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PROCEEDINGS

Proceedings of the 157th meeting of the Society of British Neurological Surgeons

This meeting is being hosted by the Department of Neurosurgery, Frenchay Hospital, Bristol, UK, commencing on the 30th March 2011.

The full abstracts of platform presentations are followed by the titles of those submissions accepted as posters.

These abstracts are published in advance of the meeting – if any papers are subsequently withdrawn or not read to the society, an addendum to this effect will be published in the next issue of the journal.

The order of abstracts is that of presentation, with the abstracts presented in the parallel session following those in the first.

PRESENTED ABSTRACTS

General

WM1-1: A prospective, randomised and controlled trial investigating the use of lumbar cerebrospinal fluid drainage following aneurysmal subarachnoid haemorrhage

Y. Z. Al-Tamimi, D. Bhargava, G. Hall, R. Feltbower, A. C. Quinn & S. A. Ross (Leeds General Infirmary)

Objectives: A single-centre prospective randomised and controlled trial has been conducted in order to test the hypothesis that lumbar drainage of cerebrospinal fluid (CSF) following aneurysmal subarachnoid haemorrhage (aSAH) reduces the incidence of delayed ischaemic neurological deficit (DIND) and improves outcome.

Design: A single-centre prospective randomised and controlled trial has been conducted in order to test the hypothesis that lumbar drainage of cerebrospinal fluid (CSF) following aneurysmal subarachnoid haemorrhage (aSAH) reduces the incidence of delayed ischaemic neurological deficit (DIND) and improves outcome.

Subjects: 210 patients with aSAH (166 f, 44 m; median age 54 years, interquartile range 45-62 years) were recruited between October 2006 and July 2010 into the control ($n = 105$) and study ($n = 105$) groups of the trial. WFNS grade was: 1 ($n = 139$), 2 ($n = 60$) and 3 ($n = 11$); Fisher grade was: 2 ($n = 87$), 3 ($n = 85$) and 4 ($n = 38$). There was no significant difference in age, sex, WFNS grade, Fisher grade and aneurysmal treatment modality between the two groups.

Methods: Patients with World Federation of Neurosurgeons Grade (WFNS) 1-3 aSAH and Fisher grade 2-4 were randomised to either the study group of standard therapy plus insertion of a lumbar drain or the control group of standard therapy alone. The primary outcome measure is the incidence of delayed ischaemic neurological deficit.

Results: The incidence of DIND was 35.2% in the control group and 21.0% in the study group. This is statistically significant ($p = 0.021$). The incidence of a Modified Rankin Score of 4, 5 or 6 at day 10 post ictus was 44% in the control group and 30% in the study group ($p = 0.046$). There were 20 and 14 patients with a radiologically proven infarct at discharge in the control and study groups respectively (NS). The incidence of permanent CSF shunting was 7% in the control group and 6% in the study group (NS).

There were two cases of meningitis associated with lumbar drain use and one case of a superficial lumbar drain exit site infection. All treated successfully with antibiotics.

Conclusions: There is a significant reduction in the incidence of DIND and improvement in outcome with the use of lumbar CSF drainage following aSAH. All patients with aSAH of WFNS grades 1-3 should have insertion of a lumbar drain on admission to a neurosciences centre.

WM1-2: Early deterioration of CSF dynamics in a long-term survival neonatal piglet model of intraventricular haemorrhage

K. Aquilina, I. Pople, S. Hogan, T. Wood & M. Thoresen (Department of Neurosurgery, Frenchay Hospital, Bristol, UK)

Objectives: Early drainage, irrigation and fibrinolysis (DRIFT) is the only intervention that has led to improved long-term outcomes after neonatal intraventricular haemorrhage (IVH)[1]. Early ventricular access device (VAD) insertion with cerebrospinal fluid (CSF) aspiration is under investigation within a

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randomised trial (ELVIS). This study attempts to define the temporal progression of deterioration in CSF dynamics in a large animal model of untreated neonatal IVH.
Design: Prospective neonatal piglet laboratory study with long-term survival
Subjects: 10 Landrace piglets (age 9–22 hours, weight 1.9–2.2 kg)
Methods: Animals underwent slow injection of intraventricular autologous centrifuged blood (4 mL) under general anaesthesia[2]. A VAD was inserted within the first week. Ventricular enlargement was monitored by ultrasonography. Serial constant flow ventricular infusion studies were performed through the VAD over 8 weeks. Histopathological examination of the brain was undertaken.
Results: 9 animals demonstrated progressive permanent post-haemorrhagic ventricular dilatation. Median resistance to CSF outflow (Rout) increased from 38.6 mmHg mL-1 min in week 2 to 70, 115 and 184 in weeks 3, 4 and 5 respectively, decreasing to 50 in week 8. Changes in Rout preceded progressive ventriculomegaly; median thalamo-occipital distance increased from 4 mm in week 2 to a maximum of 11 mm in week 6. Maximal rate of ventricular enlargement occurred in week 5. Post-mortem brain examination showed extensive basal arachnoiditis, ventriculomegaly and white matter changes.
Conclusions: In this large animal model, reduction in CSF absorption capacity occurs early and precedes ventriculomegaly, supporting early aggressive management of neonatal IVH, as in DRIFT and ELVIS.

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WM1-3: Subdural collections in shunted normal pressure hydrocephalus: risk factors, incidence and recommendations for treatment

R. Sivakumaran, W. G. B. Singleton & R. J. Edwards (Department of Neurosurgery, Bristol, United Kingdom)

Objectives: Subdural effusions or haematomas (SDH) are well recognised complications of shunt insertion in NPH. This study was developed to evaluate possible risk factors leading to SDH formation.
Design: Retrospective analysis of 183 NPH patients treated with CSF shunts (2002-2010). Imaging and medical records for all patients were reviewed. Risk factors and subsequent management of SDH were analysed.
Subjects: 27 (15%) of NPH patients developed SDH (3 fixed pressure & 24 programmable valves). 21 were symptomatic (7 new focal deficit; 8 headache; 9 increased confusion). In 6 patients, SDH was detected on routine surveillance imaging.
Methods: Risk factors for SDH development: trauma $n = 8$; anti-platelets/anti-coagulant agents $n = 11$; following therapeutic reduction in valve opening pressure $n = 10$. (2 also sustained head injuries and 6 were on anti-coagulant/anti-platelet agents).
Results: 10 patients (37%) underwent surgical evacuation (8 burrhole drainage with 2 requiring re-evacuation and 2 craniotomies). 8 of these had valve opening pressures increased. 11 (41%) of symptomatic patients were managed with valve adjustment alone. 70% of all patients had their valve pressure increased.
Conclusions: The use of programmable valves for NPH patients has resulted in a substantial reduction in those requiring surgery for SDH. 30% of SDH followed a documented traumatic head injury. Anticoagulant / anti-platelet use was associated with the development of SDH. The majority of SDH can be successfully managed conservatively without long term sequelae.

WM1-4: The constant flow ventricular infusion test is a reliable test for shunt malfunction in patients with equivocal clinical and radiological findings

J. Sacree, A. Visca, R. Edwards, I. Pople, M. Carter & K. Aquilina (Department of Neurosurgery, Frenchay Hospital, Bristol, UK)

Objectives: Most episodes of ventricular shunt malfunction present with typical symptoms and changes in ventricular size. Some present with non-specific symptoms and unchanged radiology. Traditionally, these patients were observed, or underwent overnight intracranial pressure monitoring and / or shunt exploration. In this study we evaluate the role of the constant flow ventricular infusion test (VIT) in identifying shunt malfunction in this difficult patient cohort and correlate its results with surgical findings.
Design: Retrospective clinical study
Subjects: Patients with equivocal symptoms and radiology, between January 2009 and September 2010. Patients with normal pressure hydrocephalus were excluded.
Methods: Patients underwent constant flow VIT using the ICM+ software (Cambridge, UK) by a dedicated hydrocephalus nurse practitioner. Patients with high resistance to CSF outflow, B waves in the plateau phase or indication of shunt underdrainage on ICM+ analysis were surgically explored.

Results: In addition to standard investigations, because of diagnostic uncertainty, between January 2009 and September 2010, 30 shunt revisions (23 < 16 years of age) were preceded by a VIT. Almost all were performed through a separate ventricular access device. None of these patients had a functioning shunt at surgery. 11 VIT's (7 < 16 years of age) were negative; symptoms subsequently resolved over clinical follow up (median 6 months). There was no morbidity related to VIT.
Conclusions: In this patient group, VIT correlates well with findings at shunt exploration, and is a simple, safe and cost-effective investigation in the diagnosis of shunt malfunction

WM1-5: Financial, medical and social benefits in day-case craniotomy: Perspectives from two socialized medical systems

P. Goetz & M. Bernstein (University of Toronto, Division of Neurosurgery, Toronto, Canada)

Objectives: Outpatient craniotomy for supratentorial tumours (OC) is a safe alternative to routine admission; advantages include reduced cost and morbidity (e.g. nosocomial infection, thromboembolism, medical error) and improvement in patient flow. We aimed to: a) compare costs associated with inpatient and OC at our institution (TWH); b) compare bed-shortage related cancellation rates at TWH and a comparable UK unit (UKu); c) estimate potential revenue and patient flow gains at UKu by using OC.
Methods: Costing data from five in-patient overnight admissions and five OC's operated by the senior author between March 2009-2010 were obtained. Selected in-patients could have been managed as out-patients (i.e. comorbidity confounders eliminated). Operating theatre logs between June and November 2010 were analysed at both sites to establish cancellations rates and their causes.
Results: A 39% cost-saving was achieved at TWH in OC vs in-patient, based on nursing, food, laboratory and pharmacy costs. Over the six months analysed, day-of-surgery cancellation rates were 5% (34 of 698 elective procedures) and 25% (133 of 533) at TWH and UKu respectively. Assuming 1/3 cancellations (44) at UKu due to bed shortages, additional revenues of £200,000-300,000 could have been generated over 6 months. 120 craniotomies were performed during that period at UKu, none of which were day-cases. Further benefits include reduction of: bed-related emergency refusals (36 in same period at UKu), waiting lists and admission-related morbidity.
Conclusions: OC is a proven, resource-efficient option. Introducing it into mainstream practice, with appropriate training, would provide significant advantages in socialized medical systems with ever-increasing financial constraints.

Trauma

WM2-1: What comes first? Observations of brain oxygenation and blood flow at different levels of cerebral circulation

K. P. Budohoski[1], C. Zweifel[1,2], P. Smielewski[1], M. Czosnyka[1] & P. J. Kirkpatrick[1] ([1]Division of Neurosurgery, University of Cambridge, Addenbrooke's Hospital, Cambridge, UK, [2]Department of Neurosurgery, University Hospital Basel, Basel, Switzerland)

Objectives: Direct tissue oxygenation (PbtO2) and near-infrared spectroscopy (NIRS) are novel methods for evaluating cerebral oxygen status. This study aims to elucidate the response of PbtO2, NIRS and cerebral blood flow velocity (CBFV) to changes in arterial blood pressure (ABP) and intracranial pressure (ICP).
Design: Retrospective, observational study.
Subjects: 42 head-injured patients with PbtO2, NIRS and CBFV monitoring.
Methods: Changes in PbtO2, NIRS: tissue oxygenation index (TOI) and tissue hemoglobin index (THI) and CBFV in response to changes in ABP, ICP and oxygenation were analyzed (n = 131). Events were classified according to triggering parameter (ABP, ICP or oxygenation). ABP-led events were further divided depending on the integrity of cerebrovascular reactivity. Latencies between parameters were calculated and compared using non-parametric methods.
Results: In ABP-led events with preserved cerebrovascular reactivity (n = 39) changes in TOI and PbtO2 were unidirectional and followed changes in ABP. In events occurring during disturbed cerebrovascular reactivity (n = 60), in the majority (n = 31) both PbtO2 and TOI decreased while ABP and ICP increased. However, events where changes of PbtO2 and TOI were not concordant, were also observed. Changes in ICP were observed first, followed by THI, than TOI, with changes in PbtO2 visible last. This pattern was true for all cases except oxygenation-led events. Differences in latencies were statistically significant only in ABP-led events with intact cerebrovascular reactivity ($p < 0.05$).
Conclusions: All indices monitor different levels of the cerebral vascular tree. The patterns of changes in PbtO2, TOI and THI in response to ABP led events depend on the state of cerebrovascular reactivity.

WM2-2: Dynamic Cine MRI imaging of the cervical spine: a feasibility study

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Objectives: Dynamic factors are known to contribute to the pathogenesis of cervical spinal disease.

