MAIN SESSION 1 - Friday 21st September

FM1 – Spine, Muscle and Peripheral Nerve

FM1-1

Acceptance and commitment Therapy for MuscLe Disease (ACTMuS): protocol for a two-arm randomised controlled trial of a brief guided self-help ACT programme for improving quality of life in people with muscle diseases

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Objectives. Muscle disease (MD) is often associated with reduced quality of life (QoL). Acceptance and Commitment Therapy (ACT) may help improve QoL in MD. ACT is a cognitive behavioural therapy aiming to improve QoL by developing psychological flexibility. This study tests the efficacy of an ACT intervention, aiming to improve MD patients’ QoL.

Design. ACTMuS is a multi-centre, two-armed parallel-group RCT which assesses the efficacy of a brief self-guided ACT programme compared to standard medical care (SMC).

Subjects. Participants have a diagnosis of one of four MD types with a duration of at least 6 months, mild to moderate anxiety or depression (HADS ≥ 8), & were recruited from UK MD clinics & patient groups.

Methods. 77 participants in the intervention group receive four ACT modules and are supported by therapist telephone sessions. The primary outcome is the Individualised Neuromuscular Quality of Life Questionnaire. Participants are followed up at 3, 6 & 9 weeks.

Results. This is the first study to test the efficacy of ACT for MD. We have recruited our target of 155 participants and have high follow-up rates. 49% of participants have FSHD, followed by IBM (24%) and LGMD (24%) Some participants from a nested qualitative study have spoken favourably about receiving ACT.

Conclusions. This is one of the largest trials of psychological therapy in MD and has successfully recruited to target. We have high follow-up rates at all time points and await data analysis to see if this confirms the favourable qualitative feedback.
A prospective study on surgical management of foot deformities in Charcot Marie tooth disease

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Objectives. Charcot-Marie-Tooth (CMT) Disease is the most common inherited peripheral neuropathy. Foot deformities are frequently observed in CMT patients and orthopaedic surgery is often required. Currently the evidence base on surgical management is limited. We prospectively studied surgical management of CMT patients attending our centre.

Subjects. Patients were assessed at baseline and yearly after surgery.

Methods. Assessment and data included: history of ankle instability, pain, skin condition, lower limb strength assessment, Charcot-Marie-Tooth Examination Score, Foot Posture Index, ankle dorsiflexion range of movement, questionnaires, details of surgical procedures.

Results. 29 feet in 24 CMT patients (17 males, 7 females, mean age: 38.6 ±13) were evaluated prior to surgery. All patients but one had genetically confirmed CMT (18 CMT1A; 4 CMTX; 1 CMT4A). 17 feet in 12 pts were evaluated after 1 year; 10 feet in 9 pts were evaluated after 2 years; 8 feet in 7 pts were evaluated after 3 years. A wide range of surgical procedures were performed by one dedicated orthopaedic surgeon. There was significant improvement of foot alignment (p<0.001), callosities (p=0.002) and pain (p=0.022) after surgery. Surgery had no significant effect on strength, ankle range of movement, falls and fatigue.

Conclusions. The findings showed significant improvement of foot alignment, callosities and pain after surgery. Data acquired from this study will help developing orthopaedic intervention guidelines and identify areas for further research.
UK clinical practice experience of Subcutaneous Immunoglobulin (SCIg) as maintenance treatment for inflammatory neuropathy

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Objectives. The PATH trial proved efficacy of SCIg in CIDP with more patients relapsing on placebo than SCIg. Dose-dependence was demonstrated with two arbitrary doses. In practice we titrate to clinical response and actual SCIg dosing requirements are not known.

Design. Retrospective cohort

Subjects. Patients treated with SCIg for CIDP/MMN in two UK specialist neuropathy centres

Methods. Database review

Results. 37 patients on SCIg for CIDP/MMN up to April 2018; 46% female; age (mean, S.D.):57.8 (13.7) years, range=25-77 years. IVIg duration prior to transfer: 52.9 (35.6) months, range:10months-11years. Previous IVIg maintenance= 79.9 (31.1) g/month; 1.2 (0.45) g/kg/month, frequency: 4 weekly. Reasons for transfer: Lifestyle/convenience:17/37(45.9%), CV risk:2/37(4.6%), Headache:3/37(6.9%), not known:6/37(13.8%). SCIg duration=52.9 (35.6) months, range:10.2-105 months; maintenance:22.1(7.5)g/week, range:4.8-36g; 86.4 (31.5)g/month; 1.44 (0.5)g/kg/month. Difference: +6.35 (22.4) g/month; +0.1(0.4)g/kg/month. 23/37 stable on 1:1 ratio with previous IVIg dose. No statistically or clinically significant change in RODS (p:0.53, Δ:1.8), R grip or L grip strength (p:0.35,Δ:2.2kPa); p:0.60,(Δ:1.67KPa). 8/37 ↑dose due to clinical deterioration, 3/37 ↓dose due to clinical stability, 4 stopped. No adverse reactions.

Conclusions. Clinical practice experience over an extended time period supports efficacy and safety of SCIg in CIDP/MMN. We provide useful information on real-life dosing requirements.
Intraneural perineuriomas: radiologically classic, clinically varied

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Objectives. Intraneural perineurioma is a rare, benign neoplasm of peripheral nerve. The histopathological features are well defined.

Design. We describe 5 cases of histologically confirmed perineuriomas and 14 cases diagnosed on clinical and radiological characteristics to highlight the features of this rare entity.

Methods. We identified cases from the imaging and histopathology database and conducted a retrospective case note review.

Results. The subjects include 7 men and 12 women, with mean (standard deviation) age of 17.64 (13) years at onset of symptoms. 14 of the 15 lower limb cases were located in the sciatic nerve or its divisions. 1 each was identified in ulnar, median and radial nerves and 1 case was in a facial nerve. The MRI features were homogenous between the groups. The nerves biopsied included 1 tibial, 1 ulnar, 1 radial, 1 facial and 1 sciatic all showing classic pathology findings. 2 patients, interestingly, had coincidental intracranial meningioma, given the recent discovery of a potential shared pathogenesis (mutations in TRAF7) with intracranial meningiomas. 2 patients had “skip lesions” within the same nerve and 3 patients had foraminal and extraforaminal involvement of lumbosacral nerve roots.

Conclusions. Our unit now favours the clinicoradiological features for diagnosing perineuriomas rather than performing a biopsy on all patients. Also, the potential shared pathogenesis with meningiomas raises the clinical issue of screening in patients with perineuriomas but more clinical evidence is required.
The impact of neurosurgical technique on outcome of adult patients with Chiari I Malformation

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Objectives. This study aimed to compare and evaluate any differences in clinical and radiological outcomes between three surgical techniques of cranio-cervical decompression (CCD) in adults with symptomatic Chiari malformation type I (CM1).

Design. Retrospective review using the theatre management system (ORSOS) and records of the patients who underwent CCD for CM1 from January 2011 to January 2018.

Subjects. Patients over 16 years of age who underwent CCD secondary to CM1 diagnosed by clinical and radiological criteria.

Methods. Patients were divided in three cohorts according the operative technique used: an extradural osteo-ligamentous decompression (BD), BD plus dural opening either without duroplasty (DOWD) or with watertight augmentative duroplasty (DOPD). The primary clinical outcome was measured by utilizing the Chicago Chiari Outcome Scale (CCOS). Syrinx outcome was measured on post-op MRI. Statistical analysis was performed using IBM SPSS 24 with α=0.05.

Results. Fifty-two adults underwent fifty-three CCD: 7 BD, 29 DOWD, 17 DOPD. Median follow-up was 12 months (IQR 6-23). Patients who underwent BD or DOPD had a shorter median hospital stay (6 days) than DOWD (11 days). Median CCOS was lower following DOWD (13) compared to BD (14) and DOPD (15). Post-operative complications were higher in DOWD (51.7%) compared to DOPD (17.5%).

Conclusions. Better clinical outcomes, lower complication risk and shorter duration of hospital stay were associated with DOPD. Prospective randomized studies could confirm these findings.
In unilateral single level lumbar micro-discectomy, does the use of intra-operative epidural steroid affect post-operative pain control?

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Objectives. To assess whether applying the synthetic corticosteroid (Kenalog) intraoperatively, following unilateral single level lumbar microdiscectomy affects postoperative pain

Design. Retrospective study looking at back and leg – numerical pain scores at the pre-operative, immediate, early, and late post-operative periods, for patients who underwent elective unilateral lumbar microdiscectomy in a single UK neurosurgical centre.

Subjects. Patients who underwent elective unilateral single level lumbar micro-discectomy, excluding re-do operations, at Ninewells hospital over 14 months period.

Methods. Operative database search. Operation notes for eligible patients examined (n=160). 9 patients excluded. 151 patients contacted to fill a questionnaire assessing the severity of back and leg pain – using a numerical score from 0 (no pain) to 10 (worst pain ever), during 4 time periods; within 24 hours pre-op, within 24 hours post-op, 6 weeks post-op, and 3 months post-op. 66 patients replied at the time of abstract submission (27 received Kenalog, 39 did not).

Results. There was no intergroup difference regarding age, gender, BMI, smoking status, pre-operative, or immediate post-operative back or leg pain scores. The results showed worse back pain scores in the Kenalog group at 6 weeks, and 3 months (P values 0.008 and 0.001). No difference was detected regarding leg pain

Conclusions. Using intraoperative steroids in unilateral, single level, first time lumbar microdiscectomy can contribute to worse early and late post-operative pain control.
Cranio-cervical instability in Ehlers-Danlos Syndrome employing upright, dynamic MR imaging; a comparative study in the end

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Objectives. Ehlers-Danlos syndrome (EDS) is a hereditary connective tissue disorder leading to hypomobile joints including the craniocervical junction. Neck pain is a prominent feature. Structural abnormalities may have a dynamic element and thus may not be captured in a recumbent MRI. There is currently a lack of evidence (1) assessing the use and diagnostic impact of positional MRI in Ehlers-Danlos syndrome. We aim to evaluate structural features and dynamic instability in an EDS cohort employing dynamic MR imaging against a non EDS symptomatic cohort.

Design. Comparative Study

Subjects. Patients diagnosed with Ehlers-Danlos syndrome and control subjects (non EDS with cervical spondylosis) were included in this study.

Methods. Cranio-cervical spine global and segmental movement parameters in the neutral, extension and flexion positions were measured from T2-weighted images in the midline sagittal plane. These parameters included the clivo axial angle, grabb oakes line, C2 sagittal vertical axis, C0-C1 angle, C1-2 angle, cervical lordosis and T1 slope.

Results. The clivo-axial angle measured in neutral was 139.7 ± 10.4 degrees in the EDS group vs 148.9 ± 8.4 in the control group (p<0.01). The cervical range of movement between flexion and extension was 74.6 ± 24.4 in the EDS group vs 39.4 ± 11.3 in the controls (p<0.0001).

Conclusions. EDS patients with neck symptoms exhibit different static as well as dynamic craniocervical structural features compared to a general population control.

Is pituitary screening necessary in cluster headache?

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Objectives. To determine the incidence of pituitary adenomas in Cluster Headache (CH) patients and to identify clinical predictors of pituitary adenomas in these patients.

Design. A retrospective case-control study of all consecutive patients diagnosed with CH between 2007 and 2017 in a headache centre.

Subjects. Patients diagnosed with episodic cluster headache or chronic cluster headache according to the International Classification of Headache Disorders-3beta edition (ICHD-3?) diagnostic criteria, were included.

Methods. Demographics, attack characteristics, response to treatments and routine pituitary function tests were recorded. Univariate and multivariate analysis using random forests were used to analyse the data.

Results. 718 CH patients were included; 376 underwent a dedicated pituitary MRI. Pituitary adenomas occurred in 17 of 376 patients (4.52%). Non-functioning microadenomas (n=13) were the most common abnormality. 2 patients, required treatment for their pituitary lesion. No statistical difference was found between patients with pituitary adenoma and with normal pituitary MRI in terms of demographic, clinical characteristic or response to treatment.

Conclusions. The incidence of pituitary adenomas in CH is similar to that reported in the general population. We therefore conclude that the diagnostic assessment of CH patients should not include routine pituitary screening. Only patients with standard brain MRI findings or symptoms suggestive of a pituitary disorder require pituitary imaging.
FP1-2

Implementation of Duty of Candor regulation within neurosurgery: a national cross-sectional survey

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Objectives. Statutory Duty of Candor was introduced in 2014 for NHS bodies in England. Contained within the regulation were definitions regarding the threshold for what constitutes a notifiable patient safety incident. The aim of this survey was to evaluate the interpretation of these definitions by British neurosurgeons.

Methods. Full members of the SBNS were electronically invited to participate in an online survey. Surgeons were presented with 15 cases and asked to decide in each one whether they would trigger the process of Duty of Candor. Cases were stratified according to their likelihood and severity.

Results. In all, 106/357 (29.7%) members participated in the survey. Responses varied widely with almost no members triggering the process of Duty of Candor in cases where adverse events were likely (>10% likelihood) and required only outpatient follow up (7/106; 6.6%), and almost all members doing so in cases where adverse events were rare (<0.1% likelihood) and resulted in death (102/106; 96.2%). However, there was clear equipoise in triggering the process of Duty of Candor in cases where adverse events were unlikely (0.1-10% likelihood) and resulted in moderate harm (38/106; 35.8%), severe harm (57/106; 53.8%), or death (49/106; 46.2%).

Conclusions. There is considerable nationwide variation in the interpretation of definitions regarding the threshold for Duty of Candor; this has important implications with some providers at risk of penalties, and others unduly burdened by the associated administrative processes.
A multidisciplinary quality improvement initiative for SAFER care of neurosciences patients

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Objectives. To assess the SAFER programme, a multidisciplinary neurosciences intervention which utilises the principles of a national NHS patient safety initiative.

Design. This was a quality improvement initiative which centred around established SAFER principles, aiming to improve coordination of patient care, identify barriers to early discharge and reduce length of stay.

Subjects. All patients admitted to neurosciences wards at the Royal London Hospital under the care of neurosurgery or neurology.

Methods. An MDT handover meeting focused around a visual management board was introduced to facilitate integrated medical, nursing and therapy team input into the patient journey. This provided a structured forum for discussion, early senior decision making and collaborative discharge planning. Length of stay was measured for all patients admitted over one year. Standard quality improvement methodology was used to assess the impact of this intervention.

Results. Common barriers to early discharge and patient flow through a neurosurgical centre included limited availability of rehabilitation beds, lack of timely referral to local hospitals and complex social issues. Median length of stay decreased from 25 days to 11 days after a period of 2 months. This reduction was sustained over a 6 month period.

Conclusions. SAFER has identified barriers to patient flow and has reduced length of stay. Further improvements will include junior workforce planning, input from a complex discharge team and development of inpatient rehabilitation services.
Factors affecting patient flow in a neurosurgery department

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Objectives. The objectives of this study were to audit the NHS Improvement SAFER patient flow bundle, evaluate the impact of the Red2Green initiative, and assess the impact of frailty on patient flow.

Design. A prospective review over a 3 month period.

Subjects. All patients admitted to a Neurosurgery Unit from 01/09/2017 to 30/11/2017 were included.

Methods. Data were prospectively collected from daily ward lists and patient notes, including demographics, admission/discharge details, length of stay (LOS), expected discharge date, red days with reasons, and frailty (Rockwood Clinical Frailty Scale). NHS Improvement Reference Costs were used for cost analyses.

Results. 420 patients (55% elective) were included, total 3909 bed days. All patients received a daily senior review before midday, and EDDs were set at daily MDT meetings. 10% patients were discharged before midday. There were 21% (837) red days, significantly more (76%) for emergency patients (639 vs 198 elective; p<0.001). 63% red days were attributed to awaiting a bed in a local hospital. 25% (106) patients were classed as frail (50 elective), which was associated with a significantly longer LOS (17.3 vs 6; p<0.01), and more red days (615 vs 222; p<0.01). Considering bed costs and lost revenue (with penalties), red days cost is estimated at over £1M per year.

Conclusions. SAFER has identified areas for improvement in patient flow, with obvious cost implications. It has created a platform for discussion within the referral network, and identified a role for a geriatric liaison service.
Objectives. To survey neurological services available across the UK

Design. Electronic survey

Subjects. All hospital sites providing neurological services

Methods. All hospitals providing neurological services are being surveyed.

Results. The Census is running in the month of June 2018. The Census will provide a description of neurology services in England. There will be information on the inpatient and acute neurology services provided and the range of outpatient services available in all hospital sites across England. There will be information on the supporting services, neurophysiology, neuroradiology and rehabilitation that are available.

Conclusions. This study will provide a comprehensive description of the services reported to be available in England. We appreciate the ABN does not normally consider papers submitted before the results are available we suggest that members of the Association, who will be providing this information, will wish to know the results as soon as they are available.
Factors influencing clinician’s participation in neurosurgical research - a multicentre cross-sectional study

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Objectives. Research remains a foundation in advancing the field of neurosurgery. We explore attitudes and perceived barriers to conducting research in neurosurgery globally.

Design. A 29-item questionnaire, consisting of multiple-choice questions, Likert scales and short answers.

Subjects. Clinicians at various stages of the Neurosurgical career.

Methods. The questionnaire was distributed through the Society of British Neurological Surgeons (SBNS) and European Association of Neurosurgical Societies (EANS).

Results. A total of 324 responses from 29 countries consisted of Clinical Fellows (n=26), Junior Trainees (n=48), Senior Trainees (n=46), Sub-specialty Fellows (n=18), Consultants (n=128) and Professors of Neurosurgery (n=58). Whilst 83% of participants believe research is a crucial aspect of a neurosurgeons’ career, only a third (33%) believed that neurosurgery as a speciality fosters a culture that promotes research. The top three perceived barriers to conducting research were lack of time (78%), insufficient access to funding (58%) and lack of mentorship (49%). Despite these, more than 87% of participants are interested in formal academic roles with 58% willing to interrupt clinical training to pursue research opportunities. The region of clinical practice had no correlation with respondents' research output or their perceptions towards research barriers.

Conclusions. This study identified important barriers to research, elucidating which, allows the neurosurgical community to improve integration of research into clinical practice.
Objectives. The case records at Queen Square afford a unique opportunity to understand the evolution of neurological diagnosis between 1870 and 1920. This period witnessed a shift from the descriptive and observational to a sophisticated and detailed understanding of discrete disease patterns.

Results. By 1870, the introduction of microscopic pathological analysis of the nervous system had led to the recognition of disease processes including tumour, haemorrhage, infarction, meningitis and sclerosis. However, the most frequent diagnoses remained symptomatic (epilepsy, movement & functional disorders, visual loss and paralysis). Syphilis, paralysis agitans, and poliomyelitis were amongst the few specific diagnoses. The final decade of the 19th century saw the description of disease patterns, particularly in France, Germany and the US. These included disseminated and amyotrophic lateral sclerosis, myasthenia gravis and latterly eponymous disorders and signs attributed to Dejerine, Duchenne, Sanger Brown, Huntington, Marie, Romberg, Wernicke, Babinski and Charcot as well as Bright, Jackson, Gowers and Wilson in the UK.

Conclusions. The case record diagnoses, as well as the writings of Gowers and others, show how rapidly neurological thought evolved over 50 years. Queen Square was able to systematise neurological disease but was also remarkably responsive in understanding, accepting and adopting the neurological advances made across Europe.
Objectives. Functional neurological disorders are common, but there is a lack of objective tests for these conditions. Although accelerometry can distinguish functional from other tremor types, it is not routinely used at the bedside. Computer vision describes the processing of camera images by computer. It requires only ubiquitous hardware (e.g. smartphone, laptop) and standard clinical assessment, i.e. simple observation. We investigated computer vision to detect tremor distraction/entrainment in functional tremor.

Design. Early results comparing computer analysis of video from a functional tremor and an essential tremor.

Methods. 30 second (60 fps) video of extended forearm was recorded using a smartphone, for a functional tremor and an essential tremor patient. From 15 seconds, each participant tapped in time with a 3 Hz metronome using the contralateral hand (outside the video frame). Computing algorithms amplified the magnitude of video pixel movement and then measured the direction and size of pixel movement over time.

Results. After the metronome onset, there was a marked change in video pixel movement for the functional tremor patient, with the frequency concentrating at 3 Hz, and this was statistically significant by linear discriminant analysis. There was no significant change in pixel movement after the metronome for the essential tremor patient (frequency remained 8-12 Hz).

Conclusions. Smartphone video pixel movement can detect functional tremor entrainment, suggesting a possible new objective, bedside test.
Exploratory analysis whether wearable sensor data can correlate with aspects of non-motor symptoms in Parkinson’s: a real life study with the Parkinson’s KinetigraphTM

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Objectives. To determine the association between the range and nature of non-motor symptoms (NMS) in people with Parkinson’s (PwP) and validated Parkinson’s KinetigraphTM (PKG) outcome measures.

Design. Cross-sectional retrospective study of participants enrolled in the Non-motor Longitudinal International Study (NILS, UKCRN No: 10084) at King’s College Hospital, London.

Subjects. 108 PwP with a PKG recording within 4 months of a NILS assessment were included in the analysis.

Methods. PKG is a validated accelerometry-based measure for motor function in PwP, reporting scores for global bradykinesia (BKS) and dyskinesia (DKS). NMS were assessed by the NMS scale (NMSS).

Results. Using multiple linear regression, BKS was predicted by NMSS domains 6 (gastrointestinal tract; p=0.006) and 8 (sexual function; p=0.003). DKS was predicted by domains 3 (mood/cognition; p=0.016), domain 4 (perceptual problems; p=0.025), domain 6 (gastrointestinal tract; p=0.029) and domain 9 (miscellaneous, p=0.003). In these domains, anxiety, delusions, dysphagia, hyposmia, weight change and hyperhidrosis significantly predicted DKS. In addition, carbidopa dose predicted NMSS total scores (p = 0.037), but not total LEDD (p=0.91).

Conclusions. In PwP, measures of BK and DK were mainly associated with gastrointestinal problems, underpinning the importance of gastric absorption of oral medications and constipation and the related motor effects in PwP. Interestingly, carbidopa appears to have a role in non-motor symptoms in PwP, which deserves further investigation.
Slave to the rhythm: seasonal differences in non-motor symptoms in Parkinson’s

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Objectives. To determine the effect of the change of season on non-motor symptoms in Parkinson’s disease (PD).

Design. Cross-sectional retrospective study.

Subjects. 364 consecutive Parkinson’s patients in the London area taking part in the Non-motor Longitudinal International Study (NILS) study at King’s College Hospital London between November 2011 and April 2018.

Methods. Participants were divided into three groups based on their assessment date, using a simplified ecological seasonal model: 1) November until February; 2) March until 15 June; 3) 16 June until October. The primary outcome was a seasonal difference in non-motor symptom scale (NMSS) total scores and the secondary outcomes were NMSS subscores. Outcomes were adjusted for multiple testing using formal Bonferroni correction.

Results. 102 patients were allocated to group 1, 105 patients to group 2 and 157 patients to group 3. Seasonal differences were present in NMSS total scores (p=0.042), especially between groups 1 and 3 (p=0.037). Differences were also present for NMSS domain 1 (cardiovascular and falls; p=0.004), 2 (sleep and fatigue; p=0.049), 4 (hallucinations; p=0.003) and 9 (miscellaneous; p=0.031). Within domain 9 there was only a significant difference for question 28 (smell; p=0.008).

Conclusions. These results indicate that non-motor symptoms in Parkinson’s fluctuate throughout the year with lowest scores in the summer months and highest in the winter months. These variations need to be taken into account to avoid inappropriate changes in medication regimes.
Long-term prognosis and survival of new clinical Parkinson’s disease subtypes

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Objectives. The aim of this study is to evaluate: 1) applicability in clinical practice 2) long-term prognostic value of new data-driven Parkinson’s disease (PD) subtypes incorporating non-motor symptoms

Design. Retrospective cohort study

Subjects. Consecutive patients with a postmortem diagnosis of PD from the Queen Square Brain Bank

Methods. Clinical records were systematically reviewed and motor signs and non-motor symptoms (autonomic dysfunction, cognitive impairment, REM sleep behaviour disorder) severity at time of diagnosis was documented. Based on this information, patients were classified into mild motor-predominant, intermediate or diffuse-malignant subtypes (adapted from PPMI cohort study). Disease milestones (falls, wheelchair, dementia, nursing care) and survival were calculated and their risk was estimated for each PD subtype using Cox regression models

Results. 117 PD patients were included (61.5% male; age at diagnosis 62.3 ± 11.5 years) Diffuse-malignant patients were older, had poor response to levodopa, faster disease progression and reduced survival (all P<0.001). Diffuse-malignant subtype has a higher risk of faster disease progression (first milestone HR 12.58 (5.94-26.65); P < 0.001) and death (HR 4.01 (2.02-7.98); P < 0.001) compared to mild motor-predominant.

