NACCSGBI ASM Abstracts 2016

The effect of acupuncture at the Yintang point on pre-operative anxiety levels in neurosurgical patients: a randomised control trial.

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Introduction: Pre-operative anxiety is common in neurosurgical patients with an incidence of around 80%[1] but traditional therapies such as benzodiazepines are undesirable in this population due to the incidence of prolonged sedative effects. Acupuncture at the Yintang point (on the forehead between the eyebrows) has been shown to effectively reduce pre-operative anxiety[2], but studies undertaken in neurosurgical patients are lacking.

Methods: After ethical approval we randomised patients (1:1) to either receive acupuncture at the Yintang point or control (no intervention). Anxiety levels were assessed at baseline and 30 min after invention using the Amsterdam Preoperative Anxiety and Information Scale (APAIS). Previous data have suggested that acupuncture may reduce anxiety levels by 25-37%. In order to demonstrate a 30% reduction in anxiety scores, we required 58 patients in each group ($\alpha < 0.05$ and β 0.9). Data were not normally distributed and are expressed as median (IQR) with Mann-Whitney Rank Sum and Wilcoxon Signed Rank tests used for comparison.

Results: Patient characteristics are shown in Table 1. Five patients were excluded for logistical reasons leaving 119 for analysis. Ninety-eight (82.4%) patients had high levels of anxiety pre-operatively (defined as APAIS ≥ 10) but baseline anxiety levels were similar in both groups (p=0.355). The patients who received acupuncture had a decrease in the anxiety levels [APAIS 10 (6-13.5) to 7 (4-10.5); p<0.001], with no change seen in the control group [APAIS 9 (7-12) to 9 (6.25-12); p=0.929]. There were no adverse events secondary to acupuncture use.

Conclusions: The use of acupuncture reduced pre-operative anxiety levels in neurosurgical patients by 30%. Preoperative anxiety has been associated with adverse consequences, including increased anaesthetic and analgesic requirements and overall dissatisfaction with care[3]. Acupuncture is a low-cost and effective treatment for anxiety in neurosurgical patients.

1. Whitaker J, Sanders M, Hirst C, et al. Determination of preoperative anxiety in neurosurgical patients: a prospective, observational study. *J Neurosurg Anesthesiol* 2015;**27**:379-389.

2. Agarwal A, Ranjan R, Dhiraaj S, Lakra A, Kumar M, Singh U. Acupressure for prevention of pre-operative anxiety: a prospective, randomised, placebo controlled study. *Anaesthesia* 2005;**60**:978-981.
3. Williams JGI, Jones JR. Psychophysiological responses to anesthesia and operation. *JAMA* 1968;**203**:415-417.

Table 1. Patient characteristics and anxiety scores. APAIS, Amsterdam Preoperative Anxiety and Information Scale; IQR, interquartile range. Data are number (proportion) or median (IQR).

	Control Group (n=59)	Acupuncture Group (n=60)
Age; years	57 (38-69.75)	53 (45-63.5)
Female sex	31 (53%)	36 (60%)
Intracranial surgery	24 (41%)	18 (30%)
Spinal surgery	35 (59%)	42 (70%)
APAIS at baseline	9 (7-12)	10 (6-13.5)
APAIS after 30 min	9 (6.25-12)	7 (4-10.5)

Measurement of cerebral perfusion pressure in traumatic brain injury: a survey of neurocritical care units following a joint position statement from the Neuroanaesthesia and Critical Care Society of Great Britain and Ireland (NACCSGBI) and the Society of British Neurological Surgeons (SBNS)

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Introduction: Measurement of cerebral perfusion pressure (CPP) is a standard of care in the management of traumatic brain injury (TBI)[1]. In a joint position statement in May 2014, the NACCSGBI and the SBNS recommended that the arterial line transducer be placed at the level of the middle cranial fossa, approximating with the tragus, when calculating CPP in TBI[2]. This is in order to more accurately measure cranial perfusion, standardise practice and improve comparison between centres. The subject was subsequently discussed in an editorial in 2015. The objective of our survey was to assess the impact of the 2014 statement in neurocritical care units in Great Britain and Ireland (GB&I).

Methods: In December 2015, 32 questionnaires were sent to NACCS link-persons via Surveygalaxy®, with a series of questions about current CPP measurement practices and the impact of the consensus statement within their adult neurocritical care units. All responses returned by February 2016 were analysed.

Results: Twenty-eight (87.5% response rate) questionnaires were returned, one was incomplete. The results are summarised in Table 1 and show that 63% of units now measure mean arterial pressure (MAP) at the tragus compared to 29.6% before the consensus statement and editorial. 14.8% of centres expressed that they intend to change their policy in the near future. In our own institution we audited compliance with the statement and found the arterial line transducer was positioned at the tragus in 65.4% of patients with TBI.

Conclusion: This survey demonstrates that the consensus statement has increased consistency between neurocritical care units in GB&I with improved standardised practice strengthening our ability to make comparisons between centres, and reveal features of management that truly impact on morbidity and mortality in TBI. However, considerable variation continues to exist and it is a small majority that feels that the position from which MAP is measured makes a difference clinically.

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2. Thomas E, Czosnyka M, Hutchinson P. Calculation of cerebral perfusion pressure in the management of traumatic brain injury: joint position statement by the councils of the

Neuroanaesthesia and Critical Care Society of Great Britain and Ireland (NACCS) and the Society of British Neurological Surgeons (SBNS). *Br J Anaesth* 2015;**115**:487-8

Table 1: Summary of responses from 28 neurocritical care units within Great Britain and Ireland

Survey Question	Options	Response (%)
Prior to this survey, had you read the NACCS/SBNS consensus statement?	Yes	85.7
	No	14.3
Prior to the publication of the consensus statement at what level was the arterial transducer positioned to calculate CPP in TBI?	At the level of the right atrium	51.9
	At the level of the tragus	29.6
	No consistent policy/other	18.5
While calculating CPP in TBI now, at what level is the arterial transducer positioned?	At the level of the right atrium	29.6
	At the level of the tragus	63.0
	No consistent policy/other	7.4
Do you believe that the level at which the arterial line transducer is placed in TBI management makes a significant difference clinically?	Yes	59.3
	No	40.7
Since the publication of the consensus statement have you moved your arterial transducer, changed your CPP target or guidelines?	No - Transducer was at tragus level anyway and we have not changed CPP value	33.3
	No - However we have agreed and are planning to do this in the near future	14.8
	No - We have no initial set value for CPP as we always individualise using PRx or similar so moving transducer has no impact	7.4
	No - Not moved transducer to tragus level or changed CPP targets and no plans to change	14.8
	Yes - Moved transducer to tragus level but left CPP target at >70mmHg	7.4
	Yes - Moved transducer to tragus level but left CPP target at >60mmHg	11.1
	Yes - Moved transducer to tragus level and changed CPP target from >60 to >50mmHg	7.4
	Other (*)	3.7

NACCS indicates Neuroanaesthesia and Critical Care Society of Great Britain and Ireland; SBNS, Society of British Neurological Surgeons; CPP, cerebral perfusion pressure; TBI, traumatic brain injury; *"Not moved transducer, but we discussed this years ago and changed CPP target from >60 to >70"

Elective coiling of cerebral aneurysms - do they need level 2 care post-operatively?

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Introduction: Cerebral aneurysms affect 1-3 % of the population. Treatment of unruptured aneurysms by endovascular coiling is increasing due to improved radiological diagnosis, and also the need for secondary treatments. At the inception of this service, patients undergoing elective treatment defaulted to a pathway of level 2 care similar to those having coiling for ruptured aneurysms. As our experience grows and the pathways become more developed we are able to pare away unnecessary elements including routine level 2 care.

Methods: We retrospectively audited two cohorts of patients who underwent elective coiling of cerebral aneurysms, one in 2012, and one in 2014 following a change in local guidelines for post-operative care directing low risk patients to level 1 care. Data were provided by the neurovascular specialist nurse and data collected using our hospital patient record system Evolve, the hospital Critical Care booking database and by retrieving the patient's paper notes.

Results: In 2012, 32 patients underwent elective coiling. 84% went to level 2 care post op but only 6% received any kind of level 2 intervention. This resulted in an average of 1.1 critical care days and 5.2 days in hospital per operation. In 2014 56 patients underwent elective coiling. Post-operatively 3% went to level 3 and 27% to level 2 care. Only 5% received any level 2 intervention and 3%any level 3 intervention. This resulted in an average of 0.56 critical care days and 4.4 days in hospital. There were four unplanned admissions to critical care, all arranged intraoperatively or in recovery due to recognised complications.

Conclusion: Routinely sending patients to level 1 care post elective coiling of cerebral aneurysms is safe and results in reduced use of valuable critical care beds and hospital length of stay and should be the default for all elective coilings. The small number needing a higher level of care were all identified safely peri-operatively, and re-directed to level 2/3 care.

Evaluation of a new multidisciplinary pre-operative anaemia pathway

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Introduction: The incidence of pre-operative anaemia in elective surgery is around 30%. Peri-operative anaemia and blood transfusion are risk factors for increased morbidity and mortality[1-2]. Identification and pre-operative treatment may reduce this risk. Following local audit in 2014-15, a multidisciplinary [MDT] pre-operative anaemia pathway was implemented for elective neurosurgery. Patients diagnosed with i)moderate-severe anaemia (WHO definition) or ii)mild anaemia having procedures at high-risk of bleeding have haematinics prior to assessment at a MDT meeting, led by a consultant neuroanaesthetist and haematologist to optimise anaemia management. We sought to evaluate the pathway's progress

Methods: We reviewed prospectively collected data for patients treated via our pathway between March–November 2015.

Results: One-hundred and twenty anaemic patients were assessed with good adherence to the pathway. Mean age 61 (standard deviation (SD) 17) years, 56.7% female. Mean Hb 110.2gL^{-1} (SD 9.2). Incidence of moderate anaemia 41.7%. No cases of severe anaemia. 80% had complete lab tests (14% partial, 6% none) at time of MDT. Mean MDT–surgery time 16.6 (SD 30.3) days. The commonest diagnosis was iron deficiency anaemia (IDA)(42.5%) (Fig. 1) with 62% newly diagnosed. 52% of patients with known IDA required a change in therapy or further investigation. Five patients (10%) in moderate anaemia group and one (1.4%) in mild group had peri-operative blood transfusion; overall rate of blood transfusion 5%. 84.6% patients had results and follow-up arranged with their GP.

Conclusion: Iron deficiency anaemia was the commonest cause of anaemia. A large proportion had moderate anaemia. Our pathway, although in its infancy, benefits patients by identifying undiagnosed or incorrectly managed anaemia, potentially reducing need for blood transfusion, and improved MDT communication. Future work will focus on more timely identification of anaemia by obtaining initial blood tests at time of surgical listing rather than pre-assessment.