The aim of this study was to assess the potential of dynamic cine MRI sequences to image the cervical spine during real time flexion and extension movements.
Design: Observational single-centre study with local ethical approval.
Subjects: Initially 20 healthy volunteers were recruited. Subsequently, eligible patients were identified in spinal outpatient clinics or referred by clinicians if dynamic imaging was thought to be of potential benefit. 13 patients have been recruited so far with a mean age of 54.3 years.
Methods: The patients were scanned in an MRI scanner with head/neck coil using standard MRI sequences and a dynamic sequence developed for cardiac imaging (based on FIESTA sequence). The patients flexed and extended their neck whilst images are acquired at 8 frames/second in real time.
Results: In all patients moving sequential mid-saggital MRI sequences were reviewed on PACS workstations by radiologists. These were of sufficient quality to demonstrate and measure flexion and extension occurring within the cervical spine and spinal cord. The observed range of movement extended from approximately 48 to 94 degrees (between C1 and C7). The spatial resolution of the images, as expected, was limited and thus the images were interpreted in conjunction with conventional static MRI.
Conclusions: Dynamic MRI imaging of the cervical spine is a unique new modality which allows us to assess the in-vivo kinetic components of the cervical spine. It seems an excellent tool for assessing dynamic patterns of instability and cord impingement. Moreover, it may provide further insight into a number of cervical pathologies for which further prospective data and comparative studies are required.

WM2-3: Severe Traumatic Brain Injury Managed in a District General Hospital

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Objectives: To investigate how effectively adults with severe traumatic brain injury (TBI) can be managed in a district general hospital intensive care unit offering intracranial pressure monitoring (ICPM) receiving advice from a neurosurgical unit.
Design: Single-centre case series with retrospective review of prospectively collected information.
Subjects: 49 consecutive patients presenting over seven years from January 2003 to January 2010 with severe traumatic brain injury to a single district general hospital intensive care unit serving a population of 500,000 adults.
Methods: A prospectively entered clinical database was used to obtain information including patient demographics, GCS on admission, ICPM insertion, ICPM-related complications, inpatient mortality and neurosurgical advice. Case notes were used to ratify information and obtain neurorehabilitation clinic functional outcome scores.
Results: 49 patients were identified (43 male, age range 16-77 years). Mortality in intensive care was 27%. 28 patients (57%) received frontal twistdrill ICPM following neurosurgical advice. ICPM had 2 (7%) device malfunctions but no other complications. 7 patients (15%) were transferred to tertiary neurosurgical intensive care, 6 (13%) discharged home and 23 (47%) were referred to neurorehabilitation. Mean clinic follow-up was 14 months. All patients had a Glasgow Outcome Score (GOS) of 3 or 4 at initial clinic assessment. 22 improved to GOS to 4 or 5 at clinic discharge. 1 patient died prior to clinic discharge.
Conclusions: Carefully selected patients with severe TBI can be managed safely and effectively in a district general hospital offering ICPM insertion. Neurosurgical advice regarding patient selection and ongoing management is fundamental to providing a good service.

WM2-4: Has becoming a London 'Major Trauma Centre' improved the care of Head Injured Patients?

D. Wright, L. Zhang, P. Razis & P. Minhas (St. Georges Hospital, London, UK)

Objectives: To assess the delays in access to treatment of head injured patients at a newly appointed major trauma centre in South West London
Design: Retrospective audit
Subjects: All adult patients with head injuries requiring transfer to neuro intensive care approximately six months prior to instatement of Major Trauma Centre status and six months post.
Methods: The data was collected from the Intensive Care National Audit and Research Centre's (ICNARC) Risk Adjustment in Neurocritical Care (RAIN) study database. We looked at the recorded time of traumatic brain injury (TBI) and the time it then took to get a hospital, then to a CT scanner, to be transferred to Neuro ITU and then to be taken to theatre.
Results: The data collected included 34 patients (mean age: 36y) in the six months prior to (6 admissions per month) and 63 patients (mean age 38y) in a seven month period post instatement (8 admissions per month). Following the injury the median times of arrival at the Neurosurgical Centre (in hours and minutes, pre: 05:09 (via DGH), post: 01:45), the first CT scan (pre: 02:35, post: 02:31), admission to NICU (pre: 06:11, post: 05:24) and of getting to

theatre (pre: 09:30, post: 08:10 have all decreased post instatement.
Conclusions: The study provides some encouraging early data on the speed of treatment of this group of patients following the advent of the Major Trauma Centre.

WM2-5: Wide variation and systematic bias in clinicians' perceptions of prognosis following brain injury

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Objectives: The heterogeneous nature of traumatic brain injury (TBI) makes outcome prediction particularly difficult. Well-validated predictive models are available, but are not widely used. There appears to be a gap between the quality and rigour of the prognostic models, and their application in clinical practice. In order to investigate whether this prognostic gap might have a deleterious impact on patient care, we aimed to determine whether expert clinical judgement is accurate and consistent at predicting outcome.
Methods: Neurosurgeons and neurointensivists were asked to predict the probability of death at 6 months for 12 case vignettes describing patients with isolated TBI. Predictions were compared against a well-validated prognostic model (IMPACT model).'
Results: 27 of 33 questionnaires were returned. Doctors predicted a significantly greater probability of death than the model ($n = 318$, mean difference +16.31%, 95% CI 19.37-13.32, $p < 0.001$). The median range of probability of mortality predicted by doctors was 71.5%. Standard deviation between doctors' predictions ranged from 12-30% ($n = 24$, mean sd 22.4%, 95% CI 20.16-24.54). Only 15% of doctors reported using prognostic models in practice.
Conclusions: Experts' predictions of outcome in TBI are widely variable and systematically pessimistic compared to prognostic models. Utilising prognostic models in TBI may support clinical decision making by identifying and protecting patients who may have a better outcome than predicted by clinical acumen alone.

Paediatric neurosurgery

TM1-1: Paediatric shunt surgery – does surgeon experience influence outcome?

N. Barua, K. Aquilina, M. R. Carter, I. K. Pople & R. J. Edwards (Frenchay Hospital, Bristol, UK)

Objectives: Ventriculoperitoneal shunt failure is common in the paediatric population and a significant cause of morbidity and mortality. The aims of this study were to identify the rate of early shunt failure, to identify which procedures were performed outside normal working hours and by whom, and to determine whether failure rates were higher for procedures performed by unsupervised trainees compared with consultants.
Methods: A total of 271 paediatric shunt procedures between September 2006 and March 2010 were identified from our institution's operative database. Patient and surgeon data were cross-referenced with prospectively collected morbidity and mortality data.
Results: Overall early shunt failure rate (within 30 days of surgery) was 15.5%. Early failure was more common in procedures performed by unsupervised trainees compared with consultant paediatric neurosurgeons (22.8% vs. 11.5%; $p = 0.02$, chi-square). Trainees were more likely to perform unsupervised paediatric shunt procedures when a non-paediatric subspecialist consultant was on-call ($p = 0.04$, chi-square). Multivariate regression analysis confirmed younger patient age ($p = 0.04$) and grade of surgeon ($p = 0.008$) as risk factors for early failure. Kaplan-Meier shunt survival curves revealed that shunt procedures performed by unsupervised trainees had reduced survival compared to procedures performed or directly supervised by consultant neurosurgeons ($p = 0.002$, log rank test).
Conclusions: This study demonstrates that shunt survival is significantly worse for procedures performed by unsupervised trainees, and that trainees were more likely to perform unsupervised procedures when non-paediatric consultants were on-call. This study illustrates the importance of consultant-led paediatric shunt surgery in attaining optimum outcomes.

TM1-2: What are the long term impacts of antibiotic-impregnated shunt (AIS) on shunt infection?

R. D. Morgan, J. Hartley, O. N. Jeelani, D. Thompson, W. Harkness, R. Hayward & J. Ternier (Great Ormond Street Hospital for Children NHS Trust, London, UK)

Objectives: Infective complications in shunts remain a significant source of morbidity and financial burden in paediatric neurosurgical care. AIS represent a potential solution although data has been inconclusive[1–4].
Design: We decided to pursue a retrospective analysis of 500 cases of AIS to evaluate their long-term impact on shunt infection.
Subjects: We identified 500 surgical procedures of AIS implantation in 346 patients. Patients were aged from 1 day to 22 years old (mean average: 3.9). There were 172 female and 174 male patients. We included patients having de novo AI Shunt, AI Shunt revision and non AI Shunt revised using AI tubing. The mean follow up was 31 months (range: 6-59.3).

Methods: The data was collected between June 2005 and October 2010. Each surgical case consisted of an AIS implantation with ventricular and/or distal tubing according to our surgical protocol. The primary outcome measures were 1) infection rate, 2) bacteriologic agent causing infection and, 3) delay between implantation and infection. We compared these results to our historical series of simple shunts from 1993 to 2003 ($n = 1592$).
Results: Amongst AIS procedures the infection rate per procedure per patient was 5%. This was significantly lower compared to our historical series (8.4%: $p < 0.005$). In the AIS cohort infections also occurred in older patients (average 4.4 years old verses 1.1 year old previously) and, interestingly, the average time-to-infection lengthened (139 days verses 23 days previously). Overall, the incidence of coagulase negative Staphylococcus aureus reduced ($p = 0.0005$) whereas the incidence of Propionibacteria increased ($p = 0.032$). There was no antibiotic resistance following AIS implantation.
Conclusions: This study confirms that using AIS improves the overall shunt infection rate, particularly in our youngest patients. In addition, AIS appears to lengthen the time-to-infection and affects the pattern of shunt infection.

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TM1-3: A Regional Paediatric Neurosurgery Referrals Database: Patterns of referral in more than 900 cases and evidence for shortfalls in resource provision

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Objectives: Following a review of specialist services at our institution supported by SHA and HCC a database of referrals was set up in 2009. This database captured the referral source, provisional diagnosis, urgency and ability to admit within a stipulated time-frame for each clinical scenario.

Subjects: 927 (368 girls, 552 boys, 7 unknown) children were included in the database.

The M:F = 1.5:1, ages ranged from 1 day to under 18 years. Median age was 7 years.
Methods: We present a preliminary retrospective analysis of 927 patients referred to a regional paediatric neurosurgery unit from April 2009 to December 2010.
Results: There were 938 database entries. 18(1.8%) blank/incorrect entries were excluded from the analysis. 4.5% had missing age data. About 20% were less than 1 year old. 20% were 1–3 years, 7% 3–5 years, 28.6% were 5–12 years and 21% were older than 12 years.

The top 5 conditions (HI, HCP, Tumours, Infections and spinal conditions) accounted for about 90% of emergency admissions. HCP & HI accounted for 40% of the referral workload and for the highest proportion of Immediate (admit < 1 hr) and emergency referrals (admit < 4hrs).

Life-critical immediate and emergency referrals were refused in 14 cases for lack of PICU/ward beds. 49 children suffered additional transfer delays including retrieval. Of these, 29 (60%) needed immediate/emergency admission.
Conclusions: A paediatric neurosurgery referrals database is essential to identify patterns of care delivery and resource gaps. This report identified local resource shortfalls which on addressing should lead to improved delivery of care and its use is highly recommended.

TM1-4: Management of Fronto-nasal dermoids in Children: An eight year experience from a supraregional centre

B. Pettorini, N. White, H. Nishikawa, G. Solanki, P. Noons, S. Dover, M. Evans & D. Rodrigues (Paediatric Neurosurgery, Birmingham Children's Hospital, Birmingham, UK)

Objectives: The purpose of this study is to determine effectiveness and safety of a transcranial approach for treatment of fronto-nasal dermoids in children and discuss the merits of CT versus MRI in their pre-operative evaluation.
Design: A retrospective review of fronto-nasal dermoids treated surgically over an 8 year period in a single paediatric centre. We analyse the presentation, surgical approach, post-operative complications and recurrence rate with our procedure.
Subjects: Dermoid sinus is the most common midline nasal anomaly. Intracranial extension has been reported in up to 45% of cases. Complete surgical excision is the only theraopeutic option.
Methods: Database was used to identify all children diagnosed as nasal dermoids. Case notes and radiology was used to identify and analyse the subgroup of children treated for fronto-nasal dermoids.

Results: We identified 34 patients with nasal dermoids of which 32% were transcranial. The median age at presentation was 2 years. Four patients presented with intermittent discharge while seven had swelling over the bridge of the nose or glabella. Radiology demostrated evidence of intracranial extension in these cases.
No major complication was noted in our series. No patients had intracranial recurrence but extracranial (nasal) recurrence occurred in 3 cases.
Conclusions: Combined one-stage intracranial approach for treatment of nasal dermoids with intracranial extension is effective and safe. Preoperative evaluation is essential to rule out intracranial extension and we discuss the relative merits of CT versus MRI in this. The role of pericranial flaps, Fibrin glue and Duragen to prevent CSF leaks is discussed.

