 7%
Prompts for pre-operative risk assessment: <ul style="list-style-type: none"> <li>• Complex spine surgery</li> <li>• Intracranial surgery</li> <li>• Interventional neuroradiology</li> <li>• ASA grade 3 or more</li> <li>• Suspicion of high-risk</li> <li>• Other</li> </ul>	41% 34% 26% 54% 72% 13%
Patients normally formally risk assessed: <ul style="list-style-type: none"> <li>• Elective</li> <li>• Emergency</li> <li>• Both</li> </ul>	32% 4% 56%

## **A survey of techniques and logistics of anaesthetising head injured patients in the emergency department**

O. Harrison BMBS FRCA; J. Sebastian MRCP FRCA. *Salford Royal NHS Foundation Trust, Salford, UK.*

### Introduction

Anaesthetists are often asked to help manage patients with head injury in the emergency department. Many of these patients will require anaesthesia for neuroprotection or to facilitate investigation. We set out to investigate whether the opinions and practice of neuroanaesthetists were consistent with regards to the ideal management of patients with isolated head injury, particularly in terms of drugs used and physiological variables targeted.

### Methods

All 291 consultant members of the NASGBI were asked to complete a survey on their preferred method of anaesthetising a theoretical patient with a Glasgow Coma Score of 6 following an isolated head injury. The survey was carried out using the Survey Galaxy website.

### Results

145 responses were received (50% response rate) from consultants working in 32 neurosurgical centres. 51% of respondents chose propofol as their preferred induction agent; 33% chose thiopentone and 2% chose ketamine. 98% of respondents used a pharmacological adjunct for induction of anaesthesia, with fentanyl and alfentanil the most popular choices (60 and 26% respectively). Respondents targeted different MAP ranges; 43% aimed for 81-90mmHg, 21% 71-80mmHg and 13% 61-70mmHg. Mannitol was preferred for osmotherapy, (selected by 72%), versus 16% using hypertonic saline. 10% of respondents use a challenge-response checklist before emergency department intubations, whilst 17% have a protocol or guideline for the anaesthetic management of head injured patients.

### Conclusions

Practice varies considerably between neuroanaesthetists with regards to the perceived ideal anaesthetic management of head injured patients. It is particularly surprising that ketamine was not a more popular agent given its effectiveness in maintaining cerebral perfusion pressure [1]. Furthermore, there is little consensus as to the most appropriate mean arterial pressure that should be targeted in the case of isolated head injury with unknown intracranial pressure.



1. Cohen L, Athaide V, Wickham ME et al. The Effect of Ketamine on Intracranial and Cerebral Perfusion Pressure and Health Outcomes: A Systematic Review. *Ann Emerg Med* 2015;65:43-51.e2

## **Central venous catheter use in the management of patients for coil embolisation following subarachnoid haemorrhage**

M. Clark FRCA; S. Murphy FRCA. *Department of Anaesthesia, Leeds General Infirmary, Leeds, UK.*

### Background

Central venous catheter (CVC) insertion in patients for cerebral aneurysm coil embolisation following acute Subarachnoid Haemorrhage (SAH) is recommended in our institution's guidance on the anaesthetic management for this procedure. In response to two recent incidents in our trust related to inadvertent carotid placement of CVCs, we examined the use of CVCs in this group of patients with the aim of assessing the appropriateness of the recommendation and improving patient safety.

### Methods

Patients undergoing coil embolisation following SAH were followed-up. Data collected included demographics, medical history, neurological assessment, procedure details, outcome and details relating to use of the CVC (if applicable). Data was collated and analysed by the authors.

### Results

29 patients were followed-up. 19 patients had CVCs inserted prior to embolisation in the angiography suite. Of these, no patient received noradrenaline infusion intra-operatively. 6 patients received cardiovascular support post-operatively. Of the 10 patients that did not have a CVC inserted pre-procedure, 4 patients had one inserted post-operatively, of which one received noradrenaline. It was noted that of the 6 patients with documented vasospasm, 5 were known smokers. One patient removed their CVC during an episode of agitation and required reinsertion. No other complications from CVC use were documented.

### Discussion

Our observations suggest that not all patients undergoing this procedure require a CVC. All inserted lines were used for monitoring, fluid and drug administration, however most patients did not require a potent vasopressor (i.e. noradrenaline). The finding related to vasospasm and smoking would seem to agree with the literature [1] although our numbers are too small to be conclusive. We plan to use this data to update our institution guidance on the management of this group of patients with the aim of reducing unnecessary CVC insertion and improving patient safety.

1. Lasner TM, Weil RJ, Riina HA, King JT, Zager EL, Raps EC, Flamm ES. Cigarette smoking-induced increase in the risk of symptomatic vasospasm after aneurysmal subarachnoid hemorrhage. *J Neurosurg.* 1997;87:381–384.

## **Transfer of critically ill patients to a neurosciences centre – repeating the audit**

F. Somavilla Dr med univ; E. Nurmi Licentiate Degree in Medicine; H. Burgess BSc (Hons) Nursing; C.J. Taylor BSc (Hons) MBBS MRCP (Paeds) FRCA FFICM; A.M.V. Luoma MBChB FRCA. *Department of Neuroanaesthesia and Neurocritical Care, National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, UK.*

### Introduction

Guidelines exist for the transfer of critically ill patients to a neurosciences centre with delays associated with poor outcome [1-3]. We began collecting data on transfer times in 2000, with mean improving from 8.4 to 4.7 hours for traumatic brain injury. Our predominant pathology has changed from isolated traumatic brain injury to stroke & sub-arachnoid haemorrhage [SAH]. Quality & speed of transfer continues to be paramount in ensuring a good neurological outcome for these patients with over 5 hours independently associated with worse outcome for stroke [2-3].

### Methods

- Prospective audit of all external critical care transfers to our institution over 3 months
- Data collected from patient notes: demographics, physiological data, documentation & transfer time.