Conclusions. Clinical PD subtyping at the time of diagnosis - is feasible in clinical practice using retrospective clinical data - accurately estimates long-term prognosis prediction on disease progression, disability and survival
Objectives. The neurological response to psychological trauma during the Great War changed between the initial engagements, the final offensive and the later reflections of the Southborough enquiry.

Design. At Queen Square, neurasthenia was a recorded diagnosis from 1890 and, for the next 30 years, between 4-8% of all admissions were so described. The term ‘shell shock’ was first used in 1914 but the diagnosis burgeoned until, by 1918, it amounted to 25% of all admissions.

Subjects. Early in the war, affected soldiers were rapidly evacuated to the UK, but attitudes changed after the Somme, because of the need to expedite return to the frontline. The use of 'Electrical Therapy' at Queen Square was an example of this imperative (Linden 2013).

Results. Review of the case records suggests that 'Shell Shock' became an increasingly pejorative term as the condition was seen as a ‘contagious psychological response of the weak.’ The records show it was largely restricted to the lower ranks whilst officers were generally considered to have neurasthenia requiring a more gentle psychotherapeutic approach, occasionally involving transfer to specialist facilities.

Conclusions. Ultimately, at Queen Square, the diagnosis and management of acute traumatic neurosis was driven by the needs of war but also by popular prejudice.
Cell delivery for intracerebral cell transplantation

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Objectives. Clinical trials of intracerebral cell replacement therapy (CRT) yield inconsistent results owing to poor graft survival and ectopic graft placement. A paucity of available CE marked specialised delivery systems and a lack of reliable delivery protocols could be major contributing factors to both phenomena. Here, we aimed to investigate current needle delivery strategies in-vitro and in a large animal model in pigs.

Design. In-vitro laboratory and in-vivo pigs experiments

Subjects. In-vitro: Agaroose gel In-vivo: 4 white Landracer pigs

Methods. In-vitro: Human Embryonic Kidney cells expressing luciferase and 0.6% agarose gel were used to test 3 delivery strategies: 1) Bracelet deposit, 2) Large deposit in a pre-formed tract, 3) Multiple deposits in a pre-formed tract. In-vivo: Pigs underwent MRI-guided Human Foetal Luciferase-transduced cell transplantation into the putamen and thalamus. Post-operative MRI, Bioluminescence imaging (BLI) and histology were used to identify graft location and viability.

Results. Using a commercially available needle delivery system, significant reflux of deposits was noted in all 3 delivery strategies during in-vitro testing. Deposting into a preformed tract yielded the best delivery, and was therefore used for in-vivo testing. Studies in pigs using MRI and BLI confirmed significant reflux and ectopic deposition of grafts.

Conclusions. Simple needle delivery systems appear to suffer from significant reflux and ectopic cell deposition. This may adversely affect the outcomes of CRT trials in humans.
Paediatric robot-assisted DBS surgery: electrode problems and revision techniques

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Objectives. We review our cases of hardware problems requiring revision surgery and consider the technical aspects of revising the electrodes, including a frameless technique using the Renishaw Guide tubes.

Design. Retrospective Review

Subjects. Children (<=18 years old) who presented with hardware problems following implantation of a DBS for dystonia at King’s College Hospital between May 2005 and April 2018

Methods. Information was obtained from a prospectively kept database.

Results. Of 166 paediatric patients with DBS, 25 patients had hardware problems, and of these 21 (13%) patients had specifically electrode problems requiring replacement/revision of one or more electrodes. 7 patients had high impedances requiring revision, without obvious lead migration of fracture. 7 patients had lead migration and a further 7 patients had a lead fracture with or without lead migration. 15 patients had original DBS insertion with the Leksell Stereotactic System utilising the Medtronic Stimlock for lead fixation. 6 patients had DBS inserted with the Renishaw Stereotactic Robot and utilised the Renishaw Guide Tubes, in these patients who required lead replacement it was possible to revise the electrode without using stereotactic apparatus. As the guide tubes are implanted in the correct trajectory it is possible to measure the distance required to advance/implant the lead within this to target without the need for full stereotactic reimplantation.

Conclusions. Electrode dysfunction is relatively common in children with DBS and a systematic approach is required to identify the cause. When an electrode requires repositioning or replacement, the procedure can be performed in the conventional manner with a stereotactic frame, or freehand without a frame if a Renishaw Guide tube is used at time of first insertion.
Prognostic value of leucocytosis in paediatric traumatic brain injury

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Objectives. We assessed leucocytosis and evaluated its prognostic value in isolated paediatric traumatic brain injury (TBI).

Design. Retrospective analysis

Subjects. 106 consecutive paediatric patients with isolated TBI admitted between June 2008 and June 2016

Methods. Initial blood leucocyte count (WCC), Glasgow Coma Score (GCS), computed tomographic (CT) findings, duration of hospital stay, and Paediatric Cerebral Performance Category Scale (PCPCS) scores were analysed.

Results. Mean age was 4.2 years. For patients with GCS 3-8, 9-13 and 14-15, WCC was 20, 15.9 and 10.7 x 10⁹/L respectively. Differences in WCC were significant between the different GCS groups (p < 0.01). Length of hospital stay, extent of midline shift on CT and poor 6-month PCPCS rating were each significantly correlated with WCC (p < 0.05). Multivariate regression analysis revealed a cut-off WCC of 16.1 x 10⁹/L, above which GCS, CT findings, length of hospital stay and PCPCS were less favourable. Application of the International Mission on Prognosis and Analysis of randomized Controlled Trials in TBI (IMPACT) adult TBI prediction model to our paediatric cohort, using area under the operating curve (AUROC) and coefficient analyses, demonstrated increased accuracy with incorporation of WCC as a risk factor.

Conclusions. High initial leucocytosis (>16.1 x 10⁹/L) is predictive for poor GCS, severe CT findings, lengthy hospital stay and poor PCPCS in isolated paediatric TBI. Incorporating WCC into TBI prediction models may increase the accuracy of prognostication.
Decompressive craniectomy for the treatment of paediatric traumatic brain injury: a systematic review

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Objectives. Paediatric traumatic brain injury (pTBI) is one of the most frequent neurological presentations encountered in Emergency Departments worldwide. Every year, ten million children suffer pTBIs, and many suffer long-term damage. We aim to review the existing literature to assess the efficacy of the decompressive craniectomy (DC) in controlling intracranial pressure (ICP) and improving long-term outcomes in children with pTBI.

Design. This systematic review was made following guidelines proposed in the PRISMA statement.

Subjects. Randomised clinical trials (RCTs), case series or two-arm studies involving patients aged <18 years, included TBI patients who underwent DC to control ICP, and measured long-term (>4-week) outcomes were included.

Methods. A comprehensive search of MEDLINE and EMBASE databases led to screening of 212 studies, 12 of which satisfied inclusion criteria. Data extracted included number and ages of patients; Glasgow Coma Scale scores at presentation; treatment protocols; short- and long-term outcomes.

Results. Each of the nine studies including ICP as an outcome reported that it was successfully controlled by DC. The 6-12 month outcome scores of patients undergoing DC were positive, or superior to those of medically treated groups in 9 of 11 studies. Mortality was compared in only one study, and was lower in the DC group (p<0.05).

Conclusions. The currently available evidence supports the beneficial role of DC in the treatment of children with refractory high ICP (>20 mmHg) and GCS <8 at the time presentation.
Ten years of paediatric neurooncology surgery: quantifying and predicting complications after surgery for intracranial tumour excision

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Objectives. To measure complications of paediatric neurooncology surgery using the Clavien Dindo grading scale, and identify predictors of surgical morbidity.

Design. Retrospective review of prospectively collected data.

Subjects. All paediatric patients treated with for excision of intracranial tumour between 2008 and 2017 in a single tertiary paediatric neurosurgery centre.

Methods. Demographics, surgical details and perioperative complications were prospectively recorded between 0 and 30 days post-operatively. These were retrospectively graded using the CD scale. Data analysis was done in R using logistic regression. Significance was defined as p<0.05.

Results. Between 3/1/2008 and 21/12/2017 there were 371 operations, on 286 patients (161 Male). Median age at surgery was 10 years (IQR 5-14 years). 54% were without complication on the CD scale. Maximum CD grade complication for each procedure was 1 in 11%, 2 in 19%, 3A in 1.9%, 3B in 13%, and 4 in 0.5% of operations. 30 day mortality was 0.8%. CD grade of 3A or over was associated with infratentorial tumours (OR 0.32, CI 0.17-0.59, p<0.001) and re-operation for disease progression (OR 0.36, CI 0.15-0.88, p=0.02).

Conclusions. Complications in paediatric neurooncology surgery are common overall, but our results are favourable in comparison to the literature. The CD scale has limitations in neurosurgery but gives insight into the health economic impact of complications. Infratentorial tumours, and repeat surgery for disease progression were associated with increased morbidity.
Paediatric posterior fossa tumour resection rates in a small volume centre: the past decade’s experience

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Objectives. Resection rates for paediatric brain tumours correlate with outcome. At the 2018 BPNG meeting a commitment to prospectively collect resection data was made. Here we review our posterior fossa resection rates for the last decade.

Design. Retrospective observational cohort study of paediatric posterior fossa astrocytomas, medulloblastomas and ependymomas from 2008-2018. Primary outcome measure was extent of resection on post-op MRI, with secondary outcomes including post-op complications and need for temporary/permanent CSF diversion.

Subjects. 57 patients had 62 operations for: 26 astrocytomas, 28 medulloblastomas and 8 ependymomas. Ages ranged from 7 months-16 years, with a median of 9, 7 and 6 years, respectively, and an even male:female split. Follow-up ranged from 2 months to >10 years.

Methods. Patients were identified from a prospectively collected paediatric neuro-oncology database, with clinical notes and peri-operative imaging used for analysis. Our results were compared to the published literature.

Results. Complete resection (CR) rates after 1st surgery for patients with astrocytomas, medulloblastomas and ependymomas were 77%, 79% and 63%, respectively. 5/57 patients had a 2nd operation later, 3 of whom had primary CR followed by recurrence.

Conclusions. Our resection rates, complications and need for CSF diversion are comparable to the literature. Factors enabling this in a low-volume centre may include a robust paediatric neuro-oncology framework, fellowship-trained subspecialty surgeons and joint operating.
Surgical management of Chiari I malformations in a paediatric population – a single institution experience

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Objectives. To evaluate the surgical outcomes of different methods of foramen magnum decompression surgery on Chiari-I Malformation in paediatric patients.

Design. Comparison of bony decompression (BD) alone vs bony decompression and dural opening (BDD) for surgical outcomes of Chiari malformation assessed at 1 year from surgery.

Subjects. 50 children with age range from 3 to 18 years old; mean age 11.34 years. 20 boys and 25 girls were included. 5 children had revision surgery.

Methods. Retrospective study covering a 9 year period in a Children's Hospital including 50 consecutive FMD procedures in 45 children. Indications were headaches, neurological symptoms or radiological syringomyelia.

Results. Headaches improved in 12/16 patients (75%). Radiological syrinx improvement in 28/33 (85%). Neurological symptoms stabilised or improved in 15/21 patients (71%). BD alone in 23 patients and BDD in 21 patients and bony decompression with duraplasty in 1 patient. BD alone was successful in 6/7 patients and BDD was successful in 5/6 patients. BD alone for syrinx improvement in 9/13 and BD with durotomy successful in 18/19

Conclusions. BD alone is quite successful in Chiari 1 patients undergoing surgery for headaches whereas BDD is better for Chiari 1 patients undergoing surgery for syringomelia.
Modelling neonatal intraventricular haemorrhage using organotypic samples from the wall of the lateral ventricle

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**Objectives.** Intraventricular Haemorrhage (IVH) impacts on ependyma and neural stem cells (NSC) within the subventricular zone (1). Developing therapeutic interventions to curtail this impact is a key research goal. Organotypic models from the wall of the lateral ventricle (LV) of mice (2) and humans have the potential to offer unique insight into the dynamic impact of IVH.

**Design.** Basic science research using whole mount preparations (WMP) from the wall of the LV from mice and humans (SOLVe trial: IRAS ID 247936)

**Subjects.** Transgenic mouse line: Fucci:hGFAPCreER:TomatoTD. Human samples from children undergoing surgery for medically intractable epilepsy.

**Methods.** Using a published protocol (2) WMP of the LV were prepared. Two samples of human CSF were acquired: a ‘haemorrhagic’ sample from a neonate with IVH and a ‘clean’ sample from a newborn undergoing repair of myelomeningocele. 72 hours time-lapse confocal microscopy was undertaken from multiple wells.

**Results.** Colocalisation of GFP (Fucci+ve) in hGFAP+ve (RFP+ve) cells revealed dividing NSC within the wall of the LV. Quantification of fucci+ve cells revealed ‘haemorrhagic’ CSF caused a significant reduction in proliferation whilst ‘clean’ CSF caused a significant increase in early proliferation.

**Conclusions.** Organotypic slice preparation from mice and human lateral ventricle represents a novel approach to investigating the impact of IVH on the wall of the lateral ventricle.


Is whole spine imaging necessary in the evaluation of children with lumbosacral lipoma?

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Objectives. Paediatric lumbosacral lipomas are commonly assessed by whole spine MRI, which is costly, time consuming and reduces imaging detail at the region of interest. This study evaluates the utility of whole spine vs local spine MRI in paediatric lumbosacral lipoma (LSL).

Design. Single centre, retrospective, radiological review.

Subjects. 119 patients (77F:46M) aged 0.8 years (0.2 – 3.9) (median ± IQR) with complex LSL who had whole spine MRI between 2001-17.

Methods. Lumbosacral lipomas were identified from a prospectively collected database. Cases where whole spine MRI was available were included. Type of lipoma and any associated spinal anomalies were recorded.

Results. 347 patients had LSL, of which 119 (34%) patients had whole spine MRI. 3% were excluded due diagnosis of fatty filum terminale. 13% scans were unavailable. 119 patients were studied: 77F:46M aged 0.8 years at scan. Type of LML: transitional 36%; caudal 18%; dorsal 19%; unclassified 26%. Additional imaging abnormalities included: syrinx 18%; Chiari 1%; dermal sinus tract 13%; vertebral segmentation 13%; other 2%. None were associated with clinical symptoms nor required surgical treatment. Investigating the cost-benefit analysis of modality, lumbar spine required less MR time and cost less (40 vs 20 mins; £228.69 vs £282.39).

Conclusions. The low incidence of clinically relevant secondary lesions suggests that lumbosacral MRI only is necessary in the assessment of LSL. Imaging quality of the ROI can be optimised and MRI time and costs reduced.
ONCOLOGY

PI

Cavity size post tumour resection; simply elastic recoil of the brain or gradual two phase remodelling.
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Objectives. Stereotactic Radiosurgery (SRS) to the post-operative cavity is playing an increasingly important role in management of metastatic brain tumours. Planning for such lesions requires appropriate identification of the field to be treated. Appreciating the viscoelastic properties of brain parenchyma post-excision of a lesion will contribute to the understanding of the degree of cavity size change and the need for delayed imaging before treatment.

Design. To measure the cavity size after tumour resection within the two days post op and compare with cavity on imaging done greater than fourteen days post op.

Methods. Review of imaging of patient who had brain metastatic lesion excised. Computational volume analysis was used to record cavity size at two separate time intervals.

Results. 27 lesions were identified as having the imaging required for analysis. Mean age of 60yrs and a male to female ratio of 2:1. The location of the lesions: Frontal 5, Parietal 6, Occipital 7 and Cerebellum 9. The average size of the cavity on initial imaging (<D2) post-resection was 46% of the size of the tumour resected (range 0.3-100%) and the average size of cavity in delayed imaging (>D14) was 25% of original lesion (range 0-91%). Analysis revealed the difference to be statistically significant (p<0.05).

Conclusions. The viscoelastic properties of brain tissue and CSF dynamics influences cavity size post tumour resection. The changes develop over time and therefore delayed imaging is important prior to planning therapy using SRS.

P2

A clinical pathway for the investigation and follow-up of incidental pineal cysts
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Objectives. Pineal cysts (PCs) may be incidentally found on intracranial imaging. They are typically quiescent, benign and asymptomatic. However, imaging alone cannot exclude an underlying pineal malignancy. This study reviewed our hospital’s experience of managing PCs in order to develop a clinical pathway to guide their investigation and follow-up.

Design. Single-centre retrospective review of cases.

Subjects. Patients referred to our hospital with a PC.

Methods. Case notes and imaging from patients referred to our hospital with a clinically-coded ‘pineal cyst’ between 2007 and 2017 were reviewed.
**Results.** 43 cases were included. The most common indication for intracranial imaging was headache (12/43), followed by seizures (4/43). No symptoms were attributable to the PC. Follow-up imaging to monitor the PC was performed in 13/43 cases; in a further 10/43 cases, it was carried out for an indication unrelated to the PC. Follow-up was arranged by the neurosurgical team in 12 cases. Uncertainty about the diagnosis led to an endoscopic biopsy in one case, which confirmed a PC. There was no consistent clinical rationale underlying the decision to undertake follow-up imaging, nor its interval or duration.

**Conclusions.** Clinical practice varied widely for the management of incidental PCs. We propose that all PCs should be investigated with standardised MRI, reported by a neuroradiologist and repeated at 6-12 months. Further follow-up and its duration should be guided by the patient’s clinical condition and the radiological features of the PC.

**P3**

**Outcomes following diagnostic brain biopsy: a 1 year case review**

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**Objectives.** Stereotactic brain biopsy is an established neurosurgical procedure utilised in times of diagnostic or therapeutic uncertainty. Achieving a definitive tissue diagnosis allows tailored surgical, medical or oncological management. We present a 1 year case review of brain biopsies and compare suspected pre-operative diagnosis with final tissue outcome.

**Design.** Retrospective analysis of all brain biopsies performed in 2017 in an adult-only neurosurgical unit.

**Subjects.** All patients undergoing brain biopsy.

**Methods.** Theatre records were retrospectively analysed to identify patients undergoing brain biopsy in 2017. Further information was obtained using electronic patient records and radiology reports.

**Results.** 41 patients underwent brain biopsy in 2017. Only 1 proved inconclusive and required repeat procedure. 26 patients had a suspected diagnosis documented pre-operatively based on radiological/clinical evidence. The most commonly suspected pathologies were low grade and high grade gliomas (9 and 15 patients). Of 25 patients with both a pre-operative differential and subsequent conclusive tissue diagnosis, 10 (40%) were ultimately given diagnoses which did not match the suspected pathology. Significantly, 1 biopsy diagnosed cerebral lymphoma.

**Conclusions.** Brain biopsy is a relatively safe and simple neurosurgical procedure which can reliably provide a definitive tissue diagnosis. We have demonstrated how it remains a crucial component in formally establishing diagnosis prior to determining optimum management plans.
Spinal cord haemangioblastomas: surgical management and clinical outcome

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Objectives. Spinal haemangioblastomas are rare tumours that can be either sporadic or as part of the CNS expression of Von Hippel Lindau syndrome (VHL). The aim of this study was to identify the characteristics of the haemangioblastomas both in sporadic and in VHL cases and to assess the outcome of the surgical management.

Methods. We retrospectively reviewed all spinal haemangioblastomas that were operated between 2004 and 2017 including clinical letters, MRIs and pathology reports.

Results. A total of 14 patients underwent excision of a spinal haemangioblastoma. Average follow up time was 50 months (range 4-164 months). The location was: medulla n=3, cervical region n=4, thoracic region n=5 and conus n=2. Six patients had VHL (42%) and from those n=5 had more than one lesion. A syrinx was present in n=9 cases (VHL n=6, multiple lesions n=5) and 2 had a syringoperitoneal shunt inserted followed by excision of the haemangioblastoma. In all but one case a total excision was achieved and the syrinx disappeared or improved in 6 cases. A clinical improvement was seen in n=10 patients, in n=2 a deterioration was seen post-operatively and in n=2 new symptoms developed during their follow up from the other lesions. None of the haemangioblastomas that were removed recurred.

Conclusions. Total excision of spinal haemangioblastomas offers a good outcome with possible cure in cases of a single lesion. Patients with VHL present more commonly with multiple lesions and large syrinxes which pose a challenge to the surgical management.

Post-operative resection serum lactate levels are indicative of tumour type

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Objectives. High lactate levels are associated with inadequate tissue oxygen perfusion but are also frequently associated with a large tumour burden. Here we explore the use of serum lactate as a tumour biomarker following resection.


Subjects. 116 patients who had immediate post-operative care on the neurosurgical ICU following tumour resection were screened between April 2017-2018. Subjects were included if serum lactate levels, tumour neuropathological diagnosis, anaesthetic chart information and operative times were available.

Methods. 31 subjects met inclusion criteria. These included patients following resection of a vestibular schwannoma (10); meningioma (9); pituitary adenoma (7) and GBM (5). Single-point serum lactate levels were obtained from arterial blood gas analysis.
Results. No significant differences in lactate measurement time were found between groups and associated pH levels were all within the normal range. Lactate levels significantly differed (p<0.05) between tumour groups: vestibular schwannoma (mean lactate 3.0, SD 1.02), GBM (mean lactate 1.9, SD 0.79), meningioma (mean lactate 1.8, SD 0.63) and pituitary adenoma (mean lactate 1.2, SD 0.75).

Conclusions. Our results indicate for the first time, that post-operative serum lactate levels are associated with tumour type. Large-scale prospective work is now underway to assess the predictive value of the lactate profile: pre-, intra- and post-operatively and its correlation with tumour grade, type and prognosis.

P6

The use of 5-ALA fluorescence in excision of supratentorial endodermal cyst
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Objectives. The first documented use of 5-ALA in the excision of an intraparenchymal endodermal cyst.

Design. Case review

Subjects. 52 year old female presented with headaches, progressive right sided hemiparesis and anomic aphasia. She had a large cystic frontal lesion, adjacent of the frontal horn of the lateral ventricles cyst which did not show any nodular or solid component, and did not enhance with gadolinium.

Methods. Case report and review of the literature

Results. 5-ALA assisted, image guided fenestration of the cystic lesion and insertion of a ventricular catheter connected to an Ommaya reservoir was performed. The cyst wall was observed under the microscope and it fluoresced with 5-ALA. Multiple biopsies were obtained from this tissue, which confirmed diagnosis of endodermal cyst. The patient had improvement in clinical symptoms and size of the cyst radiologically in both the immediate post-operative period and the 6 months follow up.

Conclusions. Previous reports described the use of 5-ALA to identify tumour cells within the solid component of cystic haemangioblastomas as well as in cystic ependymomas where the cystic component does not fluoresce. In our patient, the homogeneous fluorescence of the wall suggested that this was indeed a different entity from a haemangioblastoma or an ependymoma because of the different pattern of fluorescence observed. 5-ALA-assisted resection of cystic lesions should be considered when a tumoral origin is uncertain.

P7

The three sisters
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Objectives. We present a case report of a family with an interesting constellation of neurological disorders across two generations.

Design. Retrospective analysis of three individuals referred to our service

Subjects. The cohort involved in this study is twin sisters and their younger sister, all presenting with Intracranial tumors, in addition to two of the sisters having children with severe neural tube defects. The subjects came into our service individually and were treated according to best practice with pre and post op imaging, biopsies for histopathology and genetic screening with standard follow up.

Results. The first sister presented with dizziness and a headache and was found to have a WHO grade I meningioma. Her twin sister presented with facial numbness and paralysis and was found to have a glomus jugulare paragangliogimoma. The third sister presented with dysarthria and memory loss and was found to have a Glioblastoma. Finally both of the twin sisters also gave birth to male children with severe neural tube defects, one of whom died at two weeks post partum and the other at seven months.

Conclusions. Through standard genetic and pathological investigations, in addition to a literature search, we have been unable to find a definitive link between the aforementioned cases. We hypothesise an as-yet undetermined genetic mechanism as the causative agent which may generate an interesting debate.

TRAUMA / TRAUMATIC BRAIN INJURY

P8

Sports-related traumatic brain injury in the Republic of Ireland


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Objectives. To evaluate the mechanisms of sports-related TBI referred to the National Neurosurgical Centre in Dublin and to analyse the characteristics of injuries.