TM1-5: Purse String Closure of Large Myelomeningoceles

J. Walkden, L. Highton, J. Thorne & P. Davenport (Departments of Neurosurgery and Plastic Surgery, Royal Manchester Childrens Hospital, Manchester, UK)

Objectives: The closure of myelomeningocele defects poses a significant challenge that requires the collaboration of Neurosurgeons and Plastic Surgeons. A variety of techniques have been described utilising a variety of grafts and flaps, we describe our experience of using a purse string closure technique with excellent cosmetic results.
Design: We present a case series of six neonates since 2008 where a purse string suture has been succesfully used to close large myelomeningocele defects.
Subjects: Subjects were neonates presenting with myelomeningocele defects at birth to our institution since 2008.
Methods: We describe the technique of purse string myelomeningocele closure and present our experience of cosmesis following surgery.
Results: Our experience demonstrates grafting and flap techniques are often overly aggressive as a purse string suture can be used in the majority of cases to close even large defects, with excellent cosmetic results.
Conclusions: The closure of large myelomeningocele defects poses a significant surgical challenge and often prompts overly aggressive techniques. We have described durable closure of large myelomeningoceles in six neonates with a simple purse string suture. This technique has the benefits of short operative time, minimal blood loss, no donor site morbidity and an aesthetically pleasing scar. We recommend the use of a purse string suture over more complicated alternatives wherever possible.

TM1-6: Outcomes following Transsphenoidal and Transcranial surgery in selected paediatric patients with craniopharyngioma at a single institution

K. Deniz, E. Ikazoboh, H. Spoudeas & M. Powell (Great Ormond Street Hospital for Sick Children, London, UK)

Objectives: Comparing outcomes and complications following transsphenoidal surgery (TSS) and transcranial surgery (TCS) in paediatric patients with craniopharyngiomas treated at a single institution between 1995 and 2009.
Design: A retrospective analysis of case notes and imaging studies was performed. Information regarding tumour characteristics, peri-operative endocrine status, peri-operative visual assessment, extent of resection and tumour recurrence rates, need for adjuvant radiotherapy and adverse events was extracted and compared for the two groups.
Subjects: Twenty-one patients were identified. Ten patients underwent TSS and were followed up after a mean duration of 63.75 months (range 6-128 months). Eleven patients underwent TCS and were followed up after a mean duration of 74.8 months (122–145 months).
Methods: Medical records and imaging studies were retrospectively analysed.
Results: Complete tumour resection was achieved in 2 patients (1 patient each following TSS and TCS). Sixteen patients had adjuvant radiotherapy: 6 following TSS and 10 following TCS. Eight patients experienced tumour recurrence: 4 following TSS and 4 following TCS. Mortality rate and incidence of complications including sepsis, CSF rhinorrhea and haemorrhage are discussed.

All patients who had TSS had at least one pituitary hormone deficiency, GHD being the most prevalent (100%), and DI the least prevalent (50%) (compared with 72.7% and 36.4% for TCS patients). Following TSS, 4 patients had panhypopituitarism with DI, compared with 5 following TCS.
Conclusions: TSS in selected paediatric patients with craniopharyngioma is safe and is associated with endocrine and hypothalamic outcomes that are comparable to outcomes following TCS.

TM1-7: Paediatric Craniopharingyomas: a case series and service management evaluation

D. G. Barone & H. M. Fernandes (Addenbrookes Hospital, Cambridge, UK)

Objectives: To review all cases of paediatric craniopharyngiomas in a neurosurgical unit over the last 10 years, correlating changes in pre-operative and present-status morbidity with risk factors and comparing our results with the medical literature.
Design: Retrospective observational study.
Subjects: Paediatric craniopharyngiomas.

Methods: Inclusion criteria: Paediatric patients (0-16 years) with diagnosis of craniopharingioma made between 2001-2010. Fourteen patients were included with age range at diagnosis 4–15 years (median 6.98). We calculated changes in pre-operative and present morbidity scores (including endocrine, ophthalmologic, neurologic, educational and hypothalamic profiles[1]. Follow-up for these patients is 4.17–9.59 years (median 6.54). We correlated these changes with important pre-operative and operative risk factors.
Results: All patients had surgery with no fatalities. In 28.5% a total excision of the lesion was achieved at first operation. 42.8% had a recurrence (average 4.16 years). 78.5% received radiotherapy, following the first surgical resection. 86.8% of patients had increased clinical-status morbidity score: pre- and post- operative morbidity scores were higher in younger patients but without significant correlation with age at diagnosis. The endocrine profile is the most affected from surgery, with no significant difference in the type of surgical approach used.
Conclusions: The results showed that the treatment approach used in this neurosurgical unit during the last 10 years has the same morbidity and better mortality outcomes compared to the literature. Our aim is to implement a formal cognitive assessment for each craniopharyngioma patient and design protocols to facilitate a prospective study.

Reference

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TM1-8: Impact of extent of resection on relapse and survival in Primary Spinal Cord Ependymomas: A 25 year review

Roberto Ramirez, Martin English & Guirish Solanki (Birmingham Children's Hospital)

Aim: To report on the treatment and outcome including relapses in a series of paediatric spinal cord ependymomas carried out at a single institution.
Design: Study type: Retrospective cross-sectional study.
Subjects: Between 1985-2009, 12 children(7 boys, 5 girls), with spinal cord ependymoma were identified. Median age at diagnosis was 8.3(3.5-12.3) years.
Results: Average FU was 7.4(1-19)years. 5 children had myxopapillary ependymoma, 4 WHO grade I and one grade II and III each. In one suspected case, the biopsy was negative. This child is being followed-up conservatively. 11/12(92%) patients are alive. The only death occurred 4-months post-surgery in an anaplastic ependymoma WHO grade III. 41%(5/12) children relapsed at a median interval of 2(0.25-4.9) years following surgery. 4 had Gross-total-resections(GTR) and 8 had subtotal resections/biopsy. None of GTR relapsed. Extent of resection and relapses were significantly inversely related ($p < 0.02$), but not with histology type($p < 0.19$, NS). Mortality was strongly related to malignant histology of the tumour ($p < 0.012$). 75%(6/8) children with subtotal resection/biopsy underwent primary adjuvant therapy. None of the GTR group received adjuvant therapy. Event-free survival (EFS) was 71.4% and overall survival(OS) was 92%. EFS for subtotal group was 37.5%. 20% of myxopapillary lesions relapsed.
Conclusions:

1. Gross total resection was associated with increased survival but GTR was only possible in 33%. Resection rates have improved in the last 2 decades.
2. Myxopapillary type showed a lower relapse rate than previously reported.
3. Improved GTR rates are key to preventing relapses.

TM1-9: Complications of Intrathecal Baclofen Therapy

P. D. Eunson, K. McWilliam, L. Myles, J. Ross & A. J. W. Steers (Royal Hospital for Sick Children, Edinburgh, UK)

Objectives: To review complications of Intrathecal Baclofen Therapy in children and young people from 1999-2010
Design: Retrospective audit
Subjects: 118 children and young people, predominantly with cerebral palsy who received Intrathecal Baclofen Therapy in a tertiary centre
Methods: Inpatient and outpatient note review from time of implant to date, transfer to another centre, or to death
Results: There were 22 neurosurgical complications including 5 pump pocket infections, 3 catheter infections and 3 pump migrations. There were three instances of Baclofen overdose, but no Baclofen withdrawal syndromes. There were no perioperative deaths. 12 young people have died as a result of their underlying condition.
Conclusions: With each complication identified, the team have reviewed procedures; scrupulous attention to prevention of infection and programming errors is essential in this effective but potentially hazardous treatment.

Posters selected for oral presentation

TMOP1-1: Comparison of acrylic and titanium cranioplasty

Y. Z. Al-Tamimi, P. Sinha, M. Trivedi, T. Al-Musawi & G. Towns (Leeds General Infirmary, Leeds, UK)

Objectives: There are many indications for cranioplasty with an increasing incidence due to an increase in decompressive craniectomy following trauma and stroke. Numerous materials and techniques have been described in the literature. The aim of this study is to compare the survival of acrylic and titanium cranioplasties used in our department.
Design: Retrospective cohort study.
Subjects: 126 patients who underwent cranioplasty between 1997 and 2007.
Methods: A comparison was made between those with acrylic (n = 61) and titanium (n = 65) cranioplasties. There was no significant difference in age and length of time between craniectomy and cranioplasty between the two groups. Those with titanium tended to be associated with a higher incidence of 'high risk' indications for craniectomy including trauma and stroke. Those with acrylic tended to have a higher incidence of infection prior to cranioplasty. Mean follow up was 97.2 and 34 months for acrylic and titanium cranioplasties respectively.
Results: Mean survival (95% confidence intervals) was 135 months (134-153) and 92 months (82-102) for acrylic and cranioplasty respectively. Out of 13 failures, only two were associated with pre-existing infection. Overall cumulative survival was better for acrylic cranioplasty although this difference did not reach statistical significance.
Conclusions: Although survival of acrylic cranioplasty appears to be better than titanium plates, there is no statistical significance. Both techniques have been well tolerated and result in good aesthetic and functional outcome with an acceptable complication rate. Acrylic has the advantage of being able to be applied at the time of surgery without any planning and does not cause artefact on future imaging. Titanium cranioplasty is strong, light-weight and inert and can be fashioned in the pre-operative setting.

TMOP1-2: Cerebral abscess in the twenty-first century

K. T. Tsang, D. S. Jeyaretna, W. Singleton, B. Fisher & P. C. Whitfield (Level 4 Neurosurgery, Derriford Hospital, Plymouth, UK)

Objectives: To evaluate the incidence, aetiology, management and outcomes in patients with intracranial infection in a regional neurosurgical unit.
Design: Retrospective study of a consecutive series of patients.
Subjects: All patients with either a subdural empyema or cerebral abscess from June 2002 to June 2010.
Methods: A review of clinical, radiological and laboratory data was performed. Outcome measures included clinical outcome and the need for repeat surgery.
Results: 44 patients (mean age 48 yr) were identified. 61.3% were male. 60% were smokers, 9.1% diabetic and 13.6% immunocompromised. Presenting features included headache (54.6%), neurological deficit (61.4%) and seizure (30%). GCS ranged from 7 to 15. White cell count (range 3.1 to 25.7 × 109/L) and CRP (<10 to 524mg/L) were wide-ranging. 15.9% had multiple abscesses.

ENT (25%), post-operative (20.5%) and dental (2.3%) sources were common. No primary source was found in 52.3%. Pathogens were identified in 81.8%. The commonest being Staph aureus (15.9%) and Strep milleri (13.6%). 40 patients underwent aspiration of the abscess; 22.5% of these required repeat drainage compared to none in those undergoing craniotomy for excision/marsupialisation.

81.8% of cases achieved a favourable outcome. There were 3 deaths (6.8%) within 2 months of presentation.
Conclusions: Intracranial infection continues to present as a rare (1 in 300 000/year) condition of middle age. The primary infective source is frequently occult and the causative pathogens are variable. Surgical aspiration often needs to be repeated. The mortality and morbidity of this condition are considerable despite modern antibiotic and surgical treatments.

TMOP1-3: Effect of on-call duties on speed of fine motor skills in surgical trainees

A. Tarnaris, D. Kombogiorgas, N. Furtado, A. Harries, K. Hossain-Ibrahim, B. Homapour, P. Nightingale & G. Cruickshank (Queen Elizabeth Hospital, Birmingham, UK)

Objectives: Full shift working is currently the most prevalent working pattern for trainees in surgery. To date however, no study has examined the accumulative effect of tiredness in the performance of surgical trainees. There is an assumption that since trainees achieve compulsory 11 hours rest during 24 hours there is no decline in the performance hence safeguarding patient's safety. The objective of this study was to quantify the effect of consecutive full shifts on the performance of surgical trainees.
Design: The grooved pegboard test (GPT) was used as a means of assessment of performance speed. The score of the GPT is given as a continuous variable (seconds).
Subjects: 8 Neurosurgical registrars were assessed.The trainees were assessed at the beginning and end of 12 hour night shift on 7 non-consecutive full shifts and also at the beginning of a normal working week (5 days) in order to obtain baseline values for each individual trainee. The assessed trainee was blind to the score achieved at each time of assessment.
Methods: Generalized Estimating Equations was used to assess for difference between the start and

end of shift scores, as well as the difference between the normal working day and beginning of night shift scores.

Results: The mean score for start of day time duty was 50.96 (SD = 6.09). The mean times for start of night shift were 50.55 (6.01) and for end of night shift 51.61 (4.75). There was no significant difference between the day time baseline and the beginning of night shift value. The difference between beginning and end of night shift was 1.50 sec ($p = 0.042$). Analysing the start times for nights 1 to 4, there is no significant difference between the times for the 4 nights ($p = 0.322$).

Analysing the finish times for nights 1 to 4, there is a significant difference between the times for the 4 nights ($p < 0.001$). For the finish times for nights 1 to 4, the time on night 4 is estimated to be 6.084 seconds shorter than the time on night 1 ($p < 0.001$). Analysing the start and finish times for nights 5 to 7, there is no significant difference between the start and finish times of the 3 nights ($p = 0.294$ and $p = 0.841$) respectively.

Conclusions: Although night shifts do not affect the times of motor performance of trainees in a significant degree, our data suggests that it takes more than 3 consecutive night shifts until the effect of night time on motor performance is abolished. The data did not suggest an accumulative effect of tiredness in the motor performance of trainees.