Transfer time: time arrived in A&E to arrival in ITU

- Expected standard: adherence to AAGBI guidelines
- Data compared with historical data

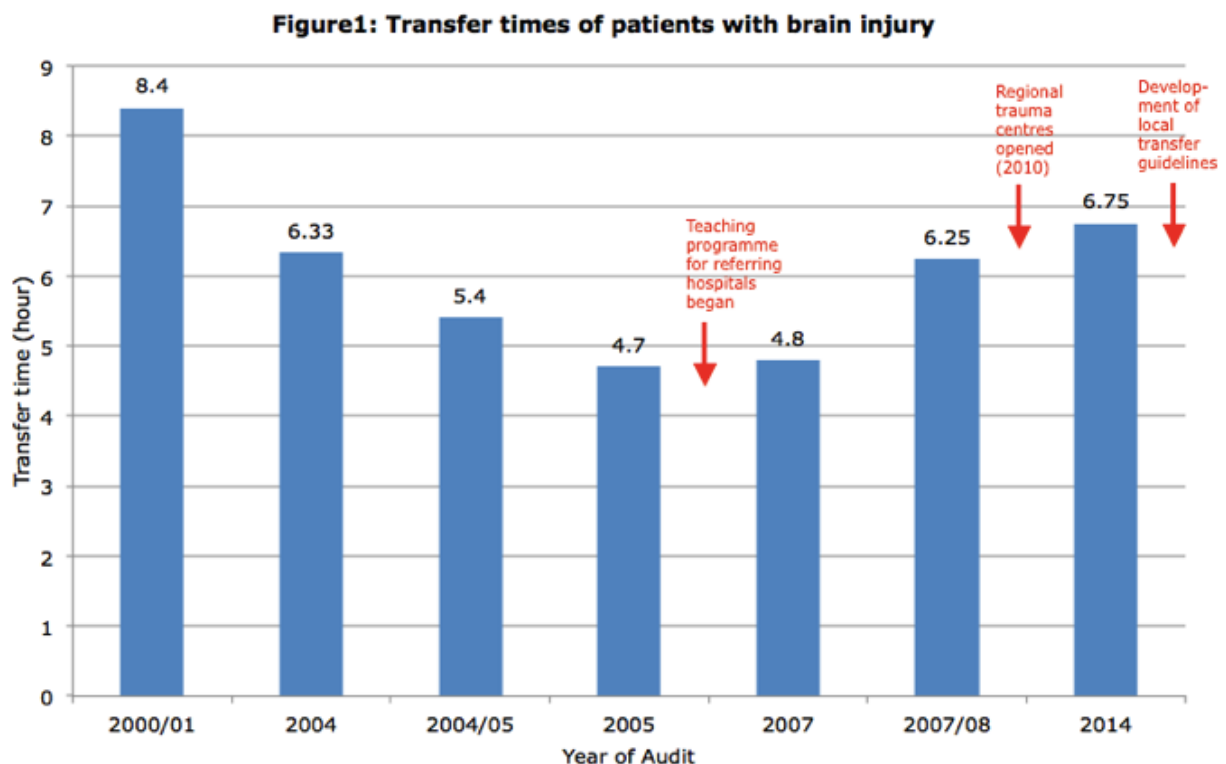
### Results

- 26 patients included. Mean [SD] age 46.6 [14.6] years. 61% female. 42% SAH & 35% haemorrhagic stroke
- Mean [SD] transfer time 6hr44min [4.43]. Longest time in pathway was from arrival in A&E to referral. 50% transferred within 5 hours
- Transfer times increased but change in pathology [figure 1]
- Documentation of transfer was poor [30% none, 11% full] but where documented, physiological data was within expected parameters

### Conclusion

Mean transfer time has increased from previous audits but encouragingly 50% were transferred within 5 hours. Although patient numbers are small, documentation is sub-standard. Where documented, patient management appears to adhere to national guidelines. High quality and timely transfer of all patients with brain injury is key to improving neurological outcome [1,3]. To improve management, we developed & published local transfer guidelines for our referring hospitals. Our data collection is ongoing to continuously improve safety & standards of care. Results will be published locally to feedback to referring hospitals.

1. <http://www.aagbi.org/publications/publications-guidelines/A/F>
2. [http://www.ncepod.org.uk/2013report2/downloads/Managing%20the%20Flow\\_SummaryReport.pdf](http://www.ncepod.org.uk/2013report2/downloads/Managing%20the%20Flow_SummaryReport.pdf)
3. Rincon F, Mayer SA, Rivolta J, Stillman J, Boden-Albala B, Elkind MSV, Marshall R, Chong JY. Impact of delayed transfer of critically ill stroke patients from the emergency department to the neuro-ICU. *Neurocrit Care* (2010) 13: 75-81



## **Being cLEAR on cerebral perfusion pressure monitoring: implementing the Joint Council statement for tragus zeroing in traumatic brain injury**

T. Fudge MB ChB FFICM; C. Carroll MB ChB FRCA, J. Naisbitt MB ChB FRCA DICM FFICM. *Critical Care Unit, Salford Royal NHS Foundation Trust, UK.*

### Introduction

In May 2014, a joint position statement from NASGBI/SBNS recommended measuring cerebral perfusion pressure (CPP) at the level of the tragus for traumatic brain injury (TBI) [1]. The Model for Improvement tested this in a 16 bedded neurocritical care.

### Method

Brainstorming identified key reliability and safety issues. Data collected over 6 months (1/9/14-1/3/15) included all adult admissions with TBI and intra-cranial pressure (ICP) monitoring. Patients were excluded when monitoring discontinued <24 hours or injury was unsurvivable.

Change included nurse-led education, handover briefings. Medics were informed by e-mail and teaching. Process capture labels (Fig. 1) were attached to patient charts. QI Macros constructed control charts. Statistical Process Control and root-cause analysis were used to understand variance.

### Results

30 patients (isolated TBI=20, polytrauma=10) provided 216 patient-days of data. There was a 15% increase in setting of perfusion targets (40% to 65%). Goal compliance was higher for isolated TBI with no change in mean noradrenaline use (6.3ml/hr noradrenaline 4mg/50ml).

28 patient-days fluid balance exceeded >30ml/kg (increased lung water=2). 41 patient-days >10ml/hr 4mg/50ml noradrenaline (arrhythmia/ischaemia=5). 3 patients without TBI received tragus calibration, 1 didn't receive measurement and 2 cases continued beyond bolt removal.

### Conclusions

Implementing tragus derived CPP using the Model for Improvement was successful. It improved target-setting within neurocritical care. Adverse cardiorespiratory variances were due to recognised pathophysiological circumstances. Staff knowledge was the greatest problem, particularly at de-

escalation. More testing is required before spread. This project raises questions about cardiac output monitoring with mannitol, diabetes insipidus or pyrexial fluid-shifts. Reflection on the scope and impact of this guidance in polytrauma is required.

1. Neuroanaesthesia Society of Great Britain and Ireland and Society of British Neurological Surgeons. Joint position statement by the Councils of the Neuroanaesthesia Society of Great Britain and Ireland (NASGBI) and the Society of British Neurological Surgeons (SBNS) with regards to the calculation of cerebral perfusion pressure in the management of traumatic brain injury, 2014.

[http://nasgbi.somcom.co.uk/media/uploads/Final\\_Revised\\_Joint\\_CPP\\_statement\\_Aug\\_2014.pdf](http://nasgbi.somcom.co.uk/media/uploads/Final_Revised_Joint_CPP_statement_Aug_2014.pdf). Accessed 5th March 2015.

Figure 1.