1. Musallam KM, Tamim HM, Richards T, et al. Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study. *Lancet* 2011;**378**:1396-407.
2. Bydon M, Abt NB, Macki M, et al. Preoperative anemia increases postoperative morbidity in elective cranial neurosurgery. *Surg Neurol Int* 2014;**5**:156

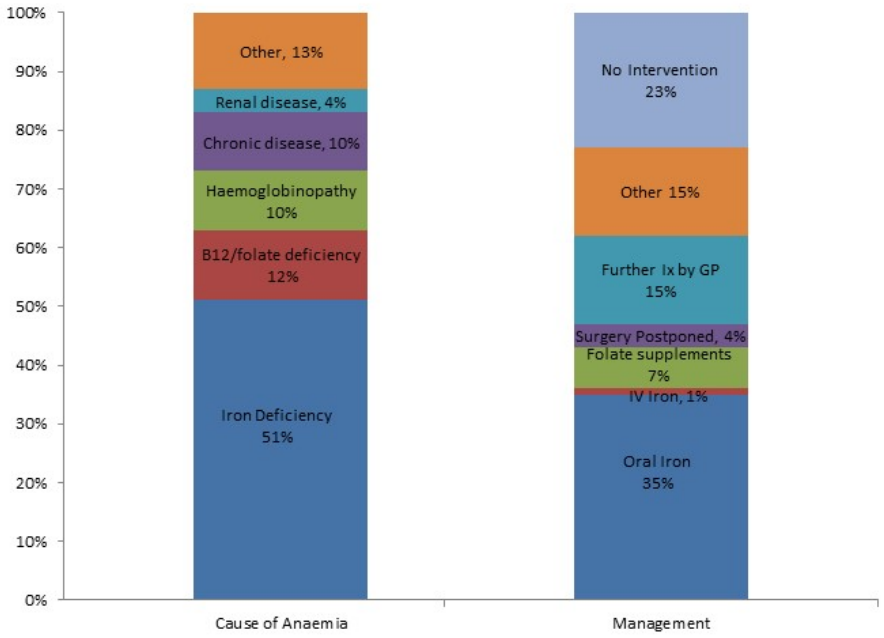

Fig 1. Diagnoses and Interventions for all patient seen

An audit of blood pressure control in aneurysmal subarachnoid haemorrhage

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Introduction: The target blood pressure to achieve following aneurysmal subarachnoid haemorrhage (SAH) is poorly defined. Guidance from expert opinion and clinical trials suggests maintaining systolic blood pressure (SBP) below 160-180mmHg in an unsecured aneurysm.1, 2 Using these guidelines, our neurosciences intensive care unit (NICU) aims to maintain SBP below 160mmHg in unsecured aneurysms and between 140-180mmHg in secured aneurysms. We prospectively collected data for patients admitted to NICU with aneurysmal SAH to observe the trends in mean SBP before and after securing the aneurysm.

Methods: All patients admitted to NICU during a four month period with aneurysmal SAH were included. Daily mean SBP measurements were collected from electronic records (MetaVision, IMDsoft, Dusseldorf). The mean SBP and standard deviation (SD) for each patient were calculated for the period after securing the aneurysm and compared to the baseline mean SBP.

Results: Twenty five patients were admitted. The aneurysm was secured with either endovascular coiling or surgical clipping within 72 hours in 19 patients, after 72 hours in 4 patients and was not secured in 2 patients. In unsecured aneurysms, mean SBP was less than 160mmHg in all but 2 patients. In secured aneurysms, mean SBP was between 140-180mmHg in 19 patients. Vasoconstrictors were used in 13 patients to achieve this. In 4 patients, mean SBP was below 140mmHg after intervention but no vasoconstrictors were used (Figure 1). The baseline SBP of these patients was below 140mmHg and they did not show any signs of delayed cerebral ischaemia. There was minimal intra-individual variation in the SBP as reflected by a SD of less than 15 in 20 patients.

Conclusion: We were able to achieve the target SBP in 23 patients with unsecured aneurysm and 19 patients with secured aneurysm. We wish to observe this audit population over the next 12 months and consider the outcome against the peri-operative blood pressure management described.

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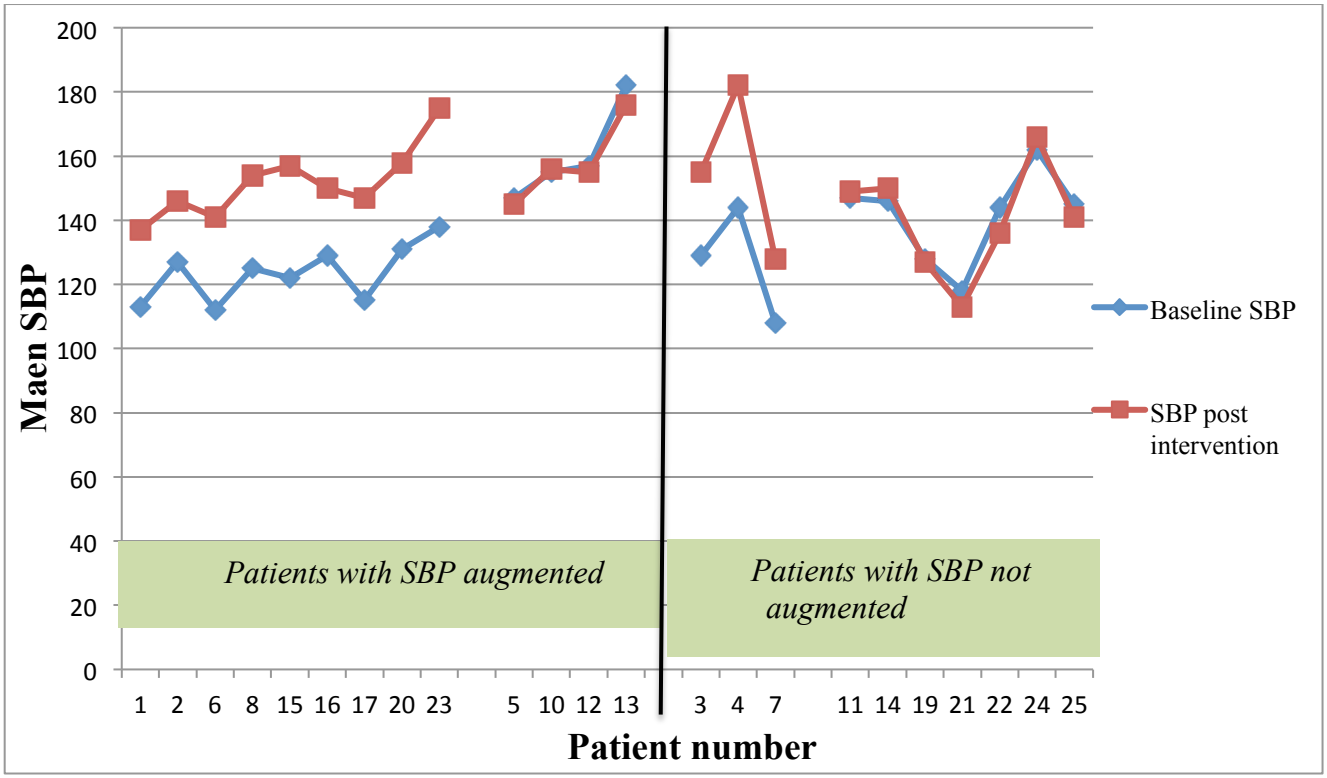
2. Steiner T, Juvela S, Unterberg A, et al. European Stroke Organization Guidelines for the Management of Intracranial Aneurysms and Subarachnoid Haemorrhage. *Cerebrovasc Dis* 2013;**35**:93–112.

Figure 1: Comparison between baseline and post-intervention mean systolic blood pressure (SBP) for each patient.



Assessment of the 'Ceretom' portable CT scanner in Wessex Neurosciences Intensive Care Unit. A slice of future practice

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Introduction: CT scans of the brain are a fundamental investigation required for the effective management of neurointensive care patients. There is a 13% morbidity associated with transporting critically-ill patients outside of the ICU. The incidence of adverse events during transport specifically for CT imaging is as high as 71%[1]. The 'Ceretom' portable CT scanner could enable fast and safe bedside imaging[2]. We assessed its ease of use and image quality in neurocritical care.

Methods: A prospective audit was carried out in NICU over an eight-week period between September and November 2015. Data were collected from electronic worklists, PACS system and paper forms. Data were collected on patients transferred to radiology and those having portable CT scans on neurointensive care. In addition, all portable scans performed from Sept 2015 - March 2016 were reviewed by a neuroradiologist and graded on adequacy of image quality.

Results: One-hundred and three CT heads were performed in the eight-week period, 23 portable and 80 non-portable. Data were complete for 17 portable and 32 non portable scans. The image quality was reviewed in 54 cases. The median time for set up, transfer and scanning for non-portable CT was 53 min compared to 36 min for portable CT. Technologists and nurses were required for 30/32 and doctors for 27/32 of non-portable CTs. Every portable CT required a nurse, 14/17 required a technologist and 1/17 required a doctor. All 54/54 portable CTs were of sufficient quality to answer the clinical question. In addition 22/54 had enough quality to make a good overall assessment (Table 1). Limitations were noted in detecting ischaemia and posterior fossa pathology.

Conclusion: The portable CT scanner in neurointensive care has reduced the number of transfers out of the unit with a reduced length of time to complete with less senior staff involvement. It also has produced images of sufficient quality. We feel this has allowed us to have a slice of future practice.

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2. Neurologica. Bridging the power of imaging to your patients. http://www.neurologica.com/ceretom 2015

Table 1: Showing the image quality of the portable CT scans (September 2015 – March 2016)

CT Image quality:	Number of Scans
Clinical question cannot be answered / scan is of very poor quality.	0
Clinical question can be reasonably answered but scan is of limited quality.	32
Able to answer clinical question and make a good overall assessment	22
Excellent quality / equivalent to departmental CT	0
Total	54

Respiratory support using Nasal High Flow Oxygenation during an 'awake throughout' craniotomy to maximise safety in an obese patient with suspected obstructive sleep apnoea

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Introduction: Awake craniotomy improves both the efficacy and safety of tumour resection in eloquent areas of the cortex[1]. The benefits of real-time intra-operative speech, sensory and motor monitoring must be carefully balanced against its unique anaesthetic challenges, namely the risk of an unprotected airway with limited intra-operative access. Concerns for patient safety have led to an understandable reluctance to carry out this method in some groups of neurosurgical patient. The UK's escalating obesity crisis poses a particular challenge for this awake technique. The optimal anaesthetic management of such patients remains unclear[2].

Case Report: We describe the anaesthetic dilemma of a 43-year-old, 126 kg male (BMI 39.6) presenting for an awake left frontal craniotomy for resection of a low-grade astrocytoma adjacent to the primary motor cortex and speech area. We successfully adopted a novel opioid free anaesthetic approach using a levobupivicane based scalp nerve block and dexmedetomodine as our sole sedative agent. Features suggestive of undiagnosed obstructive sleep apnoea became evident prior to surgery. The use of nasal high flow oxygen therapy successfully allowed for the maintenance of oxygenation and normocapnia.