TMOP1-4: External Ventricular Drain (EVD) Infections: an analysis of patients with Subarachnoid Haemorrhage (SAH)

W. J. Kitchen, N. Singh, S. Hulme, J. Galea, H. Patel & A. King (Hope Hospital, Salford, UK)

Objectives: Blood in the Cerebrospinal fluid (CSF) has been described as increasing the risk of EVD associated CSF infection[1,2]. The purpose of this study was two-fold:

1) To determine the overall infection rate in clinical SAH patients and to identify patients who are at increased risk of developing EVD infection.
2) To compare the infection rate with a similar group of SAH research patients in whom a new EVD care pathway had been introduced as part of the research protocol.

Design: A retrospective case note review.

Subjects: 94 patients had 156 EVD placed for clinical reasons with a diagnosis of SAH.
39 patients had 39 EVD placed for clinical reasons within the research group.

Methods: A review of 206 patient records was performed. Demographic data, duration of EVD placement, CSF sample results, WFNS grades, Fisher grades and treatments were recorded.

The 39 research patients were identified from a pre-existing research database.

The administration of intrathecal antibiotics was used as an endpoint for the diagnosis of CNS infection.

A logistic regression analysis was used to identify statistically significant association of infection within SAH subgroups. An uncorrected X2 was used for analysis of continuous data, a p value of < 0.05 was considered significant.

Results: Of the 206 cases reviewed 112 patients were excluded due to drains being placed for diagnoses other than SAH.

94 patients had 156 EVD placed with a diagnosis of SAH. 49 patients were treated for presumed CSF infection. Overall infection rate was 52.1% per patient and 31.4% per EVD. In comparison, the research group infection rate was 10.3% (p value < 0.0001).

Within the clinical group, increased Fisher grade and increased sampling are associated with statistically significant increased risk of developing EVD infection ($p = 0.02$ and $p = < 0.0001$ respectively).

Conclusions: Risk factors for EVD infection include increased blood volume and opening of the drain for CSF sampling. However with the meticulous management of EVDs we have found that the infection rate can be significantly reduced despite these risk factors.

References

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TMOP1-5: A retrospective study of clinical and quality of life (QOL) outcomes in generalised dystonia patients undergoing deep brain stimulation (DBS) of the globus pallidus interna (GPi)

H. Sims-Williams, S. Javed, S. Khan, P. Plaha, A. Whone & S. Gill (Department of Functional Neurosurgery, Institute of Clinical Neurosciences, Frenchay Hospital)

Objectives: To assess the clinical efficacy of DBS in patients with generalised dystonia refractory to medical therapy.

Design: A retrospective case series of 13 patients operated between 2002 and 2007, were assessed

prior to DBS surgery with a mean follow up period of 23 months (SD = 21).

Methods: All patients underwent MRI-directed bilateral Medtronic 3389 electrode implantation into the GPi under general anaesthesia. Patients were assessed using the Burke Fahn-Marsden Scale (BFMS), and Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS). QOL was compared using the SF-36 survey.

Results: The mean age of this cohort was 34.1 (SD 16.6) years, and the mean time from diagnosis to operation was 20.0 years (SD 17.8). There was a mean improvement in the BFMS at follow-up of 43% ($p = 0.0001$) with 45%($p = 0.001$) and 33% ($p = 0.003$) improvement in the movement and disability scores respectively. TWSTRS were calculated for 11 patients who had cervical dystonia. There was an overall improvement of 45% ($p = 0.028$); with pain, disability and severity scores improved by 37% ($p = 0.346$), 45% ($p = 0.003$) and 51% ($p = 0.155$) respectively. Total SF36 scores improved by 12.4% ($p = 0.014$). However there was a non-significant 5% ($p = 0.329$) improvement in SF36-mental scores but significant 18% ($p = 0.019$) improvement in SF36-physical scores. There were no surgical complications.

Conclusions: Generalised dystonia can be treated effectively by deep brain stimulation (DBS) of the globus pallidus pars interna (GPi). This retro-prospective case series analysis details the results at our centre and adds to the existing literature[1,2]. Significant gain in objective measurements of dystonia and the physical SF36 score is seen in these patients.

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TMOP1-6: Balloon compression for Trigeminal neuralgia – 10 years analysis from a single centre

G. Sivakumar[1], M. Stovell[1], S. J. Smith[2], J. O. Farah[1], T. Nixon[1] & P. R. Eldridge[1] ([1]The Walton Centre for Neurology and Neurosurgery, Liverpool, United Kingdom, [2]University of Nottingham, Nottingham, United Kingdom)

Objectives: To look at the efficacy of Balloon Compression for Trigeminal Neuralgia in a series of 105 patients over a period of 10 years from a single centre and to correlate the primary outcome of pain relief with the age and sex, pain distribution, duration of pain prior to procedure, time to failure of medical treatment, typical / atypical pain, right / left facial pain, presence of vascular contact on MRTA and multiple sclerosis

Design: This is a retrospective study of patients with trigeminal neuralgia treated with balloon compression either as a primary or secondary procedure in the last 10 years (2000 to 2009)

Subjects: A total of 105 patients (186 procedures) were included with a follow up of 6 months to 10 years

Methods: Data was collected in reference to age and sex, side of facial pain, typical/atypical, distribution (V1/V2/V3), presence of multiple sclerosis, duration of pain before procedure, co-morbidities, medical treatment, time to failure of medical treatment, previous procedures, MRTA findings, pain relief period, number of times procedure repeated, complications, time to follow-up. Statistical analysis was done using Kaplan-Meier survival estimator and univariate and multivariate analysis in terms of pain relief (primary outcome).

Results: Median time for pain relief was apporximately 18 months Females responded better than males ($p = 0.038$). Patients with pain in V2 and V3 do better ($p = 0.036$).Duration of previous symptoms is nearly a negative predictive factor ($p = 0.059$). Time to failure, typical/atypical pain, side of facial pain, age, MRTA and multiple sclerosis had no significant relationship to outcome of pain relief

Conclusions: Balloon compression for treating trigeminal neuralgia is a safe and effective method that can repeated with minimal morbidity.

TMOP1-7: The application of ultrasound elastography to intra-operative guidance in neurosurgery

C. E. Uff[1,2], L. Garcia[2], J. Fromageau[2], J. C. Bamber[2], A. Chakraborty[3] & N. L. Dorward[1] ([1]Royal Free Hospital, London, UK, [2]Institute of Cancer Research, Sutton, UK, [3]Great Ormond Street Hospital, London, UK)

Introduction: Ultrasound elastography is a method for imaging the biomechanical properties of soft tissues by calculating strain (displacement) in response to a small force. In practice, the ultrasound transducer is used to compress the tissue a few millimetres and real-time strain images are displayed alongside standard B-mode images. First used in breast imaging and available in real time since 2000, it has been used in neurosurgery by only three groups including ours.

Objectives: Detection of the biomechanical properties of brain and spine lesions.

Characterisation of the boundary for intraoperative guidance.

Subjects: 63 patients (55 adult, 8 paediatric).

Methods: Patients underwent ultrasound elastography during surgery for brain (Meningioma, (22) High Grade Glioma (17), Metastasis (6), Other (10), Cortical Dysplasia (5)) and spinal lesions (3).
Results: In all cases, the elastograms correlated well with surgical findings. Stiff lesions were seen with greater resolution than soft lesions and this is supported by Finite Element Analysis simulations and experimental data. We were able to characterise the nature of the boundary prior to surgical exploration, in some cases predicting the existence of a surgical plane that was not suspected or seen on other imaging modalities (MRI). Cortical dysplasia that was not detected on MRI was imaged elastographically, supported by electrophysiological agreement.
Conclusions: Ultrasound elastography can safely and effectively characterise the stiffness of lesions in the brain and spine. It can identify and locate surgical planes as an adjunct to real-time intra-operative ultrasound. Combined with B-mode, it is an effective way of imaging cortical dysplasia during surgery.

TMOP1-8: Right hemispheric language lateralisation in right handed patient with temporal-lobe epilepsy of left mesial temporal sclerosis aetiology: case report and literature review

N. Carleton-Bland & V. A. Josan (Department of Neurosurgery, Greater Manchester Neurosciences Centre, UK)

Objectives: Case report and literature review of the subject of language lateralisation and factors that may lead to atypical topographic representation of language centres
Design: We describe a case of a 43-year-old, right-handed woman with and atypical complete right hemispheric language dominance with a 30 year history of medically-refractive right sided complex partial seizures
Subjects: A 44 year old woman was referred to the epilepsy service.
She suffered febrile seizures at 18months of age and developed regular seizures from the age of 5 years

The semiology is typical of temporal lobe epilepsy with automatisms, repeated vocalizations and right limb posturing. She had a history of complex partial symptoms presenting in clusters of several seizures over a few days, usually occurring monthly. Theses attacks had severe ramifications on her life and career. There remained problematical despite multi-antiepileptic drug therapy
Methods: A diagnosis of left mesial temporal sclerosis was made on sagital MR Brain sequences. Language dominance was localised with functional magnetic resonance imaging (fMRI) and Wada intracarotid sodium amytal (IAT) assessment. During an object-naming task, fMRI showed atypical right hemispheric language dominance, which was confirmed by a WADA assessment with the TEA elevator counting assessment tool.
Results: This information enabled a left temporal lobectomy and amygdalohippocampectomy, with no sequelae on language function, and an abolition seizure activity.
Conclusions: This case report and literature review adds to the limited previous literature in this field. Inherent neuroplasticity can allow a shift in lateralization of function, especially when a pathological process arises in the developing brain. In a situation of chronic, intractable epilepsy, language dominance can not be assumed from hand dominance, potentially widening the cohort of patient that could safely benefit from resective therapy

TMOP1-9: Use of TEG in Acute Haemorrhagic Brain Injury: Review of current literature, our work with transgenic murine models, and presentation of recent case studies

K. E. McCann, M. Walsh, S. Thomas, E. Evans & R. Navari (Indiana University School of Medicine)

Objectives: Thromboelastogram (TEG) has been used routinely in the area of cardiovascular & transplant surgery; recently it has found a role in acute TBI, especially in the rapid identification and treatment of coagulopathies with or without accompanying polytrauma. The TEG with platelet mapping allows for the analysis of the effects of temperature, acidosis, hypocalemia, dilution and hypoperfusion on each aspect of clotting from enzymatic activation, thrombin generation and fibrin formation, clot strength and platelet function as well as clot fibrinolysis. It more accurately defines abnormalities in the mechanisms of thrombus initiation, amplification, propagation & termination than the plasma based coagulation tests.
Design: Literature review
Laboratory investigation in murine models
Case reports
Subjects: Wild type mice, used under guidelines approved by IACUC

Patients presenting to Level II trauma centre with acute haemorrhagic TBI who had serial TEG measurements as part of their initial resuscitation and assessment
Methods: An analysis of the TEG of normal WT strain mice was undertaken to establish a normal curve to facilitate our current work with Nobel-Collip drum. Murine blood was collected in 4% citrate and measured in TEG 5000 Hemostasis system, and measurements made for 120 minutes. Current literature of the use of TEG/platelet mapping in TBI and emergency department protocols was reviewed. TBI case reports from a Level II trauma centre are presented.
Results: We successfully characterize the normal values of TEG in normal wild strain mice that

facilitate are current murine model work. Cases studies demonstrate that in addition to pharmacological agents, a primary platelet abnormality is also associated with traumatic hemorrhage. TBI impairs ability of platelets to respond to arachidonic acid. Platelet dysfunction may also be secondary to the hypoperfusion, hypothermia, hypocalcaemia, or the dilutional effects of resuscitation fluids of any type: crystalloid, colloid, or blood products.
Conclusions: The creation of a set of normal TEG values in wild type mice expands the use of Nobel-Collip drums in TBI. TEG and platelet mapping in TBI patients shows that the established biphasic coagulopathies are multi-factorial and patients benefit from rapid assessment, rapid replacement with blood products, and inclusion of a perfusionist in neurosurgical management.

TMOP1-10: Peculiarities and Management challenges of open fronto-orbital head injuries – an institution experience

E. O. Komolafe, M. A. Komolafe, O. H. Onakpoya & J. Wasserberg (Obafemi Awolowo Unniversity Teaching Hospitals Complex, Ile-Ife, Nigeria)

Objectives: To draw attention to the current challenges in the management of open fronto-orbital injuries in a developing country.
Design: Prospective observational study.
Subjects: Adults with combined frontal and orbital open head injury
Methods: Clinical study of all adult head injuries associated with combined frontal and orbital open injuries over the past three years to determine its pattern, peculiarities, associated disability, and management challenges. Prospective audit using a proforma to capture data on patient and injury characetristics, treatment given and outcomes at 6 weeks and three months. Mortality and morbidity data was collected.
Results: Thirty-five adult patients with open fronto-orbital injuries were admitted to a single neurosurgical unit in Nigeria between x and y (insert dates). 30 males and five females were admitted giving a M:F of 6:1. The age ranged from 18years to 75years. Road traffic injury was the most common cause 26(74.3%) followed by Gunshot injury 5(14%). More than half of the patients 21(60%) presented later than 24 hours. Only 9(55.7%) patients had other injuries. The left side of the face was involved in 21 (60%) patients. The most common complication noted was unilateral loss of vision with enophthalmos 27(77.1%). All the patients underwent surgery ie debridement, elevation (with or without removal) of bone fragments and duroplasty in some. Two patients developed sympathetic ophthalmitis. Three patients (8.6%) had cranioplasty with methamethylacrylate. The other patients had no cranial reconstruction. Four mortalities were noted in the series.
Conclusions: Adequate treatment and acceptable cosmetic outcome of these injuries depends on timely and multidisciplinary approach to management. Survival rates were high with low morbidity. Despite the unavailability of reconstructive surgery acceptable outcomes were achieved. Cosmesis is given low importance by our patient group.