**TBI + ICP monitor: be clEAR**  
**TARGET MAP\_\_\_\_\_ TARGET CPP\_\_\_\_\_**

## **Intracranial pressure monitoring and interventions in traumatic brain injury patients in neurointensive care**

L. Urquhart<sup>1</sup> BMSc; M. Airlie<sup>2</sup> MBChB; L. Alakandy<sup>2</sup> MBBS MPhil FRCS FRCSEd FRCS(Neurosurgery); C. Hawthorne<sup>2</sup> MBBS FRCA. *1. School of Medicine, University of Dundee, Ninewells Hospital and Medical School, Dundee, UK. 2. Department of Neurosurgery and Neuroanaesthesia, Institute of Neurological Sciences, Southern General Hospital, Glasgow, UK.*

### Introduction

The Brain Trauma Foundation (BTF) recommends that intracranial pressure (ICP) is monitored in all salvageable patients with severe traumatic brain injury (TBI; Glasgow coma scale [GCS] 3-8) and computed tomography (CT) abnormalities [1]. Suggested targets are ICP below 20mmHg and cerebral perfusion pressure (CPP) 50 to 70mmHg. A retrospective audit of the 2014 calendar year was undertaken to compare ICP management practice at our institution to BTF guidelines. Data was compared to a previous study in the same unit. The audit will inform development of a TBI protocol for the unit.

### Methods

The Wardwatcher database was searched for all TBI admissions to the neurointensive care unit (NICU) from 01/01/14 to 01/01/15. The NICU integrated electronic record for each patient was searched for medical note entries, drug administration and ICP and CPP data. This allowed us to identify indication for ICP monitoring, duration of monitoring, ICP and CPP based interventions and length of time that ICP and CPP were outwith suggested targets.

### Results

45 TBI patients were admitted in the audit period. All patients had CT abnormalities but 3 had no documented post-resus GCS and were not included. 17 patients (40%) received invasive ICP monitoring. BTF indicated monitoring in 25 patients, with 11 receiving it (44%). 3 received monitoring with no surgical or BTF indication. 3 patients had no telemetry data available. ICP was >20 for 10.2% of total monitoring duration. Initial interventions were sedation alterations (5 patients), ventilator control (3 patients) and osmotherapy (1 patient). CPP was <50 for 3.7%, and >70 for 15%, of total monitoring duration.



## Discussion

79% of patients receiving ICP monitoring met BTF criteria, compared to 90% in 2010. TBI admissions dropped from 108 in the previous audit to 45, with overall monitoring rates increasing (40% v 33%). ICP was below the suggested limit for 89.8% - and CPP within range for 81.3% - of total monitoring duration.

1. Bratton SL, Chestnut RM, Ghajar J, et al. Guidelines for the management of severe traumatic brain injury. VI. Indications for intracranial pressure monitoring. J Neurotrauma 2007; 24 Suppl 1: S37-44.

## **A survey of clinical experience of neuro-anaesthetic trainees in the north-West deanery**

M. Anders MBChB FRCA; J. Sebastian MBChB FRCA. *Salford Royal NHS Foundation Trust, Salford, UK.*

### Introduction

The RCOA neuroanaesthesia syllabus involves a wide variety of experiences from elective and emergency intracranial and spinal surgery to interventional radiology and anaesthetics for imaging such as MRI. The number of sessions can be counted but this does not directly reflect the breadth of experience needed. Logbooks can be reviewed to gain this data.

### Methods

All trainees who had completed a module in the last year were contacted. They completed an online questionnaire which split up cases into various areas or submitted a case list from their module. Caselists were then compared to the relevant RCOA syllabus.

### Results

24 caselists were gained with a further 9 partial lists. The average number of intermediate module cases was 51 with a range of 36 to 84 cases. The average number of higher cases was 54 with a range of 36 to 93. The ratio of the different areas of the casemix is shown in Fig. 1

Intermediate trainees experienced 14.8 craniotomy cases and higher trainees 13.7 cases.

The least represented areas were awake craniotomies (11/24 trainees had experience), clippings (15/24) and anaesthesia for MRI (15/23).

All on their intermediate module spent time in neuroradiology and experienced at least one coiling. Two of nine higher trainees did not have this experience.

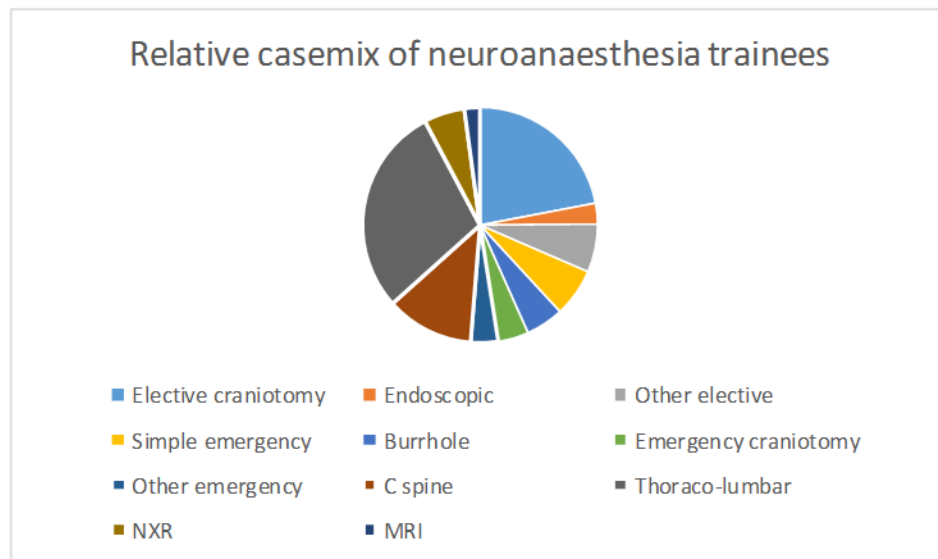
8/12 intermediate trainees directly experienced emergency shunt surgery and 9/12 experienced emergency intracranial operations.

90% of neuroanaesthetic cases were directly supervised by a senior anaesthetist for the intermediate trainees and 66% for higher trainees.

### Conclusions

The majority of trainees have no difficulty in attaining sufficient numbers of craniotomies for their module. Higher trainees only had on average three more cases per attachment but experienced more emergency cases.

Difficult areas to gain experience in were awake craniotomies and neuroradiology. Neuroradiology is specifically present in the syllabus and this could be reinforced during future pre-module meetings.



## **Incidence of post-operative nausea and vomiting (PONV) in elective anterior fossa tumour resections – the Salford experience**

S. Kulkarni, C. Carroll. *Department of Anaesthesia, Salford Royal Foundation Trust, Salford, UK.*

### Introduction

To retrospectively investigate Post Operative Nausea and Vomiting (PONV) in elective anterior fossa tumour resection surgeries in 200 Craniotomies performed at Salford Royal Foundation Trust by examining:

1. Anti-emetics used intra-operatively
2. PONV scores in the first 24 hours following operation

### Methods

Electronic Patient Records of 200 patients who underwent elective craniotomy for anterior fossa tumour resection during Jan 2013 to Oct 2014 used. Data collected from Pre-op assessment notes, Anaesthetic chart, Operative notes, Electronic prescription chart, Recovery notes and Nursing observation chart for first 24 hours. The data collected also included duration of surgery, anti-emetics used intra-operatively and PONV score in recovery. Incidence of PONV during first 24 hours on ward and anti-emetics administered also recorded. Data collected on use of analgesics intraoperatively and post-op analgesia prescribed (using electronic prescription system-EPMAR).