Methods. Information on all referrals made to the National Neurosurgical Centre are stored electronically. We retrospectively analysed the electronic records of referrals made between July 2016 and December 2017, and identified cases referred with TBI related to sporting activities.

Results. Over the 18-month period, there were 117 (M:F=88:28) patients referred with head injuries, 34 (M:F=27:7) of whom were transferred to our acute neurosurgical unit. The mean age of the referred patients was 29.2 (18 for transferred patients). The mean GCS for both groups was 14. The most common recreational activity performed at time of injury was cycling (45 overall and 13 of patients transferred). Football (18:5), horse riding (10:5) and hurling(8:2) were also common. Of the patients transferred, 59% were observed, while 41% (n=14) underwent surgical intervention, with 1 patient requiring a decompressive craniectomy. Overall, the transferred patients had excellent outcomes, 94% were discharged with GCS of 15.

Conclusions. Sporting activities, ranging from contact team sports to individual activities, are common causes of traumatic brain injury with significant associated morbidity. 18% of transferred trauma cases to our unit was associated with recreational activities. This highlights the requisite for a national public healthcare policy in the Republic of Ireland.
Impact of the relocation of a regional neuroscience service on major trauma patients

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Objectives. Evaluating the impact of relocating a regional neuroscience service on major trauma patients.

Design. Retrospective analysis of prospectively collected data from 01/08/2013 to 31/07/2017.

Subjects. Patients ≥20 years with a TBI in the 2 years pre-relocation (cohort 1) and 2 years post-relocation (cohort 2).

Methods. Patients were identified using the TARN registry. Comparison of the cohorts for demographics, type of neurosurgical input, site of first presentation and the times to first CT head and operation was conducted using cross-tabulation, percentages and statistical analysis (SPSS).

Results. 30% of patients in cohort 1 (112 or 373) were admitted in neurosurgery. This increased to 40% of patients in cohort 2 (181 of 450). There was an increase in admissions for monitoring (70% vs 82%). Patients <60 years had a higher increment in admission (+16 points) than patients ≥60 years (+8 points). A strong association was found between the relocation of the neuroscience service and the increase in proportion of patients first transported to the major trauma centre (63% vs 74%; p=0.037). There was a significant decrease in the mean time to operation (3.9 h vs 2.0 h; p=0.008) and no significant difference in the mean time to first CT head (1.3 h vs 1.4 h; p=0.689).

Conclusions. The relocation of neurosurgery has resulted in a significant increase in admission of patients <60 years with TBI in neurosurgery for monitoring, an increase in the proportion of patients first transported to the MTC and a reduction in the time to operation.

Traumatic brain injury outcomes in older adults: is there an age-dependent cut off?

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Objectives. To assess the outcomes in patients >60 years with traumatic brain injury (TBI) and determine if there is an age cut-off for worse prognosis.

Design. Single centre retrospective study. Data collected as part of TrIBAL study.

Subjects. All patients with TBI admitted to our hospital over a 4-month period.

Methods. Patients were divided into 6 groups based on their age; group 0 included patients <60 years, 60≤Group1<65, 65≤Group2<70, 70≤Group3<75, 75≤Group4<80 and Group5>80. Data was collected on various factors that influence outcomes in TBI patients including presenting GCS, hypotension, hypoxia, antithrombotic therapy and Marshall CT score. Glasgow outcome score (GOS) at discharge from hospital was used. A multinomial logistic regression analysis was performed.
Results. Over the 4-month period 144 patients with TBI were admitted. There were no significant differences in baseline characteristics including presenting GCS and Marshall CT scores between the groups. The GOS at discharge was significantly worse only in Group 5 when Group 0 was considered as the base outcome (p< 0.001). Groups 1 to 5 had a significant increased number of patients on antithrombotic therapy when compared with Group 0 (p<0.05). The adjusted analysis for GOS at discharge revealed the use of antithrombotic therapy in Group 5 was the only factor that influenced outcome (p=0.014).

Conclusions. In this cohort, age >80 years was the cut off for worse prognosis. In this age group anticoagulation was the only factor we found that influenced outcome.

PI1

Which factors influence the decision to transfer patients with traumatic brain injury to a neurosurgery unit in a major trauma network?

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Objectives. To identify factors that influence the decision to transfer patients with traumatic brain injury (TBI) to a neurosurgical centre.

Design. Retrospective data collected as part of TrIBAL study.

Subjects. All patients with TBI referred to our neurosurgery unit from regional acute hospitals over a 4-month period.

Methods. Our primary outcome was transfer to a neurosurgical centre. We identified the following factors that may predict decision to transfer: patient demographics, transfer distance, anticoagulation therapy and severity of TBI (initial GCS and Marshall score). A multivariable logistic regression analysis was performed.

Results. A total of 347 patients were referred from regional hospitals with TBI and of these, 53 (15%) were transferred. The mean age of patients referred was 69.6 years, 62.5% were men and 43% on antiplatelets or anticoagulated. Similar number of patients were referred from hospitals within 30 miles (54%) and those more than 30miles away (46%). Eighty-four percent of patients had mild TBI (GCS 13-15) on initial assessment and 67% had a Marshall CT score of 2. After regression analysis, younger age, male gender and higher Marshall score predicted transfer to our neurosurgical centre (p<0.05).

Conclusions. Many patients with TBI have relatively “minor” injuries and remain at their local hospital. In our cohort higher Marshall score, younger age and male gender predicted transfer to a neurosurgical centre. Transfer distance, anticoagulation therapy and initial GCS did not influence decision to transfer.
Prognostic ability of the FOUR score assessment of consciousness: a systematic review

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Objectives. To determine the ability of FOUR score to predict outcome in adult patients with impaired consciousness.

Design. Systematic review

Subjects. Adult patients with impaired consciousness

Methods. A literature search was performed in CENTRAL, MEDLINE, EMBASE, Scopus, Web of Science, ClinicalTrials.gov and OpenGrey. Prospective observational studies which assessed consciousness using FOUR score and reported outcome in mortality or validated functional outcome scores were included. Consensus-based screening and quality appraisal were performed. Outcome prognostication was synthesized narratively.

Results. 345 studies were screened and 31 met the criteria for detailed review. There was significant heterogeneity in patient characteristics, time points of assessment and outcome, and characteristics of observer. Studies were methodologically strong (n=10), moderate (n=11), or weak (n=10). FOUR score showed good to excellent prognostication of in-hospital mortality in most studies (Area Under Curve, AUC, >0.80); good at predicting poor functional outcome (AUC 0.80-0.90). However, there was insufficient evidence to demonstrate that the brainstem and respiratory components that distinguish FOUR score from GCS improved prognostication.

Conclusions. FOUR score can predict in-hospital mortality and poor functional outcome, but more standardized studies are required to investigate whether FOUR score performs better than the Glasgow Coma Score, especially in intubated patients, for which it was designed.

PI3


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Objectives. To implement and assess a protocol to activate senior decision-makers at the earliest opportunity in response to time-critical neurotrauma, with the aim of expediting intervention when needed.

Methods. A multidisciplinary working group devised a standardized protocol for the rapid triage and escalation of critically unwell neurotrauma patients. A retrospective cohort study was carried out on all patients admitted to the Royal London Hospital from Jan 2014 to Dec 2016 with head injuries
requiring neurosurgical intervention and level three care within 24 hours. Case notes were identified retrospectively from Trauma and Audit Research Data.

**Results.** A time-critical neurotrauma emergency protocol termed Code Black (CB) was developed and implemented in July 2015. 114 patients were included with 64 patients in the CB cohort and 50 patients in the pre-CB cohort. Average age was 45 years in the CB group and 43 years in pre-CB. M:F ratio was 5:1 in both groups. Implementation of CB resulted in reduction of median time to scanner from 0.47 hours to 0.36 hours. Median time to theatre reduced from 1.3 to 1.0 hour. ITU length of stay was reduced by 4.5 days (p-value= 0.036). In both groups, patients with lower GCS reached CT scan and theatre significantly earlier (p-value= 0.016, 0.031 respectively).

**Conclusions.** Implementation of the “Code Black” protocol facilitates rapid transfer of patients from ED to CT scan and thereafter to theatre if indicated. This has resulted in significantly decreased ITU and hospital LOS.

**PI4**

**Management of traumatic skull base fractures and their complications – a seven-year experience**

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**Objectives.** We aim to present our experience of managing traumatic base of skull fractures and our outcomes.

**Design.** Retrospective case note review.

**Subjects.** All patients in our trauma database with radiographic evidence of a skull base fracture from January 2010 to June 2017.

**Methods.** Skull base fractures were classified according to their anatomical location. Evidence of vascular injury, CSF leak or cranial nerve injury were recorded. The mechanism of injury, length of follow up, interventions and outcomes were documented.

**Results.** 872 cases had a skull base fracture diagnosed by head CT scan, of which 760 had sufficient radiological and clinic data to analyse. 79.4% of the cohort were male, with a mean age of 43 years. Median length of stay was 8 days and median length of follow up was 114 days. 40.1% were lost to follow up. The mortality rate was 14.9%. Injuries predominantly affected the middle cranial fossa. Vascular injury was the commonest complication (N = 87), followed by CSF leak (N = 38). 28 patients sustained injury to the facial nerve. Complications were managed conservatively in most cases.

**Conclusions.** There is little reported literature on the long term outcomes of patients who sustain CSF leak, vascular injury or cranial nerve deficit following a base of skull fracture. In our experience, many of these patients are lost to follow up and indeed, the nature of this study is limited by it’s retrospective nature. Further prospective work must be done in this patient group to better understand the history of these patients.
PI5

Resuming antiplatelet and anticoagulant therapy following isolated traumatic brain injury in adults: a national survey and review of literature

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Objectives. Antithrombotics use in the elderly is widespread and is seen as a risk factor for intracranial complications following TBI. Antithrombotics are commonly discontinued on admission, with little guidance on when or how to restart them. This study aims to establish current national practices with restarting antithrombotic medications following TBI and review available evidence identifying areas for further research.

Design. An online survey and a literature review.

Subjects. SBNS members.

Methods. A SBNS Academic Committee approved survey with five TBI scenarios dealing with different antithrombotics. Respondents were asked to indicate when they would restart the medications for each scenario and what drives their decision.

Results. Preliminary results included responses from 22 consultants. The most common practice was to restart antithrombotics after two weeks; however, less than 50% agreed on each individual option. About 50% had the same approach to everything and 1/3 believed single antiplatelet can be resumed earlier than dual antiplatelets. Other deciding factors included size of intracranial bleed, patient’s neurological recovery, and follow up imaging. Some advocated involving the physicians. Final results following a repeat dissemination of the survey will be presented at the meeting.

Conclusions. There is obvious discrepancy in how the problem of restarting antithrombotics following TBI is approached nationally. Further research is needed to help decision making with this everyday clinical problem.

PI6

Relation of timing of surgery to outcome from traumatic acute subdural haematoma

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Objectives. Acute subdural haemorrhage (ASDH) is a neurosurgical emergency with high mortality and morbidity rates. Time to surgical intervention is implicated as an important factor affecting patient outcomes, however, more recent studies do not support this. We aimed to determine the correlation between time interval to surgery and outcome of patients with traumatic ASDH.

Methods. We retrospectively reviewed consecutive ASDH patients who underwent haematoma evacuation in the period between 2010 and 2016 at this tertiary neurosurgical centre. 49 patients were included for the analysis. Patient data was extracted from theatre records, patient notes and electronic records.
**Results.** The median time interval from injury to surgery was 403 minutes (6 hours 43 minutes) with road traffic accident being the commonest mechanism of injury. 20 of 49 (34.7%) patients underwent evacuation within five hours from time of injury. Of these, 12 (41.4%) had good recovery (GOS 5), versus 15 (51.7%) amongst the 29 patients who underwent operation after five hours. Spearman rank correlation test (rs =0.07375) showed no statistically significant correlation between time interval to surgery and patient outcomes as measured by GOS. The overall mortality rate of evacuated patients at JCUH was 8.16% and the majority had good functional status, 55.1% with GOS 5.

**Conclusions.** Longer time interval of more than four hours from injury to surgical intervention was not associated with higher mortality rate, or worse functional outcome.

PI7

**Evaluation of New Orleans criteria for cranial CT scan in mild traumatic brain injury at an emergency trauma unit of a developing country**

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National Hospital Abuja, Abuja, Nigeria

**Objectives.** To assess compliance to New Orleans Criteria for cranial CT scan and its predictive value for intracranial pathology in mild TBI

**Design.** A retrospective review

**Subjects.** All patients with mild traumatic brain injury presenting at the emergency unit of a National Trauma Centre of a Developing Country over 24 months

**Methods.** Patients information were retrieved from medical record and entered into SPSS spreadsheet. The New Orleans Criteria (NOC) was used to determine indications for brain CT scan. Compliance to the criteria was determined. The CT scan findings were evaluated in all patients that had scan and the findings were compared between those met NOC and those who did not

**Results.** One-hundred and eighteen patients were studied. Majority were males 92 (82%) with mean age of 27 year. Most injuries (66.9%) resulted from road traffic crashes. Among 65 (55.1%) patients who met NOC only 41 (63.1%) had CT scan while 25 (47.2%) patients who did not had CT giving a compliance rate of 58.5%. Twenty three (56.1%) patients who met NOC had abnormal CT compared to 9 (36%) patients that did not. The most common abnormal CT findings in both groups were skull vault fractures (9 for NOC group and 2 for non NOC group) Only two patients had surgical intervention and both met NOC criteria.

**Conclusions.** The compliance for NOC guideline was below average in our Centre. NOC guideline is useful in predicting abnormal CT findings. There is a need for continuous education of emergency physicians to ensure optimal CT scan utilisation in mild TBI.

PI8

**The role of decompressive craniectomy for traumatic brain injury: should we be leaving the lid off?**

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Objectives. The RESCUEicp study has not culminated in consensus about the role of decompressive craniectomy following head injury. Another study (RESCUE-ASDH) also questions craniectomy for patients with ASDH. We examined our own practice over 5 years.

Design. Retrospective analysis at a single UK unit. Comparison of outcomes with RESCUEicp results and national data obtained from the Neurosurgical National Audit Programme (NNAP).

Subjects. 82 patients over 5 years. 87% male. 90% adults (age >16).

Methods. Local data: demographics, CT features, pre-op GCS/pupil reaction/ICP, primary/secondary craniectomy, operative timings, length of stay (critical care/overall), Extended Glasgow Outcome Scores, discharge location. NNAP data analysis.

Results. 43% had ASDH with MLS >5mm (91% primary decompression). Median time to primary surgery from referral 1h37. 11 primary, 6 secondary decompressions/year; no change over 5 years. 3 extensions of craniectomy, 3 had previous craniotomy converted. 30-day mortality 28%. Overall GOS-E: death 33%, lower severe disability 6%, upper severe disability 6%, moderate disability 16%, good recovery 37% (improved by better presentation GCS). 75% had cranioplasty. Median length of stay 41 days.

Conclusions. Our practice has not changed over time, despite RESCUEicp. Good outcomes observed may be due to local specialist management of these patients, or reflect judicious case selection. Case-by-case decisions are crucial and may explain why large trials fail to change real-world management strategies. NNAP data comparison ongoing.

PI9 withdrawn

P20

Parental understanding of concussion in youth rugby is significantly improved by viewing the RFU concussion education video

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Objectives. To investigate the current understanding parents have of concussion in their rugby-playing children aged 9-17.

Design. Cross-sectional study.

Subjects. 86 parents from four clubs completed an online questionnaire.

Methods. Areas covered (1) Parental experience of concussion (2) Rate of viewing of the RFU concussion educational video (RFUCEV), (3) Identification of symptoms of concussion (4) Understanding of the risk of concussion. Each participant was given a composite score, out of 19, based on their performance in symptom identification and true/false questions. Independent-sample two-tailed t-tests were conducted to analyse scores, primarily controlling for viewing of the RFUCEV.

Results. There was a significant difference in the scores between the group that had viewed the RFUCEV (n=32, M=14.75, SD=2.55) and those who had not (n=54, M=13.05, SD=2.87); t(84)=2.75, p=0.00721. Additionally, over 25% of parents reported that their child had suffered a concussion, and this was also found to significantly improve the awareness score (p=0.04678).
Conclusions. Statistically significant improvement in composite scores after viewing the RFUCEV makes it reasonable to require compulsory parental education prior to signing up a child to play rugby. This would build on the protocol changes made by the RFU in 2014 and further progress the safety of the sport. We suggest the video be improved to emphasise the areas highlighted as inadequately understood, including the increased risk of concussion in under-18s compared to adults.

P21
withdrawn

P22
Phenytoin versus levetiracetam for post traumatic brain injury seizure prophylaxis; a retrospective study at a UK major trauma centre

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Objectives. 12% of patients with severe Traumatic brain injury (TBI) suffer from seizures. Evidence suggests that the use of an antiepileptic drug (AED) is beneficial in preventing early post TBI seizures. To date, no specific NICE guidelines exist on the choice of post TBI seizure prophylaxis. This study aims to identify the trend in AED usage, the impact on length of stay and to compare the tolerability of phenytoin and levetiracetam.

Design. Retrospective observational study.

Subjects. 201 patients.

Methods. All patients admitted to a Major Trauma Unit following a head injury treated with levetiracetam or phenytoin for seizure prophylaxis were included in the study. Data was collected between October 2013 - September 2014 and November 2016 - October 2017. Patient demographics, Glasgow Coma Score (GCS) on admission, length of treatment, AED toxicity, length of stay, complications, surgical input and length of ITU stay were recorded.

Results. 85.6% of patients were treated with phenytoin in 2013-2014 and 82.5% were treated with levetiracetam in 2016-2017. The average length of stay for phenytoin was 23.2 days and 13.9 days for levetiracetam. Subgroup analysis was performed on patients with an admission GCS of 14 -15. Length of stay for phenytoin was 14.9 days (SD -11.87) and levetiracetam 9.4 days (SD 10.588) (p=0.07). 24% of patients on phenytoin and 14% on levetiracetam suffered from dizziness.

Conclusions. This suggests that levetiracetam is tolerated better with fewer side effects. We recommend its use in clinical practice.

BASIC SCIENCE / FUNCTIONAL

P23
Investigating synaptopathy following traumatic brain injury in a preclinical model

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Objectives. The impact of Traumatic Brain Injury (TBI) on the synapse is poorly understood. We examined the impact of TBI on the distribution of two postsynaptic density proteins (PSD95 and SAP102) at single-synapse resolution.

Subjects. 44 male transgenic knock-in mice, aged 8-16 weeks, expressing fluorescently labelled PSD95 and SAP102.

Methods. Mice were randomised to a mild lateral fluid percussion injury (LFPI) or sham treatment and brain sections were examined at 7 and 28 days. Using high resolution confocal microscopy and machine learning algorithms, the synaptic puncta density, size and intensity were mapped across 222 brain regions. Microglia and presynaptic changes were indexed using Iba1 and SV2A immunostaining. Pearson correlation and t-tests were used (significance p<0.05).

Results. We found a significant reduction in synaptic puncta density at 28 days post-injury in brain regions distal to the injury site including the hippocampus. PSD95 and SAP102 density changes had a strong positive correlation at 28 days (r=0.8; p<0.0001). We also observed evidence of synapse recovery in the ipsilateral cortex between 7 and 28 days. Puncta density had a positive correlation with SV2A (r=0.7; p<0.01) and a negative correlation with (r=-0.6; p<0.001) Iba1 count.

Conclusions. Focal LFPI induced progressive region-specific loss of synapses for which microglia may play a role. Our study highlights the value of brain-wide synaptome mapping technology and suggests a capacity for synaptic recovery which could be a therapeutic target.

P24 withdrawn

P25

Hydrogel systems to enhance the delivery of cell therapy for traumatic spinal cord injury

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Objectives. Cell therapies are an emerging therapeutic approach for spinal cord injury. We assessed the survival and phenotype of olfactory ensheathing cells (OECs) in hydrogel delivery systems suitable for clinical use.

Design. Laboratory study.

Methods. Cell survival in different formulations of collagen and fibrin hydrogels was assessed using Syto 9 and propidium iodide. The proportion of cells staining positive for a key repair marker (p75NTR) was also quantified using immunocytochemistry and fluorescence microscopy.

Results. There were significant differences in OEC survival between the various collagen and fibrin hydrogel formulations tested (p<0.001 one-way ANOVA, n=17). 10% v/v fibrin conferred the best cell survival with 85% of OECs remaining alive. Incorporating OECs into collagen hydrogels promoted the highest proportion of p75NTR immunopositive cells (78%) and this was significantly higher than both
fibrin hydrogels and traditional monolayer culture (53% and 20%, respectively, p<0.0001 one-way ANOVA, n=24).

Conclusions. Collagen and fibrin hydrogels both have the potential to enhance the delivery, survival and retention of transplanted OECs for spinal cord repair. Both materials are clinically scalable, promote favourable OEC survival and have the potential to increase the proportion of cells expressing a key repair marker (p75NTR). Optimised hydrogel delivery systems may provide a valuable approach to improve the delivery of OECs for spinal cord repair in the future.

P26

Bridging the gap – benefits of neurosurgical tissue for pre-clinical research

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Objectives. The use of primary human neural tissue for research provides an invaluable insight into human neural function that cannot be achieved in any other way. Despite this it is successfully collected and used in only a small minority of units. We have established a collaboration between Neurosurgical Unit and the University that allows us to study using human tissue resected during neurosurgery. Tissue is most commonly collected from oncological, epilepsy and vascular operations. Here we share our experiences of the practicalities and try to provide some insights for practicing neurosurgeons.

Subjects. We discuss the practical difficulties of the co-ordination of the clinical and academic teams, and challenge of optimization of the tissue for the research. We will present the mechanisms in place to optimize the study of human neural tissue. We will review the progression from resection of limited tissue to any neurosurgical procedure in which the normal brain is resected and tissue discarded. We discuss the different models that can be used and the application locally to glioma stem cells, pathways activated in TBI and the electrophysiology of the normal brain.

Conclusions. We will present examples of the value of human tissue studies, including electrophysiological differences between humans and rodent that could only be investigated through the use of live human tissue. We will also demonstrate how we have moved to streamline tissue collection and propose a move to establish a national framework.

P27

Management of neurosurgical site infection

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Objectives. To review the management of surgical site infection (SSI) in a large regional neurosciences unit.

Design. A prospective cohort study with data collected over 23 months from June 2016 until April 2018.

Subjects. Patients with confirmed SSI. External ventricular drain and shunt patients were excluded.
Methods. Neurosurgical patients with confirmed SSI were entered into the database and their further management was reviewed.

Results. 57 patients were identified in total. 40 (70%) of these patients required further surgery to treat the infection. 23 out of 28 patients (82%) with identified cranial SSI required further surgery. Of these, 13 (47%) had wound washout only, 7 (25%) had removal of bone flap and 3 (11%) had removal of titanium cranioplasty. 17 out of 29 patients (59%) with identified spinal SSI required further surgery. Here the revisional surgery was uniform: wound washout and re-closure. 1 of these patients required 2 washouts. All patients received prophylactic antibiotics at the time of initial surgery. All patients with confirmed cranial SSI were prescribed a course of antibiotics. 26 of the 29 spinal SSI received a course of antibiotics. Thus, 3 patients in the spinal cohort did not receive antibiotics after repeat surgery.

Conclusions. Confirmed SSI in neurosurgical patients frequently requires further surgery (70%). Cranial SSI is more likely to require repeat surgery than spinal SSI (82% v 59%). The vast majority of patients in the combined cohort required treatment with antibiotics following revisional surgery.

P28

Surgical site infections – what's bugging us?

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Objectives. To analyse the incidence of cranial and spinal surgical site infections and the causative organisms.

Design. A prospective cohort study with data collected over 23 months from June 2016 until April 2018.

Subjects. All patients undergoing neurosurgical procedures were under surveillance for surgical site infection. External ventricular drain and shunt patients were excluded.

Methods. Surgical site infection was defined in two ways: (1) Organism grown on culture (2) Definite pus at the site of surgery seen by a neurosurgeon. Confirmed cases were entered into the database and analysed

Results. 4100 procedures were performed during the study period. 57 patients had confirmed post-operative infection (29 spinal and 28 cranial cases). Staphylococcus Aureus was the causative organism in 20 cases (71%) of post-operative cranial infection compared to 17 cases (59%) of spinal infection. In 6 cases (21%) of the spinal cohort, definite pus was seen but no causative organism was identified. This only applied to 1 case (4%) in the cranial cohort. In spinal procedures the next most common organisms were Group B Streptococcus, Escherichia Coli and Staphylococcus Epidermidis with 2 cases (7%) of each. In cranial procedures Propionibacterium Acnes and Escherichia Coli were the next most frequent organisms with 2 cases (7%) of each.