TMOP1-11: One piece surgical removal of huge supratentorial tumours. Why I do it?

E. O. Komolafe & J. Wasserberg (Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria)

Objectives: To evaluate a potentially safe, fast, and simple method of removal of huge supratentorial tumours.
Design: Prospective study of surgical outcomes, mortality and morbidity.
Subjects: Patients with large supratentorial extracerebral tumours greater than 50 mls in volume.
Methods: Prospective collection of pre and post-operative data on all patients who underwent craniotomy and one piece tumour removal.
Results: A total of fifty-eight huge supratentorial tumours were operated and excised as a single piece over ten years. The main presenting clinical features were headache 58(100%), new onset seizures 52(89.7%), visual impairment/visual loss 32(55.2%), personality changes 10(17.2%), limb weakness 30(51.7%) and speech impairment 14(24.1%). Seven were operated in emergent situations. The weight of the excised tumour ranges from 90gm to 305gm (average 240gm). Histopathological diagnoses of the excised tumour were meningiomas 47(81%), oligodendroglioma 8(13.8%), and tuberculoma 3(5.2%). Complete tumour excision was achieved in 55(94.8%) patients. No recurrence or mortality recorded in the series.
Conclusions: Huge benign supratentorial tumours can be safely excised in one piece with few complications. This approach may be better and safer in centres in developing countries with limited resources and logistic problems.

Neuroncology

TM2-1: Determining invasive phenotypes in glioblastoma patients: a diffusion tensor imaging study

S. J. Price, L. Moshen, V. Shi & R Jena (Addenbrooke's Hospital, Cambridge, UK)

Objectives: Post mortem studies have shown there is marked heterogeneity in the degree of invasion of glioblastomas with 25% showing invasion <1cm and 25% showing invasion >3cm. If we could determine if patients were minimally invasive it may allow

aggressive local therapy. This study uses diffusion tensor MR (DTI), a method that can identify occult invasion, to determine the invasive phenotype and see how it relates to the time to progression.
Design: A prospective cohort study.
Subjects: 21 patients with confirmed GBM (mean age 54, range 30-68; WHO Performance Status 0-1) that were being treated with chemo-radiotherapy according to the Stupp procotol were included.
Methods: Patients were imaged pre-radiotherapy at 1.5T with both anatomical and DTI sequences. The DTI was processed to determine isotropic (p) and anisotropic (q) components. The invasive phenotype was assessed according to previously published methods[1]. The invasive phenotypes was correlated to the time-to-progression.
Results: 8 patients had a diffuse phenotype, 9 had a localized phenotype and 4 had a minimally invasive phenotype. Each group were matched in terms of age, sex and extent of surgical resection. The mean TTP for the diffuse group was 314 days, for the localised group 466 days and 705 days for the minimally invasive group. None of the diffuse patients and only one of the localised patients were progression free at 18 months. Three quarters of the minimally invasive group were progression free at 18 months (Chi square 6.9; $P = 0.02$).
Conclusions: DTI can identify a minimally invasive phenotype that may be suitable for aggressive local therapy.

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TM2-2: When can we safely discharge patients after surgery for non-functioning pituitary adenoma?

S. A. Cudlip, P. Plaha, J. Byrne, O. Ansorge, R. Reddy, N. Karavitaki & J. Wass (John Radcliffe Hospital, Oxford, UK)

Objectives: To detect the rate of late recurrence of non-functioning pituitary adenoma in patients undergoing pituitary surgery without radiotherapy, and thus establish the optimum length of time follow-up surveillance imaging is needed.
Design: A retrospective review of case notes and imaging of patients undergoing surgery for histologically proven non-functioning pituitary adenoma in the Oxford Department of Neurosurgery 1984-2007. All patients were treated with surgery alone and had a minimum of 1 year follow-up.
Subjects: 155 patients met the inclusion criteria, 29 of whom were followed-up for more than 10 years. Mean follow-up was 6.1 years (1-25.8). Mean age was 57.9 (18-88)
Methods: Tumour classification was based on biochemical and immuno-histopathological evaluation. Initial MRI scans were performed at 3 months, then yearly for the first five years and 2 yearly thereafter, all scans were reviewed by a neuroradiologist. Prior to 1993 CT scanning was used ($n = 12$). All patients underwent followup pituitary function testing and visual assessment.
Results: Radiological recurrence was demonstrated in 54 cases (34.8%), 20.4% of these were after 10 years follow-up. There were tumour relapse rates of 23.1%, 46.7%, and 67.9% at 5-, 10- and 15-years, respectively. 50% of the recurrences were detected by 7 years, 75% by 9.8 years and 95% by 17 years (range1-25.8).
Conclusions: Delayed recurrence or regrowth of non-functioning pituitary adenoma is more common than originally thought with 20.4% of those patients with recurrent disease developing recurrent tumour 10 years or more after surgery was performed. Variables associated with increased recurrence rate were younger age at presentation, size of immediate postoperative tumour remnant, and extrasellar tumour. These results suggest that patients with pituitary adenoma undergoing surgery are at risk of late recurrence beyond 10 years (up to 18 years in this study) and thus should continue to be followed up with surveillance MRI imaging beyond this period.

TM2-3: Targeting Mitochondria in Glioma: chemotherapeutics and neurotoxicity

K. E. McCann & E. McKee (Indiana University School of Medicine)

Objectives: Recently there has been increased interest in targeting mitochondria in glioma research. The study of dNTP pools in brain mitochondria is central to both understanding mutagenesis and targeting therapies in glioma. As CNS lack replicating nuclear DNA, the target of chemotherapeutics is the repair process in mitochondrial DNA. We establish the pyrimidine salvage pathway in brain mitochondria, and the effects of one of thymidine analogue chemotherapeutic drugs, AZT. We consider mechanisms of neurotoxicity.
Design: Laboratory investigations in molecular neurobiology/neuro-oncology
Subjects: Harlan-Sprague-Dawley rats, obtained and used under guidelines approved by IACUC
Methods: Mitochondria were isolated from freshly removed brains from rats. The protein content was measured by the method of Lowry; intactness of the mitochondria determined by respiratory control ratio. Mitochondria were incubated with labeled deoxynucleosides and deoxynucleoside analogs. Samples were removed at time points & combined

with trichloroacetic acid to lyse mitochondria and precipitate protein and nucleic acids, followed by centrifugation. AG-11A8 ion exchange resin to remove the TCA; mixture vortexed & t extract filtered. Radioactivity determined with liquid scintillation counter. Quantitation and phosphorylated products analyzed by HPLC. Peaks were identified by comparison to standards.

Results: Mitochondria transport thymidine into matrix and phosphorylate thymidine; they possess all enzymes necessary in this pathway. They transport deoxycytidine and possess all enzymes necessary to readily phosphorylate deoxycytidine (dC). Deoxyuridine is phosphorylated more slowly than thymidine, but only to dUMP. AZT was phosphorylated to AZT-MP as readily as thymidine was phosphorylated to TMP. AZT at 5.5 ± 1.7 μM was shown to inhibit thymidine phosphorylation by 50%, but was not observed to inhibit dC phosphorylation. dC inhibited thymidine phosphorylation 50% at 8.8 ± 1.7 μM, thymidine did not inhibit dC phosphorylation except at high concentrations.

Conclusions: Brain mitochondria transport and contain all enzymes necessary to phosphorylate dNTPs. Neurotoxicity may ultimately be mediated by TTP pool depletion, not inhibition of DNA polymerase. Kinetics of phosphorylation are significantly different in brain mitochondria. These pathways suggest metabolic targets and therapeutic options for neurotoxicity.

TM2-4: Realtime intraoperative three dimensional ultrasound in biopsy/resection of intrinsic brain lesions

S. J. Camp, V. Apostolopoulos, A. Mehta, F. Roncaroli & D. Nandi (Charing Cross Hospital, London, UK)

Objectives: Accurate tissue diagnosis and near total resection influence management/outcome in intrinsic brain lesions, hence intraoperative imaging has gained popularity. It allows readjustment by visualisation of brain shift, biopsy needle position, or tumour resection progress. Realtime three dimensional ultrasound (3DUS) is a cost effective alternative to intraoperative magnetic resonance imaging (MRI), which despite finer images requires expensive resources.

Design: This ongoing study assessed the benefits of realtime intraoperative 3DUS in patients with intrinsic brain lesions.

Subjects: Thirty one patients were evaluated: 15 underwent multiple biopsies; 14 maximum resection. Data from 2 patients were not analysed due to poor image quality.

Methods: In biopsy patients preoperative scans and intraoperative 3DUS images were correlated with the descriptive characteristics of histological samples. The images of patients in whom maximum resection was achieved, were correlated with postoperative MRI.

Results: Discrepancies between navigation based on preoperative imaging and intraoperative 3DUS were observed due to brain shift. 3DUS produced a high biopsy yield. In a patient with gliomatosis cerebri 3DUS detected areas of differing echogenicity, correlating with varying cellularity. Radical or complete resection of intrinsic lesions was also facilitated by realtime 3DUS.

Conclusions: Intraoperative 3DUS can be employed as an adjunct to preoperative imaging. It improves the yield of biopsy and maximises the resection of intrinsic brain lesions, with few changes required to existing theatre costs, space and scheduling.

TM2-5: A single centre case control study of the efficacy and safety of 5-aminolevulinic acid guided resections of grade IV (WHO) glioblastomas

J. D. Bruch, J. Ho, C. Watts & S. J. Price (Addenbrooke's Hospital, Cambridge, UK)

Objectives: To assess the safety and efficacy of using 5-aminolevulinic acid (5ALA) to guide the resection of grade IV glioblastomas based on the data obtained in a single UK centre.

Methods: 58 patients with a primary histologically-confirmed grade IV glioblastoma who underwent 5ALA guided resection were included in the study. Each patient was matched by age and tumour location to a control patient with similar performance status who had a resection without 5ALA. Outcome measures include residual tumour on post-op MRI, post-op complications and access to chemoradiotherapy.

Results: The proportion of gross total resections (GTRs) in 5ALA patients was 53% ($n = 58$) and thus significantly better compared to the control group with 33% ($n = 46$), ($p = 0.047$). The absence of residual fluorescence at the end of the resection predicted a significantly better GTR rate of 74%, compared to a GTR rate of 21% in the presence of residual fluorescence ($p = 0.0004$).

Two cases with mild adverse effects could be attributed to 5ALA. There was no significant difference in mean length of hospital stay and new neurological deficits between the two groups. There was also no significant difference between 5ALA patients and controls in the proportion who received chemoradiotherapy (85% and 73% respectively, $p = 0.11$).

Conclusions: 5ALA guided resection of grade IV glioblastomas results in a significantly better GTR rate compared to conventional surgery. This result reflects the findings of the previous stage III clinical trials. The procedure also appears to be safe with no significant increase in hospital stay, post-operative complications and only few side effects.

TM2-6: Gamma Knife radiosurgery is an appropriate treatment for multiple metastases

M. J. Torrens, P. Nomikos, K. Kafkoula & C. Stergiou (Hygeia Hospital, Athens, Greece)

Objectives: To review results of treatment of cerebral metastasis by Gamma Knife radiosurgery (GKS) according to the number of metastases and to define whether multiplicity alone represents a contra-indication to radiosurgery as is often proposed.
Design: A prospective matched group study.
Subjects: Data was collected prospectively from 227 GKS procedures. The subjects were divided into 3 groups - with single metastases, 2-9 metastases and >9 metastases.
Methods: Matching was assessed for age, sex, diagnosis, size, Karnowsky performance score (KPS) and BSBN prognostic index using Kruskal Wallis or Cross-tabs tests. Some patients from the larger groups were randomly deselected until the groups were adequately matched for analysis. The Kaplan-Meier method with log rank tests (Bonferroni correction) was used to evaluate outcome. Outcome was defined as survival in months from date of treatment.
Results: Within the groups the numbers analyzed were single metastases ($n=24$), 2-9 metastases ($n=30$) and >9 metastases ($n=16$). The latter group contained a total of 294 treatment targets (average = 19.6 per case). The groups were matched for age ($p=0.150$), sex ($p=0.087$), KPS ($p=0.079$) and diagnosis ($p=0.095$). Groups were not matched for size ($p=0.004$) and BSBM ($p=0.016$). The Kaplan Meier method revealed no statistically significant difference in outcome – single vs. 2-9 ($p=0.236$), 2-9 vs. >9 ($p=0.516$) and single vs. >9 ($p=0.064$). The latter value approaches significance and so a further analysis (Cox regression) was made to take into account the effect of size and BSBM. This then revealed a less obvious difference ($p=0.220$).
Conclusions: Restriction of GKS to cases with few metastases is not appropriate. The decision to treat should be based on the various prognostic indexes and not on the multiplicity of lesions.