Discussion: The 'awake throughout' craniotomy has recently replaced the traditional 'asleep awake asleep' technique within our institution allowing patients with greater anaesthetic risk to undergo an awake procedure. Nasal high flow oxygenation is an innovative method of oxygen delivery with recent evidence supporting its use within anaesthetic practice[3]. It provides a constant oxygen fraction, humidification and continuous positive pressure (CPAP), whilst is well tolerated by patients for extended periods making it an ideal tool for use during an awake craniotomy. We found that it played a pivotal role in maintaining patient safety, providing superior respiratory support whilst crucially not impeding on speech assessment.

1. Sarang A, Dinsmore J. Anaesthesia for awake craniotomy – evolution of a technique that facilitates awake neurological testing. *Br J Anaesth* 2003;**90**:161-165

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3. Patel A, Nouraei SAR. Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE): a physiological method of increasing apnoea time in patients with difficult airways. *Anaesthesia* 2015;**70**:323-329

Is Salford Royal NHS Foundation Trust compliant with prescribing venous thromboembolism prophylaxis post head injury?

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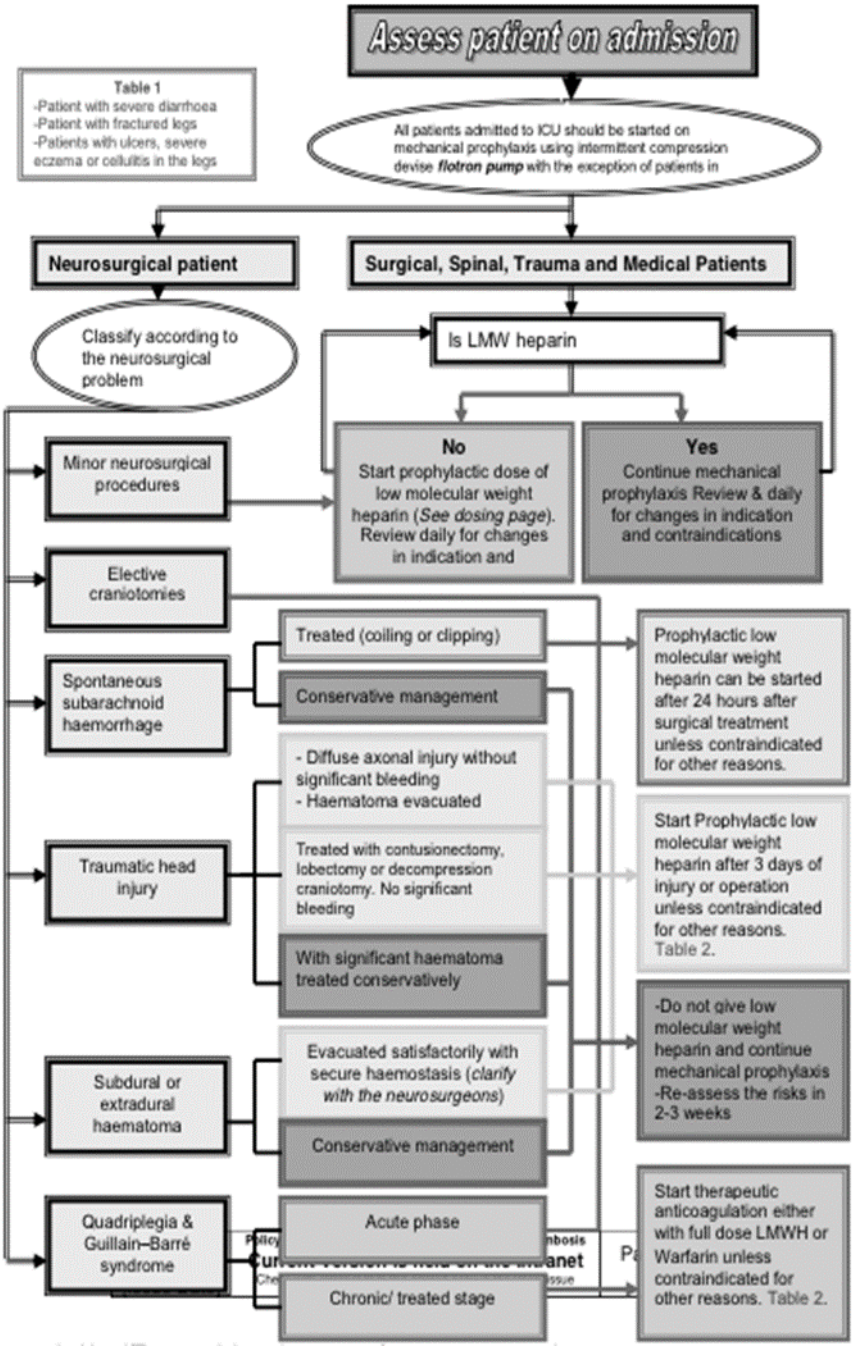
Introduction: Prolonged immobilisation risks development of venous thromboembolism (VTE) with this risk further increased in head-injury patients. In view of the paucity of national guidelines, we sought to identify our compliance with trust policy at our tertiary neurosurgical referral centre (Fig. 1). Our minimum standards set were 100% of patients must undergo a VTE assessment on admission and receive mechanical VTE prophylaxis.

Methods: Using our internal database (TARN), 100 adult neurosurgical trauma patient notes were evaluated for completion of VTE assessment, date of commencement and complications that arose. To assess compliance with VTE prophylaxis, we divided patients in to those receiving conservative management and those undergoing a neurosurgical intervention.

Results: 100% had VTE assessment on admission with no recorded complications secondary to prophylaxis. No VTE was recorded but overall mortality was 8%. Conservative management accounted for 83 patients, of whom 28 patients received no prophylaxis, two received dual mechanical, 37 received single mechanical prophylaxis, eight received drug therapy alone or mechanical prophylaxis with drug prophylaxis. Of the 17 patients managed surgically, six received single mechanical prophylaxis and one received both. Three patients had no treatment, three received mechanical prophylaxis with tinzaparin and four received tinzaparin alone. Correct management was instituted in 56% of patients with 10% receiving treatment outside of trust policy. Management of 34% of patients deviated from trust policy, whereby 31% received no prophylaxis.

Conclusion: We have demonstrated 100% compliance in conforming with trust Neurosurgical VTE assessments. Only 56% received correct VTE prophylaxis. We recommend that all patients should receive mechanical prophylaxis. We intend on sharing our findings to help foster a collaborative national strategy towards implementation of guidelines in the management of VTE following head injury.

Figure 1.


Assess patient on admission
Table 1
-Patient with severe diarrhoea
-Patient with fractured legs
-Patients with ulcers, severe eczema or cellulitis in the legs
All patients admitted to ICU should be started on mechanical prophylaxis using intermittent compression devise flotron pump with the exception of patients in
Neurosurgical patient
Surgical, Spinal, Trauma and Medical Patients
Classify according to the neurosurgical problem
Is LMW heparin
No
Start prophylactic dose of low molecular weight heparin (See dosing page). Review daily for changes in indication and
Yes
Continue mechanical prophylaxis Review & daily for changes in indication and contraindications
Minor neurosurgical procedures
Elective craniotomies
Spontaneous subarachnoid haemorrhage
Traumatic head injury
Subdural or extradural haematoma
Quadriplegia & Guillain–Barré syndrome
Treated (coiling or clipping)
Conservative management
- Diffuse axonal injury without significant bleeding
- Haematoma evacuated
Treated with contusionectomy, lobectomy or decompression craniotomy. No significant bleeding
With significant haematoma treated conservatively
Evacuated satisfactorily with secure haemostasis (clarify with the neurosurgeons)
Conservative management
Acute phase
Chronic/ treated stage
Prophylactic low molecular weight heparin can be started after 24 hours after surgical treatment unless contraindicated for other reasons.
Start Prophylactic low molecular weight heparin after 3 days of injury or operation unless contraindicated for other reasons. Table 2.
-Do not give low molecular weight heparin and continue mechanical prophylaxis
-Re-assess the risks in 2-3 weeks
Start therapeutic anticoagulation either with full dose LMWH or Warfarin unless contraindicated for other reasons. Table 2.

Risk factors for postoperative morbidity in adult spinal deformity surgery

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Introduction: Adult deformity surgery is associated with significant morbidity, with complication rates of 80% reported. Adult deformity surgery is complex and lengthy and blood loss is substantial. Patients undergo significant physiological stress intra- and postoperatively. Patients are older with multiple morbidities, potentially increasing surgical risk and complication rates. We aim to identify which pre- and intra-operative factors predict increased postoperative morbidity.

Methods: We performed a retrospective review of patients' notes from 4 years of surgery for fusion of five or more vertebrae. Data collected were patient demographics, surgical and anaesthetic data, complications, length of stay (LOS) and the risk assessment tools P-POSSUM and Surgical Outcome Risk Tool (SORT). Complications were classified according to Clavien-Dindo criteria.

Results: Table 1 shows results from the 47 patients studied. Overall complication rate was 55%. 28% of patients had grade 1 or 2 complications e.g. antibiotics use or difficult pain management. 26% of patients had grade 3 or 4 complications e.g. organ failure or critical care admission. Neither P-POSSUM nor SORT reliably predicted morbidity. Patients with grade 3 or 4 complications showed weak correlation (Pearson coefficient 0.42) between P-POSSUM and LOS, good correlation (0.52) between pre-operative anaemia and LOS and even stronger correlation (0.84) between post-operative anaemia and LOS. We found no other associations with LOS.

Conclusion: The 55% overall complication rate and the correlation between anaemia and LOS were consistent with the literature[1-3]. Anaemia was the only modifiable factor for prevention of complications identified, possibly owing to sample size. We suggest further work looking at validation of P-POSSUM as a marker for informed consent for ADS and postoperative critical care requirements. We feel an MDT perioperative care pathway could benefit these patients, facilitating pre-operative risk assessment and optimisation of peri-operative care.

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2. Halpin RJ, Sugrue PA, Gould RW, et al. Standardizing Care for High Risk Patients in Spine Surgery: The Northwestern High Risk Spine Protocol. *Spine* 2010;35:2232-2238

3. Emami A, Deviren V, Berven S, et al. Outcome and complications of long fusions to the sacrum in the adult spine deformity: luque-galveston, combined illiac and sacral screws, and sacral fixation. *Spine* 2002; **27**:776-86

Table 1.