Conclusions. The overall infection rates for surgery in our unit was 1.4%. Staphylococcus Aureus was the most frequent causative organism in both categories. This supports the current antibiotic prophylaxis policy
Dissection using pulsed radiofrequency energy device (PlasmaBlade) is safe round implanted neuromodulation hardwares


Queens Medical Centre, Nottingham, UK

Objectives. To assess risk of damage to implanted neuromodulation hardware's during dissection using the pulsed radiofrequency energy device (PlasmaBlade) in a simulated setting.

Design. Simulated experiment.

Methods. A simulated setting with fresh chicken breast threaded with different hardwires and PlasmaBlade in three configurations. Multiple substrates (wires), operators and observations were used representing typical hardware encountered in a functional neurosurgery service. Post dissection, the wires are inspected naked eye and under operating microscope. Induced current was assessed contemporaneously. A simple risk of physical and physiological damage is estimated.

Results. Five surgeons, of various grades, tested the PlasmaBlade at different CUT and COAG settings. Sixty dissections were undertaken. There was no structural damage and no induced current identified when PlasmaBlade was used at manufacturer recommended settings. At higher settings than would normally be used (CUT 6, COAG 5), there was opacification of insulation material of some wires (in 15 of 20 dissections; 75%), There was no dissolution of insulation even at this setting. Surgeons appreciated visibly lesser collateral damage to tissue and lesser smoke in the operative field using PlasmaBlade compared to conventional diathermy.

Conclusions. When used at recommended settings, PlasmaBlade dissection did not cause any damage to implant wiring or tubing in this simulated setting. This report seeks to add to clinical data suggesting PlasmaBlade dissection is safe for dissection around DBS, SCS, VNS, ITB hardware.

A PRISMA systematic review and meta-analysis of open and novel 'minimally invasive' techniques for mesial temporal lobe epilepsy (MTLE)

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Objectives. One third of patients with focal epilepsy fail to achieve seizure freedom despite best medical therapy. Surgery may provide seizure freedom if the epileptogenic zone can be safely removed. We compare the outcomes following open surgery, laser interstitial thermal therapy (LITT), radiofrequency ablation (RFA) and radiosurgery (RS).

Design. PRISMA systematic review and meta-analysis

Subjects. MTLE
**Methods.** Structured searches of PubMed, Embase and Cochrane databases. Random effects meta-analysis to calculate effects sizes and a pooled estimate of the probability of remaining seizure free at one year following intervention.

**Results.** From 1212 screened publications, 57 articles were included in the quantitative analysis. Open surgery included anterior temporal lobectomy as well as transcortical, subtemporal and transsylvian selective amygdalohippocampectomy. The probability of remaining seizure free at one year was 0.89 (95% CI 0.83-0.93) with open surgery based on Level 1 and 2 evidence. RS resulted in 0.88 (95% CI 0.84-0.90) probability and a single RCT revealed RS was less efficacious than open surgery. Follow up duration and study sizes were limited with LITT and RFA providing a probability of remaining seizure free at one year of 0.71 (95% CI 0.65-0.76) and 0.86 (95% CI 0.76-0.92) respectively.

**Conclusions.** There is no evidence supporting novel ‘minimally invasive’ approaches as being as efficacious as open surgery. Secondary outcome measures such as neuropsychological outcome and intervention morbidity are poorly reported.

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P3I

**Optimising trajectories in computer assisted planning for cranial laser interstitial thermal therapy: a machine learning approach**

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**Objectives.** Optimal trajectory planning for cranial laser interstitial thermal therapy (cLITT) in drug resistant focal mesial temporal lobe epilepsy (MTLE)

**Design.** A composite ablation score of ablated AHC minus ablated PHG volumes were calculated and normalised. Random forest and linear regression were implemented to predict composite ablation scores and determine the optimal entry and target point combinations to maximize this.

**Subjects.** Ten patients with hippocampal sclerosis were included.

**Methods.** Computer Assisted Planning (CAP) cLITT trajectories were generated using entry regions that include the inferior occipital gyri (IOG), middle occipital gyri (MOG), inferior temporal gyri (ITG) and middle temporal gyri (MTG). Target points were varied by sequential erosions and transformations of the centroid of the amygdala. In total 760 trajectory combinations were generated per patient and ablation volumes were calculated based on a conservative 15 mm maximum ablation diameter.

**Results.** Linear regression was superior to random forest predictions. Linear regression indicated that maximal composite ablation scores were associated with entry points that clustered around the junction of the IOG, MOG and MTG. The optimal target point was a translation of the centroid of the amygdala anteriorly and medially.
Conclusions. Machine learning techniques accurately predict composite ablation scores with linear regression outperforming the random forest approach. Optimal CAP entry points for cLITT maximize ablation of the AHC and spare the PHG.

P32

Targeting accuracy of the neuromate robot in DBS implantation for paediatric dystonia

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Objectives. To quantify the accuracy of DBS electrode implantation for movement disorder in paediatric patients utilising the neuroinspire™ software and neuromate® robot.

Design. Retrospective, single-centre, cohort study.

Subjects. Fifteen patients with dystonia (67% female; median age 11 years, range 8 – 18 years) underwent intervention since May 2017.

Methods. DBS procedures were planned on the neuroinspire™ software and electrodes were implanted using the Renishaw neuromate® robot and Renishaw guide tubes and secured with a dog-bone plate under general anaesthetic. Post-operative CT imaging with the intra-operative O-arm was fused to pre-operative imaging. Planned entry and target coordinates were compared to actual entry and final target coordinates in order to obtain absolute and directional errors in x (medial-lateral), y (anterior-posterior) and z (dorsal-ventral) planes. Euclidean error was calculated for each electrode. Wilcoxon signed-rank test was used to analyse error.

Results. Bilateral GPi were targeted and Medtronic DBS systems were implanted for each patient (n = 30). Overall median Euclidean error for electrode implantation was 2.13 mm (range, 0.71 – 4.85; P < 0.001). No discrepancy between left- and right-sided electrodes was seen (P = 0.346). Absolute errors in x (med 1.25 mm, range 0.10-4.10), y (med 0.80 mm, range 0-2.70) and z (med 1.45 mm, range 0-3.90) planes were individually significant (P < 0.001). On overall anterior displacement of leads was observed (med 0.55 + 0.85 mm, P = 0.001) but there was no significant directional bias in x (P = 0.219) or z (P = 0.077) planes.

Conclusions. We observed an improvement in the discrepancy seen between planned and actual lead location compared to a previously reported series using the Leksell frame in a similar cohort. Addressing possible compounding factors such as drilling techniques and electrode fixation should increase accuracy further. The neuromate® Robot is a reliable and accurate alternative to the Leksell frame.

P33

On lambs, DBS, and diathermy

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Objectives. Over 150,000 patients have been treated with deep brain stimulation (DBS), but some aspects of their ongoing management are poorly defined. Guidelines for the use of electrocautery in patients undergoing further surgery are vague, suggesting the use of bipolar cautery only. However
there is likely to be a safe limit for the use of monopolar electrocautery, a useful if not necessary adjunct for most surgeons. Establishing this would be valuable.

**Design.** Literature review, correspondence with equipment representatives, and animal cadaveric model

**Methods.** PubMed, the Cochrane Database, and Google Scholar were used for the literature review. Technical team advisers were approached for DBS systems and electrocautery devices. A commercially available freshly slaughtered lamb was prepared in a room with constant ambient temperature. A DBS system was implanted in tandem with a thermocouple at depths and distances matching patient practice. Monopolar electrocautery was employed in coagulation and cutting modes at set distances and levels with constant temperature recording. The implant site was examined microscopically post procedure.

**Results.** The current "ban" on monopolar use appears to be extrapolated from the use of medical diathermy, a very different modality. At no point did the implant site temperature rise more than 2.4 °C. Microscopic analysis post procedure revealed no thermal damage.

**Conclusions.** Electrocautery in the context of DBS is safer than previously thought

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**P34**

**Radiofrequency thalamotomy for tremor - correlating heating parameters to lesion size and comparison to gamma knife and ultrasound.**

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**Subjects.** Patients with tremor dominant movement disorders have excellent and sustained results when treated with radiofrequency thalamotomy.

**Results.** We present the results of four patients who underwent thalamotomies for tremor performed by a single surgeon at a single centre during an eight-month period. Three patients had Parkinson’s disease and one patient had essential tremor. We correlate lesion size on post-operative MRI with radiofrequency heating parameters (temperature and time) using Brainlab Elements fibre tracking and volume of tissue activation software. We also evaluate MRI changes in lesion size and connectivity from 2-4 weeks after surgery to six months follow-up using T1, T2, FLAIR, FGATIR, DWI and DTI imaging. We present the indications, outcome and complications and discuss the results with a literature review and comparison with Gamma Knife and ultrasound and contextualisation with regard to deep brain stimulation.

**P35**

**Ability to quantify stereoelectroencephalography (SEEG) electrode trajectory proximity to vessels across imaging protocols**

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Objectives. Automated planning of stereoelectroencephalography (SEEG) electrode trajectories is dependent on vessel segmentation [1]. We quantify imaging protocols ability to measure trajectory-to-vessel distance.

Design. Retrospective analysis.

Subjects. Ten consecutive patients were selected whom had SEEG implantation (95 electrodes) and Digital Catheter Subtraction Angiography (DSA) with catheterization of carotid or vertebral arteries, post-gadolinium T1-weighted (GAD), phase-contrast MR angiography and MR venography (MR) acquired.

Methods. SEEG trajectories were planned manually with DSA. Minimum distance to vessels and risk [1] were computed for each trajectory using vessel segmentation from GAD, MR, or DSA. Vessel size was considered by including DSA vessels diameters above 1, 2, 3, or 4 mm.

Results. Minimum distance to a vessel was 6.2±3.9 mm (GAD), 2.5±1.6 mm (MR), and 1.5±1.2 mm (DSA). Based on DSA vessel size minimum distances were 2.0±1.5 mm (DSA>1 mm), 3.4±2.6 (DSA>2 mm), 6.6±4.6 mm (DSA>3 mm), and 11.8±7.9 mm (DSA>4 mm). Risk was 0.4±0.4 (GAD), 0.8±0.4 (MR), and 1.1±0.2 (all DSA), 1.0±0.2 (DSA>1 mm), 0.7±0.4 (DSA>2 mm), 0.4±0.5 (DSA>3 mm), and 0.2±0.3 (DSA>4 mm).

Conclusions. DSA is best able to segment vessels. MR has metrics similar to DSA vessels above 2 mm. GAD has metrics similar to DSA vessels above 3 mm.

P36

A 1 and 5 Year outcome analysis of epilepsy surgery in adults and children

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Objectives. To evaluate the efficacy of epilepsy surgery at 1 year following surgery and to assess sustainability of seizure control at 5 years post-surgery. To find prognostic factors for good surgical outcomes.

Design. Retrospective case notes analysis

Subjects. 82 consecutive patients operated on for epilepsy by a single surgeon between 2008-2013

Methods. Patients were identified in pre-existing hospital databases and included if 5 year follow-up was available. Their clinical records were accessed via the electronic patient records system at each site. The Engel Classification was used to grade seizure outcome at years 1 and 5 post-surgery. We classified Engel Class I and II as a good outcome and Engel class III and IV as a poor outcome. Case notes were also examined to find prognostic factors for a good long-term surgical outcome.

Results. 86.4% of patients had a good outcome 1 year post-surgery and 77.9% had a good outcome at 5 years. The surgery site (temporal or otherwise) and the presence of a good outcome at year one
were found to contribute significantly to odds of a good outcome at year 5. The ability to wean off medication is also commonly an important factor for patients and 24.4% of patients were AED free at 5 years.

**Conclusions.** Surgery is an effective management option for intractable epilepsy in suitably selected patients with complete or near complete seizure cessation in about 80% of the patients and about a quarter of the patients no longer requiring AEDs.

**SKULLBASE**

**P37**

**Do all notochordal lesions require proton beam radiotherapy? A case series of ecchordosis physaliphora**

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**Objectives.** Ecchordosis physaliphora (EP) is a benign, usually asymptomatic, notochord tumour but may also present with a spontaneous CSF fistula. Differentiating EP from its more aggressive counterpart, chordoma is challenging but important as the clinical course and management differ significantly, with the latter requiring proton beam radiotherapy. This case series aims to further inform this discussion.

**Design.** Case series.

**Subjects.** Patients with suspected EP from 2015-2018.

**Methods.** Retrospective analysis.

**Results.** Six patients were identified. Four presented with suspected CSF leak. MRI revealed a T1-hypointense and T2-hyperintense clival lesion without enhancement. CT showed pneumocephalus, a clival defect and no mass lesion. All underwent endoscopic endonasal repair of CSF fistula with biopsy. Histology revealed physaliphorous cells with no mitoses; immunohistochemistry confirmed notochord origin (EMA, S100, CD10 and/or MNF116) and low proliferation index. In 2 patients, EP was found incidentally on imaging and these lesions have remained static on follow-up.

**Conclusions.** In the absence of a clival mass, notochord remnant lesions with benign histopathology can be treated as EP and patients can avoid radiotherapy. The diagnosis of EP, however, remains challenging as no distinctive histopathological marker exists to differentiate it from chordoma and until a genetic or immunohistochemical marker is identified, the diagnosis rests solely on the presence or absence of a mass on imaging.

**P38**

**Informed consent for patients undergoing transsphenoidal excision of pituitary adenoma: Development and evaluation of a procedure-specific online educational resource**

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**Objectives.** Recent high-profile cases now require doctors to take “reasonable care to ensure that the patient is aware of any material risks involved in any recommended treatment, and of any reasonable alternative or variant treatments.” To this end, we report the development and evaluation of a procedure-specific online educational resource to support the informed consent process for patients undergoing transsphenoidal excision of pituitary adenoma.

**Methods.** An interactive educational multimedia website was developed using a combination of text, images, and videos. A telephone questionnaire was devised to evaluate patient understanding that included 15 True/False questions, and administered to separate cohorts of patients on the waiting list for surgery, before and after introduction of the website. Patients were also asked to rate the extent to which they found the website easy to understand and useful on a Likert scale. Data were compared using the Chi-square with a value of p<0.05 considered significant.

**Results.** In all, ten consecutive patients completed the questionnaire before the introduction of the website, and nine afterwards. The median questionnaire scores were significantly greater after introduction of the website (14 v 12/15; p=0.002) and all patients subjectively found the website easy to understand and useful (10/10 in both cases).

**Conclusions.** An interactive educational multimedia website appears to be a helpful adjunct to the informed consent process for patients undergoing transsphenoidal surgery.

**P39**

**Sphenoid sinus mucosal thickening in pituitary apoplexy: a link to abnormal microbiota**

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**Objectives.** Sphenoid sinus mucosal thickening (SSMT) is described in small preliminary studies in the setting of pituitary apoplexy (PA). The aim of this study was to explore the possible association between PA and SSMT, and the microbial profile of SSMT.

**Design.** Single-centre case notes and tissue samples review (2007-16).

**Subjects.** PA group: radiological/histologically confirmed PA; control group: non-functioning pituitary adenomas (NFPAs).

**Methods.** SSMT was measured on presenting MRI scans (pathological >1mm). Forward stepwise logistic regression was used to identify factors associated with SSMT. Sphenoid sinus mucosal specimens were microbiologically profiled by PCR in a subset.

**Results.** Imaging arm: 50 NFPA and 47 PA patients included. In multivariate analysis of both the PA and NFPA groups, the presence of PA was the only factor associated with SSMT (OR=0.043, 95% CI 0.012-0.16; p<0.001). In multivariate analysis of the PA group alone, a shorter time from symptom onset to presenting MRI scan (OR=0.12, 95% CI 0.026-0.54; p=0.006) and more severe grade of apoplexy (OR=7.29, 95% CI 1.10-48.40; p = 0.04), were associated with SSMT. Microbiological arm: 5 PA and 5 NFPA patients included. PA patients harboured microbiota similar to that seen in sinusitis, unlike NFPA patients.
Conclusions. SSMT is associated with PA, especially during the acute phase. SSMT is also associated with microbiota seen in sinusitis. Our results require further validation.

P40

CNS involvement in IgG4 related disease, a new diagnostic challenge

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Objectives. Central nervous system (CNS) involvement in IgG4-related disease (IgG4-RD) is a relatively recent discovery, first reported in 2006. The disease can present a diagnostic challenge, as the clinical and neurological findings can mimic multiple oncological and inflammatory conditions. Here, we review our experience of IgG4-RD.

Design. A retrospective study of patients presenting to our centre between 2013 to 2018.

Subjects. All patients with a histopathologically-confirmed diagnosis of IgG4-RD.

Methods. Review of our centre’s neuropathology database

Results. We identified 10 patients (5 males and 5 females, age range: 26 – 73 years) with a histopathological diagnosis of IgG4-RD. Median follow-up from diagnosis was 36 months. All patients presented with CNS manifestation of IgG4-RD, and none had any manifestations of the disease. Two patients presented with cranial or peripheral nerve involvement and seizures, and the remaining 8 with clinical evidence of hypophysitis. All had biochemical evidence of panhypopituitarism at the time of presentation, and none had visual impairment. All patients underwent biopsy / debulking), and five were subsequently treated with steroids / immunosuppressants. At last follow-up, all were alive

Conclusions. IgG4-RD is a rare cause of neurological and endocrine dysfunction, and requires individualised management. Once confirmation of the diagnosis has been obtained, some patients can be managed conservatively, although some require treatment with steroids and immunosuppressants, for example rituximab

P41

Endoscopy in cerebellopontine angle lesions: feasibility and technical considerations.

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Objectives. To define selection criteria and describe technique nuances for the use of endoscopy in surgery for cerebello-pontine angle (CPA) lesions.

Design. Prospective observational study.

Subjects. Patients undergoing CPA lesion resection were selected for endoscope-assisted and/or endoscope-guided lesion resection.
Methods. CPA interventions without mass lesions were excluded. 10 CPA lesions were identified pre-operatively for intra-operative endoscopic use across two neurosurgical centres. We describe equipment and technique selection.

Results. 10 cases were selected over a one year period. Histology revealed 3 vestibular schwannomas (VS) (30%), 1 cyst (10%), 3 epidermoids (30%), 3 meningiomata (30%). Three cases were planned and carried out fully endoscopically (including two VS and the cyst) based on patient factors and favourable anatomy. Four cases were carried out with endoscopic assistance. The endoscope was used in three cases for anatomical orientation “around the corner” only. Techniques and equipment vary depending on surgical aims, surgical anatomy and working area. Tips and pitfalls are identified and described.

Conclusions. Endoscopy can be applied safely in CPA pathologies, as an alternative to the operating microscope for highly selected cases, or as an adjunct for specific surgical steps, especially when microscope optics do not allow angled visualisation. It is particularly useful in identifying lesion residuum and “working around the corner”. High level training is required before applying endoscopy to the CPA.

P42
Predicting bleeding risk during meningioma surgery
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Objectives. Surgical treatment of meningioma is frequently accompanied by significant intraoperative blood loss and the associated risks of blood transfusion. Surgical adjuncts such as pre-operative embolisation and the use of tranexamic acid have attendant risks. An ability to estimate blood loss can appropriately target these interventions.

Design. Retrospective study

Subjects. Patients following surgery for meningioma between 2015-2018

Methods. Intraoperative blood loss, pre- to post-operative haemoglobin difference and blood transfusion were evaluated. Pre-operative imaging included size, shape and location of meningioma, involvement of sinuses and blood vessels, T1 and T2 weighted characteristics, restricted diffusion, peritumoral oedema, dural tail and hyperostosis. Multivariate analysis was used to determine the relationship between meningioma characteristics and blood loss.

Results. Tumour diameter and venous sinus opening were significantly related to blood loss on multivariate analysis (p=0.004 and p=0.001 respectively). Furthermore, on univariate analysis additional factors included procedure duration (p<0.0001), pre-operative radiotherapy (p=0.042) and pre-operative platelet count (p=0.03).

Conclusions. Only size of tumour and opening venous sinuses was related to intraoperative blood loss in this cohort of patients. Further research is required to define tumour characteristics that can be used to identify patients suitable for pre- and intra-operative adjunct therapies.
Parasellar capillary haemangioma with intrasellar extension

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Objectives. Capillary haemangioma is a benign vascular tumour that typically arises from skin and mucosal surfaces at birth and in infants. Central nervous system (CNS) capillary haemangioma in adults is extremely rare. We describe a case of capillary haemangioma located within the parasellar region extending into the sella.

Design. Case report

Results. We report a 64-year-old patient who presented with a short history of ptosis and left sided headaches. CT showed a 3 cm by 2.5 cm parasellar lesion extending into the sella. MRI showed a homogenously hyperintense lesion on T2-weighted MRI and FLAIR, which was isointense with adjacent brain parenchyma on T1-weighted MRI. This lesion also demonstrated contrast enhancement. The patient underwent an initial endoscopic transsphenoidal biopsy, which was inconclusive, followed by a craniotomy and debulking. Histological examination revealed fibrous tissue containing numerous thin walled and irregular vascular channels of varying sizes. There was a mild associated inflammatory infiltrate, mainly formed of small mononuclear chronic inflammatory cells, and occasional histiocytes. The histological appearances were in keeping capillary haemangioma.

Conclusions. The present case describes a capillary haemangioma located in the sella. The rarity of this vascular entity and the absence of any pathognomonic imaging features make it difficult to diagnose based on radiological appearances alone. Although rare, CH should be a differential when considering a sella or parasellar lesion.

Is restoration of pituitary function a realistic goal in endoscopic pituitary surgery?

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Objectives. The ability to restore pituitary function after endoscopic transsphenoidal surgery (ETSS) in pituitary tumours causing hypopituitarism remains unclear. This study analyses patients that required steroid replacement therapy prior to ETSS, and reviews endocrine function postoperatively.

Methods. A prospectively held pituitary database was retrospectively analysed from May 2011 – July 2017 at a tertiary university hospital. Patients requiring steroids for hypopituitarism pre-operatively were included. Patient demographic data, tumour characteristics, and tumour hormonal profile were recorded.

Results. From a database of 156 patients, 28 (18%) were hypoadrenal pre-operatively and were included in the study. All patients underwent ETSS by a single neurosurgeon. The median age of patients was 56 years (range 17 - 81), whilst median follow-up was 48 months (range 6 – 78). 20 male
patients and 8 female patients were included. All patients were established on steroid therapy preoperatively with either hydrocortisone (26 patients) or prednisolone (2 patients). 5 (18%) patients were able to stop steroid replacement postoperatively. The median time to cessation of steroid therapy was 4 months (range 2 – 16 months).

Conclusions. Restoration of pituitary function following ETSS surgery was only successful in a small number of patients despite meticulous gland preservation. Our results suggest that restoration of function in all patients undergoing ETSS is an unrealistic goal and patients should be counselled accordingly.

P45

Gamma knife radiosurgery for the primary management of acromegaly

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Design. Retrospective

Subjects. 20 patients with acromegaly who underwent primary STRS at the National Centre for Radiosurgery, Sheffield (UK) between 1985 and 2015.

Methods. Review of notes, database, laboratory results, patient questionnaire and death certification. Guideline-based control was defined as normal age-sex-adjusted IGF1 levels and either random GH<1 µg/l or GH<0.3µg/l (OGTT) or mean Growth Hormone Day Curve (GHDC)<1 µg/l.

Results. Control at 20 years was 100% and 75% on and off medication respectively. Median time to control on medication was 3 years and 7.4 years off medication. Median marginal radiation dose was 27.5 Gray and median follow-up was 167 months. Seven patients died, median age 65 years. There were no STRS-related deaths. 53% of patients developed new hypopituitarism at median follow-up of 146 months. First onset of hypopituitarism occurred up to 20 years after treatment. No other complications were noted. Three patients underwent trans-sphenoidal surgery due to poor biochemical control at a mean of 35 months.

Conclusions. Morbidity from STRS is low. There is significant latency to biochemical control and new onset hypopituitarism. While primary surgical intervention remains the gold standard in acromegaly, primary STRS results should inform discussions with patients considering non-surgical management.