TM2-7: The Use of Intra-Operative Carmustine Chemotherapy Wafers in the Management of High Grade Gliomas: An Assessment of Complications and Access to Further Therapy

J. Ho, J. Bruch, C. Watts & S. J. Price (Department of Neurosurgery, Addenbrooke's Hospital, Cambridge, UK)

Objectives: NICE have approved the use of Gliadel and Temozolomide in the treatment of high-grade gliomas, but have not commented on the combined use. The concern is that Gliadel will lead to increased complications that will prevent patients receiving Temozolomide. This study aims to see if this is happening.
Methods: Retrospective review of high grade glioma patients in whom the intention was to insert Gliadel implants. Outcome data assessed complication rates and subsequent access to oncological treatment. Those patients where Gliadel was not inserted were used as controls.
Results: 68 patients were included, 26 received Gliadel wafer implants and 42 did not. Out of the 42, 10 had diagnoses that were not high-grade gliomas (HGG). Comparing HGG patients only, 6/26 (23.1%) in the group receiving Gliadel and 7/32 (21.9%) in the control group not receiving Gliadel experienced complications. Subsequently, 23/26 (88.5%) of those receiving Gliadel went on to have chemoradiotherapy compared to 21/32 (65.6%) of those not receiving Gliadel.
Conclusions: In our series, we found that there is no difference in complication rates between patients given Gliadel and those who were not. Gliadel also did not compromise the subsequent access to radical oncological follow-up treatment.

TM2-8: Challenges and pitfalls in the diagnosis and management of primary CNS lymphoma

O. A. Sobowale, C. McBain, C. Soh, S. Mills, S. Gupta & K. Karabatsou (Department of Neurosurgery, Greater Manchester Neurosciences Centre, Salford Royal Hospital, Salford, Greater Manchester, UK)

Objectives: Although primary CNS lymphomas (PCNSLs) have distinctive imaging characteristics their diagnosis can be challenging and often hindered by the administration of steroids. We review and compare the radiological and histological diagnosis (where available) and also evaluate the effects of steroids on imaging appearances.
Design/Methods: Retrospective review of neurooncology database between November 2008 and November 2010.
Subjects: Patients with radiological and/or histological diagnosis of PCNSL.
Design/Methods: Retrospective review of neurooncology database between November 2008 and November 2010.
Results: 38 cases of suspected/confirmed PCNSLs were reviewed. 7 cases excluded as biopsy indicated alternative diagnosis. Of the 31 remaining patients 18 were male and 13 female with a median age of 70 (range 39-95). 16 were proven histologically (11/16 were correctly assumed to be PCNSL radiologically) and were referred for radiotherapy and/or chemotherapy. Another 6 were also treated as PCNSLs without biopsy (not fit for surgery and/or regressed on steroids). Of the 22 treated as PCNSL 9 showed signs of radiological regression on steroids.

Regression on steroids prevented biopsy in one case and delayed biopsy in one. Of the remaining 11 patients, 1 declined any further investigations and 10 were not suitable for intervention and were referred for palliative care. 9 of them received steroids but 6 showed radiological response.

Conclusions: Our study demonstrates the need for a standardized protocol in the management of PCNSLs. Steroids should not be used as diagnostic test and biopsy should be attempted in every suspected case in order to confirm diagnosis and guide management.

This is a challenging patient group, many of them are not suitable for intervention and therefore clearer guidance is required.

Miscellaneous section

FM1-1: 10-Year follow up after gamma knife radiosurgery of meningioma

Bodo Lippitz[1,2] ([1]Gamma Knife Centre, Bupa Cromwell Hospital, London, UK, [2]Karolinska Gamma Knife Center Stockholm, Sweden)

Background: In 11 published Gamma Knife series comprising 1336 meningioma patients the local tumor control ranges between 90 and 98%. However, sufficient data describing the long-term outcome of meningiomas have been lacking so far and 82 % of patients were in series with a median follow-up of less than 5 years. Hence it appears crucial to investigate if the results of short term follow-up studies can be reproduced in the long-term perspective.

Objectives: The current study describes the clinical and radiological long-term outcome of meningioma patients treated with Gamma Knife radiosurgery.

Patients and Methods: Between 3/91 and 5/2001 86 consecutive Swedish patients with meningiomas were treated with Gamma Knife radiosurgery at the Karolinska Hospital Stockholm. A total of 130 tumors were treated radiosurgically in 115 treatment sessions. The median prescription dose was 15 Gy (7-35 Gy), the median maximum dose 30.7 Gy (17-70 Gy). The median tumor volume was 2.5 cc (0.05-50.4cc). The median radiological and clinical follow-up period after GKS was 10 years (1.8-16.5y) and 9.4 years (2.1-17.4y) respectively. Follow-up was available in 94.6% (123/130 meningiomas)

Results: After a median follow-up period of 10 years, tumor control was achieved in 87.8 % of meningiomas (108/123 tumors). The median time between initial treatment and recurrence ($n = 15$) was 5.8 years (1.9-11.5 years). In 15.1% of patients (13/86) out of field recurrences were documented at a median of 7.5 years (1.3-15.7). New meningiomas were seen in 10.5% after a median of 5.4 years (0.9-10.8). 72% of patients did not require further treatment, in 23.3% (20/86) underwent a second Gamma Knife treatment, 10.5% (9/86) required later open surgery, 5.8% (5/86) required both secondary treatments. 86% of patients were neurologically unchanged or improved. Meningiomas treated with a prescription dose of > 13.4 Gy experienced a significantly lower rate of local recurrences (7.1% vs 24% $p = 0.0096$).

Discussion: The current retrospective analysis comprises one of the longest available follow-up investigations in a larger series after radiosurgery of meningiomas. It documents a persistent high local tumor control after Gamma Knife treatment, which is only slightly lower than in after published observations with shorter follow-up. The current series allowed an estimation of a necessary minimum dose for tumor control in meningiomas. A significant number of meningioma patients did develop tumor recurrences outside the radiation field and even new tumors and these tumor recurrences appeared late after treatment which may explain the slightly better outcome in series with shorter follow-up. The majority of secondary symptoms were unrelated to the actual treatment but appeared in relation to tumor recurrences or recurrences outside the radiation field.

FM1-2: The use of somatosensory evoked potential (SSEP) monitoring in the prevention of neurological injury in spinal surgery: a 5 year review of timing and response to an abnormal trace

I. S. Vanhegan, G. Cannon, S. M. R. Kabir, J. Cowan & A. T. H. Casey (Spinal Surgery Department, The Royal National Orthopaedic Hospital, Stanmore, UK)

Objectives: There is strong evidence that intra-operative spinal cord monitoring is sensitive and specific for detecting neurological injury. However there is little literature regarding the surgeon's response to changes in the intra-operative somato-sensory evoked potential (SSEP) and the effect of this response on resultant neurological outcome. This study aims to examine the role of intra-operative (SSEP) monitoring in the prevention of neurological injury.

Design: Case note review of prospectively collected data

Subjects: Case notes from operations using SSEP spinal cord monitoring between 1st October 2005 and 31st March 2009 were reviewed. This allowed sufficient time for accurate long-term follow up of neurological status. Demographic information was recorded and the operations categorised into: deformity, degenerative, trauma, tumour, infection.

Methods: Significant trace abnormality was defined as a decrease in signal amplitude of 50% or 10% increase in latency. Timing of trace abnormality, surgeon's response and prospective neurological outcome were recorded. Sensitivity, specificity,

positive / negative predictive value were calculated. A Chi-squared test was used to assess the effect of intervention on neurological outcome ($p < 0.05$).
Results: 2953 operations using SCM were performed and 106 significant abnormalities detected. Instrumentation was the most common triggering event. SSEP monitoring was found to have: sensitivity 100%, specificity 97.3%, positive predictive value 24%, negative predictive value 100%. Chi-squared test was not significant ($p = 0.18$) suggesting intervention did not affect neurological outcome.
Conclusions: Triggering events are uncommon and the development of a neurological deficit which persists beyond the time of discharge is rare (0.85%). In the majority of cases detection of a monitoring abnormality prompts a corrective reaction by the surgeon. SSEP monitoring is therefore a useful adjunct in safeguarding neurological structures which are vulnerable during surgery.

FM1-3: The incidence of primary brain tumour is associated with social class

K. Gupta & P. M. Brennan (Department Clinical Neurosciences, Western General Hospital, Edinburgh, UK)

Objectives: We observed anecdotally that primary brain tumours are not distributed equally across social classes. We investigated the association between social class and the incidence of meningioma and malignant glioma in comparison to lung cancer and normal vaginal delivery (NVD).
Design: Retrospective data were obtained from central hospital coding records, selected using ICD10 classifications of the above diseases. Social class was approximated using Carstairs deprivation quintiles.
Subjects: 17,836 patients were analysed, comprising 28.5% lung cancer, 2.5% meningioma, 4.3% glioma, and 64.7% NVD.
Methods: The distribution of incidence of the four disease groups was compared between quintiles, and the significance of variations in the distribution of quintiles with diagnoses calculated with Pearson-Chi square test (p value = 0.05 significant).
Results: Distributions of quintiles (1-5) with diagnoses were (%): Meningioma 37.5, 27.3, 21.4, 11.8, 2.0, malignant glioma 32.6, 28.4, 24.3, 10.2, 4.5, lung cancer 27.4, 28.0, 23.2, 13.2, 8.2, NVD 19.2, 16.6, 20.6, 23.5, 20.1. The incidence of meningioma and malignant glioma, unlike lung cancer and NVD, was significantly raised in social class 1, and significantly lower in social class 5 ($p < 0.05$).
Conclusions: These data suggest an association between social class and the incidence of primary brain tumour. These data do not suggest causation, but highlight the need for further studies.

FM1-4: Web Based Acute Neurosurgical Referrals - 56 month experience

M. H. Wilson & D. Bulters (Southampton Hospital, Imperial Hospitals NHS Trust and Addenbrooke's Hospital, Cambridge)

Objectives: Emergency referrals form a large proportion of all referrals to Neurosurgical units. These can be difficult to manage as most are made by phone. Our aim was to implement a web based referral system and assess its advantages and disadvantages.
Design: In recent years there has been an evolution of referral management from paper to local databases. Such ''electronic'' systems remain phone dependent however. Neurorefer.co.uk is a webform, which collects data from referring units and securely transfers this (and any images) to the referring unit for review.
Subjects: Since May 2006, the Wessex Neurological Unit has taken all referrals via neurorefer.co.uk
Methods: The referral is received by NHS.net. From here neurosurgical advice can be issued and automatically sent back. In this way there is a permanent record of the referral and the advice issued.
Results: In total 8,017 referrals have been made over 56 months. The largest number of referrals were from Portsmouth (1478), Poole (998) and Chichester (900), with Southampton itself generating 810. The commonest provisional diagnosis referred was head trauma (total 2,005 with 719 acute subdural haematomas, 321 chronic subdural haematomas and 71 extradural haematomas). There were 1361 Intracerebral haemorrhages, 722 subarachnoid haemorrhages and 1180 intracerebral tumours referred.
Conclusions: It is feasible and safe to receive emergency referrals via the web. Implementation of such a system reduces errors and saves time, as well as generating a permanent record which can be used in the event of a complaint and provides a unique opportunity for audit and research.

FM1-5: Post Craniotomy Infection

A. O'Keefe, T. P. Lawrence, D. Agombar & S. Bojanic (John Radcliffe Hospital, Oxford, UK)

Objectives: To determine the current rate, impact of and risk-factors for surgical site infection following craniotomy performed at the John Radcliffe Hospital, Oxford. To implement a reliable system to prospectively identify cases of infection according to internationally recognised criteria with a view to creating a national database.
Design: A prospective, consecutive audit.
Subjects: All adult neurosurgical patients undergoing elective or emergency craniotomy at the John Radcliffe Hospital from January 2010.

Methods: Patients were identified through the operating theatre electronic booking system. Cases of surgical site infection were diagnosed according to the Center For Disease Control Criteria which includes microbiological, clinical and radiological findings[1].
Results: 250 craniotomies were included. There were 20 cases of surgical site infection identified (8%). Mean hospital stay for the infection group was 21days compared with 9 days for control patients. A cost analysis for these patients reveals increased hospital stay alone to account for £86,780 of the total departmental budget.
Conclusions: The current rate of surgical site infection following craniotomy at The John Radcliffe Hospital is difficult to compare to those of other hospitals because of a lack of similar published databases for other units. Infection has a significant impact on length of hospital stay and cost.