Demographics	
Gender male: female	15:32
Age [mean, SD] years	63 [8.36]
ASA [median, range]	2 [2-3]
BMI (mean, SD]	25.3 [4.03]
Incidence multi-morbidity	25
Surgical technique	
Osteotomy used	16 (34%)
Iliac bolts used	4 (8.5%)
Duration [mean, SD] minutes	421 [135.28]
Peri-operative Care	
Use of TIVA	77%
Estimated blood loss [mean, SD] ml	1768 [1394]
Incidence blood transfusion	72%
Fluid management	
Total [mean, SD] ml	5874 [2484]
• Crystalloid	3477 [1333]
• Colloid	648 [687]
• Blood products	909 [1212]
○ Red blood cells	468 [640]
○ Cell salvage	586 [425]
Post-operative care	
• HDU admission	74%
• ITU admission	13%
• Post-operative ventilation	8.7%
○ Duration [mean, SD] hours	17.5 [5.5]
• Length of stay [median, range] days	3 [7.63]
Length of hospital stay [median, range] days	13 [4-192]
Complications*	
• Incidence [% of all patients]	55%
○ Severe [grade 3 or 4]	26%
○ > 1 complication	17%
Type of complication (episodes)	
Grade 1 (mild e.g. fluids, analgesia)	9
Grade 2 (moderate e.g. antibiotics)	45
Grade 3 or 4 (severe e.g. invasive procedure, surgery)	17
Number of patients requiring blood transfusion	2

Spinal assessment and management in unconscious adult trauma patients: a survey of practice in major trauma centres in England and Wales

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Introduction: Spinal precautions, from collars to protective movement strategies are taken to prevent the exacerbation of potential injury in all trauma patients. A mismanaged injury must remain a never event to prevent significant morbidity, however the precautions themselves place patients at increased risk of deterioration[1]. Following previous surveys which demonstrated little uniformity in spinal assessment[2], guidance was written by the Intensive Care Society and NICE. Since the introduction of regional trauma networks in 2012 there has been a 63% increase in survival of severely injured patients[3], which may be due to standardisation of care, including spinal assessment and management.

Methods: Following consultation with local stakeholders a survey was designed. This was posed to the remaining 22 adult major trauma centres in England and Wales via telephone or email.

Results: Trauma centres were telephoned up to 6 times for 13 responses (57%). All centres utilised whole-body computed tomography (CT) as the initial method of spinal assessment with a broad variety of clinicians interpreting this data (Table 1) All 13 centres ceased to logroll if CT scan did not reveal any signs of spinal injury, 10 centres also removed cervical collars, one routinely placed a cervical collar for 48 hours with further clinical assessment, two centres reconsidered mechanism and other factors and placed collars for the waking period. Seven of 13 centres had a specific goal for timeliness of definitive management plan.

Conclusion: Our survey demonstrates consensus on assessment of the spine with whole-body CT, as per the recent NICE guidance. There is also agreement on when to relax protective measures as demonstrated by 13 centres ceasing to logroll and 10 removing cervical collars. There is no consensus on reporting of the initial CT. This survey provides further information on national practice that has been incorporated into a quality improvement project in our regional network.

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2. Jones PS, Wadley J, Healy M. Clearing the cervical spine in unconscious adult trauma patients: a survey of practice in specialist centres in the UK. *Anaesthesia* 2004;**59**:1095-9.

3. Lecky F, Coats T. Press release on Major Trauma 2015. [TARN website] Avaliable at: https://www.tarn.ac.uk/Content.aspx?c=3477. Accessed March 7th, 2016

Table 1.

	Response	Number
Reporting of imaging/ Assessment of Spine	Dual: Specialist Radiology Consultant AND Spinal (Neurosurgeon or Orthopaedic) Consultant	1
	Dual: Any Radiology Consultant AND Clinical (Intensive care or Spinal) Consultant	1
	Specialist Radiology Consultant OR Spinal Consultant	1
	Any Radiology Consultant OR Spinal Consultant	4
	Radiology Consultant at Major Trauma Centre	3
	Radiology OR Spinal Fellow/SpR at Major Trauma Centre	3
	Radiology Fellow/SpR at Trauma Unit	0

Audit of entropy monitoring with Total Intravenous Anaesthesia in neurosurgical patients

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Introduction: Neurosurgery confers a 2.5 fold higher risk for accidental awareness under general anaesthetic (AAGA) than other specialities. The National Institute for Health and Care Excellence, Association of Anaesthetists in Great Britain and Ireland and 5th National Audit Project recommend the use of depth of anaesthesia (DOA) monitoring in specific patient groups; the elderly, patients with comorbidities, and with total intravenous anaesthesia (TIVA) in combination with neuromuscular blockade[1-3.] We audited the proportion of patients undergoing neurosurgery receiving DOA monitoring in the following 3 situations: TIVA; ASA ≥ 3; age >70; and whether DOA values were recorded.
Methods: Data collection was retrospective over a two-month period. Patient notes were reviewed for the following: age, ASA, procedure, type of anaesthetic, use and documentation of entropy values. Cases included cranial and spinal surgery, both in theatre and the interventional radiology suite.
Results: one-hundred and twenty cases were reviewed, of which 32 (26.6%) received entropy monitoring. 49% used a TIVA technique with 30.5% of these using entropy monitoring. 27.3% were ASA ≥ 3; 31.2% of these having entropy monitoring. 16.6% of patients were aged >70 with 35% of these having entropy monitoring. Of a total 32 'entropy cases', 3 (9.3%) had sensor malfunction resulting in two cases (6.2%) where the entropy values were not recorded in the anaesthetic chart.
Conclusion: Approximately 1/3 of 'high risk' patients received entropy monitoring. Nearly 10%, had a technical malfunction, highlighting the difficulties in using DOA monitors in neurosurgery. Reasons for not using entropy could be explored with departmental surveys and review of equipment availability. Trust guidelines could be issued to clarify the role of entropy and further training to educate anaesthetists towards more effective use. Re-audit will focus on consultant vs trainee usage, elective vs emergency work and its use in other surgical specialities

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An audit of the peri-operative management of diabetic patients undergoing elective cranial neurosurgery

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Introduction: It has long been known that hyperglycaemia in neurosurgical patients is associated with adverse outcomes. Therefore, diabetic patients undergoing neurosurgery need optimal perioperative management to prevent this. To assess our centres performance in this area we carried out a retrospective audit of elective neurosurgical diabetic management over the past year.

Methods: Working with the trust informatics department we produced a list of adult diabetic patients undergoing elective cranial neurosurgery in the period 01/04/14 - 30/03/15. The records of these patients were then used to audit their care against the following standards, based on established guidelines[1].

- HbA1C should be measured in all diabetic patients presenting for surgery
- HbA1C should be < 75mmol/mol prior to elective surgery
- Preoperative blood glucose should be <10.0mmol/l
- Postoperative blood glucose should be <10.0mmol/l
- Blood glucose should be measured < 60 min prior to induction
- Blood glucose should be measured < 60 min post arrival in recovery

Results: The search identified 45 patients, eight of which had incomplete data, leaving a sample of 37. The audit results are shown in Table 1.

Conclusion: This audit not only looked at the absolute glucose values, but was able to capture the timing of measurement in the perioperative period. The sample size reflects the large amount of non-elective neurosurgical work carried out in our centre. The results showed that the preoperative assessment and management of these patients is generally good. The timing of measurement of blood glucose both pre-induction and particularly after surgery is inconsistent and in some cases significantly delayed. A significant proportion of patients are hyperglycaemic post operatively, which may be as a result of intraoperative steroid use. The audit has provided a useful picture of the management of these patients, and highlighted areas where improvements need to be made.

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Table 1. Pre- and post-operative blood glucose and pre-operative HbA1C of adult diabetic patients undergoing elective cranial neurosurgery during the audit period

HbA1C	Mean HbA1C (mmol/mol)	56.8 (39 – 106)
	HbA1C < 75 mmol/mol / >75 mmol/mol (n)	26 / 5
	Not Measured	6
Preoperative Blood Glucose	Mean Blood Glucose (mmol/l)	7.4 (4.7 - 15.3)
	Number of Patients with Glucose: < 6.0 mmol/l / 6.0 - 10.0 mmol/l / >10.0 mmol/l	7 / 23 / 3
	Glucose Measured: < 60 mins / > 60 min Pre-induction / Not Measured	21 / 33 / 4
Postoperative Blood Glucose	Mean Blood Glucose (mmol/l)	9.6 (4.6 – 17.2)
	Number of Patients with Glucose: < 6.0 mmol/l / 6.0 - 10.0 mmol/l / >10.0 mmol/l	6 / 9 / 13
	Glucose Measured: < 60 mins / > 60 min after Surgery / Not Measured	13 / 15 / 9

General anaesthesia or conscious sedation for endovascular treatment of acute ischaemic stroke - Nottingham experience

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Introduction: There is increasing evidence to support mechanical thrombectomy for the treatment of acute ischaemic stroke, but little about the choice of anaesthesia/sedation. The aim of this quality improvement project was to develop standard operating procedures at a tertiary neurointerventional referral centre where care is provided by the anaesthesia emergency team, and study the effects of implementation.

Methods: We implemented an anaesthesia guideline for endovascular treatment of acute ischaemic stroke in March 2015. Using a data collection form we examined the notes of all patients that were managed following implementation (March 15 to Jan 16). Data collected included procedural details and timings, anaesthesia/sedation techniques, discharge destination and complications.

Results: Ten patients were treated after implementation of the guideline over a 10-month period. Three patients required general anaesthesia (GA): two to facilitate safe transfer from referring hospital and one patient with bulbar dysfunction. Three patients had conscious sedation (CS), with one patient converted to GA due to movement. Four patients had local anaesthesia (LA), with one patient having no anaesthetist present. The median time to treat for GA, CS and LA were 232 min, 162 min and 240 min, and the median duration of procedures were 49 min, 50 min and 77 min, respectively. All three patients receiving GA underwent mechanical ventilation on the AICU following the procedure; all other patients were discharged to the Stroke Unit. Complications: one delayed transfer from referring hospital (GA), one delayed - no anaesthetist available (LA), one abandoned due to failure to cannulate the vessel (GA), one died the next day (CS), one died two days later (LA).

Conclusion: We successfully implemented anaesthetic guidance for a safe, timely thrombectomy service. Further work is required to monitor long-term outcomes and compare the relative efficacy of different anaesthetic techniques

Table 1

Type of anaesthetic	Median length of procedure	Median time to treat	Highest BP during procedure	Lowest BP during procedure	Median discharge time	Destination	Complications
GA 3 patients	49 min	232 min	135/60	90/50	N/A	AICU	Delay from referring hospital to transfer; procedure abandoned – unable to cannulate vessel
CS 3 patients	50 min	162 min	170/80	90/50	107 min	HASU	1 converted to GA during procedure – unable to lie still; 1 died following day
LA 4 patients	77 min	240 min	160/85	88/60	60	HASU	Poor documentation of timings, died two days post-procedure; anaesthetist delayed due to high service demand

HASU = Hyper-Acute Stroke Unit; Length of procedure = anaesthetic start time to procedure end time; Time to treat = time from diagnosis to procedure start time; Discharge time = procedure end time to discharge from anaesthetic care. All patients transferred back to the HASU were transferred without anaesthetic escort

Wessex N.I.C.E. (Neuro Intensive Care Emergencies) course: simulation-based training improves confidence and skills for neuro critical care staff

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Introduction: Wessex Neurosciences Intensive Care Unit (NICU) is a 13-bedded unit which serves a population of about three million. It is part of a major trauma centre. The unit is consultant -led with junior trainees. Overnight the immediate cover is one clinical fellow, commonly post foundation ('F3'), sometimes an ACCS or ICM trainee. The post of a trainee NICU advanced nurse practitioner (ANP) has just commenced. We have run formal weekly teaching for all junior doctors for the last few years. This has included simulation sessions covering neurosurgical and intensive care scenarios. We developed the N.I.C.E. (Neurointensive Care Emergencies) simulation course with the hypothesis that running a simulation based course at the start of a six-month job will increase confidence in managing emergencies.