MISCELLANEOUS / TEACHING & TRAINING

P46

Evaluating the clinical utility of pre-surgical fMRI bilingual language mapping

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Objectives. We examined the impact of bilingual to English fMRI mapping on surgical planning and treatment of neurosurgical patients.

Design. Active cortical areas were mapped using functional MRI (fMRI) for bilingual neurosurgical patients in an attempt to localize language areas.

Subjects. 13 bilingual patients (range 23 to 59 years) with brain lesions participated in the study. Subjects performed the antonym generation task in English and one non-English language.

Methods. Blood-oxygen-level dependent fMRI data were analyzed using Statistical Parametric Mapping software (SPM12). Threshold-independent laterality index (LI), activation volumes and DICE coefficient (percentage overlap) were subsequently calculated. We also evaluated its clinical utility through a 3-part questionnaire completed by neurosurgeons.

Results. Our results reveal differences in lateralization of languages in bilingual patients (English vs Non-English), LI: Anterior ROI 0.558+/−0.367 vs 0.744+/−0.253, Posterior ROI 0.3803+/−0.3984 vs 0.6593+/−0.300. DICE coefficient exhibited fair overlap (0.458+/−0.160). The questionnaire revealed no significant increase in confidence of language localization with the addition of a second language map. However, we identified individual cases where the neurosurgeon’s surgical approach, risk of post-operative deficit varied with the introduction of the bilingual fMRI.

Conclusions. Results suggest that dual mapping could improve the sensitivity of pre-operative planning, which is of great importance for surgical planning.

P47

30 Day readmission is not an accurate measure of morbidity in cranial meningioma surgery

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Objectives. 30 day readmission rate is a widely adopted marker of quality and performance of acute care, but validity is not well demonstrated. We analysed readmission data following cranial meningioma surgery to assess risk factors for readmission.

Design. Retrospective cohort study.

Subjects. All adult patients who underwent cranial meningioma resection from January 2015 to December 2017 in a single institution.

Methods. Using Welsh Clinical Portal electronic data to identify readmission within and beyond 30 days to both the index hospital and regional hospitals. Causes of readmission were recorded.

Results. 160 patients were included (76% female, median age 58). 28 cases were emergency admissions, median length of initial admission 7 days. 26% had seizures at presentation. Total readmission rate was 13.5% (median age 54.5, pre-operative seizure rate 40.1%, median length of readmission 9 days). 13 (59%) patients presented within 30 days and 9 (41%) >30 days. Readmission causes were seizure, neurological deficit, thromboembolic, infection, CSF, bleeding and social. Causes after 30 days were the same except social or neurological deficit.

Conclusions. Readmission rates are not associated with age, admission route or initial length of stay. Those who have had seizures are more likely to be readmitted. 41% of readmissions presented
outside of the 30 day post-operative time. 30 day readmission rates may not be the most suitable method to demonstrate neurosurgical unit performance in meningioma surgery.

**P48**

**A novel methodology for the identification of infective source during neurosurgical procedures**

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**Objectives.** Infection during elective surgery is a significant cause of patient morbidity. Contact of instruments or personnel with non sterile surfaces increases the risk of wound contamination. Our aim was to assess normal practice in an operating room and to develop a novel methodology based on cleanroom principles to determine the source of contamination if a surgical site infection were to occur in theatre.

**Design.** A prospective, non blinded, survey

**Subjects.** Operating theatre staff

**Methods.** The gloves of surgeons, surgeon's assistants and scrub nurses were touched onto agar plates at the end of surgery and incubated to detect bacterial and fungi colony forming units (CFUs). Five agar plates were placed in consistent locations on the floor around the operating theatres (floor plates), whilst two agar plates were placed on instrument trolleys (trolley plates). The frequency of theatre door openings and the number of people in the operating theatre were recorded.

**Results.** 191 glove samples were obtained. CFUs on contact plates for outer gloves ranged from 0 to 500 but the median was 0 and inter quartile range 0-1. Variations were seen in transnasal and transoral surgery. CFUs on settle plates ranged from 18 to 2789, CFUs on trolley plates ranged from 0-39. Door openings per hour ranged from 4 to 250. The number of people in theatre ranged from 6 to 14.

**Conclusions.** This study demonstrates a novel method for assessing and tracking contamination in an operating room. It can be used to determine potential sources when infection outbreaks occur.

**P49**

**Community consultation for a surgical site infection trial: is surrogate consent acceptable for adults and their children?**

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**Objectives.** A patient and public consultation process was undertaken to gauge opinion on participation in a trial of pre-operative skin preparation in neurosurgery, with particular emphasis on the use of surrogate consent for emergency procedures and recruitment of children.

**Design.** Online Survey

**Subjects.** 106 participants.
Methods. Participants were recruited to a piloted, online survey, from Neurosurgical community forums on Facebook. Trial components, including participation, consent and recruitment of a participant’s children, were assessed using 5-point Likert scales. Responses were compared by collected demographics (age, gender, education, previous research experience and previous operative infection experience)

Results. 89.5% (n=105) of participants would consent to participating in the RCT. 86.8% (n=61) would allow their child to participate. In the emergency setting 83.3% (n=90) would accept emergency entry into the RCT, provided retrospective consent was offered, preferably immediately. 95.1% (n=60) would allow emergency participation of a child provided consent was gained retrospectively. 94.4% (n=90) of participants would accept consent by a proxy (close relative etc.) Older patients (>46) were less likely to participate in the trial compared to younger participants (P=0.0306).

Conclusions. Respondents recognised the importance of preventing surgical site infection and were happy to participate in a trial and most would enrol their children. Surrogate consent was acceptable for participants and their children.

P50
The role of care of the elderly in neurosurgery
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Objectives. Assess the volume of frailty in a neurosurgical centre and role of geriatric liaison

Design. Retrospective Review

Subjects. All patients admitted to Charing Cross Hospital in Jan 2018

Methods. We reviewed patient notes to assess frailty score using the Clinical Frailty Scale (Dalhousie University) and differences with emergency vs elective admissions and length of stay (LoS).

Results. More than 50% of patients admitted to the unit were above 65 years old. 30% of all admissions met the criteria for mild to moderate frailty moreover 34% were classed as severely frail. These findings are comparable to acute medical wards. Two third of patients had an average LoS above 10 days, of these 50% were severely frail. Emergency admissions demonstrated a greater burden of frailty and expectedly LoS in severely frail patients was significantly higher 15 vs 40 days in elective and emergency admissions.

Conclusions. Neurosurgery units would benefit from a geriatric liaison service given the burden of frailty is equivalent to medical wards in-order to improve patient care, experience, turnover and LoS.

P51
Cerebral abscesses: are we seeing them more?
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Objectives. Cerebral abscesses are considered a neurosurgical emergency and prompt diagnosis with initiation of medical/surgical management often leads to better outcomes. We present our local epidemiological data over the last 10 years.

Design. Retrospective review

Subjects. All patients diagnosed with cerebral abscess (es) between May 2008-2018.

Methods. Patients were identified using the hospital operations database and their electronic case notes were interrogated.

Results. A total of 154 patients presented with one or more cerebral abscesses. There was a male predominance of 2.4 to 1. Median age was 46 years (2-88 years). There has been a recent increase in incidence with 49% of cases occurring in the last 4 years. Sources of infection included sinusitis (16%), otogenic (25%), dental (3%), neurosurgery (20%), and endocarditis (4%), whilst 23% of cases were unable to identify a source. The commonest location was within the frontal lobe (37%). A positive culture was obtained in 99/119 cases and the commonest causative microorganism encountered was Streptococcus Intermedius. The mortality rate was 6% within our cohort.

Conclusions. In our local practice, we have seen a gradual increase in the incidence of intracerebral abscesses. Consistent with existing literature, mortality has considerably reduced compared to 30 years ago, most likely owing to the improvement in treatment with anti-microbials, neuro-imaging and surgical technique. Further up-to-date studies are required to establish whether these findings are consistent in other units.

P52

Prescription of patient’s regular medications on admission to neurosurgical unit

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Objectives. Timely and correct prescription of patients’ regular medications on admission to neurosurgical unit is noticed not to be fully compliant with set standards. This audit aims to review the practice of medication prescription by junior doctors during patient admission to a national neurosurgical unit, and to identify areas of improvement for prompt and accurate prescription.

Design. Prospective clinical audit.

Subjects. 130 patients admitted to the neurosurgical unit in 2 weeks.

Methods. Prescription of patient’s regular medications on admission was audited. The prescription practice was compared against the set standards, and between different settings (in-hour vs. out-of-hour, emergency vs. elective, experienced vs. new SHOs).

Results. 18% of patients had no regular medications prescribed by clerking doctors, the majority of which were elective admissions during in-hour clerking and performed by experienced SHOs. Of the patients who had their regular medications prescribed on admission, 29% were prescribed inaccurately, and 16% in wrong doses. Total percentage of missed and error prescription was 46%, in which only 18% were corrected within 24 hours and 21% corrected up to 48 hours after admission.

Conclusions. Areas of improvement identified: prescription practice of experienced SHOs during elective admissions, medication and dose check on prescription in both elective and emergency
settings, medication reconciliation within 24 hours and thereafter. Changes (e.g. an alert system) are being implemented and re-audit is in plan.

**P53**

**Early years training – a survey of the British Neurosurgery Trainees’ Association**

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**Objectives.** To evaluate trainees’ perceptions of early years neurosurgical training in the UK and to establish if there are regional differences in how neurosurgical trainees across the UK spend their ST1-3 years, both in terms of neurosurgical and non-neurosurgical placements

**Design.** Evaluation study

**Subjects.** Trainees with National Training Numbers (ST1-8)

**Methods.** Online survey distributed to all BNTA (British Neurosurgical Trainees’ Association) members in May-June 2017. Thematic analysis of qualitative data.

**Results.** 50 participants from 11 deaneries. Time spent in neurosurgery rotations ranged from 12 to 30 months out of a maximum of 36 months. Duration of individual rotations to any non-neurosurgical specialty ranged from 6 weeks to 6 months. Whilst experience in non-neurosurgical specialities was clearly perceived to enrich early years neurosurgical training, trainees were also concerned about the opportunity cost of spending extended periods of time in non-neurosurgical rotations. 84% estimated that at least half of their service workload in a neurosurgery SHO role could have been undertaken by a Physician’s Assistant, Clinical Nurse Practitioner or Clinical Nurse Specialist.

**Conclusions.** There are significant regional variations in both neurosurgical and non-neurosurgical rotations in early years neurosurgical training across the UK which could potentially impact overall quality of training. This study also highlights the potential role for allied medical professionals in filling the increasing number of rota gaps at SHO level.

**P54**

**Formative test questions in neurology and neurosurgery**

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**Objectives.** To provide a formative educational test of knowledge that allows clinicians to measure themselves against their peers

**Design.** Annual Neurosurgery and Neurology knowledge tests, supported by the ABN & SBNS, have been available since 2014 (NSurg) and 2017 (Neurol). The NSurg test requires all candidates to participate over 3 days, answers are available after the test whereas the Neurol formative questions are available over 6 weeks, answers are available immediately
Subjects. There have been 821 first attempts at the formative questions; NSurg; 44, 63,187,143,164 and Neurol; 74, 146. Candidates are mostly from UK (NSurg 92%, Neurol 69%) and mostly specialty trainees (NSurg 98%, Neurol 63%)

Methods. The formative questions are delivered through the ebrain virtual learning platform, statistics are generated automatically. Proposed questions are written by candidates as “payment” for doing the formative test

Results. Mean Cronbach’s alpha was 87.3%. The mean score for the tests was 60.4% (Range 55.9% - 77.9%). Feedback is voluntary: In 2018 17 feedback comments were received, 10 were unambiguously positive, 5 were mixed including criticism of one or more questions, 2 were judged to be neutral. Examples of feedback comments received this year included “Comprehensive exam that covers a wide range of topics” & “This is of great value”

Conclusions. This formative educational initiative has high internal consistency and solid feedback. Although set up differently, it is proving both valuable & popular in both specialties

P55

The neurosurgical physician: a new role in the UK

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Objectives. With reduction in numbers of junior doctors and strict deanery requirements for training opportunities, the provision of ward cover and continuity has consistently fallen. Various methods of addressing this have been implemented in the UK, including increased nurse practitioners and physician associates. We introduced a new position of GP with a specialist neuroscience interest in line with the North American model of hospitalist and review the impact on patients and trainees

Design. Qualitative descriptive study

Subjects. 14 core and specialty trainees

Methods. Retrospective review of the impact of a permanent neurosurgical physician on ward care and provision of training with a qualitative study of trainee experience. Saturation was reached at 14 interviews.

Results. A neurosurgical physician role was instituted in 2013, enabling a formal training rota to fulfil deanery requirements for core training and provide continuity of care at senior medical level, reducing medical ward consults to zero, improved communication with relatives and reduced the need for ST ward rounds. Qualitative assessment revealed a senior medical presence aided trainees own knowledge, resulted in better rapport and communication with patients and improved patient care through knowledge of best medical practice guidelines.

Conclusions. The addition of the neurosurgical physician role has positively impacted on the quality of patient care and junior doctor training. Senior medical care is provided with continuity, in contrast to other models.
Virtual reality simulation in neurosurgical training: a single blinded randomised controlled trial & review of all available training models

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Objectives. Virtual reality (VR) simulators are one of the training models allowing the practice of surgical skills for trainees. We aim to assess the benefit of VR training in neurosurgery.

Design. A single-blinded randomised controlled trial and a literature review.

Subjects. Trainees (n=12), Fellows & Consultant Neurosurgeons (n=4) and Medical Students (n=6) with no experience of VR.

Methods. Participants were randomised according to their grades. Both groups completed microsurgical tasks and duration and quality of each task was recorded at the start and the endpoint of the study. Questionnaires were used to assess the participants’ confidence in microsurgical skills. The intervention group underwent structured training using a VR simulator (NeuroVR). The primary outcome measure was microsurgical performance assessed by three independent assessors blinded to trainee status. The secondary outcome measure was performance time and confidence levels.

Results. Observed improvements in the primary outcome were not significant. The performance time in the intervention group improved significantly with a mean difference of 79.8 seconds (8.178sec)(p< 0.05). The intervention group reported significantly improved confidence levels in all microsurgical skills (8.8%, p< 0.001). Less experienced trainees had the greatest reductions in time and improved confidence levels.

Conclusions. VR training in neurosurgery, particularly in less experienced trainees, can prove useful. Future studies should assess the effect of VR training on clinical procedures.

An innovative approach to workplace based didactic teaching in neurosurgery: initial experience


Queen’s Medical Centre, Nottingham, UK

Objectives. To increase the amount and quality of didactic teaching by commissioning an in-house Diploma course using distance-learning methodologies to supplement regular departmental teaching sessions.

Design. Web-based course consisting of 9 modules covering the breadth of neurosurgical topics. A Diploma was conferred by the Head of Service upon successful completion of all modules.

Subjects. To date, eleven learners (junior doctors at F1/F2/SHO level) have started the Diploma, including doctors from outside our department.

Methods. Learners download a module, dedicate a period of self-study and then discuss the module with their Tutor. To complete a module, a learner would be expected to demonstrate to the Tutor
that their knowledge was at ST2 standard as described in the neurosurgical curriculum. Assessment of modules was documented on learners’ existing portfolios.

**Results.** By way of feedback, all learners (100%) strongly agreed that the Diploma was useful for their day to day job, that it helped understand management of acute neurosurgical problems, that it was interesting, that they would recommend it to a friend/colleague and that support received from the Course Tutor was helpful.

**Conclusions.** Learners reportedly enjoyed the self-directed, flexible aspect of the Diploma and found that it promoted interactive discussions with registrars and consultants. Feedback obtained externally through HEE and GMC was highly praiseworthy of the Diploma. We intend to continue to offer this course.

### Setting up an encephalitis multidisciplinary meeting in a tertiary neurology centre

**P58**

**Setting up an encephalitis multidisciplinary meeting in a tertiary neurology centre**

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**Objectives.** To improve the outcome of encephalitis in the region.

**Design.** Service evaluation of the introduction of monthly encephalitis meetings attended by specialist neuroradiologists, neurologists and infection doctors.

**Subjects.** Patient referred at the discretion of the clinician from local hospitals and the tertiary referral centre.

**Methods.** Diagnosis confirmed at the MDT or as a direct result of the MDT discussion.

**Results.** To be presented.

**Conclusions.** Encephalitis is a rare and complex clinical syndrome that requires close communication between neurologists and infection doctors. Setting up an MDT established this interaction, and streamlines patient care. Further, it provides access to novel technologies such as metagenomic diagnostic approaches.

### ACUTE NEUROLOGY / COGNITIVE, MUSCULOSKELETAL & MOVEMENT DISORDERS / HEADACHE & PAIN

### P59

**Acute varicella zoster encephalitis? Don’t forget the treatment!**

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**Objectives.** Educate physicians on the need for monitoring of Aciclovir levels in renal failure

**Design.** Retrospective case report

**Subjects.** 59 year old woman presented with acute psychosis following recent herpes zoster treated with oral Aciclovir
Methods. Data collection from; original casenotes, electronic laboratory records, electronic picture archiving and communication system (PACS)

Results. Lumbar puncture showed raised protein (0.92g/L), CSF:serum glucose ratio(0.9), 36 WBCs/cmm(72% polymorphs) and detection of VZV DNA. MRI brain only revealed intracranial-hypotension secondary to lumbar puncture. Despite absence of VZV DNA on surveillance lumbar puncture, she remained minimally responsive. Aciclovir levels were significantly elevated post-dose at 32.7mg/L (cutoff 10.8mg/L) and a sedation hold revealed temporal correlation of pre-dose levels(6.4mg/L) with improvement of GCS, strongly implicating Aciclovir as causative agent. Rapid resolution of encephalopathy occurred upon cessation with no residual neurological compromise.

Conclusions. Aciclovir neurotoxicity mimics zoster-related encephalitis and VZV DNA is commonly detected in cerebrospinal fluid of patient’s with herpes zoster (Rudzek et al 2007). Our case highlights the need for vigilance of Aciclovir-neurotoxicity in renal failure patients.

References. Rudzek D, Piskunova N, Zampachova E. High variability in viral load in cerebrospinal fluid from patients with herpes simplex and varicella-zoster infections of the central nervous system. Clinical Microbiology and Infection. 2007; 13(12): 1217-1219

P60

Chorea complicating hyperglycaemic states: caution in those with heart disease

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Design. Chorea hyperglycaemia basal ganglia syndrome (C-H-BG) is a rare complication of hyperglycaemic hyperosmolar states. Although the mechanism is unclear, a proposed theory relates to hyperviscosity and ischaemia of basal ganglia. With prompt treatment it is usually reversible.

Conclusions. A 78 year old man with a background of type 2 diabetes mellitus and ischaemic heart disease presented with florid choreiform movements of all limbs a month after presenting with a central nervous system infection of unknown aetiology. On admission his blood glucose levels were more than 30 mmol/L. A MRI brain scan showed subtle T2 hyperintensity in the thalamus and high T1 signal bilaterally in the putamina. Cerebrospinal fluid examination was normal and basal ganglia antibodies were negative. He suffered an acute coronary syndrome secondary to the aggressive physical nature of the movements and required intubation and ventilation to gain control. The chorea gradually resolved with tight blood glucose control, haloperidol, clonazepam and tetrabenazine. He made a good recovery and was discharged for rehabilitation.  C-H-BG can be life threatening. Awareness of the condition is important as lowering blood glucose can lead to complete resolution of symptoms and avoid unnecessary tests. We highlight the potential consequences of increased metabolic demand particularly in those with preexisting heart disease. In severe or at-risk cases, pharmacological therapy may be required and pallidotomy is considered.

P61

ATN classification: utility and pitfalls in fluid biomarker-based stratification

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Objectives. The 2018 Research Framework for Alzheimer’s disease (AD) classifies individuals as +/- for amyloid(A), tau(T) and neurodegeneration(N), allowing 8 ATN categories. We explored how individuals were classified by proposed CSF markers, i.e. Aβ42(A), p-tau(T) and t-tau(N); and replacing N with CSF/serum neurofilament light chain (NFL).

Design. Single site retrospective series

Methods. ELISAs measured CSF Aβ42, t-tau, p-tau & NFL. Simoa HD-1 digital immunoassay measured serum NFL. Published cut points were used to determine CSF-based ATN classifications. ROC analysis yielded a serum NFL cut point (14.1 pg/ml). We assessed inter-marker correlations using linear regression, classification agreement using κ statistics, & relations between ATN & clinical diagnosis using frequency distributions.

Results. We found strong correlations between CSF p-tau & t-tau (r²=0.9), weaker correlations between either p-tau or t-tau & CSF NFL (r²=0.05-0.12), and no correlation between CSF Aβ42 & other markers. ATN using NFL in CSF or serum showed substantial agreement (κ>0.6); these did not agree with the Aβ42/p-tau/t-tau ATN classification. The group A+T+N+ identified 0-3% of FTD but 55-80% of AD cases across all classifications. The groups A-T+N+ & A-T+N+ existed only if NFL was used, & identified 66-91% of FTD but only 8-33% of AD cases.

Conclusions. CSF t-tau & p-tau are highly collinear; including both in ATN introduces redundancy. Defining N by CSF/serum NFL improves diagnostic separation.

P62

Some unintended consequences of neonicotinoid insecticide use

J. Ponsford

Objectives. To question permitted Maximum Residue Levels and Acceptable Daily Intake

Design. Review solely of published work. Discovered in 1980s, neonics. now account for c 1/3rd of insecticide use globally, as seed coating / spray / drench

Subjects. In 2004 patients came with unusual symptoms including chest pain and ECG change after exposure to aerial Organo Phosphate spray. Spraying of OP was stopped but symptoms and signs continued to occur with regular high dose intake of tea and / or domestic fruit. Urinary neonic. metabolites were found. Recovery took up to 2 months with dietary restriction. MRLs for grapes and tea were high.

Methods. A Prevalence Case Control study supported neonic.s as causal. After linearly increasing neonic. and OP detection in urine of adult women since 1994, and a rising prevalence of neurodevelopmental disorders and of low birth weight, children’s urine is studied.

Results. Literature:- Bee brains may accumulate neonicotonid day by day. Longer exposure greatly increases sensitivity of their nAChRs, and of mammalian cell lines, to a very low nanoMolar level of
neonic. Results of in vitro studies, chronic low doses in animals, fish and Drosophila, evidence of BBB permeability, and epidemiology, suggest potential for cognitive and developmental neurotoxicity, ASD / ADHD and obesity

Conclusions. Despite a partial ban Neonic. will accumulate and spread in soil and water. Current Human ADI may be too high

P63
Botulinum toxin A for post craniotomy head pain: a single centre case series of 11 patients
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Objectives. Botulinum Toxin for post craniotomy head pain is not an established therapy. One small case series commented that it was effective in 3 patients. (1) We report our single centre experience.

Design. We performed a retrospective review of case notes of all patients treated with Botox for persistent post craniotomy or craniotomy head pain at Greater Manchester Neurosciences Centre, UK. All patients treated with Botulinum Toxin from 2014 at Greater Manchester Neurosciences Centre are listed on a central database, irrespective of indication. From the database 11 patients were identified who had received Botulinum Toxin A for post craniotomy scalp pain.

Subjects. Eleven (n=11) patients were identified. The mean age was 43 yr. Of the 11 patients; 6 were women and 5 were men. The majority of patients underwent surgery for medically intractable epilepsy (n=7).

Methods. Information obtained: -Demographics -Date, indication and type of initial cranial neurosurgery Headache Characteristics (site, descriptors, duration, frequency) -Previous medical therapy -The presence of Epileptic Seizures -Frequency, dose and site of Botulinum Toxin injection -Response

Results. A majority of patients (10/11) reported improvement in headache burden with 6 patients reported being pain free with no further daily headache. The duration of this effect varied from 4 to 12 weeks. No specific headache characteristic (site, descriptor) predicted a favourable response. Of the remaining 5 who continue to report daily head pain, 4 felt the burden was more manageable. One patient felt there was no response. Of the 5 patients with persistent headaches, 3 were chronic epileptics with ongoing seizures, compared to only 1 patient in the responder group.

Conclusions. This case series is limited by small numbers and no objective headaches made prior or post therapy. Botulinum Toxin A appears to have a beneficial effect in the management of chronic post craniotomy head pain within this small sample with complete abolition of pain in 55%. The presence of ongoing epileptic seizures may indicate a poor response. Further controlled studies are warranted.