Reference

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FM1-6: Factors influencing decision-making and outcome in the surgical management of trigeminal neuralgia

M. B. Ammori, A. T. King & S. A. Rutherford (Salford Royal Hospital, Salford, UK)

Objectives: To identify factors that will optimise the outcome of surgical intervention for trigeminal neuralgia (TN).
Design: Analysis of prospectively gathered data on patients undergoing surgical intervention for TN.
Subjects: Seventy-one patients who underwent 79 procedures (54 microvascular decompressions (MVD) and 25 percutaneous glycerol injections (PGI)) from 2007-2009.
Methods: Data were analysed regarding demographics, characteristics of TN, duration of symptoms, pre-operative magnetic resonance imaging (MRI), operative findings and outcome after surgery.
Results: A multivariate analysis did not identify any statistically significant patient factors influencing success or recurrence, including duration of symptoms. Multiplanar MRI was found to be sensitive in the assessment of neurovascular conflict in 95.7% of 48 patients who underwent MVD. The initial success in relieving neuralgia for MVD and PGI were 96.2% and 87.5% respectively. The recurrence rates were 9.8% following MVD and 33.3% following PGI at a mean follow up of 17.2 months and 13.4 months respectively.
Conclusions: The high success of surgery is not influenced by duration of symptoms. Pre-operative MRI provides an accurate assessment of neurovascular conflict of the trigeminal nerve, and can accurately inform a surgical decision. Both MVD and PGI offer effective treatment options for TN, although MVD has a higher initial success rate and a lower recurrence rate. Surgery should be offered early when medical management fails.

FM1-7: Acute spinal cord injuries – wide variability of treatment within the UK

M. C. Werndle, B. A. Bell & M. C. Papadopoulos (Academic Neurosurgery Unit, St Georges University of London, London, UK)

Objectives: To ascertain the current treatment of acute traumatic spinal cord injuries within the British Neurosurgical community.
Design: Online survey tool and postal questionnaire.
Subjects: All full members of the Society of British Neurological Surgeons (SBNS) were invited to participate.
Methods: Prior approval was obtained from the Academic Committee of the SBNS. Two clinical scenarios were designed, of an incomplete and complete C6/7 spinal cord injury, aimed to reflect the thinking of neurosurgeons regarding treatment and timings. Via the SBNS, full members were sent both an online link, as well as a postal survey. A total of 82 responded, i.e. 33% response rate.
Results: Regarding timing of transfer to a neurosurgical unit, most (78%) would transfer incomplete injuries immediately, but only 48% would transfer complete injuries immediately. Approximately 1/5 of respondents would give glucocorticoids (20% incomplete, 16% complete). There appeared to be no consensus on the timing of surgery with either group. 25.8% (incomplete); 13.6% (complete) would operate within 4 hours, 63.6% (incomplete); 32.2% (complete) within 24 hours. Comparatively, 72.9% (incomplete); 46.2% (complete) of respondents to a similar survey internationally would operate within 6 hours, 87.5% (incomplete); 85.2% (complete) within 24 hours. 9 respondents felt these patients should be directly referred to a spinal injuries centre.
Conclusions: Our data suggests most Neurosurgeons treat incomplete spinal cord injuries as a surgical emergency, however there remains variation regarding medical management and role and timing of surgery. The UK Neurosurgical population treats SCI more conservatively than our International colleagues[1,2]. This may reflect availability of resources.

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FM1-8: Principal Component Analysis of Cytokine Response Following Traumatic Brain Injury

A. Helmy, C. A. Antoniades, M. R. Guilfoyle, K. L. H. Carpenter & P. J. Hutchinson (Addenbrooke's Hospital, Cambridge, UK; Department of Clinical Neurology, University of Oxford, UK)

Objectives: We have recovered 42 cytokines, using cerebral microdialysis, following traumatic brain injury (TBI). Conventional statistical methods such as multivariate regression analysis require large numbers of subjects when there are large numbers of variables. Here we describe Principal Component Analysis (PCA) as a method for reducing large numbers of variables into principal components that summarise the sources of variation within the dataset.
Methods: We have utilised cerebral microdialysis in 12 patients to assay a panel of 42 cytokines over 5 days of monitoring. Statistical analysis was performed using multivariate analysis, including PCA, followed by partial least squares discriminant analysis (PLS – DA). SIMCA – P+ version 12 (Umetrics , Umea, Sweden) was used to identify principal components which accounted for the majority of the variation within the dataset.
Results: Multivariate analysis has revealed a small group of cytokines to be responsible for the majority of the variation in cytokine response between patients including IL6, IL1beta, and TNFalpha. Interestingly, these cytokines have been heavily implicated in the pathophysiology of TBI in rodent models.
Conclusions: Multivariate analysis is a powerful method for analysing complex datasets that have multiple variables in small numbers of subjects. This reveals underlying structure within the dataset that allows for the multiple complex interactions between the cytokines.

FM1-9: Accuracy of free hand placement of emergency frontal external ventricular drains and the relevance to clinical outcome

M. Nowell, S. Jagani & K. Aquilina (Department of Neurosurgery, Institute of Clinical Neuroscience, Frenchay Hospital, Bristol, UK)

Objectives: Previous studies have demonstrated variable accuracy of free hand insertion of emergency frontal external ventricular drains (EVD)[1,2]. The relevance of inaccurate drain placement and EVD revision to clinical outcome has not been previously studied. We have audited our practice to assess accuracy of EVD placement, EVD revision rates and association with outcome.
Design: Retrospective analysis.
Subjects: All patients undergoing emergency frontal EVD placement between March 2008 and July 2010 in our institution
Methods: Clinical patient records and radiology were evaluated for pre-EVD ventricular size, catheter length, tip position, patient course and outcome. Logistic regression analysis was carried out to identify factors associated with clinical outcome.
Results: A total of 135 consecutive post-EVD insertion scans were reviewed. Of those, 43 (32%) EVD tips were in the ipsilateral frontal horn, 66 (49%) were in a different CSF space and 26 (19%) were intraparenchymal. There was no significant difference in revision rates between optimally (20%) and sub-optimally placed (19.5%) EVD's. Logistic regression did not identify an association between EVD tip position or revision rates with clinical outcome.
Conclusions: Our study of free hand EVD insertion demonstrates that it is an inaccurate procedure, consistent with previous studies[1]. However, this series also demonstrates that radiological accuracy of EVD placement does not affect clinical outcome.

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FM2-1: Cervical band division for neurogenic thoracic outlet syndrome

S. Hettige & J. S. Norris (Hurstwood Park Neuroscience Centre, Haywards Heath, Sussex, UK)

Objectives: To describe neurogenic thoracic outlet syndrome (NTOS) and the treatment options. We evaluate a series of patients diagnosed with NTOS after thorough investigation who underwent surgical cervical band division as treatment of this esoteric, obscure condition.
Design: Case series study.
Subjects: 7 patients were referred with unilateral or bilateral brachalgia, exacerbated by elevation of arms and carrying heavy objects.
Methods: Imaging of the cervical spine and chest was used to rule out common pathologies such as degenerative disc/facet disease, cervical ribs or tumours. EMG studies ruled out a peripheral neuropathy, but in some cases indicated an entrapment at the brachial plexus. All patients were sent to

a neurologist for a 2nd opinion to confirm the clinical diagnosis and a mandate for surgical exploration.
Results: At each surgical exploration, a fibrous band from a vestigial cervical rib was found compromising the lower brachial plexus trunks and divided within the interscalene triangle. Post operatively all patients reported improvement and had returned to employment within 3 months. Only one patient reported transient recurrence of symptoms 3 years later.
Conclusions: While investigating complex upper limb symptoms, NTOS must be kept in mind. Lack of objective and definitive confirmatory tests causes controversy amongst clinicians on its true incidence. Provocative clinical tests such as the Adson's and the elevated arm stress test are useful. We have evidence to suggest that simple surgical exploration of the ipsilateral anterior triangle of the neck to look for and divide a cervical band or cervical transverse process 'spur' is safe and yields satisfactory results with no re-exploration required to date.

FM2-2: Hitting the ground running: A course to better prepare junior doctors for their first neurosurgical job

H. J. Marcus[1], M. A. Hughes[2], G. James[3], C. Uff[4] & M. Murphy[4] ([1]The Royal London Hospital, London, UK, [2]Western General Hospital, Edinburgh, UK, [3]Charing Cross Hospital, London, UK, [4]The Royal Free Hospital, London, UK)

Objectives: Neurosurgery is a busy and demanding speciality that typically receives little attention in undergraduate curricula. In addition, a trend towards shortened training and reduced working hours, along with increasing concerns about patient safety, has had the net effect of significantly reducing postgraduate clinical exposure to patients with neurosurgical conditions. We set out to design a course to better prepare junior doctors for their first neurosurgical job.
Design: One-day course with stations on neurosurgical history and examination, management of core neurosurgical conditions, interpretation of imaging and technical skills such as lumbar puncture. A combination of didactic lectures, case based discussions, and simulation-based learning was utilised.
Subjects: Twenty trainees participated (17 Foundation Year Trainees and 3 Senior Medical Students).
Methods: All trainees provided feedback on the relevance and quality of teaching provided (1 = Very Poor; 5 = Excellent). In addition 95% (19/20) of trainees completed a self-assessment of their confidence and competence in various neurosurgical topics before and after attending the course (1 = Not at all; 5 = Very). Differences between pre- and post-course scores were assessed used Wilcoxon signed rank test.
Results: Trainees rated highly the overall relevance (Median = 5, Range = 4–5) and quality (Median = 5, Range = 4–5) of teaching provided. Trainees rated themselves as more confident and competent in all topics assessed ($p < 0.01$).
Conclusions: We have demonstrated that a structured neurosurgical course may be useful in preparing junior doctors for their first neurosurgical job. It is hoped that such courses, alongside initiatives such as E-learning, will enhance subsequent on-the-job experience and ultimately improve patient care.

FM2-3: Management of chronic subdural haematoma. A review of subdural drain use after burr–hole evacuation

Y. Antwi-Yeboah, C Mansi & G. Critchley (Hurstwood Park, Haywards Heath)

Objectives: A recent publication[1] reported a beneficial outcome with placement of subdural drains following evacuation of chronic subdural haematoma (CSDH). These findings produced a change in the management of CSDH at our unit, Hurstwood Park Neurological Centre, with standard practice since 2009 being the insertion of a subdural drain. It is our intention to review our results from this change in policy, comparing use of a drain versus no drain.
Design: A retrospective cohort study of our treatment of chronic subdural haematoma was performed. We collated all chronic subdural cases between September 2008 and September 2010 using a retrospective examination of case notes, CT scans and subsequent mortality figures.
Subjects: 99 patients treated with Burr hole evacuation of a CSDH were selected. 46 had subdural drains inserted and 53 had no drain.
Methods: Only the primary operation for chronic subdural drainage was examined. Patients had to have undergone burr hole drainage with or without placement of a subdural drain. Patients who had minicraniotomies or operations for acute subdural haemorrhages were also excluded. We compared the outcomes for patients treated with or without a subdural drain. Chi squared test and Fisher's exact test were used where appropriate.
Results: 99 patients fit our inclusion criteria. Recurrence occurred in 6 out of 46 (13%) of patients with a drain, and 8 out of 53 (15%) patients without a drain ($p = 1$; 95% CI 0.27-2.64). If we exclude bilateral chronic subdural haemorrhages we get recurrence rates of 6 out of 40 with a drain and 5 out of 42 without ($p = 1$; 95% CI 0.36-4.45). The 30 day mortality rate in the drain group was 1 out of 46 with the drain and 3 out of 53 without ($p = 0.62$; 95% CI 0.03–3.7). Cumulative mortality is 5 out of 46 (11%) with a drain and 6 out of 53 (11%) without the drain $p = 0.81$; 95% CI 0.27-3.36). The mean length of stay was 9.5 days with a drain and without a drain was 6.7 days ($p = 0.028$; 95% CI ± 0.007)
Conclusions: There was no statistically significant difference in the 30 day mortality between the group

with a drain and the group without a drain. Length of stay was significantly longer for those with a drain. The associated increase in costs, and in our case, lack of benefit in early mortality, calls into question the routine use of drains for all CSDH.