Methods: Our junior doctor changeover dates are February and August. We ran two sessions in March 2016. All participants were asked to fill in a pre and post–course questionnaire using a 1-5 Likert-type grading scale. We graded the confidence of the candidate in dealing with each emergency and overall confidence prior to starting night shifts.

Results: There were 10 participants: five 'F3s'; one ACCS trainee; one trainee ANP; and three junior nurses. Six had no previous ICU experience. Scenarios run were as in Table 1. There was a reported increase in confidence in managing all scenarios, and an increase in overall confidence dealing with emergencies overnight. All scored a statistically significant change ($p<0.05$) using MeanA-MeanB from a two-tailed paired t-test for correlated sample.

Conclusion: The N.I.C.E. course shows a significant improvement in the confidence of NICU staff with managing common emergencies. We plan to run this course on a six-monthly basis, and develop it into a whole day session. We believe this course will be vital in preparing staff for managing emergencies on Neuro ICU, thus aiming to ensure safe practice prior to senior support.

Table 1. Mean score of all 10 candidates in each individual scenario & overall confidence using 1-5 grading. (P score from two tailed paired t-test for correlated sample. 1 = Unable to Manage; 2 = Slightly comfortable managing; 3 = Moderately comfortable managing; 4 = Fairly comfortable managing; and 5 = Can comfortably manage; (% Increase in mean score of confidence post simulation training)

Scenario	Mean Pre simulation	Mean Post Simulation	Difference	P value
Head Injury/Raised ICP	2.5	3.7	1.2 (24% increase)	0.001
Subarachnoid Haemorrhage & Cardiac complications	2.2	3.5	1.3 (26% increase)	0.004
Spinal Shock	2.1	3.2	1.1 (22% increase)	0.004
Status Epilepticus with airway compromise	2.6	3.7	1.1 (22% increase)	0.002
Blocked Tracheostomy tube	2	3.6	1.6 (32% increase)	<0.0001
Overall comfort level of dealing with Neuro ICU emergencies	1.9	3.8	1.9 (38% increase)	0.0002
Total score for all 60 questions combined.	2.2	3.57	1.37 (27% increase)	<0.0001

Prevalence of anaemia among patients undergoing neurointerventional cerebral aneurysm repair

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Introduction: Pre-operative anaemia is associated with adverse outcomes and events in patients undergoing neurosurgical and interventional radiological procedures[1-2]. We sought to establish the prevalence of anaemia among patients undergoing endovascular cerebral aneurysm repair at our institution and its implications.

Methods: All patients undergoing endovascular management of intracranial aneurysm in 2014 were identified retrospectively from theatre logbooks. Haematological data was retrieved from the Clinical Portal laboratory database. Anaemia was diagnosed according to WHO criteria (<130g/L for men or <120g/L for women).

Results: One hundred and eighty-two patients underwent endovascular cerebral aneurysm repair in 2014. Most of these procedures were emergencies (n=114, 62.6%). Overall, 28.6% (52/182) of patients were anaemic immediately pre-procedure. Anaemia was more prevalent among men than women – 31.3% (15/48) versus 27.6% (37/134). Anaemia was more common among patients undergoing emergency procedures than elective procedures – 34.2% (39/114) versus 19.1% (13/68).

Conclusion: Anaemia is common among patients presenting for both elective and emergency neurointerventional cerebral aneurysm repair. The prevalence among patients undergoing emergency procedures may be due to haemodilution therapy, to optimise cerebral blood flow in the presence of prevence of vasospasm following subarachnoid haemorrhage, the risks and benefits of which continue to provoke much debate[3]. Given the prevalence of anaemia among elective patients, it is important to ensure that these patients are identified and investigated appropriately.

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A review of the management of Traumatic Brain Injuries in critical care: introducing physiological goal-directed head injury protective parameters

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Introduction: Traumatic brain injuries (TBI) remain a major cause of death and disability[1]. Preventing further insults in the hours and days following the initial injury is key to minimising further damage. A limited evidence base due to ethics has prevented formal guidelines. There are commonly accepted physiological parameters for reducing this risk, creating the standards for this audit[2-3].

Methods: Following a literature review and meeting with the Neurosurgical Department, ten standards were agreed. It was agreed GCS, intubation and outcomes would also be recorded. Patients with TBI requiring critical care admission over a six-month period were identified retrospectively via ICNARC coding. Data was collated from case notes by reviewing daily observation charts.

Results: Thirty-five patients were identified and five excluded (four - lack of brain injury, one repatriation). Compliance was highest with cerebral perfusion pressure (80%) and any deviations promptly actioned. Associated injuries reduced compliance with mean arterial pressure (70%) and oxygenation (60%). Lowest compliance was with temperature, arterial carbon dioxide levels and glucose. Extremes of the former two were common on arrival suggesting poor control prior to admission. Hyperpyrexia was common despite treatment and felt to be centrally mediated or due to chest infections. Documentation regarding reasons deviations were not actioned was often lacking. A correlation between compliance and outcome was noted; it was felt this reflected the severity of the pathophysiology rather than a causal relationship based on the initial presentation.

Conclusion: Current compliance has room for improvement, though polytrauma is a factor in deviations involving cardiovascular control and oxygenation. It appears some factors are not well controlled prior to admission. The action plan involves increased awareness of desired parameters, and the introduction of early warning system and polyuria flowchart.

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A prospective audit of transfusion triggers in neuro intensive care

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Introduction: Evidence shows that blood transfusion is an independent risk factor for increased morbidity and mortality, ICU admission and hospital length of stay[1]. A haemoglobin (Hb) transfusion trigger of 70 grams/Litre (g/L) or below represents standard best practice within general intensive care units, as reflected in national guidelines[2] and our local neuro intensive care unit (NICU) guidelines[3].

Methods: We carried out a two-month prospective audit in NICU to assess adherence to guidelines, as part of a regional ICU audit. Data collection included patients aged 18 years or older who had received a blood transfusion and were not acutely bleeding. Patients who had received a transfusion within 24 hours of surgery, had proven or suspected active GI bleed or major trauma, were excluded. All data collected were anonymised.

Results: One-hundred and thrity-nine patients were admitted to Neuro ICU over the study period. There were eight transfusions, of which six were eligible. Two were excluded due to transfusion within 24 hours of surgery and within 24 hours of major trauma. There were two male and four female patients, age range 18 to 57 years. Reason for admission was traumatic brain injury (4), subarachnoid haemorrhage (1) and spinal injury (1). Mean length of stay in these patients was 10 days. Mean laboratory Hb prior to transfusion was 67.8g/L and mean ABG (arterial blood gas) Hb was 66.7g/L. Out six transfusions, five had a laboratory Hb of 70g/L or less and four had an ABG Hb of 70g/L or less (Fig. 1). One transfusion was performed when laboratory and ABG Hb were above the transfusion threshold. This was prior to major surgery with significant expected blood loss.

Conclusion: The vast majority of transfusions on our NICU were performed as per national and local guidelines. This may be due to consultant led care with a unified departmental approach to transfusions in the form of local NICU guidelines[3].

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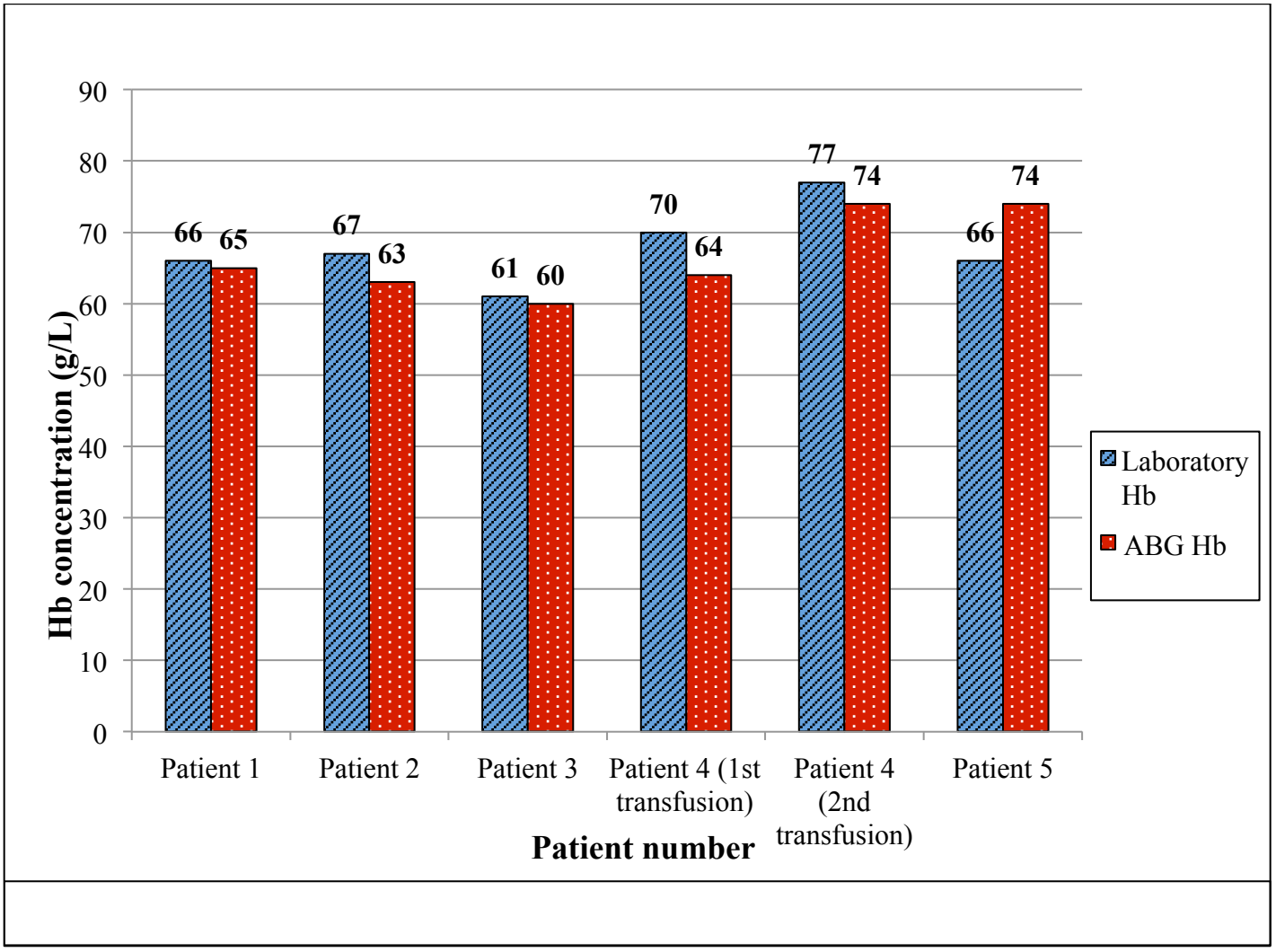
3. Cordingly M, Hell J. Wessex Neuro ICU Guidelines 2016. 5 January, 2016. Available at: http://www.neuroicu.org.uk/uploads/2/0/7/6/20767920/guidelines_book_5_jan_2016.pdf. Accessed 1 February 2016

Figure 1. Laboratory Hb and blood gas Hb prior to blood transfusion in each patient transfused.