P64
withdrawn

P65
Implementing a pain scale to improve Botulinum toxin practice for cervical dystonia
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**Objectives.** To evaluate the effectiveness of introducing a pain scale to improve cervical dystonia (CD) patient satisfaction rates in the National Hospital for Neurology and Neurosurgery (NHNN) Botox clinic.

**Design.** Case control study.

**Subjects.** Subjects included CD patients attending the NHNN Botox clinic to receive injections.

**Methods.** Injectors were educated about the Toronto Western Spasmodic Torticollis Rating pain subscale (TWSTRS) and subsequently incorporated it into their standard assessment of CD patients prior to injections. Surveys were created and disseminated to patients immediately following their appointment to assess their opinions of the clinical team. Information was entered into Microsoft Excel and analysed using appropriate statistical methods. Results were compared with a previous NHNN Botox clinic audit.

**Results.** 42 surveys were collected in total from CD patients over a 4-week period. 36 patients (85.7%) reported pain associated with the condition. In comparison to an audit conducted in 2016, involving a similar sample size (n=40, with 28 reporting pain), a higher proportion of CD patients felt their pain was well understood by the clinical team (89.3% vs 94.4%). Furthermore, a higher proportion felt the team were competent in managing their pain (67.9% vs 94.4%).

**Conclusions.** Our study supports the use of a TWSTRS pain subscale to improve CD patient satisfaction rates in the Botox clinic. Further studies are encouraged to validate these findings and determine other suitable pain scales for implementation.

P66

**Should we be screening for depression and quality of life in all patients attending botulinum toxin injection clinics or just those with cervical dystonia?**

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**Objectives.** Cervical dystonia (CD) is known to be associated with depression and low quality of life (QoL) but we know little about these measures in non-CD patients attending botulinum toxin clinics. The objective was to evaluate the prevalence of depression and low QoL in both CD and non-CD patients.

**Design.** Cross-sectional pilot study.

**Subjects.** Consecutive patients attending teaching hospital botulinum toxin clinic.

**Methods.** Patients completed the Beck’s Depression Inventory (BDI) questionnaire and a Recovering Quality of Life (ReQoL) scale. BDI and ReQoL scores of ≥ 17 and ≤ 24 indicated depression and impaired QoL respectively.

**Results.** 43 patients (27 female; age 45-75 years) were evaluated; 28:15 CD:non-CD. The non-CD group comprised hemifacial spasm, upper limb dystonia/tremor, and Meige syndrome. 21% (9/43) of all patients had depression: 25% (7/28) of CD and 13% (2/15) of non-CD (2/15, 13.3%) (p 0.37). Depression rates were similar between females and males (22%; 19%) (p 0.74). 33% of all
patients had low QoL - 36% (10/28) and 27% (10/28) in the CD and non-CD groups respectively (p 0.74). Low QoL scores were more frequent in females (37%) than males (25%) but this difference was not significant (p 0.51).

Conclusions. Depression and low quality of life were common in all patients in this pilot study. This suggests that screening of all patients attending botulinum toxin clinics, regardless of their diagnosis, may be clinically important. A larger study is required to validate these findings.

P67

Possible Modulation of Concurrent Parkinson's disease in the Management of Metastatic GIST: A Review of Two Cases.

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PUBLISHED ELSEWHERE

P68

Activation of the geste antagonist improves speed of finger tapping in organic and functional dystonia

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Objectives. The geste antagonist is a typical feature of dystonia’s motor phenomenology. Gestes may also occur in functional dystonia. We investigated how gestes affect the kinematics of voluntary movement.

Design. Cross-sectional study.

Subjects. Twenty-three patients with organic dystonia and three with functional dystonia were studied.

Methods. Finger tapping was assessed while subjects wore electromagnetic sensors secured to index finger and thumb. Subjects were instructed to tap “as fast and as big as possible” for 15 seconds, first with and then without activation of their geste. Precise position and orientation data, in six degrees of freedom, were recorded. Separable motor components were derived from a comparison of the x, y and z coordinates of each sensor. The product of amplitude and frequency, giving the sensor excursion per unit time, was used as a measure of average speed. A repeated measures ANOVA was conducted, with the factors CONDITION (with vs without geste), HAND (dominant vs non-dominant) and GROUP (organic vs functional).

Results. For average speed, there was a significant effect of CONDITION—patients with both organic and functional dystonia performed better with geste (F1,24=13.5; p=0.001). There was no main effect of HAND or GROUP.
Conclusions. Geste antagonistes enhance motor performance in organic and functional dystonia. These selective voluntary movements may have a general effect on the execution of motor plans in dystonia. Sample numbers were too small to allow meaningful analysis of GROUP effects.

P69 withdrawn

P70 withdrawn

P71

Neurosurgical presentation of hereditary transthyretin (ATTR) amyloidosis: early recognition for earlier genetic therapies

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Objectives. Hereditary Transthyretin (ATTR) amyloidosis is a genetic disorder where insoluble amyloid fibrils deposit in heart, nerves and various musculoskeletal tissues. Early recognition of TTR-FAP is important as new genetic therapies become available.

Design. We present one confirmed and one clinical case of ATTR deposition in ligamentum flavum causing lumbar canal stenosis.

Subjects. The first case is a 44-year-old female with TTR 184S heterozygous mutation who developed urinary urgency and bilateral leg pain exacerbated by walking. Neurological examination was normal. MRI lumbar spine showed a disc bulge in combination with ligamentum flavum thickening at L2/3 causing stenosis of the vertebral canal. She had a laminectomy of the L2/3 level. Histopathological analysis of the surgical tissue was positive on Congo red staining for amyloid and immunohistochemically identified as TTR type. The second case is a 68-year-old man with TTR V122I heterozygous mutation. He presented with paraesthesia from the knees to dorsum of the feet. On examination, power was normal and he had a length dependent neuropathy. A CT myelogram demonstrated spondylosis at L4/5 and L3/4 from disc bulge and marked flaval hypertrophy causing canal stenosis. He was placed on the waitlist for L4-5 decompression but unfortunately died prior to surgery.

Conclusions. Identifying ATTR in surgical specimens may diagnose hereditary amyloidosis in otherwise asymptomatic patients and in the future, provide early access to effective therapies.

P72

Riluzole causing pancytopenia: a clinically important rarity

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Design. Case Report: An 83-year-old lady, was admitted with progressive speech and swallowing difficulty and wasting of small muscles of hand for 3 months. EMG revealed widespread anterior
horn cell disease. With a diagnosis of MND, She was started on Riluzole 50 mg, LFT & FBC were normal before and 2 days after 1st dose and the dose increased to a recommended dose of 50 mg twice a day. While waiting for PEG tube insertion, within 7 days, FBC showed a significant drop in Hb of 23g/L (from 125 to 102g/L), Platelet dropped to 150x10^9 /L from 208x10^9 /L, leucopenia (2.4 x10^9 /L) without any significant neutropenia. Her follow up haemogram showed persistent pancytopenia with more evident leucopenia and thrombocytopenia over next 7 days. She had no symptoms and signs of infection with normal infection screen. Her medication history was unremarkable apart from riluzole and thyroxine. No past history of liver disease or haematological conditions. Serum electrophoresis, Vitamin B12 and Folate were completely normal. A diagnosis of riluzole induced pancytopenia was made. A study by FDA suggests out of 861 patients, 3 patients (0.35%) developed Pancytopenia and 100% of them had it in the 1st month. The aim of this case report to highlight the importance of considering Pancytopenia as an adverse reaction of riluzole. Patient may develop overt sepsis as a part of the spectrum. In that case, risk and benefit of riluzole prescription needs to addressed as an individual case basis.

P73

The use of intracranial pressure monitoring in patients with suspected CSF leaks

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Objectives. Spontaneous and iatrogenic cerebrospinal fluid (CSF) leaks present with debilitating orthostatic headaches. CSF leaks can be difficult to identify in a significant proportion of patients. Recent studies have also highlighted how lumbar puncture opening pressure can often be normal (rather than low) and this can pose a diagnostic challenge. This study aims to describe the utility of continuous intracranial pressure (ICP) monitoring in a group of patients with suspected CSF leaks.

Design. Single centre retrospective study.

Subjects. Forty-seven patients (19M, 28F), mean age 46 yrs. (±14).

Methods. Patients were retrospectively identified screening a clinical letters database. Inclusion criteria were: patients with orthostatic headache who had normal neuroimaging and/or had failed to respond to treatments

Results. Mean duration of symptoms was 47 months (±36). ICP monitoring was performed to exclude a CSF dynamic disturbance in patients with normal neuroimaging in 22 patients (47%). The remaining patients had ICP monitoring due to treatment failure (Blood patch, IV caffeine or both). ICP monitoring demonstrated low 24-hours ICP in 14 patients (30%) and high 24-hours ICP in 7 patients (15%).

Conclusions. Continuous ICPM can be a useful additional method of investigation for patients affected by lorthostatic headache and it should be considered when a suspected CFS pressure syndrome cannot be confirmed or excluded with more conventional investigations. Furthermore, high CSF pressure can present as paradoxical orthostatic headache.

SPINE

P74
Cervical disc arthroplasty employing a novel compressible prosthesis: a single arm observational study of 101 patients

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Objectives. The study aims to evaluate the radiological, clinical efficacy and safety of a novel compressible cervical disc prosthesis in the treatment of degenerative cervical radiculopathy

Design. Observational non-randomised case series based in two centres.

Subjects. 101 consecutive patients (137 artificial discs) treated for cervical radiculopathy secondary to cervical disc degeneration. Mean age at operation 45.4 years.

Methods. Neck Disability Index, Visual Analogue Score for neck and arm pain, Euro Quality of Life - 5D survey, index level range of movement, heterotopic ossification, adjacent level disease, re-intervention rate and safety profile were assessed. Clinical (outpatient and telephone questionnaires) and radiological (Nuvaline & McKeeson PACS suites) were employed

Results. Index range of movement was 7.9 degrees pre operatively and 7.6 at two years. 2 reoperations at supradjacent levels took place post treatment in a 35 month follow-up period. 1 post-operative haematoma and 1 delayed infection occurred. All four primary outcome measures exhibited significant improvement from baseline to last follow up; NDI (47.5 to 24.9, p<0.001) EURO QOL index (0.36 to 0.84, p< 0.0001) and VAS Arm (5.6 to 0.85 p< 0.0001) and VAS Neck (7.1 to 1.7, p< 0.0001).

Conclusions. The compressible disc prosthesis preserved 96.2% of the initial range of movement at index level whilst exhibiting a favourable re operation rate and safety profile.

P75

Factors that predict degree of spinal cord compression and optimal spinal cord perfusion pressure in patients with acute, severe traumatic spinal cord injuries

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Objectives. To identify factors which predict intra-spinal pressure (ISP) and optimal spinal cord perfusion pressure (SCPPopt) in patients with acute, severe traumatic spinal cord injuries (TSCI) that could be used instead of invasive ISP monitoring.

Methods. We monitored ISP, mean arterial pressure (MAP) and computed spinal cord perfusion pressure (SCPP), spinal pressure reactivity index (sPRx) and SCPPopt in 64 TSCI patients, AIS grades A–C who were part of the Injured Spinal Cord Pressure Evaluation (ISCOPE) study. We recorded baseline, injury/imaging and management variables which may influence ISP/SCPPopt. Statistical analysis was used to investigate differences in ISP/SCPPopt between the variables

Results. 51 % (34/64) had U-shaped sPRx vs. SCPP curve in the first 24 hours after surgery. Mean SCPPopt was 74 mmHg (range 48–103). Lower mean 24-hour ISP was found with: older age, alcohol excess, non-conus medullaris injury, duroplasty and less surgical bleeding. Mean ISP on day 1 after
surgery correlates with mean ISP over the first week. Lower 24-hour SCPPopt was associated with:
higher mean ISP and conus medullaris injury. No MRI factors predicted ISP or SCPPopt.

Conclusions. Several factors predict ISP. Modifiable factors to reduce ISP are less surgical bleeding
and expansion duroplasty. No variables predict SCPPopt. ISP monitoring remains the only way to
estimate SCPPopt to help prevent secondary damage and we continue to support use of ISP
monitoring to individualise management in acute, severe TSCI.

P76

Skip laminectomy versus cervical laminectomy, an analysis of patient reported outcomes,

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Objectives. To compare clinical, radiological and complication results between skip laminectomy and
cervical laminectomy for posterior cervical decompression for cervical spondylotic myelopathy.

Design. Retrospective single institution cohort study.

Subjects. Subjects underwent primary skip or cervical laminectomy between 2008-2016.

Methods. Statistical analysis compared pre- and post-operative differences in Visual Analogue Scale,
Neck Disability Index and radiological differences in sagittal alignment of the vertebral bodies.
Analysis of re-operation rates was performed.

Results. A total of 42 and 29 patients had skip and cervical laminectomy respectively. Median follow
up was 32±23.1 (Range: 1-325) weeks. Post-operatively there was no difference in patient reported
outcomes namely Visual Analogue Scale and Neck Disability Index between skip laminectomy and
cervical laminectomy groups compared to pre-operatively (p=0.64, p=0.75). No difference was seen
in sagittal alignment between both groups following surgery (p=0.65). Three patients (7.1%) in the
skip laminectomy group and two patients (6.9%) in the cervical laminectomy group required revision
surgery to the cervical spinal region at a different level to the original surgery. No patients needed
further instrumentation.

Conclusions. Both skip laminectomy and cervical laminectomy appear to deliver similar outcomes
with regards to patient reported outcomes, preserving sagittal alignment and re-operation rates over
this short follow-up period.

P77

Type II odontoid fractures: collar or no collar

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Objectives. Type 2 peg fractures are known to have low fusion rates but most are elderly with
comorbidities and not fit for surgery. Increasingly, clinicians want to stop using hard collars due to its
complications, but with little supporting evidence. We aim to provide data to add to this debate.
**Design.** Single centre cohort study.

**Subjects.** 145 consecutive patients referred to a Major Trauma Centre as type 2 peg fracture.

**Methods.** All patients referred with a suspected peg fracture between March 2015 and December 2017 were included. All imaging were assessed and case notes reviewed for patient demographics, fracture management, complications and outcomes.

**Results.** 102 cases were peg fractures (mean age = 80 years). 92 (90.2%) were managed conservatively with a hard collar (mean of 87 days). 37% developed symptoms from the collar, namely pain, stiffness and non-tolerance. Bony union was achieved in only 39.1% of patients with increasing age being an independent risk factor (p<0.001). Of the 56 patients who did not have bony union, there were no reported symptoms and 90% were discharged without a collar. 2 patients were offered but declined fixation and neither reported any ongoing symptoms.

**Conclusions.** This study adds to the body of evidence that fusion rates are low, and collar complications are not insignificant when type 2 peg fractures are treated in a hard collar. However, outcomes are good regardless of union, potentially rendering the collar unnecessary. We aim to conduct a randomised prospective study to further investigate.

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**P78**

**Recovery priorities for patients with degenerative cervical myelopathy**

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**Objectives.** The misalignment of patient and researcher objectives has been shown to contribute to research inefficiency and wastage. The patient research priorities in degenerative cervical myelopathy [DCM] are unknown. The present study aimed to establish relevant functional domains and their recovery priority to DCM sufferers.

**Design.** Functional domains were established from qualitative patient interviews (N=4), and the recovery priority through an e-survey (N=659)

**Subjects.** DCM Patients recruited via a DCM charity [Myelopathy.org] and Google Adwords.

**Methods.** Seven functional domains were identified: arm and hand, walking, upper body/trunk, sexual, elimination of pain, normal sensation and bladder/bowel function. Patients were asked to rank these domains. The influence of disease characteristics on selection was analysed

**Results.** 481 complete responses were analysed. Overall, pain was the most popular recovery priority (39.9%), followed by walking (20.2%), sensation (11.9) and arm and hand function (11.5%). Sexual function (5.7%), bladder and bowel (3.7%) or trunk function (3.5%) were chosen less frequently. With respect to disease characteristics, overall pain remained the recovery priority [with the exception of patients with greater walking impairment (p<0.005) who prioritised walking] even amongst patients with lower pain scores.

**Conclusions.** Pain is a recovery priority for DCM patients, even amongst those reporting low levels of pain.

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**P79**
Is length of stay (LOS) equivalent for elective anterior cervical discectomy (ACD) patients in an NHS hospital and as waiting list initiative cases in a private hospital?

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Objectives. To investigate if there is a significant difference between the LOS for patients admitted as waiting list initiative patients to a private hospital versus standard care in an NHS hospital

Design. Retrospective analysis between 2015 and 2017 of all ACD procedures at the two hospitals

Subjects. 674 elective NHS patients were included, 340 were admitted to the NHS hospital and 334 as waiting list initiative patients to the private hospital. Acute patients were excluded

Methods. Retrospective database search of electronic hospital records for all ACD procedures carried out between 2015 and 2017. The student standard t test analysis was used to compare the difference in LOS

Results. In both groups 100% were admitted on the day of surgery. The mean NHS LOS was 3.3 (SD=6.34) days and the private hospital was 1.1 (SD=0.97) days. (p<0.001) For the patients admitted to the private hospital 96% of the patients went home with 1 night stay, only 61% of the patients went home in the same period in the NHS hospital

Conclusions. We found that length of stay is significantly shorter in the private hospital than in the NHS hospital. This could be due to patient selection, a swifter patient pathway or a combination of the two and these factors will be explored.

P80

Evaluation of nationwide referral pathways, and treatment of suspected cauda equina syndrome in the United Kingdom

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Objectives. This study sought to evaluate current practice of the investigation and treatment of patients with suspected cauda equina syndrome in the United Kingdom against national guidelines that all referred patients should receive an MRI at the hospital receiving the patient prior to referral.

Design. Retrospective, multicentre observational study.

Subjects. All patients with suspected cauda equina syndrome referred to a spinal unit between 1st October 2016 and 31st March 2017.

Methods. Within each spinal unit, a team of collaborators were formed including a lead consultant, neurosurgical trainee, foundation programme trainees and medical students. Data were collected using a standardised form on an electronic data platform. Univariable and multivariable analyses were performed on referral pathway timing data.
Results. A total of 4441 referrals were made across 28 spinal units. Over half of referrals were made without any previous imaging (n=2572, 57.9%). The majority of referrals were made out-of-hours, of which 2.9% (n=45/1529) underwent surgical decompression. Patients investigated outside of the spinal unit were associated with significantly longer time intervals from presentation and from referral to completing an MRI.

Conclusions. A significant proportion of referrals for suspected cauda equina syndrome were made without adequate investigations, often undertaken out-of-hours. Time interval analysis highlights important implications of the ongoing lack of out-of-hours MRI scanning in hospitals other than the tertiary spinal centre.

P81

Intraoperative MEP recordings from a urethral sphincter electrode for spinal conus tumour surgery and its importance

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Objectives. To emphasise the importance of motor evoked potential (MEP) recordings from a simple urethral sphincter electrode along with routine use of bulbocavernous reflex recordings, anal sphincter and other lower limb muscle free running and stimulated EMG and MEP's, and SEP techniques for sphincter preservation.

Design. Case report

Subjects. Patients with conus or other spinal lesions at risk of postoperative sphincter disturbance

Methods. Transcranial ‘train of 5’ stimulation (5 pulses, interstimulus interval 4msec, 200 µsec pulse width) was applied, with recordings from the urethral sphincter (small electrode taped to Foley catheter to lie just inside the urethra, referred to nearby needle anteriorly in mons pubis) and anal sphincter (paired needle electrodes in both left and right sides of external sphincter).

Results. Intraoperative stimuli of structures during dissection at one point gave a motor response confined to the urethral sphincter suggesting that these fibres may have been considered non-functional and cut had these not been assessed separately. Urethral sphincter MEP’s during the dissection confirmed that these motor fibres remained in continuity throughout. The patient was intact after tumour removal.

Conclusions. This is an avant-garde technique by which we managed to save the nerve supply to the urethral sphincter and eventually urinary continence which would have been compromised if separate urethral monitoring was not attempted along with usual intraoperative nerve monitoring. We believe its first in the UK.

P82

Pelvic neurophysiological and urodynamics findings in patients with sacral-level Tarlov cysts

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Objectives. Sacral Tarlov cysts (TC) are frequent incidental findings on spinal MRI. Controversy remains regarding their ability to cause nerve root compression. Pelvic neurophysiological and urodynamics testing provides information about sacral nerve root involvement.

Design. Case series

Subjects. Patients with MRI evidence of sacral (S1, 2 or 3) TC seen in the Uro-neurology Department between 2011 and 2018

Methods. Clinical, neurophysiological and urodynamics data were reviewed

Results. 13 patients (9 females, mean age 54/SD 13.1) were included. Symptoms were urgency/incontinence (n=8), hesitancy/urinary retention (n=7), bowel complaints (n=4), sexual complaints (n=3), back pain (n=5), genital/pelvic pain (n=6), genital numbness (n=5), impaired sensation of bladder fullness (n=2), lower limb (LL) pain/hypoesthesia (n=6), LL weakness (n=2). The following neurophysiological abnormalities were seen: anal sphincter EMG (n=10) evidence for reinnervation (n=8), pudendal sensory evoked potentials (SEPs) (n=6) absent response (n=1), S2 and S3 dermatomal SEPs (n=6) absent response (n=2), sympathetic skin response (n=6) absent response (n=3). Findings in cystometry (n=5) were: detrusor underactivity (n=2), detrusor after-contraction (n=1), equivocal obstructed voiding (n=1) and reduced bladder compliance (n=1).

Conclusions. Abnormal results in urodynamics and pelvic neurophysiology suggest involvement of the somatic and autonomic sacral innervation. Further studies are required to explore any association between structural changes on MRI and functional changes in urodynamics and neurophysiology

Spinal tumour surgery-a single centre experience

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Objectives. We report a single centre experience of spinal tumour surgery with an emphasis on epidemiology in 1.6 million population and operative complications.

Design. A retrospective audit from 2004 to 2017

Subjects. 162 procedures were performed on 139 patients. Male to female ratio was 1:1. The age range was 11 to 83 years.

Methods. A neuropathology database was filtered for spinal tumours and patients' medical notes were reviewed retrospectively to collect data.

Results. 23% (n=37) cases were for glial tumours, 20% (n=33) were schwannoma, 15% (n=24) were meningioma, 13% (n=21) were cysts including dermoid cysts. Metastatic lesions and vascular tumour cases were 6% each, whereas lymphoma and lipoma cases were 4% each. 86 (53%) patients underwent complete resection, 67 (41%) patients underwent debulking, whereas, 9 (6%) patients had biopsy only. 5 (3%) patients had motor weakness postoperatively, whereas the incidence of CSF leak, infection, urinary retention was 0.6% each.

Conclusions. The complication rate compares favourably with published literature.
Cauda equina syndrome - an assessment of long-term outcomes following surgery

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Objectives. Data regarding long-term outcomes following surgery for cauda equina syndrome (CES) is scarce, especially concerning bowel and sexual function. This study aimed to assess long-term bladder, bowel, sexual and physical function in a CES cohort.

Design. Descriptive.

Subjects. A pre-existing ethically approved database was used to identify patients who had undergone surgery for CES between August 2013-November 2014.

Methods. Patients were contacted over a one month period and completed validated questionnaires via telephone. These assessed bladder (Urinary Symptom Profile), bowel (Neurogenic Bowel Dysfunction Score), sexual (Arizona Sexual Experiences Scale) and physical function (SF-12). Patients were also asked which of their current symptoms they would most value treatment for and which NHS services they had accessed post-operatively.

Results. Forty-six of 77 patients (response rate 72%, inclusion rate 59%) with a mean age of 45 years (21-83) and mean time since admission of 43 months (range 36-60) took part in the follow up study. The prevalence of bladder dysfunction was 76%, bowel dysfunction 41% with the majority (87%) reporting very minor symptoms, sexual dysfunction 39% and physical dysfunction 48%. Pain was the most deleterious current symptom in 57% but only 7% reported post-operative pain-management referral.

Conclusions. These findings confirm the high prevalence of long-term bladder, bowel, sexual and physical dysfunction in CES patients and provide useful data to guide the expectations of patients and clinicians.

Waiting time for operative management of degenerative cervical myelopathy (DCM) and its impact on outcome

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Objectives. To audit the waiting time for patients with degenerative cervical myelopathy (DCM) and its impact on outcome in the Imperial College NHS Trust (ICNHST) against the latest AO standard.