### Results

89/200 female patients, 66/200 smokers and 22/200 had previous history of PONV. 90.5% of patients received three anti-emetics intra-operatively. Anti-emetics used were ondansetron, droperidol and dexamethasone. Mean duration of surgery was 262 minutes. All patients received paracetamol intra-operatively. Average dose of morphine used 7.6mg (114/200) and average dose of oxycodone 6.5mg (67/200). 19 patients received no opioids. No incidence of vomiting post-immediate extubation in theatre. 3 cases of nausea and 4 cases of vomiting in recovery. Average time spent in recovery 63 minutes. 4 patients had vomiting on the ward. All the patients were administered ondansetron as prescribed. Overall incidence of PONV 11/200 i.e. 5.5% in the first 24 hours.

### Conclusion

The incidence of PONV in elective anterior fossa tumour resections in our experience is very low (overall in the first 24hours being 5.5%) with multi-modal anti- emetics administered intra-operatively along with optimal analgesia.

1. Eberhart LH, Morin AM, Kranke P, Missaghi NB, Durieux ME, Himmelseher S: Prevention and control of postoperative nausea and vomiting in post-craniotomy patients. *Best Pract Res Clin Anaesthesiol* 2007; 21:575–593.
2. Fabling JM, Gan TJ, El-Moalem HE, Warner DS, Borel CO: A randomized, double-blinded comparison of ondansetron, droperidol, and placebo for prevention of postoperative nausea and vomiting after supratentorial craniotomy. *Anesth Analg* 2000; 91:358–361.
3. Fabling JM, Gan TJ, Guy J, Borel CO, el-Moalem HE, Warner DS: Postoperative nausea and vomiting. A retrospective analysis in patients undergoing elective craniotomy. *J Neurosurg Anesthesiol* 1997; 9:308–312.

## **Bradycardia in microvascular decompression/ balloon compressions**

O. Griffith BMBS BMedSci FRCA; S. Basu MD FRCSEd(SN); S Jurgens Dr. med. *Nottingham University Hospitals NHS Trust, Nottingham, UK.*

### Introduction

Microvascular decompressions or balloon compressions are offered to trigeminal neuralgia patients for whom medical treatment fails. Facial pain can also be caused by facial nerve pathology. Manipulation at cranial nerves can result in sudden bradycardia. We aim to assess the incidence of bradycardias in response to cranial nerve manipulation during relevant neurosurgical procedures.

### Methods

We analysed the incidence of sudden bradycardias in response to surgical manipulation close to the trigeminal/facial nerve in patients undergoing microvascular decompression/ balloon compression procedures in our hospital between October 2013-October 2014.

### Results

25 patients were identified, 11 male and 14 female, age range 42-78 years. 17 patients received vagolytic glycopyrronium prior to manipulation of the trigeminal nerve during surgery while 8 patients received no vagolytic prophylaxis. 4 episodes of bradycardia in response to surgical manipulation were identified in the non prophylaxis group. The cardiac decelerations were 18%, 26%, 37%, 51% of the readings immediately prior to the episodes. One patient was given glycopyrronium in response to the bradycardia, surgeons were asked to pause their intervention in all these patients and the heart rates of all four patients recovered promptly. None of these patients were on regular antiarrhythmic home medications. None of the 17 patients with vagolytic prophylaxis developed a bradycardia.

### Conclusions

Four out of eight patients (incidence of 50%) without vagolytic prophylaxis developed a bradycardia in response to surgical manipulation of the trigeminal nerve while none of the 17 patients with prophylactic vagolytic medication developed a bradycardia. Merits of routine use of vagolytic prophylaxis during these surgeries needs to be considered as standard practice.

## **Decompressive Craniectomy - The Birmingham Experience**

V. Patel FRCA; N. Singh MA (Cantab) MBBS FRCA; O. Ali MBBS; T. Veenith MRCP FRCA FFICM. *University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK.*

### Introduction

Optimal management for the treatment of patients with raised intracranial pressure following traumatic brain injury (TBI) remains contentious. The randomised Decompressive Craniectomy trial (DECRA) highlighted unfavourable neurocognitive outcomes associated with early DC as compared with standardised medical management [1]. This observation has raised considerable contention as to the benefit of DC and whether selecting patients in whom DC should be performed early (<24h) as opposed to late (>24h) may be beneficial.

### Methods

A retrospective analysis of data relating to all decompressive craniectomies performed in our centre over a ten-year period (n=81) was conducted. Statistical tests were applied to make compare data for DC performed within 24 hours of presentation (early DC) and those that were performed after this period (late DC). Data collected included patient demographics, length of stay (in ICU/on wards) and early Glasgow Outcome Score (eGOS) at discharge.

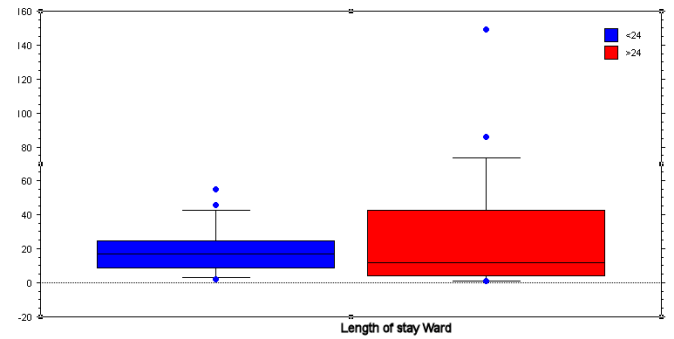
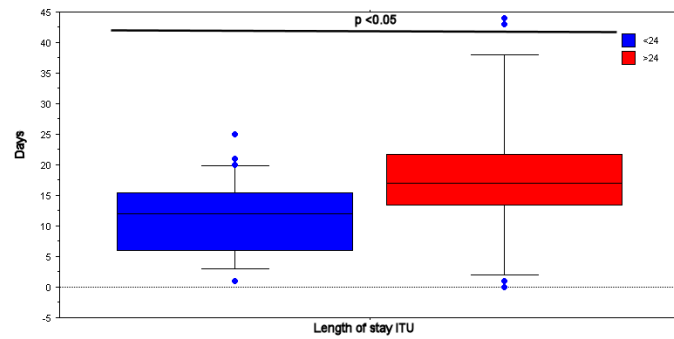
### Results

Length of stay (LOS) in ICU was found to be 7 days shorter in the group who underwent early DC as compared with late DC ( $p=0.0025$ ) but the difference in LOS on the wards following ICU discharge was not found to be statistically significant (Figure 1). When comparing eGOS scores in patients who had presented with reactive pupils as opposed to dilated, a statistically different result was noted (reacting, eGOS = 3.96, vs. dilated, eGOS = 2.67,  $p=0.09$ ).