A survey of blood pressure management in patients with Delayed Cerebral Ischemia

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Introduction: Delayed cerebral ischaemia (DCI) is a major cause of morbidity after subarachnoid haemorrhage (SAH). Haemodynamic augmentation is a mainstay of management in DCI along with nimodipine administration[1]. We conducted this survey to obtain an overview of blood pressure management practices for patients with DCI.

Methods: A case scenario of a patient presenting with DCI after acute SAH having underwent coiling was used. A 10-question survey was distributed via email to all NACCSGBI members.

Results: One hundred and fifty-five responses were received from 35 UK neuroscience centres. 89% consultants. Of those respondents 88 were responsible for adult neuro critical care patients and eligible to complete the survey. 94% would use a vasoactive drug in the treatment of DCI, noradrenaline being the preferred first line agent (83%). 61% would in addition use vasopressin, most frequently when the dose of noradrenaline is > 0.75 mcg/kg/min. 41% would use steroids in the absence of sepsis. 10% use a cardiac output monitor on all with suspected DCI requiring vasopressors. If there was difficulty achieving BP targets nearly all respondents would obtain an echocardiogram. 53% would consider stopping nimpodipine rather than changing dosing intervals or drug preparation.

Conclusion: This survey shows that haemodynamic augmentation using induced hypetension is commonplace in DCI. Published guidance is limited on therapies including BP targets and means to achieve them[1]. The role of vasopressin as second line agent and use of steroids needs to be carefully evaluated in absence of sepsis. Vasopressin may increase MAP, CPP with no increase in cerebral blood flow[2]. Further research is required to develop guidelines for haemodynamic augmentaion in patients with DCI.

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Refractory Hypotension: A Preliminary Evaluation Using the Non-Invasive Quantix ND in Comparison to the Literature. *Journal of Anesthesia and Critical Care* 2014;**1**:00017

Monitoring compliance of Royal College of Radiology recommended standards for intravascular contrast administration to adult patients in a neuroradiology unit to prevent contrast induced acute kidney injury

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Introduction: Contrast induced acute kidney injury (CI-AKI) is 3rd commonest cause of acute kidney injury in hospitalised patients[1]. The incidence is estimated at 1–2%[2]. It occurs within 72 hours of receiving contrast media and usually recovers over the following five days[3]. The guideline from the Royal College of Radiology recommends that:

-all patients should have eGFR available before contrast administration; at least in the preceding three months for stable patients having non-emergency procedures (2015 guideline);

-renal function should be checked up to 48-72 hours following the procedure in a high risk group to ensure stable renal function (2013 guideline).

Methods: This was a retrospective audit of patients having a procedure in the neuroradiology suite over three months (May 2015- July 2015). Data collected included patient demographics, procedure, volume of contrast used, renal function pre contrast, renal function post contrast, if the patient was diabetic and on metformin and length of stay in hospital. Results were analysed to assess any patient who fit the criteria for CI-AKI (Creatinine increase of >26umol/L in 48hrs).

Results: Data were collected on 207 patients. One patient was excluded due to sepsis related multi-organ failure. 94% of patients had creatinine and eGFR done pre-procedure. 100% (10 patients) of the patients in the high risk group (known chronic kidney disease, cardiac failure, diabetes or on metformin) had a post procedure eGFR done. No patient had CI-AKI and the volume of contrast did not correlate with a rise in Creatinine.

Conclusion: Currently we are compliant with checking patients renal function before contrast is given. The small proportion where it was not done, reflects the outpatient population without any risk factors. The guideline however allows for departments using a screening questionnaire for CI-AKI risk in fit and well patients. We are currently looking to audit the enhanced quality standards in the guideline.

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Post-operative analgesia in children undergoing epilepsy surgery

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Introduction: The nationally commissioned Children's Epilepsy Surgery Service was established in 2012, delivering network standards and service development. Only a few studies have focused on post-cranial surgery analgesia; a 2014 American Prospective Cohort Study failed to elicit pain score differences between modalities[1]. At Great Ormond Street, no standardised regimen currently exists for this group. The discipline's evolving nature means numerous modalities are employed, including Nurse-Controlled or Patient-Controlled Analgesia (NCA/PCA). We believed analgesic requirements might be achieved by enteral or bolus parenteral route alone; thereby simplifying practice, reducing complications and improving outcome.

Methods: We reviewed pain data in children undergoing epilepsy surgery between April 2014 and June 2015. Opiate protocol and consumption, number of follow-up days, pain scores, and side effects were collated. No ethical approval was required for this project.

Results: Ninety-five patients were analysed, comprising of 74.7% craniotomies, 11.5% Stereo EEG procedures and 13.6% vagal nerve stimulators. 76.8% were prescribed an NCA or a PCA. 97.2% had Morphine protocols, and the average follow-up was 1.67 days. Operative day average morphine consumption was 13.5mcg/kg/h falling to 10.16mcg/kg/hr on post-operative day 1. By day 2, only 6.8% continued on NCA/PCAs. Pain scores were recorded as the daily proportion in the moderate to severe range. 31.5% had more than 5% of their day 1 pain scores in the moderate to severe range; falling to 2.7% by day 3. PONV was the commonest side effect, being reported in 26.0%.

Conclusion: As predicted, opiate consumption was low, with reassuring pain scores and minimal side effects. Study expansion, prospectively comparing intravenous demand-dosing techniques with enteral analgesic regimens should be the next step. Other outcomes such as user satisfaction and length of hospital stay would facilitate protocol establishment.

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A review of abandoned endovascular aneurysm repairs at a major tertiary neurosurgical centre

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Introduction: Intracranial aneurysms may be managed by open surgical or endovascular means. Not all aneurysms are amenable to successful endovascular management, but this may not be apparent until the procedure has been attempted. We sought to investigate the frequency with which endovascular aneurysm repair was abandoned at our institution and the implications of this occurrence.

Methods: Patients undergoing endovascular management of intracranial aneurysm in 2014 were identified retrospectively from theatre logbooks. Procedural data were retrieved from the Clinical Portal database.

Results: One-hundred and eighty-two patients underwent endovascular cerebral aneurysm repair in 2014. The majority, 61.5% (112/182), of procedures were emergencies. Overall, 6% (11/182) of procedures were abandoned. A higher percentage of elective procedures were abandoned - 8.6% (6/70) versus 4.5% (5/112) of emergency procedures. All abandoned procedures were the result of anatomical factors rendering the aneurysm unsuitable for the proposed endovascular procedure. Of the five patients who had unsuccessful emergency endovascular repair, four subsequently underwent surgical clipping, whilst the remaining patient died without further intervention. The mean time interval between abandonment and clipping was two days (range 1-3 days). Demographic details of abandoned and completed procedures, along with further procedural details, are compared in Table 1.

Conclusion: The rate of abandonment of endovascular cerebral aneurysm repair at our institution is comparable to that quoted in literature[1]. It is reassuring that procedures were not abandoned due to preventable factors such as lack of appropriate resources, and that suitable patients had prompt surgical clipping. The over-representation of elective cases amongst abandoned procedures may represent a reluctance to proceed with potentially-harmful interventions in an elective population, compared to those who present with a ruptured aneurysm.

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Table 1.

	All Procedures (n=182)	Completed Procedures (n=171)	Abandoned Procedures (n=11)
Mean age (range)	54.8 years (19-90 years)	54.5 years (19-90)	58.8 years (41-79)
Sex	Men = 48 (26.4%) Women = 134 (73.6%)	Men = 48 (28%) Women = 123 (72%)	Men = 0 Women = 11 (100%)
Urgency	Elective = 70 (38.5%) Emergency = 112 (61.5%)	Elective = 64 (37%) Emergency = 107 (63%)	Elective = 6 (55%) Emergency = 5 (45%)
Aneurysm Location	Anterior = 114 (62.6%) Posterior = 68 (37.4%)	Anterior = 106 (62%) Posterior = 65 (38%)	Anterior = 8 (73%) Posterior =3 (27%)
Duration of procedure	Mean = 2:08 h Range 1:05–4:45 h	Mean = 2:07 h Range 1:05–4:45 h	Mean = 2:41 hrs Range 1:20–3:45 h
Duration of Neurosurgical Admission	Mean = 14.1 days Range 1-81 days	Mean = 14 days Range = 1-81 days	Mean = 15.2 days Range 12-21 days

Postoperative visual loss after spinal surgery

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Introduction: Postoperative visual loss (POVL) is a rare complication of non-ocular surgery. The incidence after spinal surgery ranges from 0.028 to 0.200%. Factors most frequently associated with POVL include prone positioning for more than six hours and blood loss of more than one litre. Other associated factors include hypotension, anaemia, large volume crystalloid administration, vasoactive drugs, co-existing diseases and variation in optic nerve vascular anatomy/physiology[1-3].

Case Report: We report on a 45-year old male with POVL after elective lumbar microdiscectomy. The patient had no significant medical history. He did not smoke and weighed 110 kg with a BMI of 27.He had pre-operative anaesthetic review on the day of surgery and consent for anaesthesia was taken during the preoperative assessment. The risks of prone surgery (paraesthesia, peripheral neuropathy, facial oedema and POVL) were discussed with the patient. Intraoperatively, there was no significant hypotension or blood loss. A Montreal mattress and ProneView® were used for patient positioning. The eyes were taped closed. The operation took two hours. On the first post-operative day, the patient complained of left eye visual loss. Ophthalmology review showed his visual acuity was reduced to 6/30 in the left eye compared to 6/4.5 on the right. A diagnosis of posterior ischaemic optic neuropathy (PION) was made and the uncertain prognosis explained to the patient. Over the next month, the patient's vision improved but did not return to baseline.

Discussion: Posterior ischaemic optic neuropathy and consequent visual loss have catastrophic consequences for patients. This case is unusual in that the two factors most strongly associated with POVL were absent. The surgery took significantly less than six hours and there was no significant blood loss. The patient's loss of visual acuity highlights the importance of informed consent for rare but significant complications of all surgery in the prone position.

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The management of oxygenation in ventilated patients following ischaemic stroke

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Introduction: Recent evidence suggests that oxygen therapy leading to hyperoxia may have potentially deleterious effects following ischaemic stroke, particularly amongst ventilated critical care patients[1]. Current guidelines recommend that supplemental oxygen should only be administered if oxygen saturation (SpO_2) falls below 95% in patients following ischaemic stroke[2]. In critical care patients as a whole, a degree of over-oxygenation is often tolerated, particularly as the inspired oxygen requirements fall[3]. In ventilated stroke patients, there is, therefore, a potential risk that failing to actively titrate oxygen concentrations may result in adverse outcomes. Our study aimed to measure the frequency of over-oxygenation, defined as FiO2 ≥ 0.30 despite SpO_2 levels ≥ 95%.