Design. Retrospective analysis

Subjects. 1. Waiting time for surgery and impact on outcome for DCM. 2. Operative approach

Methods. The medical records of 107 patients who had undergone surgery for DCM at ICNHST in 2016 to 2017 was reviewed. Central tendency analysis of nominal and ordinal variables such as surgery waiting time and demographics were assessed using Microsoft excel.
Results. The mean age reviewed was 58.2 years. Male to female ratio was 1:1. The mean wait time was 10.22 overall. However, 58% of cases were moderate with mean wait time in that stratum at 4 weeks. Most patients improved at 3-6 months by 2 points on the mJOA regardless of approach done although 63% of cases were anterior. The results were compatible with the latest AO recommendations except for mild patients where it seemed more efficient to converse about morbidity of surgery vs myelopathy in the first instance, since disease burden is tolerable and plated in most hence risk may outweigh benefit. The approach chosen should be individually chosen based on a gestalt of patient and disease factors since results are equivocal.

Conclusions. The approach to the cervical myelopathy must be taken at the merit of each patient based on a gestalt of the individual clinical factors involved. However, default approach to limiting wait to under 4 weeks is reasonable.

P86

Surgical management of spinal cavernous malformations

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Objectives. Evaluation of the presentation, demographics, pathology and outcomes associated with the surgical management of spinal cavernous malformations [sCM].

Design. A retrospective single-centre case series of surgically managed cavernous malformations over a 3-year period

Subjects. Ten patients were identified to have a diagnosis of sCM.

Methods. Cases were identified from electronic and theatre records at a single centre. All patients underwent pre-operative assessment and radiographic evaluation.

Results. 10 patients with a mean age of 52.6 years [SD +/-14.1] and a male to female ratio of 1:1 with a mean follow-up of 14.1 months [SD +/-7.9] were identified. Spinal CM spanned two vertebral levels in 9 out 10 cases with 3 cervical, 1 cervico-thoracic and 6 within the thoracic region. Duration of symptoms prior surgical intervention was 17 months [SD +/-24], with three cases presenting with an acute [<2-week] history. Of those that underwent surgery [n=7] pain [85%, n=6], sensory/motor changes [85% n=6] and sphincteric disturbance [43%, n=3] were the commonest presenting signs and symptoms. Acute haemorrhage was a presenting factor in 3 cases. Post-operatively motor and sensory scores improved in 4 patients, 2 patients remained unchanged and 1 patient was worse. Recent haemorrhage was associated with increased likelihood in improvement in motor scores following resection.

Conclusions. In selected cases surgical management of sCM is associated with improvement in motor and sensory function postoperatively.

P87

Spinal fractures incurred by a fall from standing height

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Objectives. Falls from standing are an important cause of vertebral fractures, particularly in the elderly. They are associated with significant morbidity and long-term mortality. The aim of this study was to determine the treatment and outcomes, in a single centre, of managing spinal fractures due to falls from standing height.

Design. Retrospective case note review of patients with a fracture sustained due to a fall from standing (2011–2016 inclusive).

Subjects. 229 patients with average age 76.6 ± 14.5 years; 134 (58.5%) female.

Methods. Patients were identified from the Trauma Audit and Research Network database. Case notes were reviewed for demographics, treatment details and outcome at 6 months post-admission.

Results. 1408 patients were admitted with spinal fractures of which 229 (16.3%) sustained a fall from standing height. Two hundred and eighty-three fractures were identified in the 229 patients, which were distributed in the cervical (n=140), thoracic (n=65) and lumbar (n=78) spine. The average ISS score was 9.7 ± 5.4. Twenty-three (10.0%) patients had either incomplete or complete spinal cord injury. Fifty-six (24.5%) patients underwent surgical intervention. Forty-three patients (18.7%) died within 6 months and increasing age and Charlson co-morbidity score were associated with higher mortality.

Conclusions. Falls from standing comprise a large portion of the spinal service emergency workload. They are associated with a high 6-month mortality similar to other fragility fractures experienced by the elderly.

Identifying risk factors for multiple revisional lumbar spine surgery

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Objectives. Recurrent lumbar spine surgery due to disc herniation is a contributor to debilitating pain, disability, and carries a high patient morbidity rate(1) We identified risk factors for recurrent lumbar disc herniation post-surgical intervention

Design. Retrospective Cohort Study

Subjects. All adult lumbar spine revisions for disc herniation performed in the Neurosurgical Department at Ninewells Hospital

Methods. The number of revisions from 2013 to 2017 for each patient was recorded and two groups were identified. The first group consisted of patients who had one revision and the second group consisted of patients who had recurrent revisions (more than one) Possible factors influencing the likelihood of recurrent revisions were also noted, including age, gender, BMI, operation length, level of surgery, time from primary surgery to revision, smoking and diabetes status

Results. 140 patients had revision surgeries, of which 87(62.1%) had one revision while 53(37.1%) had recurrent operations. Younger patients (p=0.025) and patients with higher BMI (p=0.01) were more likely to have a higher number of revisions. Patients with DM (p=0.015) were associated with a higher likelihood of recurrent revisions. Other factors had little effect on the likelihood of recurrent revisions (p>0.05)
Conclusions. Identifying risk factors that influence the recurrence of lumbar revisions helps improve patient outcome and decrease incidence of revisions.

P89

Spinal disease in neurofibromatosis type 1 (NF1): a systematic review to evaluate reported patterns of pathology

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Objectives. To describe the characteristics of reported spinal pathology in NF1 patients.

Design. Systematic review.

Subjects. 1809 patients from 23 studies.

Methods. This review was conducted as per PRISMA guidelines and registered on the PROSPERO database of systematic reviews. Systematic searches were performed on the following databases: PubMed, PsycINFO, Medline, HMIC, HBE, EMBASE, CINAHL, BNI, AMED and the Cochrane Database of Systematic Reviews. Studies with n>1 describing any spinal abnormality in NF1 patients were included.

Results. 23 studies were included from 1253 unique results. The evidence levels were as follows: I (n = 1), II (n = 2) and IV (n = 19). Data was available in 1809 patients with a mean age of 22.5 years and equal gender distribution (49.3% male). Reported spinal pathology included: dural ectasia – 93/290 (32.1%); scoliosis – 326/748 (43.6%); meningocele – 5/31 (16.1%); syrinx – 10/97 (10%); cord signal abnormalities in the absence of tumour compression – 33/97 (34%); intramedullary tumour - 7/82 (8.5%); spinal nerve root tumour - 276/1350 (20.4%); and spinal plexiform tumour - 167/364 (45.9%). Degenerative spinal disease and Chiari malformation were not described to any meaningful extent.

Conclusions. Spinal pathology is common in patients with NF1 though existing literature is heterogeneous in how findings are presented. Most existing studies are of low quality. There is a need for prospective studies on this theme to aid the establishment of a core outcome set for spinal disease in NF1 patients.

P90

A systematic review of spinal cord serum and cerebrospinal fluid biomarkers for use in degenerative cervical myelopathy

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Objectives. Whilst radiological evidence of compression is the hallmark of degenerative cervical myelopathy [DCM], it is unable to stage or prognosticate. Moreover, asymptomatic spinal cord compression is common and therefore new methods of assessing spinal cord function are required. We aimed to: 1) Evaluate the evidence-base for serum and CSF biomarkers of spinal cord damage in diagnosis, prognosis or predicting response to treatment in DCM 2) Identify serum and CSF biomarkers of spinal cord damage studied in other conditions, which may have relevance to DCM
Design. Scoping review

Subjects. Human only

Methods. A search of MEDLINE and EMBASE was performed. Studies involving DCM patients or biomarkers relevant to spinal cord pathobiology were included.

Results. 852 results were screened, of which 83 were included. 9 studies explored 12 biomarkers in DCM. NFH (N=3), S100b and NSE (N=2) received most study. 74 studies explored a further 118 biomarkers in other conditions; S100b (N=13), NFH (N=11) and GFAP (N=10) received most study. Overall, 72 studies used targeted approaches, in which candidate biomarkers were chosen in advance. 11 used unbiased approaches, in which high throughput analyses identified candidate biomarkers during the study.

Conclusions. The evidence-base for use of biomarkers in DCM is limited. Whilst targeted approaches have identified a number of candidate spinal cord markers, few have shown clinical utility. There is a shift towards investigating panels of multiple markers and unbiased, high-throughput approaches.

P91

Post-operative pain in neurosurgery

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Objectives. Are the analgesic guidelines for those neurosurgical operations associated with major and complex major pain consistently followed? Is there a correlation between adherence and post-operative pain?

Design. Patients undergoing spinal surgery and foramen magnum decompressions were visited on the first post-operative day (D1). They provided their pain score subjectively (0 = nil; 10 = worst ever experienced); objectively we recorded whether they could move in/out of bed without pain limitation.

Subjects. n=57 consecutive patients undergoing elective major and complex major pain neurosurgery between April and June 2018 at the NHNN, Queen Square.

Methods. A proforma was completed on D1. The patients consented to take part and answered three questions. We examined what (if any) analgesics they were admitted on, and what had been prescribed to cover the post-operative period. This was compared against the appropriate guideline for that category of operation.

Results. Guidelines were only followed in 16/57 (28.1%) cases; not followed in 41/57 (71.9%). A one way analysis of variance demonstrated a significant difference between the pain scores when the guidelines were followed against those when they were not. The f-ratio value is 5.786. The p-value is .0195. The result is significant at p <.05.

Conclusions. The pain guidelines are not routinely followed. Most commonly this was due to no prescription for a non-steroidal anti-inflammatory agent. We suggest regular sessions of education of the guidelines. We will reaudit in July-September.
What is a benign notochordal cell tumour?

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Objectives. Characteristics from a large systematic review.

Design. The first systematic review of benign notochordal cell tumours.

Subjects. All studies, in any language, published at any time, identified using specified search terms.

Methods. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Results. So-called benign notochordal cell tumours exhibited the following features: pain was the sole presenting symptom in 37/81 (45.7%) and neurological deficit in 36/81 (44.4%). Incidental discovery upon imaging was reported in 8/81 (9.9%). Radiologically, lesions were small, (≤30 millimetres at their maximum diameter) in 57/65 (87.7%), hypointense on T1 sequences and hyperintense on T2 sequences on magnetic resonance imaging (106/130; 81.5%), did not enhance following contrast administration (62/74; 83.8%) and were non-lytic (80/160; 50.0%). Histologically, these tumours lacked myxoid matrix (66/84; 78.6%) and nuclear atypia (100/112; 89.3%). In those managed conservatively, follow up was between 8.5 and 120 months. Most were stable at follow up (22/25; 88.0%), one lesion grew (4.0%), one patient died of an unrelated cause (4.0%) and outcome was not stated in one case (4.0%).

Conclusions. BNCTs exhibit a spectrum of features, none of which are pathognomonic and diagnosis is subjective. The majority of reports describe small, non-progressive, non-lytic lesions that lack contrast enhancement, intercellular myxoid matrix and nuclear atypia. They are nevertheless difficult to distinguish from small chordomas.

PAEDIATRICS / CSF

Randomised controlled trial to determine the role of Endoscopic Clot Lavage after intraventricular Haemorrhage in Neonates ENLIVEN

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Objectives. Clot lavage following intraventricular haemorrhage (IVH) in premature neonates has been shown to reduce rates of hydrocephalus(1) and improve neurodevelopmental outcome at 2 years and beyond(2). The aim of the ENLIVEN trial (IRAS: 198936 Rec Ref: 16/LO/1792) is to determine the efficacy of Endoscopic clot lavage after intraventricular haemorrhage in Neonates.

Design. Single centre prospective randomised controlled clinical trial comparing standard treatment with subgaleal shunt (control arm) to endoscopic washout plus standard treatment (intervention arm).

Subjects. Power calculation based on published literature (1,2): 50 neonates recruited over 4 years – enrolment commenced January 2018 - current recruitment 3 neonates.
Methods. Neonates with radiological evidence of IVH (ventricular index >99th centile +4mm).
Primary outcome is the rate of permanent shunting, secondary outcomes include advanced MRI at
term and six months, behavioural assessment at early middle and late infancy, biochemical analysis
of CSF and blood.

Results. Preliminary data from the ENLIVEN trial is presented including a full description of the
radiological analysis and behavioural assessment.

Conclusions. Determining how endoscopic clot lavage impacts on clinical outcome is of paramount
importance in the management of neonatal IVH, the ENLIVEN trial will afford us the possibility of
objectively assessing its safety and efficacy.

(references requested)

P94

Ventricular subgaleal shunting is a safe and effective temporising measure for the
treatment of neonatal post haemorrhagic hydrocephalus

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Objectives. The use of a temporising device to facilitate neonatal maturation prior to permanent
ventricular peritoneal shunt (VPS) remains gold standard treatment for neonatal posthaemorrhagic
hydrocephalus (PHH). The relative superiority of ventricular access device (VAD) or ventricular
subgaleal shunt (VSG) remains contentious.

Design. Retrospective case note review

Subjects. 49 neonates born between Sept 2012 to April 2018: (M:F 34:15); Average: gestation 26+3
(23 to 32+5); birth weight 870g (+/- 355g); Papile grade 3:4 (ratio = 1:2)

Methods. Computer records from neonatal VSG at a single tertiary care children’s hospital reviewed

Results. Early complications associated with VSG seen in 13 cases (27%). Migration of shunt n = 3,
infection n = 2, inadequate control of ventricular volume n = 5, decompression haemorrhage n = 2,
wound leak n = 1. All patients managed on NICU with an average inpatient stay of 5 days (range 2 to
15). 5 outcome groups defined: 1. Patient died (non neurological cause) (n=4) 2. VSG in situ for <1
year (n=7) 3. VSG and no VPS (n=6 16%) 4. VSG & VPS X1 never revised (n=17 45%) 5. VSG & VPS with
revisions (n=15 39%) Rate of shunting in patients with VSG >1year = 84%. All patients that needed
permanent VPS were operated within the first year. The average time elapsed prior to VPS was 86
days with over 80% of cases shunted within 100 days.

Conclusions. VSG remains a safe method of temporary CSF drainage for the treatment of neonatal
PHH with rates of shunting in line with the published literature.

P95

Surgical approach and morbidity of paediatric fourth ventricular tumours: analysis of a
large institutional series

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Objectives. To characterise the surgical management of paediatric 4th ventricular tumours and their attendant neurological complications.

Design. Retrospective cohort study.

Subjects. Children referred to our institution with tumours of the 4th ventricle between 2008-2017 inclusive.

Methods. Clinical notes and imaging review. Two-tailed Fisher’s test used to determine differences between proportions.

Results. 95 patients were seen (53 males, mean 5.81y). The commonest presenting symptom was vomiting (63.3%). The commonest tumour type was medulloblastoma (54 cases) > pilocytic astrocytoma (20) > anaplastic ependymoma (12) > ATRT (4) > Teratoma (2), with 3 miscellaneous lesions. 55 pts presented with hydrocephalus. 27.4% of patients had an EVD (30.8% of these prior to tumour surgery), and 23.3% a VP shunt sited. The surgical approach was either via telovelar (50%) or transvermian (50%) routes; 29.5% were done in the sitting position. In the first 5y of the series, 7/31 cases used the telovelar approach, whilst in the latter 5y, this proportion was 30/51 (p=0.0015). New post-operative deficit was evident in 68% of cases (42.4% gait abnormality, 23.9% cranial neuropathy, 16.3% diplopia). There was no significant difference in the rates of cerebellar mutism syndrome between telovelar or transvermian approaches (p=0.62). There was 1 mortality within 30d of operation.

Conclusions. Resection of paediatric 4th ventricular tumours is increasingly performed by the telovelar route, and carries significant morbidity, although surgical mortality remains low.

P96

Screening for cerebrovascular pathology on the basis of positive family history in the paediatric population.

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Objectives. Neurovascular disorders are uncommon, complex conditions in children. We reviewed the screening practice and outcome of children referred to the neurovascular service on the basis of positive family history.

Design. Retrospective review of prospectively maintained database.

Subjects. Children referred to the neurovascular service on the basis of family history, for screening at our hospital.

Methods. We retrospectively examined our database between July 2008 and April 2018 for the reasons for referral, family history, investigations performed, and the outcome of the screening process.

Results. 44 children were reviewed (23 male, median age 10). Thirty-one children had an MRI/MRA brain. One child subsequently had uncomplicated digital subtraction angiography. Thirty children were referred due to a family history of subarachnoid haemorrhage, of which 17 had a single first-degree relative, and two had two first-degree relatives. Nine children were referred with a family history of arteriovenous malformation, (2 were associated with hereditary haemorrhagic telangiectasia). Five children were discussed due to a family history of non-specific haemorrhagic
stroke. Seven children had a history of headache, (4 were prescribed Pizotifen for migraine). No neurovascular pathology was detected following screening within our cohort.

**Conclusions.** A consensus screening policy does not exist but is required both to guide clinical practice and to assuage parental or patient concerns. We will survey UK paediatric centres to commence this process.

**P97**

**Utility of computer technology in management of Non-syndromic craniosynostosis- Is it cost effective?**

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**Objectives.** To discuss the utility of Computer technology for non-syndromic craniosynostosis (Metopic craniosynostosis) in the form of 3D printed models that could be utilised intraoperatively to aid fronto-orbital remodelling.

**Design.** Prospective study form 2015-2017

**Subjects.** Paediatric non-syndromic metopic craniosynostosis cohort

**Methods.** We present a series of 7 patients with non-syndromic metopic craniosynostosis operated on by the craniofacial team Edinburgh over a three year period. The Edinburgh Craniofacial service is supported by the Managed Service Network (MSN) for Neurosurgery, Scotland as a part of nationally delivered Craniofacial service. We utilised 3D printing models of the orbital bar to plan a fronto-orbital advancement technique. The models were then subsequently sterilised and used intra-operatively. 3D printer utility is available to us as a part of the NHS Lothian craniomaxillofacial and plastics surgery service.

**Results.** No intra-operative or post operative complications were noted in our series. All patients undergo standardised pre and post operative 3D CT and photography follow up to objectively measure the outcome.

**Conclusions.** The utility of Computer technology is a useful and safe adjunct for non-syndromic craniosynostosis, particularly metopic craniosynostosis. A careful pre-operative planning and 3D printed model is helpful to achieve the desired bespoke surgical outcome and to reduce operative time. Post operative 3D CT and 3D photography were utilised to objectively measure the outcome. No extra costs were incurred to our service. We believe that this could be incorporated in preoperative planning as an essential tool.

**P98**

**A decade of primary tumours of the spine in the paediatric population.**

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Objectives. Primary spinal tumours in children are rare and poorly understood; we review 10 years of surgical experience.

Design. Retrospective review of prospectively maintained database.

Subjects. Children receiving surgical management of primary spinal tumours in a single, tertiary paediatric neurosurgery centre.

Methods. Operations for primary spinal tumours were abstracted from our prospectively maintained surgical database and supplemented with data from case notes, operative records, and imaging studies.

Results. Between 2008 and 2017, 37 procedures were performed on 29 patients (19 male; Median age 7.5 years, IQR 2-11.25). 28 had their primary procedure in our unit: 21 excisions, and 7 biopsies (of which 5 proceeded to further surgery). Tumours were classified as extradural (10), intradural extramedullary (3), intradural intramedullary (11) or bony (4). Tumours were found at the following levels: Cervical (8; 29%), Cervicothoracic (2; 7.1%), Thoracic (10; 36%), Thoracolumbar (3; 11%), Lumbar (2; 7.1%), Lumbosacral (2; 7.1%) and Sacral (1; 3.6%). Histology comprised: Pilocytic Astrocytoma (6), Other Astrocytoma (4), Schwannoma (3), Ewing Sarcoma (2), Langerhans cell histiocytosis (2), Lymphoma (2), Neurofibroma (2), and others (7) including one Myxopapillary Ependymoma.

Conclusions. The rarity and heterogeneity of paediatric spinal tumours makes treatment challenging. We propose a national online registry including a tissue bank, and invite collaboration with other units.

P99

Neonatal subdural haematoma following forceps-assisted delivery: a systematic review of the literature

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Objectives. Subdural haematoma (SDH) is a recognised complication of forceps-assisted delivery (FAD). There are no guidelines regarding its management. This study aims to provide a better insight into the management and outcomes of neonatal SDH post FAD.

Design. Retrospective review of our neonatal database and systematic review of the literature.

Subjects. Neonatal cases presented with SDH after FAD.

Methods. Retrospective database search of cases managed in our unit between January 2011 and January 2018. Systematic review of the literature was performed using PRISMA guidelines. Inclusion criteria: (i) neonates, (ii) forceps-assisted delivery, (iii) evidence of SDH on imaging, with or without other traumatic lesions.

Results. A literature search yielded 9 studies with 30 patients meeting our inclusion criteria. In addition three cases were identified from our institutional database. 42% (n=14) had their SDH managed surgically, with subsequent full neurological recovery in 57%. In comparison, 95% (n=18) of the conservatively managed patients made a full recovery. Hydrocephalus was present in 1 and 11 of the conservatively managed and surgically managed patients, respectively.
Conclusions. Conservative management can lead to a full neurological recovery in SDH following FAD in neonates. However, a significant number may still need neurosurgical intervention for the SDH or subsequent hydrocephalus, therefore we advocate early transfer to a specialist neuroscience centre.

P100

Removing the orbital bar in fronto-orbital advancement and reconstruction


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Objectives. To describe our technique of using reverse frontal bone graft for FOAR for patients with metopic or coronal synostosis

Design. Retrospective analysis of digital records for operation notes and radiological images.

Subjects. Since April 2014, 16 patients underwent FOAR without using orbital bar.

Methods. We plan a frontal bone graft using Marchac template and increase the angles on side by 1 cm. This graft is then reversed and supra orbital margins are drilled out. The orbital bar is then removed and drilled down to make bone dust which is then used to fill gaps on exposed dura. The reversed frontal graft is then placed in front and secured via absorbable sutures, plate and screws.

Results. All 16 patients who underwent this technique have shown excellent cosmetic results with no complications or non healing. Removing orbital bar does not cause any cosmetic defect since orbital rims are drilled out in reverse frontal bone graft. The removed orbital bar provides an excellent source of bone dust to cover gaps on exposed dura.

Conclusions. We present our technique of FOAR without using orbital bar, which is drilled down to bone dust to fill gaps. This has shown excellent cosmetic results so far with no complications. This addresses the issue of temporal thinning.

P101

The Leeds paediatric brain arteriovenous malformation (bAVM) outcomes

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Objectives. The commonest cause of stroke in a paediatric population is a ruptured brain arteriovenous malformation (bAVM). We aim to assess the functional outcomes of patients who have undergone operative intervention at our unit for ruptured and non-ruptured bAVMs.

Design. A single centre retrospective cohort analysis of paediatric bAVM patients.

Subjects. 10 paediatric patients at time of surgery between January 2007 - December 2017 mean age at follow up 15.9 years, range 2-26 years, mean time to follow up 6.3 years, range 1.5-11.2 years.

Methods. Patients with bAVMs were identified via the paediatric neurovascular database. They were contacted via telephone and the Paediatric Quality of Life (PedsQL) questionnaire administered via parent proxy if the patient was under 18, and by the patient if above 18. Functional outcomes were
assessed using the PedsQL questionnaire score and converted into a health-related quality of life (HRQOL) score.

Results. 10 patients underwent resection of their bAVMS, 9 survived and 7 were contactable. The mean HRQOL score 88.9 points, range 65.2-100. Only one patient had a HRQOL score below the mean of a child with chronic disease.

Conclusions. The mean HRQOL outcome score of operated paediatric bAVM was similar to that of healthy children. Patients having bAVM surgery within our unit have had a good functional outcome. Although there are small numbers in this series, there is a low incidence of operated paediatric bAVMs. Our findings suggest that such operations should be undertaken in units with expertise.

P102

Shunting slit ventricles: a comparison of the parieto-occipital vs frontal approach

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Objectives. Slit ventricles can be a challenging target during shunt catheter insertion. Traditionally, the frontal approach has been considered optimal. At this centre, routine use of electromagnetic (EM) stereotatic guidance (StealthTM, Medtronic) has enabled a parieto-occipital burr hole approach to the frontal horns. We compare shunt placement and revisions required for patients with slit ventricles who had shunts inserted via a parieto-occipital (P-O) approach vs. frontal shunt.

Design. Retrospective cohort.

Subjects. Patients with slit ventricles and a ventricular shunt inserted using EM guidance between 2012-2018.

Methods. Slit ventricles were defined as <3mm (widest). Outcome measures included placement accuracy and survival using Kaplan-Meier curve.