### Conclusions

Our results indicate firstly that early DC may confer benefit to patients with TBI in that a better eGOS at discharge is observed in patients with reactive pupils at presentation and that a shorter length of stay on ICU is apparent. These results expand upon the findings of the DECRA study. Further studies may help delineate other factors to inform decision-making as to early versus late DC and the role of these procedures in comparison to standardised medical management alone.

1. Cooper DJ, Rosenfeld JV, Murray L et al. Decompressive Craniectomy in Diffuse Traumatic Brain Injury. N Engl J Med 2011; 364:1493-1502.





## **Dysnatraemia burden in a neurocritical care unit**

S.P. Young BSc MB ChB FRCA EDIC FFICM; M. Kommer MBBS BA(Hons) Oxon MRCS; R. Campbell MB ChB FRCA. *Institute of Neurological Sciences, Glasgow, UK.*

### Introduction

Dysnatraemia is common in critically ill patients. It is of particular concern in patients with acute brain injury (ABI), resulting from neuroendocrine disturbance and IV fluid therapy (1), and causing further harm to a susceptible brain (2). Thoughtful management of hyper- and hypo- natraemia in patients with ABI is a fundamental component of supportive therapy in neurocritical care (NCC). A method of maintaining awareness and benchmarking treatment was sought. We assessed the 'dysnatraemic burden' in a cohort of NCC patients, looking at the weighted incidence of hyper- and hypo- natraemia.

### Methods

Adult patients with acute NCC admissions for aneurysmal subarachnoid haemorrhage (aSAH) and traumatic brain injury (TBI) at the Institute of Neurological Sciences, Glasgow were identified retrospectively (Sept 2013-Aug 2014) using WardWatcher. Formal serum sodium values were extracted manually from the laboratory database, and plotted as a histogram.

### Results

122 patients (666 serum sodium measurements) were identified. For TBI (n=61), serum sodium concentrations (repeated measures) ranged from 122-164 (median 141) mmol l<sup>-1</sup>, and for aSAH (n=61) the range was 123-167 (median 141) mmol l<sup>-1</sup>. See Fig. 1 for a representative histogram plot of values for aSAH patients.

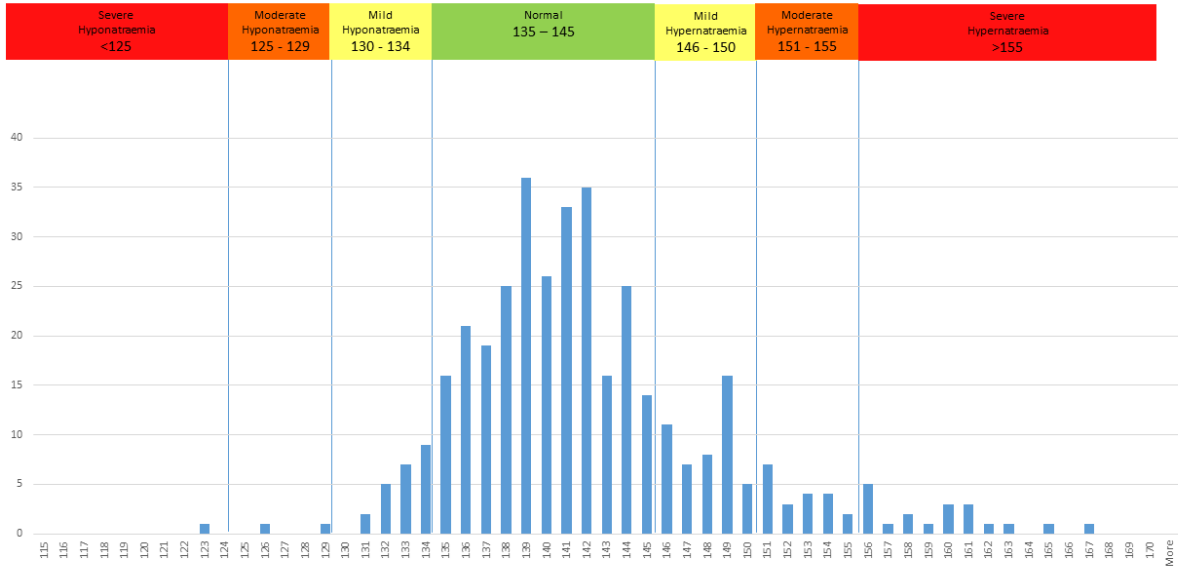
### Conclusions

With simple graphical plotting, dysnatraemia burden can be appreciated. This weighted plot can be used for a number of purposes, including: (1) raising awareness of dysnatraemia, (2) unit illness severity assessment, and (3) as a quasi-quantitative benchmark with which to improve management of dysnatraemia.

1. Sterns RH. Disorders of plasma sodium – causes, consequences, and correction. *New Eng J Med* 2015; 372; 55-65

2. Carpenter J, Weinstein S, Myseros J, et al. Inadvertent hyponatremia leading to acute cerebral edema and early evidence of herniation. Neurocrit Care 2007; 6: 195-9

### Frequency Histogram of Sodium Values for 61 SAH Patients (377 Na<sup>+</sup> data points)



## **Neurosurgery in pregnancy: a review of practice in a tertiary referral centre**

E. Hoogenboom MD FRCA FMH; S.R. Wilson FRCA FICM. National Hospital for Neurology and Neurosurgery, University College London Hospitals NHS Foundation Trust, London, UK.

### Introduction

Pregnant women rarely present with neurosurgical disorders; these are nonetheless an important cause of morbidity and mortality [1, 2]. Surgery is often urgent and the anaesthetic management uniquely challenging; maternal and foetal, anatomical and physiological considerations, for both neurosurgery and pregnancy are often conflicting.

### Methods

Casene review of patients assigned to both neurosurgical and obstetrical ICD-10-A codes between July 2010 and July 2014. We noted adherence to our local guidelines which recommends the involvement of both anaesthetic and obstetric teams, and we describe the perioperative management, complications and outcomes of those women undergoing neurosurgery.

### Results

14 encounters were identified. One woman presented twice. Median age was 32 (range 20 to 42) years and a gestational age of 22 (range, 6 to 31) weeks of all singleton pregnancies. For gestational ages greater than 22 weeks (n=6), the involvement of anaesthetic and obstetric teams was documented in 3 (50%) cases. One woman with an AVM had an angiogram under local anaesthetic. 3 women had their surgery post partum. One woman had a non-invasive treatment (VP shunt valve adjustment) and one woman was transferred to the centre where she was receiving antenatal care. Three women were monitored and underwent further investigations without any intervention. 5 women underwent GAs, notes were only available for 4 (Table 1). Maternal outcomes were mostly good, although two mothers died: one with a poor grade SAH, soon after the procedure and one a few months later from malignancy.