Methods: Adult, ventilated patients admitted in 2015 to neurocritical care within 24 h of onset of ischaemic stroke, were included. Paired data were collected on SpO_2 and corresponding inspired oxygen fractions (FiO_2), recorded at 5 mi intervals for 72 h following admission. Contemporaneous arterial oxygen partial pressure (PaO_2) was also recorded from intermittent blood gas sampling.

Results: Four patients met our inclusion criteria, providing 3256 paired sets of data. Over-oxygenation was present 94.7% of the time. (SpO_2 ≥ 95%, with a corresponding FiO_2 ≥ 0.30). 106 arterial blood gas samples were analysed. Of these, 72 (67.9%) had a PaO_2 ≥ 15kPa. The FiO_2 was subsequently reduced in only 22 cases.

Conclusion: Recent evidence implies that oxygen therapy does not improve clinical outcomes in stroke, and normoxia should be targeted. Our audit shows that over-oxygenation occurs frequently in this group of patients. Many critical care units do not routinely decrease oxygen below 30% in any patients. Clinicians need to take a more active role in titrating FiO_2 if normoxia is to be achieved in neurocritical care patients with ischaemic stroke, as recommended by NICE.

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Use of a novel intraosseus technique to drain CSF - emergency management of acute hydrocephalus outside specialist centres

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Introduction: Patients with benign tumours of the ventricular system may present to emergency departments (ED) with rapid deterioration and death[1]. Emergency treatment in neurosciences centres comprises insertion of external ventricular drains before characterisation of the tumour and its surgical removal. Outside neurosciences centres, temporising therapies are limited. A transorbital approach has been reported for emergency treatment of acute hydrocephalus[2]. Verdura et al reported a method of percutaneous ventriculocentesis via the frontal bone to alleviate acutely raised ICP[3]. We have modified Verdura's technique using equipment and techniques commonly used in the ED.

Methods: One of us (JH) assessed the ease of attempting transorbital puncture of the ventricle on both sides of three cadavers using a variety of needles. We then compared this to a transfrontal approach using a 45mm EZ-IO® needle and introducing gun, on either side of the cadaveric specimens (Fig. 1).

Results: The transorbital approach proved successful on both sides of the first cadaver but neither side of the other two specimens, despite using enough force to bend several 14-G needles. In contrast, the landmarks for insertion of the EZ-IO® needle were easy to determine and the effort required to introduce the needle through the two tables of the frontal bone was minimal. Thereafter, it proved easy to push the EZ-IO® needle up to the hilt, which should have been sufficient to drain any CSF under pressure. It was also easy to insert a 22-G spinal needle through the EZ-IO® needle, if that should be required to relieve the hydrocephalus.

Conclusion: This approach to ventricular drainage is similar to that described by Verdura and colleagues. This modification of a standard intraosseus technique that is already well accepted in pre-hospital and emergency practice has been agreed as an emergency lifesaving measure by our consultant neurosurgical colleagues.

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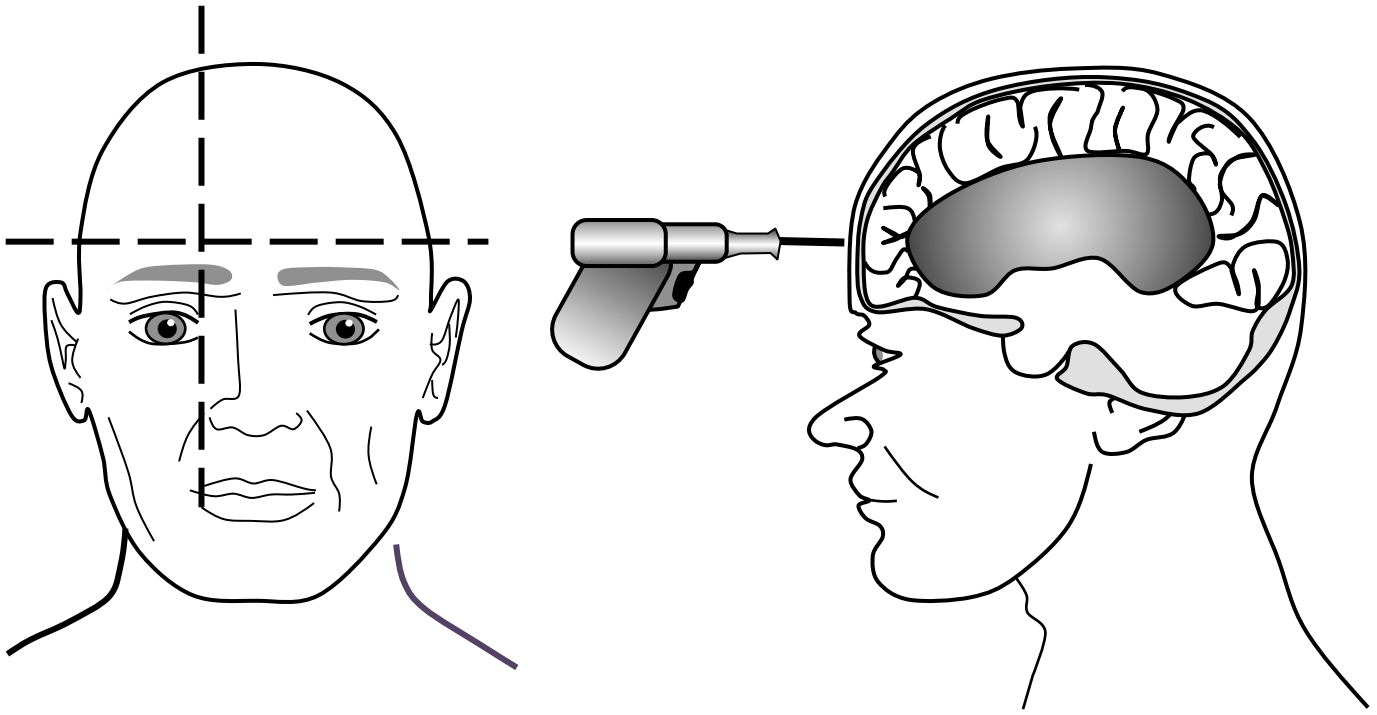
Figure 1. Diagrammatic representation of the technique of using an intraosseus needle to decompress acute hydrocephalus via a frontal approach. Point of insertion should be the intersection of the medial canthal line and the top of the frontal sinus (2-3 cm above the superior orbital ridge).



Survey of Cerebral Perfusion Pressure measurement practices 2015

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Introduction: Subhas et al showed that, in calculating CPP, 58% of neurosurgical critical care units positioned the arterial transducer at the level of the heart, and 42% positioned at the level of the tragus of the ear[1]. The NACCS and SBNS issued a joint position statement with regard to the calculation of CPP in the management of TBI[2]. They endorse positioning the arterial transducer at the level of the middle cranial fossa, which can approximated to the tragus of the ear. They do not endorse positioning the arterial transducer at the level of the heart for CPP based treatment decisions.

Methods: We conducted a survey to assess current clinical practice in the calculation of CPP.

Results: Seventy-six complete responses were from UK based colleagues who stated their primary medical speciality as either Anaesthesia or Critical Care Medicine. These 76 complete responses were subjected to further data analysis. 16 of the 76 (21.1%) complete responses incorrectly used the heart for arterial transducer levelling when calculating CPP. Sixty of the 76 (78.9%) complete responses correctly used the tragus of the ear for arterial transducer levelling when calculating CPP. Twenty-six of the 60 (43.3%) complete responses who correctly used the tragus of the ear for arterial transducer levelling when calculating CPP were aware of relevant local, regional or nationally applicable guidelines, with 10 of these 26 (38.5%) specifically stating the joint position statement by the NACCS and SBNS. The remaining 16 of the 26 (61.5%) stated they were aware of guidelines but did not specify which.

Conclusion: Our work does demonstrate an improved rate of correct use of the tragus of the ear when positioning the arterial transducer when calculating CPP (60 of 76, 78.9%), be it amongst individual clinicians. This survey also demonstrates a knowledge gradient with more senior grades more likely to correctly use the tragus of the ear, and only partial awareness of current NACCS and SBNS guidelines.

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Table 1. Arterial transducer position site according to grade of respondent.

	Tragus	Heart	Total
Consultant	25	2	27
Senior Registrar	23	4	27
Junior Registrar	9	4	13
SHO	3	6	9
Total	60	16	76

Performance of brain stem death testing within South Central region

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Introduction: The diagnosis of brain stem death (BSD) is challenging and has implications medically, ethically and legally. The Academy's Code of Practice for the Diagnosis and Confirmation of death gives clear guidance on how BSD testing should be carried out, including apnoea testing, clearly stating that the initial pH should be < 7.4 and $PaCO_2$ > 6 kPa[1]. Nationally the ICS (Intensive Care Society) has endorsed a BSD testing form. The aim of this audit was to ascertain the accuracy and completeness of BSD testing in the South Central (SC) organ donation region.

Methods: We identified all patients with likely BSD referred to the SC organ donation team in 2015. Their individual BSD testing form was accessed via the NHS BT database and results imported into an Excel spreadsheet for analysis.

Results: Sixty-two patients across 16 hospitals were referred, with 57/62 (92%) proceeding to donation. Three BSD testing forms were identified, two of which were the ICS endorsed forms. 50% were 100% complete, the most common reason was missing patient details (35%) however in 8% there were questions unanswered, in 3% no date or time documented, in 1.5% the doctors' names weren't documented and in 4.5% the information wasn't available from the database. One hundred and twenty-four apnoea tests were performed of which 120 (97%) results were available. The pH was documented in 118/120 tests however the pH was >7.4 in 7/118 tests (6%). The $PaCO_2$ was documented in all tests however initial $PaCO_2$ was <6 kPa in 6/120 tests (5%), in all tests it rose >0.5 kPa. Overall the apnoea test was not performed strictly in accordance with the Code of Practice in 14/120(12%) tests affecting 9/60 (15%) of the patients.

Conclusion: Use of the ICS endorsed forms and data completion varied across the region. The apnoea test wasn't performed according to national guidance in 15% of patients. Results and suggestions of standardisaton are to be presented at the next regional meeting and re-audited the following year.

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Survey of UK anaesthetic practice for awake craniotomy

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Introduction: Awake craniotomy is a technique that has seen an expanding role in neurosurgery in recent years. It presents unique challenges for the anaesthetist. The aims of this survey were threefold: to evaluate the current anaesthetic approach for awake craniotomy and demonstrate any changes in practice since a 2011 NASGBI survey; and evaluate patient preparation and follow-up.

Methods: A questionnaire was produced, ratified by NACCSGBI and sent by email to all members.

Results: There was a 37% response rate: (125/ 336). Twenty-nine out of the 33 UK neurosurgical centres were represented. 42% of respondents have a specific neuroanaesthetic clinic assessment. 45% have a written information leaflet available for patients, which are mostly generic rather than specific for awake surgery. 51% preferred the asleep/awake/asleep technique; 15% awake throughout; 27% asleep/awake. Only 23% of centres have guidelines or protocols on the anaesthetic management of this procedure. 71% of anaesthetists undertaking these cases manage less than 10 patients per year. Most anaesthetists use propofol and remifentanil for sedation/anaesthesia (78%). Dexmedatomidine (15%) and clonidine (5%) are also used, often in combination with other agents. Depth of anaesthesia monitoring is used by 39.7%; of these 87% use BIS. A range of complications have been experienced, most commonly seizures (47%). Post-procedure follow up includes surgical outpatients (96%); neuropsychologist clinic (17%); and specialist nurse (13%).