Results. 82 patients (77F:5M) aged 34.9 +/- 10.8 years (mean +/- SD) had shunts inserted for IIH (n=63), chiari/syrinx (n=8), congenital hydrocephalus (n=10), pseudomeningocele (n=1). 35 had primary P-O shunts and 46 had frontal shunts. Overall, 94% of cases had the catheter tip sitting in the frontal horn. The P-O approach was just as accurate as the frontal approach. Eight P-O shunts and 9 frontal shunts required revision over a 60 month periods. There was no significant different in shunt survival between the two approaches (p=0.99).

Conclusions. EM guided placement has enabled the P-O approach to be as safe and with equivalent survival to frontal approach. The accuracy of shunt placement between the two approaches was equivocal.
Chiari malformation type I: A review of literature to compare bony posterior fossa decompression with and without duraplasty

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Objectives. Two main surgical approaches for symptomatic Chiari type I malformation (CM-I) patients are posterior fossa decompression (PFD) involving craniectomy alone, and posterior fossa decompression with duraplasty (PFDD). The aim of this review was to outline the indications, advantages and disadvantages of each surgical approach, with guidance regarding surgical decisions.

Methods. We reviewed pertinent articles. Data on the surgical outcomes, complications, reoperations, duration of procedure and the length of hospital stay were compared.

Results. Eighteen articles containing data on 2840 paediatric and adult participants met the inclusion criteria. PFDD was associated with more favourable surgical outcomes. Regarding radiological outcomes, syrinx reduction was observed in 92.3% PFDD vs 12.5% PFD. PFD was associated with lower complications rates. However, PFD was linked to higher rates of reoperation with an odd ratio of 0.15 in PFDD vs PFD.

Conclusions. Both PFD and PFDD are effective and safe surgical strategies for symptomatic CM-I associated with posterior fossa volume mismatch, in the absence of hydrocephalus and craniocervical region instability. Bony PFD has a lower complication rate, and seems to be a good option when carried out in the paediatric age group, in those without major tonsillar impaction, and in the absence of a syrinx. However, these patients should be adequately counseled regarding the requirement for possible further intra-dural decompression.

One year failure rates for de novo ventriculo-peritoneal shunts in under 3-month-old children

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Objectives. Historically VPS failure and infection rates are higher for neonates than for older children. We compared our one year VPS failure and infection rates in under 3-month-olds with those of older children.

Design. A retrospective, single centre study comparing 1 year survival and infection rates of VPS in under 3-month-olds versus older children.

Subjects. 58 children under 3 months of age underwent VPS insertion between January 2007 and December 2016.

Methods. Data was collected by three independent reviewers from electronic files and case notes. Data was analysed using descriptive statistics and one year shunt survival curves were produced.
Results. For children under 3 months there was a 29.3% one-year shunt failure rate, of which 2 were shunt infections (3.4%). In patients greater than 3 months, the shunt malfunction rate was 23.4% and the infection rate was 4.3%. There were no shunt-related mortalities in either group.

Conclusions. Children under 3-months-old undergoing VPS insertion should not automatically expect an increased 1 year failure or infection rate compared with older children. Reasons for this may be increased sub-specialisation, improved neonatal care and use of antibiotic impregnated catheters.

P105

Shunt migration in ventriculoperitoneal shunting: a comprehensive review of literature

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Objectives. The mechanical shunt complication- shunt migration is roughly noted in 1 in 1000 patients with shunt. Most of the literature on shunt migration is case reports. In this narrative review we analyze about presentation, complications and management options for each site of shunt migration

Design. Narrative review

Subjects. In total 239 articles were reviewed in this narrative review which includes a total of 396 shunt migrations

Methods. Literature search was performed using PubMed Central for all articles containing the term Ventriculoperitoneal shunt migration. All articles published through 2016 were included in this review

Results. Sites of migration were - perforation of the bowel in 139 patients; abdominal wall (57); scrotum (55); chest (32); intracranial (30); cardiac/intravascular (28); genitourinary (15); breast (13); subgaleal (12) and miscellaneous (15)

Conclusions. Migration to bowel, heart, intracranial and subgaleal space are associated with 20% chance of shunt dysfunction Any extrusion (irrespective of the site) where the shunt catheter is exposed to the external environment is associated with around 50% chance of shunt infection.

P106

Complications associated with methods of lumbar drainage


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Objectives. CSF diversion via lumbar drain (LD) is common following subarachnoid haemorrhage (SAH). The LiquoGuard® device is an automated CSF drainage system that allows for continuous ICP or volume controlled drainage. We aim to determine if there is a difference in complications and outcomes between LiquoGuard® and standard drain systems.

Design. Retrospective analysis of electronic notes of patients admitted to an intensive care unit over one year.

Methods. Retrospective analysis of electronic notes

Results. Twenty-four patients (13.1 % of SAH admissions). Aged 58.3 ± 18.7 underwent LD insertion. Twenty-one had mFisher grade 3< and 7 were WFNS grade 4<. Lumbar drains remained in place for a mean of 12.8 days. The LiquoGuard7® enabled high overall CSF drainage rates (7.6 ± 4.66 ml/hour) compared to standard systems (2.36 ± 0.53 ml/hour). CSF lumbar drainage via standard gravity based systems were more likely to block (n=4) compared to LiquoGuard7®(n=1). There was one infection in both groups. There was no significant difference in Glasgow Outcome Scale (GOS) between those with LiquoGuard7® drainage (GOS=2.5) and standard drainage (GOS=3.2) (p=0.466). Length of stay on ITU was reduced by 4 days for those with LiquoGuard7® system (p=0.039).

Conclusions. Automated pressure-volume controlled CSF drainage system may reduce length of stay on ITU and reduce the rate of catheter obstruction from clots following SAH.

Implantation of a telemetry reservoir transducing intraventricular pressure following endoscopic third ventriculostomy: a case series

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Objectives. Various case series have reported the usefulness of a telemetry reservoir attached to an intraparenchymal probe to record intracranial pressure. This is the first known series of a reservoir transducing intraventricular pressure following endoscopic third ventriculostomy (ETV) to assess its usefulness.

Design. Prospective case series (n=3) with insertion of telemetry reservoir attached to ventricular catheter post-ETV with regular follow-up and non-invasive pressure recordings.

Subjects. 3 patients were identified between 2017 to 2018(2 male,1 female, ages 30-75) for ETV and reservoir insertion following intraventricular aqueductal obstruction.

Methods. Pressure readings using telemetry were recorded in sitting, recumbent and valsalva manoeuver post-operatively, at 3 weeks and 3 months alongside clinical assessment and radiology.

Results. Readings were consistent and reproducible with dynamic manoeuvres and correlated with MRI showing ETV patency and clinical improvement. This reflects literature suggesting the usefulness of such a probe especially if MRI shows stoma patency but there is no clinical improvement.

Conclusions. Telemetry with an intraventricular catheter is a useful adjunct post-ETV to monitor intracranial pressure with reproducible long-term readings consistent with clinical correlation and radiological patency.
P108

Acetazolamide for obstructive hydrocephalus in the pregnant female: a case report and literature review.

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Objectives. This study presents a case report and literature review of acetazolamide use in the pregnant patient to further delineate its role and controversies in the treatment of symptomatic hydrocephalus. Here we present a case from our neurosurgical service which demonstrated safe use and efficacy of acetazolamide in refractory hydrocephalus secondary to a space-occupying lesion.

Design. Case report and literature review.

Subjects. 33-year-old, primigravid female treated at Charing Cross Hospital, London.

Methods. Adaptation of the PRISMA guideline to facilitate an initial PubMed database search for all available full-text, peer-reviewed publications in English. Papers were screened for relevance to pregnant patients with hydrocephalus receiving acetazolamide therapy, as well as relevant papers describing related disorders of cerebrospinal fluid flow.

Results. There exist no prospective, randomised-controlled trials for the use of acetazolamide to treat hydrocephalus in pregnancy. Retrospective data in patients with related conditions suggest no significant link between acetazolamide use and teratogenicity in humans.

Conclusions. Acetazolamide can be a safe and efficacious therapy in the pregnant patient with refractory hydrocephalus as a bridge to delivery. We agree with the consensus and its appropriate use in the pregnant neurosurgical patient.

P109

Experience of tunnelled vs. bolt EVDs on the intensive care unit


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Objectives. The placement of an external ventricular drain (EVD) is a common neurosurgical operation that carries great benefit in acute hydrocephalus but is not without risk. In our centre, bolt EVDs (B-EVD) are being placed in favour of tunnelled EVDs (T-EVD). The former has allowed for urgent CSF diversion in ITU. We compared EVD survival and complication rates between the two types of EVDs.


Subjects. Twenty-five patients with B-EVDs and thirty-four patients with T-EVDs.

Methods. Clinical notes and radiographic reports were collected before and after the placement of EVDs for patients in ITU between January 2017 and June 2018.

Results. Fourteen of the 25 B-EVDs were placed on ITU, of which 2 were under stealth guidance. All 34 T-EVDs were placed in theatre. Mean time to CSF access after decision for diversion was 134
minutes in the B-EVD group and 227 minutes in the T-EVD group (p<0.05). Mean survival was 35 days for B-EVDs and 29 days for T-EVDs (p<0.05). Eight T-EVDs went onto be replaced as B-EVDs due to retraction or infection. Complications including infection, detachment or retraction were higher in the T-EVD group at 32% compared to 20% in the B-EVD group.

Conclusions. Bolt EVDs have a lower frequency of complications and higher survival compared to tunnelled EVDs. Since B-EVDs require fewer resources they can be placed faster and on ITU.

P110

External ventricular drain-related infections: a single centre study

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Objectives. To quantify the External Ventricular Drain-related infection (ERI) rate in a one year period at Cork University Hospital, and to identify any risk factors for infection.

Design. A retrospective audit of all External Ventricular Drains (EVDs) inserted in a one year period.

Subjects. All patients who had an EVD inserted between February 2017 and February 2018.

Methods. Patients were identified from operating theatre logbooks. All relevant data was obtained from a retrospective review of medical and operative records. ERI was defined as evidence of positive CSF culture.

Results. 41 EVDs were inserted in a total of 30 patients during the study period. The average age was 52.9 years. 46.6% of patients were female. The average length of EVD insertion was 8.85 days. The most common reason for EVD insertion was subarachnoid haemorrhage (31.7%) followed by supratentorial tumour (24.4%). 78% of EVDs were antibiotic-impregnated. Average EVD sampling rate was 0.7. ERI rate was 1/41 (2.4%). The infection occurred in a patient who had an EVD inserted for haemorrhage secondary to an AVM which had remained in situ for 13 days. The patient subsequently developed problems with repeated shunt infections resulting in a nine-month hospital stay.

Conclusions. The ERI rate in our patient cohort was 2.4%. We recommend using a strict EVD sampling protocol to minimise manipulation of EVDs and where possible to limit the length of time an EVD remains in situ. EVD-related infections can result in lengthy hospital stays and increased healthcare costs.

NEUROVASCULAR /STROKE

P111

Successful treatment of Type 1 spinal dural arteriovenous fistula results in reduction of spinal cord volume

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Objectives. To examine the utility of standardised volumetric spinal cord measurement as an indicator of successful disconnection of a Type 1 spinal dural arteriovenous fistula

Design. Retrospective analysis at a tertiary neuroscience centre
Subjects. Patients with symptomatic Type 1 spinal dAVFs presenting to the senior author and neurovascular MDT (June 2009 – December 2017). Inclusion based on availability of appropriate cross-sectional imaging. DAVFs arising below T12 excluded: 18 patients with a total 19 dAVFs identified.

Methods. Type 1 fistulation demonstrated on TRICKS MR angiography and spinal catheter angiography. Sagittal volumes evaluated using Horos (Purview, Annapolis, USA) and wireframe models created. Measurement arbitrarily standardised at ±2 levels from the origin of the fistulous draining vein. Pre- and post-operative clinical outcomes assessed using the Aminoff-Logue Scale. Wilcoxon test employed for between-group comparisons and Spearman’s rank test for clinico-radiological correlation (Prism 7, GraphPad Software, Inc. California).

Results. Cord volumes reduced by a mean of 0.854 cm³ (p=.0181; 95% CI= -1.55, -0.16; SD=1.44). Volume change was not related to gait (r=0.037, p=.8812, 95% CI= -0.44, 0.49) or micturition scores (r=-0.24, p=.3165, 95% CI= -0.64, 0.25).

Conclusions. Surgical disconnection of type 1 dAVF resulted in a reduction in spinal cord volume. This was not predictive of change in clinical indices in this small series but perhaps merits investigation of this as a surrogate marker in a larger series.

P112

Management and outcome of subarachnoid haemorrhage (SAH) in older people: a centre series

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Objectives. To study the management and factors associated with outcomes in SAH in elderly over 80 years of age.

Design. Retrospective records review

Subjects. All Patients with SAH confirmed on head CT admitted Jan 2012-Dec 2017

Methods. We admitted 1079 patients with SAH, 32 were aged ≥80 y (3%). We subdivided the patients into a poor outcome group (POG) (Modified Rankin Scale (mRS) 4-6), (N=24, 14F/10M, mean age 83.7±0.7 y) and good outcome group (GOG) (mRS 0-3) (N=8, 7F/1M, mean age 82.6±0.6 y). Spearman’s rank-order test evaluated correlation between outcome (mRS) and all other variables (WFNS grade, GCS, Motor score of GCS, age, sex, smoking, hypertension, intraventricular haemorrhage (IVH) and intracerebral haemorrhages (ICH)).

Results. 9 patients (38%) of POG were WFNS grades IV - V versus 1 patient (13%) in GOG. More POG than GOG patients had IVH (83% vs 38%, rs=-0.44 p=0.011). 20% of POG had ICH vs none in GOG. GOG patients had better GCS (rs=0.37, p=0.04), lower WFNS grade (rs=0.43, p=0.01) and did not need external ventricular drain (EVD) (rs=0.51, p=0.003). There was no significant correlation.
between outcome and sex, smoking, hypertension, size of aneurysm (4.9 mm± 1.0 in GOG vs 5.4 mm± 1.1 in POG, rs=-0.29, p=0.28), percentage receiving coiling or clipping, GCS motor score, procedure complications and general medical complications.

Conclusions. 75% of patients’ aged ≥80 y with SAH had poor outcome. WFNS grade (I-III), higher GCS patients who did not need EVD had better outcome.

P113

Efficacy, safety and long-term durability of endovascular treatment of MCA aneurysms: A review of 161 treated aneurysms

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Objectives. The aim of this study was to assess the long-term outcomes of endovascular treatment of MCA aneurysms and identify factors associated with recurrence.

Subjects. 161 aneurysms in 147 patients treated between January 2008 and August 2011

Methods. A retrospective case note review was performed. Aneurysm occlusion was assessed using the Raymond-Roy classification. Clinical outcome was graded using the mRS.

Results. The minimum period of follow up was 65 months, with a maximum follow up period of 120 months. 49% of aneurysms were ruptured at the time of treatment. Morbidity was observed in 15% of the unruptured aneurysms (6% permanent neurological deficit), and in 33% of ruptured aneurysms (15% permanent neurological deficit). 84% of aneurysms were fully occluded following first treatment. Of these, 34% demonstrated angiographic recurrence and 10% required re-intervention. 25% of aneurysms ≤7mm in maximal diameter demonstrated angiographic recurrence, as compared with 50% of aneurysms >7mm. Aneurysm size >7mm was associated with a significantly shorter time to recurrence (log rank =9.655, p=0.002).

Conclusions. This is a large series of MCA aneurysms with a long period of follow up. Our results demonstrate that endovascular treatment of MCA aneurysms is associated with a low morbidity and mortality. Given the increasing use of adjunctive devices (stents, web devices) full occlusion of ruptured aneurysms in the acute phase is not necessary, and deliberate staged treatment a reasonable strategy.

P114

Surgical challenges in treating recurrent aneurysms in the context of a WEB device

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Objectives. To described the features of surgery on a recurrent aneurysm previously treated with a WEB device, and review the current literature on WEB devices

Design. Case report and literature review

Subjects. Single patient who underwent surgery for a recurrent aneurysm initially treated with a web device
**Methods.** A case is described of an anterior communicating artery (acomm) aneurysm treated with a WEB device, which subsequently underwent surgical clipping. Novel surgical challenges are illustrated with intraoperative video. Literature review was performed on the Pubmed database using the search terms “WEB”, “aneurysm”, “intracranial”, “cerebral” and “recurrence”.

**Results.** The inability to remove the WEB to facilitate clipping presented unique surgical challenges. The WEB device was soft and pliable enabling reshaping of the aneurysm, and clip application compressing the WEB. However, WEB deformation led to retropulsion into the parent vessel causing occlusion requiring multiple clip adjustments. Of 701 WEB treated aneurysms identified in the literature, 478 (68.2%) were followed up. 91 (18.9) had residual/recurrent filling of the aneurysm. 59 (12.4%) were retreated via an endovascular approach and one treated surgically.

**Conclusions.** Aneurysms previously treated with WEB devices can be safely treated surgically and present novel intraoperative challenges.

**P115**

**Subarachnoid haemorrhage with negative initial vascular imaging: A single unit experience**

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**Objectives.** To investigate the incidence of vascular abnormality and clinical outcomes in a group of patients presenting with spontaneous subarachnoid haemorrhage (SAH) and negative initial vascular investigation.

**Design.** Single centre prospective cohort study

**Subjects.** All adult patients with SAH admitted to our unit over a 12 month period.

**Methods.** Prospective collection of data on secure electronic database. Information pertaining to gender, age, mode of initial and subsequent vascular investigations was acquired. Details regarding clinical outcomes at 30 days and complications were documented.

**Results.** 118 consecutive patients with SAH were admitted to our unit over the 12 month study period. 37 patients had negative initial vascular imaging (37/118 = 31.4%). M:F = 19:18, age range 26-76 years. 32 patients underwent a high quality CT angiogram as initial vascular investigation, 5 patients underwent catheter cerebral angiogram (DSA). The most common modality of further vascular imaging was DSA. 5 vascular abnormalities were detected on subsequent vascular imaging (5/37 = 13.5%). Hydrocephalus and vasospasm were the commonest complications. Clinical outcomes were very good; all patients had a GOS of 5 at 30 days.

**Conclusions.** Patients with SAH and negative initial vascular investigation are an important subset of patients with SAH. There is no uniformity in the type of subsequent vascular investigations selected. Our experience is consistent with previously published studies.
Is it still unsafe to be admitted on a weekend with a subarachnoid haemorrhage? A retrospective study to assess delays in treatment of subarachnoid haemorrhage depending on the day of admission.

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Objectives. Treatment of aneurysmal subarachnoid haemorrhage (ASAH) needs to occur promptly after the onset of symptoms, to prevent catastrophic re-bleeds. Though most UK centres are able to provide a coiling and clipping service during the weekdays, a proportion of UK centres, have a limited coiling service during weekends.

Design. A retrospective analysis of ASAH patients admitted over a two-year period in a neurosurgical centre in Yorkshire. We compared weekend & weekday admissions highlighting timing of treatment, re-bleeds and outcomes and assessed if the type of treatment (coiling vs. clipping) had an impact on timing of treatment.

Results. 56 patients were admitted on a weekday compared to 32 patients admitted over a weekend. WFNS grades were comparable between weekday and weekend admissions. There was a statistically significant difference in timing of aneurysm treatment between the two groups; 100% of patients admitted on a weekday, were treated within 48 h of admission, compared to 71.8% of patients admitted over the weekend (p value = 0.0002). There was also a trend towards lower mortality rates in patients admitted during the weekend; 11.36% of patients admitted on a weekday died, compared to 21.87% of patients admitted on a weekend (p value = 0.2417). Delays in endovascular treatment (as opposed to surgical clipping) was most prevalent with cases in which the aneurysm was treated after 48 h.

Conclusions. Significant delays in the management of ASAH are evident in the treatment of ASAH patients admitted over weekends with potential implications on outcomes. A higher proportion of the delays in treatment are associated to unavailability of coiling services on the weekends.

P117

Predictive factors of outcome in poor grade subarachnoid haemorrhage (SAH)

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Objectives. To study the factors associated with outcome in poor grade SAH in a busy tertiary centre.

Design. Retrospective records review.

Subjects. All Patients with SAH WFNS grades IV and V admitted Jan 2016-Dec 2017

Methods. We admitted 379 SAH patients, 84 (22%) were poor grade (N= 84, 33M/51F mean age 60.7±1.4 y). Outcome was assessed by Modified Rankin Scale (mRS) scores before surgery and at
latest follow up (3-6 months). mRS was dichotomised as good (0-3) and poor (4-6). Spearman’s rank-order test evaluated correlation between latest mRS and all other variables (WFNS grade, GCS, Motor score of GCS, age, sex, smoking, hypertension, intraventricular haemorrhage (IVH) and intracerebral haemorrhages (ICH)).

**Results.** 63 patients (75%) had poor outcome, of which 46 (55%) died (44 with 30 days), versus 21 (25%) had good outcome. Spearman’s correlation analysis revealed that patients with smaller aneurysms (3.3 ± 0.4 mm in good outcome patients vs 11.3 ± 1.2 mm in poor outcome) (rs=0.37, p=0.009), who are younger (rs=0.24, p=0.03), have higher GCS (rs=-0.24, p=0.03), higher motor score (rs=-0.25, p=0.02), lower WFNS grade (rs=0.3, p=0.007) and received coiling of aneurysms vs no treatment (rs=-0.39, p<0.0001) had better outcome. There was no significant correlation in outcome with ICH, IVH, external ventricular drain insertion, location of aneurysms, smoking, hypertension, other co-morbidities or sex.

**Conclusions.** In poor grade SAH, younger patients with smaller aneurysms, higher GCS and higher motor score who received endovascular coiling had better outcome

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**A novel technique for repair of the vertebral artery during cranial surgery**

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**Objectives.** To demonstrate a novel/alternative technique for repair of the vertebral artery intraoperatively.

**Design.** Left-sided retromastoid craniotomy in one patient.

**Subjects.** A 61-year-old male patient with meningioma in the foramen magnum encasing the vertebral artery on the left side.

**Methods.** Standard retrosigmoid craniotomy performed with preservation of transverse and sigmoid sinuses. The dura was opened and the cerebellum was retracted with CSF release. The tumour was debulked gradually. The attempt to peel the tumour from the vertebral artery resulted in arterial bleeding. The hole in the artery was sealed using an N-hydroxysuccinimide functionalised polyethylene glycol-coated collagen patch (Hemopatch®, Baxter Healthcare Ltd) as an onlay, applying pressure for 2 minutes. Another patch was applied for further support and the artery checked for haemostasis. The dura was closed with 3-0 vicryl and Hemopatch® onlay after further tumour debulking.

**Results.** Haemostasis of the vertebral artery was achieved at 140 mmHg SBP and a catheter angiogram found no dissection or false lumen. The patient did not suffer postoperative haemorrhage and after three months of inpatient rehabilitation was discharged with significantly improved cranial nerve function. There was no CSF leak.

**Conclusions.** Haemostasis was successfully achieved in the vertebral artery with this novel technique. It can prove to be important in such scenarios where direct cross-clamping and arterial repair is technically challenging and can lead to brainstem ischemia.
EEG correlates of postural control - a surrogate for dizziness?

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Objectives. We use EEG during continuous balance at single electrodes to see if balance task difficulty and dizziness are reflected in cortical activity.

Methods. 1) Impact of task difficulty on EEG spectral power: 24 healthy right-handed adults performed seated and balance tasks of increasing difficulty (bipedal: FLOOR, FOAM and unipedal: RFLOOR, RFOAM). 2) Impact of age and dizziness: 15 young adults, 15 healthy old adults and 10 dizzy old adults (“unexplained dizziness” putatively due to small vessel disease) recorded sitting and standing. EEG was recorded with eyes closed at regions of interest C3, Cz, C4, P3, P4 and power analysed in theta (4-8Hz) and alpha (8-12Hz) bands.

Results. 1) Significant inter-hemispheric differences in theta power were seen; theta tended to reduce during active tasks, greater on the right. Alpha power negatively correlated with task difficulty, also greater on the right. 2) Significant reductions in alpha activity were seen on standing across groups; more so for Dizzy Old than Old than Young.

Conclusions. 1) Greater reductions in alpha/theta power in right-sided areas during increasing balance demands confirms a role of the non-dominant hemisphere in monitoring postural control. 2) The progressive reduction in alpha power on standing from Young to Old to Dizzy Old may reflect the increased difficulty with balance (as in 1, above). The reduction in alpha power on standing in dizzy patients suggests abnormal cortico-subcortical interaction in relevant vestibulo-proprioceptive-motor areas.