### Conclusion

Pregnant women undergoing neurosurgery are a high risk group. All health professionals need to be consulted at the earliest opportunity, and an individualised plan for management agreed and documented. The mother's clinical state, the urgency of the operation, the stage of pregnancy and the anaesthetic considerations (3), need to be taken into account for neurosurgery.

1. Wang LP1, Paech MJ 1Neuroanesthesia for the pregnant woman. Anesth Analg. 2008 Jul;107(1):193-200
2. Ng J, Kitchen N Neurosurgery and pregnancy, J Neurol Neurosurg Psychiatry. 2008 Jul;79(7):745-52
3. Reitman E, Flood P Anaesthetic considerations for non-obstetric surgery during pregnancy, BJA 2011 Dec;107 Suppl 1:i72-8

Table 1. Perioperative management and outcomes of of pregnant patients undergoing general anaesthetic for neurosurgery.

<i>Reason for admission</i>	<i>Symptoms on admission</i>	<i>Gestational age (weeks)</i>	<i>Surgery/Intervention</i>	<i>Premedication</i>	<i>Induction drugs</i>	<i>BP Monitoring</i>	<i>Table tilt</i>	<i>Postoperative destination</i>	<i>Mode of delivery, Outcomes</i>
Aneurysmal SAH	History of cerebral aneurysm, cardiac arrest in A&E	6	Bilateral frontal EVD	nil	Already intubated and ventilated	Arterial line	No	Intensive care	RIP
SAH-AVM	Sudden onset headache, nausea and vomiting	12	Glue embolisation of AVM	nil	Midazolam Fentanyl Propofol Atracurium	Arterial line	No	Recovery	Elective LSCS 38 weeks mother and baby alive
Recurrent pituitary macroadenoma	Visual loss headache	20	Right frontal craniectomy	Ranitidine	RSI.Propofol Suxamethonium Fentanyl Remifentanyl	Arterial line	30 degrees tilt	Recovery	Term Delivery, mother and baby alive
Pituitary macroadenoma	Visual loss	31	Transphenoidal pituitary adenoma resection	Ranitidine	RSI, Thiopentone Vecuronium	Non invasive	15 degrees tilt	Recovery	Term Delivery, mother and baby alive

## **The role of simulation training in improving the management of cardiac arrest during neurosurgery**

R. Davison MBChB FRCA; C. Carroll MBChB FRCA. *Salford Royal NHS Foundation Trust, Salford, UK.*

### Introduction

An ALS scenario was experienced during neurosurgery where, strict adherence to ALS protocol may have resulted in serious patient harm. A survey of neuroanaesthesia experience of cardiac arrest in head pins was conducted through NASGBI. The risk of potential harm had not been considered by many anaesthetists surveyed. Subsequently a protocol has been devised which has Resuscitation Council and NICE approval [1]. For effective use of the protocol, we propose that regular practice through simulation may improve outcomes and have undertaken a review of available evidence.

### Method

A Medline search of English language articles (2005-15) with subject headings 'anaesthesia/anaesthesiology' was performed using the keyword syntax '(simulat\$ and (situat\$ or team or emergen\$ or critical)) not student'. This aimed to identify articles relevant to critical incident simulation amongst qualified anaesthetists. Abstracts from 181 articles were screened for relevance to simulation in anaesthetic emergencies. We included studies/systematic reviews relating to simulation training, situational awareness, skill retention, improved performance and patient safety.

### Results

Of 28 identified articles, none specific to neuroanaesthesia, simulation in relevant critical incident experience was reviewed. There is widespread use of simulation training in anaesthesia using complex scenarios. However, direct evidence that simulation improves patient outcome is not established.

### Conclusion

The simulation protocol can be easily taught, is reproducible and should be considered a basic resuscitation skill for those looking after neurosurgical patients. Review of the literature provides no direct evidence that resuscitation protocol simulation improves clinical outcomes. However, high fidelity simulation has been shown to be effective in learning and improvement of technical/non-technical skills. We therefore advocate the use of the protocol and plan to pilot a simulation scenario at NASGBI 2015.

1. Management of cardiac arrest during neurosurgery in adults. Published by Resuscitation Council UK. 2015

## **Pre-operative anaemia and blood transfusion for complex spine surgery**

C. Moss BM MRCP FRCA; A.M.V. Luoma MBChB FRCA. National Hospital for Neurology and Neurosurgery, London, UK.

### Introduction

Pre-operative anaemia is common, reported incidence up to 30%[1,2]. It is independently associated with increased 30-day morbidity & mortality after major non-cardiac surgery. Pre-operative investigation & treatment can improve patient outcome[1,2]. Peri-operative transfusion further increases morbidity & mortality[2]. Complex spine surgery is associated with high risk of peri-operative morbidity, including massive blood loss. At our institution posterior interbody fusion (PLIF) is the most common elective complex spine procedure. We aimed to establish incidence of:

- 1] Pre-operative anaemia in patients undergoing complex spine surgery
- 2] Mean peri-operative haemoglobin (Hb) drop for PLIF
- 3] Peri-operative blood transfusion rate

### Methods

Retrospective electronic case-note review of all patients undergoing elective complex spine surgery at our institution in 2014. Data collected included patient demographics, hospital stay, pre/post-operative Hb & blood transfusion rate. Anaemia defined according to WHO criteria [3]. PLIF analysed as sub-group for peri-operative Hb drop.

### Results

290 patients, 30% PLIF. 20.7% (n=59) pre-operatively anaemic, 30% moderate or severe [table 1]. Peri-operative blood transfusion rate 14.8% (n=43), 41% (n=18) anaemic pre-operatively. Peri-operative blood transfusion associated with increased length of stay [mean (SD) days 17.1(11.4) vs 8.9(8.7)  $p=0.0001$ ] but anaemia not [mean (SD) days 10.6(8.3) vs 9.3(7.4)  $p=0.35$ ]. Mean (SD) Hb drop for 1- level PLIF was 29.5(13.1) & >1-level 34.5(12.5) g/L.

### Conclusion

Findings are consistent with published data. Blood transfusion rate is high (14.8%) & associated with increased length of stay ( $p=0.0001$ ) & anaemia. Mean Hb drop is significant. Early identification and treatment of pre-operative anaemia could reduce or prevent 40% of transfusions. We developed a

multi-disciplinary pre-operative anaemia clinic inline with NATA recommendations[1] to improve quality of care & reduce peri-operative risk.