Conclusion: There remains high diversity in the anaesthetic approach for awake surgery. Most anaesthetists personally manage fairly few of these procedures. The anaesthetic involvement in patient preparation is lower than we expected. The survey allows comparison of techniques and services between centres. We have reflected on our practice and have developed our own written patient information leaflet.

Survey of tracheal extubation techniques following elective craniotomy

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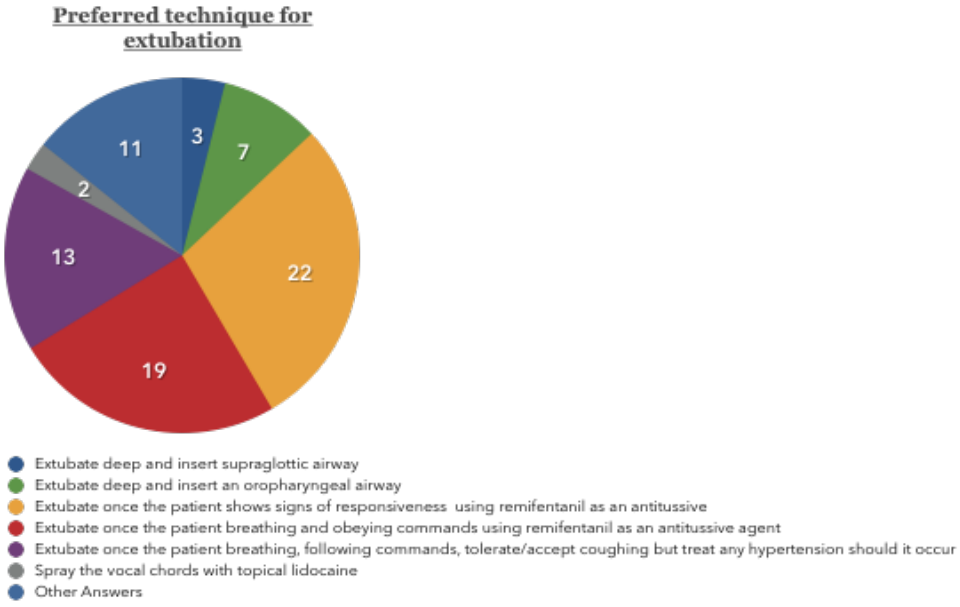
Introduction: One of the biggest concerns for neuroanaesthetists is the development of a post-operative intracranial haematoma. Both intubation and extubation are associated with transient surges in intracranial pressure, cerebral blood flow and arterial blood pressure, meaning even after adequate haemostasis the patient is at risk of bleeding and cerebral oedema. Much research has been done regarding the best method of induction and how to obtund the response to intubation however less is known as to the best method of extubation.

Methods: We developed a survey and sent it via email to all members of the Neuro Anaesthesia and Critical Care Society of Great Britain and Ireland.

Results: The survey was sent out to 383 members and asked if they regularly anaesthetise for craniotomies. One hundred and twenty-four responded (32%) of which 70 regularly anaesthetised for craniotomies. 39% thought avoiding hypertension on emergence was essential, the remaining 61% believeing it was desirable. 23% thought it essential to avoid coughing and straining on extubation, 70% thought it desirable and 7% thought it neither important nor unimportant. The preferred extubation technique is shown in Fig. 1. For those who extubate their patients on remifentanil, 78% wait for them to breathe spontaneously and 51% wait till they will follow commands. If hypertensive occurs during the emergence period the favoured antihypertensives were labetolol 57%, esmolol 5%, calcium channel blockers 2%, phentolamine 2%, magnesium 1%, hydralazine 1%, 10 % didn't use one and 7% used an analgesic.

Conclusion: The vast majority of respondents recognise the problem of hypertension, straining and coughing on extubation as at least desirable if not essential when extubating patients following an elective craniotomies. Several alternative techniques have developed the most common being extubating on remifentanil. Should hypertension occur the treatment of choice is labetolol.

Fig 1. Preferred tracheal extubation technique



Analgesia after craniotomy - a survey of anaesthetic vs neurosurgical nurse views

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Introduction: Traditionally, craniotomy was thought to be less painful than other surgical procedures. Recent evidence has challenged this, with one study finding 55% of subjects reporting moderate to severe pain on day 1 post-op. Pain delays recovery, prolongs hospital stay and increases rates of complications[1].

Methods: All Consultants and ST5-7 trainees in NHS Tayside were invited to complete an online survey on their practice in Craniotomy peri-operative analgesia. Neurosurgical HDU nurses were invited to complete a paper survey on post-operative pain management in this patient group.

Results: Twenty anaesthetists completed the survey (70% Consultants, 30% ST5-7). Results revealed that practice varied widely between individuals. Only 20% routinely used scalp blocks and 35% considered NSAIDs a suitable option with 65% citing "bleeding risk" a barrier to NSAID use. Post-operatively, practices again varied between individuals, with many prescribing strong opioids. The nursing survey revealed that anaesthetic prescriptions for strong opioids were often altered by ward staff to i.m. dihydrocodeine. When asked if the Anaesthetic analgesia regimen was adhered to, answers varied from "sometimes" to "mostly". Comments centred on nursing concerns around strong opioid side effects and perceived ineffectiveness. Almost half of anaesthetists were unsure of pain scoring systems used routinely, or for patients with a reduced GCS.

Conclusion: This survey has identified a lack of standardised practice & division between anaesthetists and nursing staff. The lack of high-level evidence in this area is a barrier to local and national production of analgesic protocols[2]. Based on best evidence, we aim to use an MDT approach to produce local guidance on peri-operative analgesia. We hope this guidance will close the division between nursing and anaesthetic staff and improve communications between theatre and the HDU.

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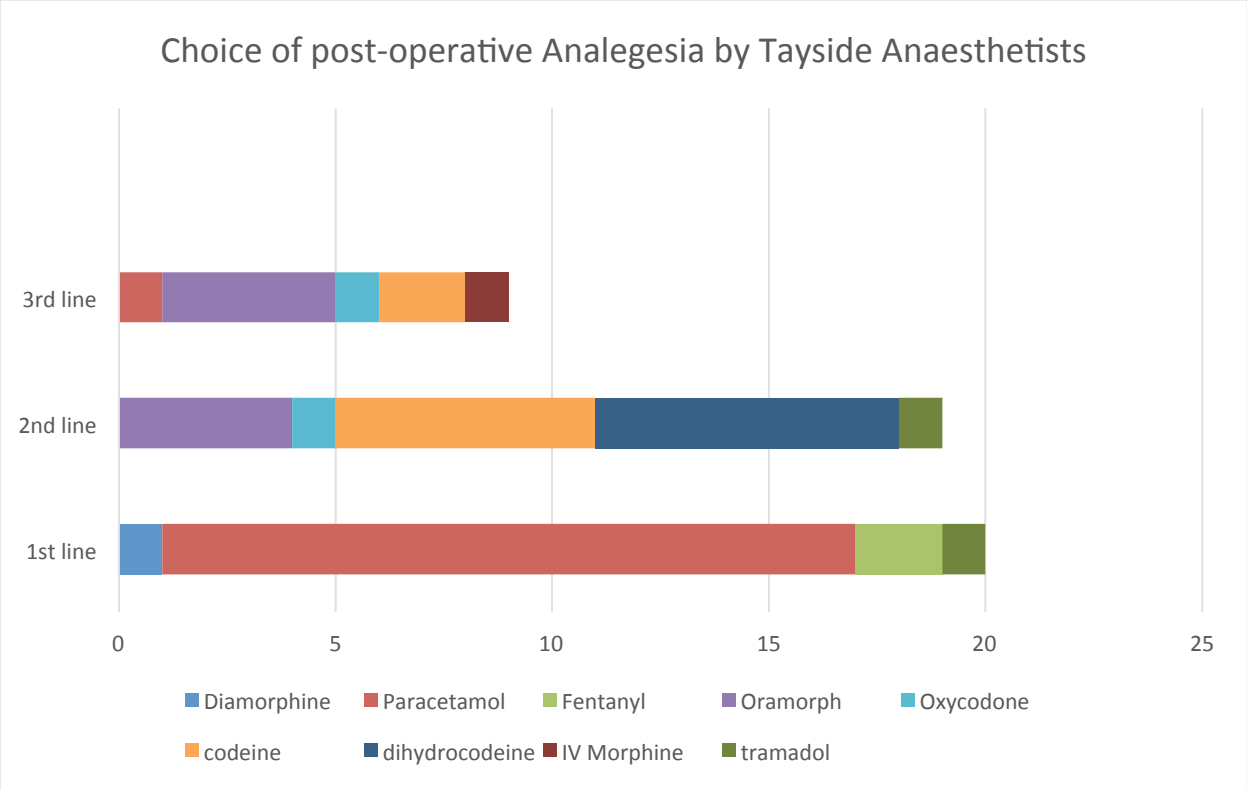
Choice of post-operative Analegesia by Tayside Anaesthetists
3rd line
2nd line
1st line
0
5
10
15
20
25
Diamorphine
Paracetamol
Fentanyl
Oramorph
Oxycodone
codeine
dihydrocodeine
IV Morphine
tramadol

Developing a Neuro Critical Care app - what do we need it for?

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Introduction: Our neurointensive care unit (NICU) is staffed by trainees with a wide skill mix. They include non-anaesthetic junior doctors who range from F1 to ST7. Previous NICU experience is rare and only a small proportion of trainee curriculum is dedicated to NICU. We identified the need for specific NICU resource for trainees rotating though the unit, for support at induction and throughout their placement.

Methods: We surveyed junior doctors due to rotate to NICU at three hospitals in Peninsula Deanery. Data collected included grade, previous experience, smart phone and medical app usage. We asked them to rate their confidence with common NICU cases from 1-10 with 1 denoting very under confident. We created an electronic resource available on NICU tablet devices and personal smart phones for nurses and doctors. It focused on key NICU clinical scenarios, local and external guidelines and additional content such as upcoming meetings and links to recommended websites. A survey via SurveyMonkey® was distributed three months after disseminating the resource access details.

Results: Twenty-four trainees responded ranging from FY1 to SPR. Twenty-three owned a smart phone and 20 felt comfortable using it at work with 17 regularly using medical apps. Trainees felt least confident dealing with post-craniotomy care and subarachnoid haemorrhage vasospasm, scoring a median of 2.5 and 3 out of 10 respectively. Eight people from nurses to consultants responded to the SurveyMonkey® survey. Five accessed the resource solely on their personal device. The resource was used by the majority for referring to local guidelines and for further education.

Conclusion: This survey shows trainees starting NICU felt under-confident when dealing with common conditions. The majority used their smart phones to access medical information as was the case for our resource. The resource was well received and valued by both doctors and nurses. Technological limitations have led us to develop an app currently in progress.