1. Goodnough LT, Maniatis A., Earnshaw P et al Detection, evaluation, and management of preoperative anaemia in the elective orthopaedic surgical patient: NATA guidelines British Journal of Anaesthesia 106 (1):13-22 (2011)
2. Musallam KM, Tamim HM, Riachards T et al Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study Lancet 2011; 378:1396-407
3. <http://www.who.int/topics/anaemia/en/>

Table 1: Patient demographics and incidence of blood transfusion

	All patients N = 290	No anaemia N = 231	Pre-op anaemia* N = 59
Demographics			
Age [median, range]	58 [18-92]	56 [18-83]	63 [25-92]
Gender F: M	172:117	138:93	34:25
Mean pre-operative haemoglobin g/L[SD]	135 [15.6]	140 [11.8]	114 [9.7]
Incidence of blood transfusion	14.8%**	10.8%	30%***

\*30% moderate or severe; \*\*40% of all transfused anaemic pre-operatively; \*\*\*p=0.0004 for difference between pre-operatively anaemic and not anaemic patients who received transfusion



## **Perioperative complications in elderly patients undergoing cervical spine surgery**

M.P. Pandia, S. Kumar, A. Chaturvedi. *All India Institute of Medical Sciences (AIIMS), New Delhi, India.*

### Introduction

Elderly patients are more prone to have perioperative complications because of the associated comorbidities. The objective of our study was to assess the incidence and characteristics of perioperative complications in elderly patients undergoing cervical spine surgery.

### Methods

This retrospective study was done in elderly patients (age 60 years or above) who underwent cervical spinal surgeries. Various perioperative data including demography, comorbidities, type and site of lesions, type of surgery, perioperative complications were collected.

### Results

The study sample included 161 elderly patients who underwent surgery cervical spine surgeries. The average age of the patients was  $66 \pm 5.6$  years (mean  $\pm$  SD) (range -60 -86 years). Hypertension was the most common co morbidity (46.6%). Other common comorbid conditions were diabetes mellitus (19.9%), cardiovascular diseases (8.07%) and pulmonary diseases (9.9%). The most common surgery performed was anterior cervical disectomy and fusion which was done in 53(32.9%) patients. Various intraoperative complications were haemodynamic fluctuations (8.7 %), cardiac arrhythmias (4.35%) and pulmonary complications (3.7%). The incidence of postoperative complication was 45.3% (73 patients). In the postoperative period, fever was the most common complications and was seen in 54 (33.5%) patients, which was followed by neurosurgical complications (17.4%), respiratory complications (10.6%), cardiovascular complications (9.9%), electrolytic abnormalities (8.7%), and coagulopathy (4.35%).

### Conclusion

Perioperative complications are quite common in elderly patients. Postoperative complications like neurosurgical complications (17.4%), respiratory complications (10.6%), and cardiovascular complications (9.9%) are quite common in these patients and they can influence the perioperative complications. Early diagnosis and efficient management of these complications are important for good outcome.

## **Enhanced recovery programme (ERP) in non-instrumented spinal surgery - our experience**

V. Patel; M. Pias; H. Krovvidi; J. van Dellen. *Queen Elizabeth Hospital, Birmingham, UK.*

### Introduction

The key goals of ERP are reduced length of hospital stay, increased number of patients treated, reduced level of resources needed and better staffing environment.(1) At Queen Elizabeth Hospital we are implementing ERP for non instrumental spinal surgery for last 18 months. We aimed to discharge all the patients who had non-instrumental spinal surgery within 24 hours after the surgery.

### Results

In a 18 months period, we collected data prospectively. One neurosurgeon, one theatre team and one ward were involved in the ERP. A total of 237 patients were included in the ERP. Mean age was 57 years (23-79). Male : Female = 142:95. ASA 1=108; 2=107; 3= 22. Surgical site: Lumbar= 187 and Cervical =50. Length of the stay: 52% (n=126) patients were discharged on the same day, 41 % ( n=99) were discharged on the next day morning ( before 12:00 pm ), 5.1% (n=12) stayed beyond 24 hrs. Readmission rate ( within 28 days after intended operation): 3.4% (n=8) were readmitted, out of which 7 were re-operated. All patients had a multimodal analgesia with opioids, local anaesthetic infiltration by the surgeon, intravenous paracetamol and COX-2 inhibitor Paracetamol ( when no contraindications existed) 34.2% (n= 81) required no further strong analgesics before their discharge.

### Conclusions

The key factors which made our ERP programme successful were,

- A consultant led preoperative assessment
- Patient and relative education.
- Meticulous surgical technique
- Minimising surgical time,
- Multimodal analgesia (minimising strong opioid use )
- Early postoperative physiotherapy involvement,
- Early mobilisation,
- Theatre and ward staff education.

1. Enhanced Recovery Partnership Programme. Delivering enhanced recovery—helping patients to get better sooner after surgery. London: Department of Health, 2010.

## **Inhalation versus intravenous technique for rapid emergence from anaesthesia in patients undergoing brain tumour surgery**

H. Prabhakar; G.P. Singh; C. Mahajan; I. Kapoor; V. Anand; M. Kalaivan. *All India Institute of Medical Sciences, New Delhi, India.*

### Introduction

Early and rapid emergence from anaesthesia is desirable in most neurosurgical patients. With the availability of newer intravenous and inhalational anaesthetic agents, we remain uncertain as to which technique may result in a more rapid early recovery from anaesthesia. The objective of our review is to compare the emergence from anaesthesia in patients receiving either inhalational (isoflurane, sevoflurane, desflurane) or intravenous (propofol) anaesthetic agents for maintenance of general anaesthesia during brain tumour surgery.

### Methods

We searched the Cochrane Central Register of Controlled Trials (CENTRAL), The Cochrane Library, 2014, issue 6, MEDLINE via OvidSP (1966 to June 2014), and EMBASE via OvidSP (1980 to June 2014). We also searched specific websites. We included randomized controlled trials (RCTs) that compared the use of intravenous anaesthetic agents with inhalational anaesthetic agents for maintenance of general anaesthesia during brain tumour surgery. The primary outcomes were emergence from and adverse events during emergence. Secondary outcomes were time to eye opening, recovery from anaesthesia, opioid consumption, brain relaxation and complications of anaesthetic techniques.

### Results

We included 15 RCTs with 1833 participants. None of the RCTs was judged to be at low risk of bias. Six trials suggest that for the outcome of emergence from anaesthesia, the mean difference (MD) with use of propofol (intravenous anaesthetic) was minutes (MD 0.88, 95% CI -1.07 to 2.83, P value 0.37, low quality of evidence).

### Conclusion

The finding of our review that intravenous technique is not superior to inhalational technique in providing early emergence from anaesthesia was derived from a limited number of studies.

## **Successful resuscitation with good neurological outcome after cardiac arrest due to major haemorrhage during spine surgery: a case report**

S. Lakhani; S. Misquita. *The Walton Centre NHS Foundation Trust, Liverpool, UK.*

### Introduction

Cardiac arrest during anaesthesia for adult non-cardiac surgery has a reported incidence of 0.01–0.34%.

Its incidence in neurosurgical patients is unknown.

We present a catastrophic event that can happen anytime - cardiac arrest under anaesthesia in prone position due to profound bleeding.

### Case History

A 34 year old ASA 2 female was posted for an elective lumbar microdiscectomy under GA in prone position. Intraoperatively her ETCO<sub>2</sub> dropped followed by severe refractory hypotension. It was felt that the resuscitation was more likely to succeed in supine position, so the surgeon was asked to close the incision quickly and she was turned supine. She soon deteriorated to PEA arrest. CPR was started. An emergency laparotomy was performed which revealed significant hemoperitoneum. CPR was continued with manual compression of the aorta and the bleeding only stopped when vascular clamps were applied. There was disruption of the left iliac vessels which were repaired with grafts. CPR was given for >90 minutes before bleeding was controlled and cardiac output restored. She received a massive transfusion of 14 units blood & 17 units of other blood products. She was transferred to ITU on multiple systemic support. She improved over a few days & was discharged home with excellent neurological & functional outcome on day 18.

### Discussion

Resuscitation Council UK has recently published a Cardiac Arrest in Neurosurgery algorithm. Specific factors influencing CPR can be surgical, position and open wound.

However there is no recommendation of a minimum duration of resuscitation. Resuscitation Council UK recommends that prolonged CPR can result in high quality survival if the patient has a potentially reversible cause for cardiac arrest. The duration should be determined on a case by case basis.

This case report demonstrates that survival is possible after a prolonged resuscitation. Although this case is not unusual, it should serve as an example of good resuscitation.

## **Anaesthetic management of a patient with angio-oedema**

A. Ramkumar; G. Kakkar; N. Qadir. *Department of Anaesthesia, Royal Stoke University Hospital, Stoke on Trent, UK.*

### Introduction

We discuss the management of a patient with history of hereditary angio-oedema presenting for elective craniotomy and excision of cerebellar metastases.

### Case History

A 53 year old woman was admitted for an elective craniotomy and excision of cerebellar metastases secondary to a small cell carcinoma of lung. Past medical history also included hereditary angioedema. She had significant family history (2 family members affected, one of whom died due to airway complications). She was on regular Danazol. She last had angio-oedema symptoms (unknown trigger) a few years ago but did not require emergency airway control.

On the day of surgery, she continued Danazol. She received 1500 I.U (around 25 IU/kg) of C1 esterase inhibitor, 1 hour before airway instrumentation. Anaesthesia was induced and maintained with total intravenous anaesthesia. Her airway was carefully secured. She had an uneventful intraoperative period. After careful inspection to look for signs of angio-oedema, endotracheal tube was removed when she became fully awake. Her post-operative period was uneventful.

### Discussion

Hereditary angio-oedema is rare (prevalence 1.5 per 100,000) but can cause significant airway compromise. It can be triggered by stress and airway manipulation. It is characterised by deficiency or impaired function of C1 esterase inhibitor. The lack of C1 esterase inhibitor leads to complement activation with the increased levels of bradykinin. Airway oedema tends to occur at the level of or above the larynx. [1]

The goal of procedural prophylaxis is to prevent an attack by meticulous airway management and pharmacotherapy. We used C1-esterase inhibitor but attenuated androgens, antifibrinolytics, icatibant, and fresh frozen plasma can also be used successfully for short-term prophylaxis. It is important to note

that drugs used normally for allergy related oedema such as antihistamines, epinephrine, and corticosteroids, are ineffective in hereditary angioedema. [2]

1. Hoyer C, Hill M, Kaminski E. Angio-oedema: An Overview of Differential Diagnosis and Clinical Management. Continuing Education in Anaesthesia, Critical Care & Pain. Vol 12 Number 6 2012.
2. Gower R, Busse P, Aygoren-Pursun E, et al. Hereditary Angioedema Caused by C1-Esterase Inhibitor Deficiency: A Literature Based Analysis and Clinical Commentary on Prophylaxis Treatment Strategies. WAO Journal 2011; 4:S9–S21

## **Successful thrombectomy for ischaemic stroke in a patient with severe left ventricular impairment**

M. Heald FRCA; N. Qadir FRCA; G. Kakkar FCARCSI. *Department of Anaesthesia, Royal Stoke University Hospital, Stoke on Trent, UK.*

### Introduction

Stroke is the leading cause of disability in the UK and the fourth leading cause of death [1]. Mechanical clot retrieval for the treatment of acute ischaemic stroke may be used when thrombolysis is unsuitable or has failed [2].

### Case History

A 49 year old female presented with dense left hemiplegia and dysphasia due to acute ischaemic stroke (NIHSS 18). She had recently been diagnosed with severe cardiac failure (NYHA class IV) with an ejection fraction of 20%, ASD and an apical thrombus. The patient was randomised to the ENCHANTED study, however attempted thrombolysis was unsuccessful, therefore she underwent mechanical thrombectomy with a SOLITAIRE device under conscious sedation. The interval between onset of symptoms at home and final angiogram was less than 4 hours (see table 1). She made full neurological recovery (NIHSS 0) and was discharged home after four days with good cognition, functional independence and full mobility, with anti-coagulation using warfarin and optimisation of heart failure medications. Unfortunately this patient subsequently suffered an out of hospital PEA arrest and died. Post-mortem revealed a systemic granulomatous disease consistent with Sarcoidosis.

### Discussion

There is a paucity of published evidence to guide the choice of general anaesthesia versus sedation for mechanical thrombectomy. At our institution it is common practice to perform a general anaesthetic for such procedures. The severity of heart failure along with severe orthopnoea precluded supine positioning and general anaesthesia. These challenges were overcome by performing conscious sedation with ketamine (total dose 50mg) and midazolam (1 mg) and using the TROOP elevation pillow. Ramped positioning mitigated the problem of orthopnoea and provided satisfactory operating conditions. The features of this case highlight some of the difficulties in providing anaesthesia for stroke thrombectomy. In this instance a simple technique proved to be successful.

1. Royal College of Physicians. National Sentinel Stroke Clinical Audit 2010. Round 7 Public report for England, Wales and Northern Ireland. Prepared on behalf of the Intercollegiate Stroke Working Party. 2011: 43-44.
2. Mechanical clot retrieval for treating acute ischaemic stroke. 2013. NICE interventional procedure guidance 458

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**TABLE 1: Chronology of significant events.**

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<b>Event</b>	<b>Time</b>
Onset of Symptoms (At home)	08:00
Ambulance at scene	08:21
Arrival at UHNS	08:59
Seen by stroke team	09:10
CT Head	09:12
TPA bolus	10:05
Arrival in cath lab	10:45
Start of sedation	11:15
Femoral Puncture	11:36
Clot capture	11:54
Final Angiogram	11:55

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