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FM2-4: A National Survey of Neurosurgical Trainees' Perceptions of the Value of Courses to Their Training, and the Adequacy of Study Leave Budgets

S. Metcalfe[1] & L. T. Dunn[2] ([1]Royal Victoria Infirmary, Newcastle upon Tyne, UK, [2]Southern General Hospital, Glasgow, UK)

Objectives: Attending educational courses is an important aspect of Neurosurgical training. However, course costs are continuing to rise, and study leave budgets are being frozen or reduced in many deaneries. It was decided to survey British Neurosurgical trainees, to ascertain which courses they had attended, their opinion of the value of those courses, and also to assess the costs involved, and how those costs were being met.
Design: An on-line questionnaire was conducted, through the British Neurosurgical Trainees' Association, which ran from March until June 2010.
Subjects: British Neurosurgical trainees.
Methods: The questionnaire was conducted using the SurveyMonkey software, and all data analysis was conducted using this software.
Results: A total of 57 responses were received. Responses were obtained from trainees of ST1-ST7 (or Calman equivalent) level. 71.9% of respondents had undergone ''old-style'' SHO training, ie undergone a Basic Surgical Training rotation, prior to commencing Registrar training. Questions were asked about specific common courses attended by Neurosurgical trainees, including Basic Surgical Skills, ATLS, CCrISP, and Operative Skills in Neurosurgery, and the majority of trainees found these courses either ''very'' or ''somewhat'' beneficial. The average study leave budget per year was £651.34, whilst the average spent on courses in 2009/2010 was £1210.45, a shortfall of £559.11, which the trainees had to fund themselves. 98.1% of respondents felt that their study leave budget was insufficient.
Conclusions: Course costs are rising for Neurosurgical trainees, whilst study leave budgets are being frozen or reduced for many trainees. This survey highlights the benefit that trainees feel they gain by attending these courses, and the financial sacrifice they make to do so.

FM2-5: Does Intra-cerebral Pathology Type Affect Seizure Outcome Following Epilepsy Surgery?

A. Kumar, I. Malik, A. Valentin, R. P. Selway, R. D. C. Elwes, J. T. Laban & G. Alarcon (King's College Hospital, London, UK)

Objectives: To investigate if there is a relationship between histological diagnosis on pathology and degree of seizure control following epilepsy surgery.
Design: Retrospective review of medical records of all patients who had resective epilepsy surgery over a 10-year period between 1st January 1999 and 31st December 2008 at King's College Hospital.
Subjects: 191 patients had pathology recorded, with 50 % of subjects being male. The average age at operation was 44.8 years; with average duration of follow-up being 43.1 months.
Methods: The pathology types of tumour ($n = 47$), mesial temporal sclerosis (MTS) ($n = 81$), focal cortical dysplasia (FCD) ($n = 17$), arterio-venous malformation (AVM) ($n = 11$), dysembryoplastic neuroepithelial tumour (DNET) ($n = 10$), cyst ($n = 2$), normal/non-specific ($n = 17$) and MTS plus a lesion (MTS+) ($n = 6$) were compared with post-operative seizure control, as defined by Engel's classification of seizure grading. Surgical outcome was classified according to Engel's scale into favourable (grades 1 or 2) and unfavourable (grades 3 or 4).
Results: Favourable outcome (Engel's grade I/II) for each histological group was: tumour (70%), MTS (75%), FCD (76%), AVM (64%), DNET (90%), Cyst (50%), normal /non-specific (41%) and MTS+ (83%) One-way ANOVA analysis with post hoc Bonferroni correction for multiple comparisons showed there was no significant difference between pathology types and surgical outcome ($p > 0.05$)
Conclusions: The histological nature of the lesion does not correlate with post-operative seizure control.

FM2-6: Gaining consent: Assessment of patient satisfaction

A. Bahl, I. Graham & T. A. Carroll (Department of Neurosurgery, Royal Hallamshire Hospital, Sheffield, UK)

Objectives: To evaluate patient satisfaction in obtaining consent for common neurosurgical procedures in the context of current recommendations for patient information provision[1,2].

Design: Patients were asked, via a structured questionnaire, about the process by which their surgery was explained to them.
Subjects: 50 consecutive patients were approached to participate after giving their consent for a neurosurgical procedure.
Methods: Patients were asked to rate satisfaction with the consent process and to rate their understanding of the risks/benefits of their procedure on a numerical scale. They were also asked if the information was clear, if the explanation felt rushed, if they were able to ask questions and if they felt they received adequate information. The grade of doctor obtaining consent and the duration between consent date and operation date were also noted.
Results: 45 patients gave a score of 80% or more. 84% of patients stated that the information they were given was adequate. 74% of patients felt they fully understood the risks/benefits of their procedure. Two patients felt the explanation given to them was rushed and one patient felt unable to ask questions. Clinic letters had been copied to patients in 20 and departmental information booklets had been provided in 17.
Conclusions: A reasonable level of satisfaction was demonstrated with the consent process amongst preoperative patients, although providing patients a copy of their clinic letters and/or information booklets did not increase satisfaction scores. We would recommend the general use of such an approach in demonstrating adequate quality control in the consenting process, including the possibility to 'test' the patients' recall of the risks and benefits explained to them.

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Functional section

WP1-1: Risk factors for haemorrhage in Functional Neurosurgery: a large case series and systematic literature review

L. Zrinzo, T. Foltynie, P. Limousin & M. I. Hariz (Unit of Functional Neurosurgery, Sobell Department of Motor Neuroscience and Movement Disorders, UCL Institute of Neurology, University College London, The National Hospital for Neurology and Neurosurgery, Queen Square, London, WC1N 3BG, UK)

Objectives: Haemorrhage carries a high risk of causing a devastating neurological outcome in functional neurosurgery; this study examines the literature to determine the risk factors for this complication.
Design: The haemorrhage rate in a consecutive series of 214 patients undergoing MRI-guided and verified deep brain stimulation without microelectrode recording (MER) was analyzed.
Methods: A systematic literature review was performed to determine the incidence and associated risk factors.
Results: The total incidence of haemorrhage in our series was 0.9%: asymptomatic in 0.5%, symptomatic in 0.5% and causing permanent deficit in 0.0% of patients. Weighted means calculated from the literature suggest that the overall incidence of haemorrhage in functional neurosurgery is 5.0%: asymptomatic in 1.9%, symptomatic in 2.1% and resulting in permanent deficit or death in 1.1 % of patients. Hypertension and age were the most important patient-related factors. Risk factors related to surgical technique included use of MER, number of MER tracks and sulcal or ventricular transgression. Studies adopting an image-guided approach without MER were associated with significantly lower haemorrhage rate (Fisher's test for all haemorrhages: $P < 0.001$, asymptomatic: $P < 0.001$, symptomatic: $P < 0.004$ and leading to permanent deficit $P = 0.001$).
Conclusions: Age, hypertension and use of MER are significant risk factors for haemorrhage in functional neurosurgery. A meticulous image-guided approach to surgery and target verification avoids surgical risk factors and lowers haemorrhage risk.

WP-1-2: Bilateral caudal zona incerta nucleus stimulation for essential tremor – Long term outcome and quality of life

P. Plaha, S. Javed, D. Agombar, G. O' Farrell, S. Khan & S. S. Gill (Dept of neurosurgery, Frenchay Hospital, Bristol BS16 1LE)

Objectives: Over the past few years we have been performing bilateral stimulation of the caudal or motor part of the zona incerta nucleus (cZI) in patients with Essential tremor (ET). We present our outcomes including quality of life data in 15 patients with a follow up period of up to 84 months (mean of 31.7 ± 28.6 months).
Design: Prospective nonrandomised Trial
Subjects: 15 consecutive patients with ET
Methods: 15 consecutive ET patients underwent MRI guided, bilateral cZI DBS implantation. Patients were assessed by applying the Fahn-Tolosa-Marin Tremor Rating scale and the SF-36 health survey to assess quality of life.
Results: The total tremor score improved by 73.8% ($p < 0.0001$). The Part A score (Item 1-9) improved by 86.6% ($p < 0.0001$). Postural tremor improved by 88.2% ($p < 0.0001$) and action tremor by 82.2% ($p < 0.0001$).

The Part B score which evaluates the functional activities of the upper limbs improved by 60.1% ($p < 0.0001$). Part C score, which evaluates the

activities of daily living improved by 80.0% ($p < 0.0001$).

The SF-36 physical component score improved by 23.7% ($p < 0.0001$) and the mental component score by 22.4% ($p < 0.0001$).

There was one wound infection and 3 patients developed stimulation related transient dysarthria. None developed any disequilibrium or tolerance to stimulation.

Conclusions: Bilateral cZI stimulation is safe and effective in suppressing the postural and action component of ET. It is associated with a low rate of stimulation related complications and the patients do not develop tolerance to stimulation with maintained clinical benefit over a follow up period of up to 7 years.

WP1-3: Outcome of microvascular decompression for trigeminal neuralgia: decompression or neocompression – does it matter?

J. A. Reaper, R. Battersby, A. Kemeny & D. Bhattacharyya (Royal Hallamshire Hospital, Sheffield, UK)

Objectives: To review our outcomes for microvascular decompression (MVD) for trigeminal neuralgia and compare results for the two different techniques employed for this operation.

Design: Retrospective review of MVD procedures from 1993-2010. Outcomes – degree of pain relief achieved, need for ongoing medication, further treatment, complications of procedure.

Subjects: 138 patients were identified – 53 male, 85 female. Average age was 57 (28-80) years. Average length of follow up was 21 months.

Methods: Patients were treated with either traditional decompressive technique (group a), or with a new technique involving wrapping the nerve in a loose silastic foam tubing (group b). 74 underwent technique a, 47 had technique b, and 17 had neither (when no causative vessel was found).

Results: In total, 106/138 (77%) patients were pain-free following surgery: 57/74 (77%) for technique a, 38/47 (81%) for technique b.

112/138 (81%) of patients had no pain or mild pain only: 60/74 (81%) for technique a, and 40/47 (85%) for technique b.

Ongoing medication was required in a total of 13/138 (9%) patients: 10/74 (14%) for technique a, 2/47 (4%) for technique b.

Further treatment was required in a total of 8/138 (6%) cases - all were following surgery with technique b: 8/74 (11%) ($p < 0.05$).

Procedural complications occurred in a total of 16/138 (12%) patients with no significant difference between the two techniques.

Conclusions: There is current debate about microvascular decompression and neocompression in the literature. Our outcomes are comparable to published results, and show both techniques to have similar results even though technique b is considered neocompressive. However, significantly fewer patients required further treatment when the neocompressive technique was performed.

WP1-4: Outcomes from Stimulation of the caudal Zona Incerta and Pedunculopontine Nucleus in patients with Parkinson's disease

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Objectives: Axial symptoms including postural instability, falls, and failure of gait initiation are some of the most disabling motor symptoms of Parkinson's disease (PD)[1,2,3]. We performed bilateral deep brain stimulation (DBS) of the Pedunculopontine nucleus (PPN) in combination with the Caudal Zona Incerta (cZi) in order to determine their efficacy in alleviating these symptoms.

Design: Prospective unblinded phase one trial.

Subjects: The patient group had a mean age of 60.7 and disease duration of 19.1 years at the time of surgery. All patients had predominant symptoms of On-medication postural instability, gait freezing, and falls.

Methods: Using a high resolution MRI-guided technique with implantable guide tubes[4] we have implanted bilateral PPN and cZi electrodes into seven patients with PD. Motor outcomes were assessed using the motor component of the Unified Parkinson's Disease Rating Scale (UPDRS 3) and an composite axial subscore derived from items 27,28,29 and 30 (arising from chair, posture, gait and postural stability). Quality of life was measured using the PDQ39. Comparisons were made between scores obtained at baseline and those at a mean follow up of 12 months.

Results: In both the Off and On medication state a statistically significant improvement in the UPDRS part 3 score was achieved by stimulation of the PPN, cZi and both in combination. In the off medication state our composite axial subscore of the UPDRS part 3 improved with stimulation of the PPN, cZi and both in combination. The composite axial subscore, in the ''On'' medication state, however, only showed a statistically significant improvement when a combination of cZi and PPN stimulation was used.

Conclusions: This study provides evidence that a combination of PPN and cZi stimulation can achieve a significant improvement in the hitherto untreatable ''On'' medication axial symptoms of PD.

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WP1-5: Functional implant infection rate: A 10-year review

D. Ramnarine & R. J. Edwards (Department of Neurosurgery, Frenchay Hospital, Bristol, UK)

Objectives: To determine the infection rate in implanted deep brain stimulators, spinal cord stimulators, vagal nerve stimulators and intrathecal pumps over a 10-year period.
Design: A retrospective audit of case notes.
Subjects: All patients having implanted deep brain stimulator (422), Vagal nerve stimulators (214), Spinal cord stimulators (218) and Intrathecal pumps (23) over a 10-year period in our institution.
Methods: A list of all devices removed was obtained from clinical coding and verified against theatre log. These patient notes were analysed to determine the reason for removal and identify those with infection. Case notes of all patients with implants were then analysed to determine if any clinical infections were treated in-situ without implant removal.
Results: All clinically infected implants were removed with attempted in-situ treatment unsuccessful. Infection rates were: 3.7% for vagal nerve stimulators, 2.1% for deep brain stimulators, 3.7% for spinal cord stimulators and 4.3% for intrathecal pumps.
Conclusions: Our infection rates are within acceptable limits when compared to published figures[1,2]. There was also notable improvement in infection rates in spinal cord stimulator implantation as a single stage procedure when compared to two-stage procedure.

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WP1-6: The Evaluation and Optimisation of Direct Intraparenchymal Delivery of Viral Vectors to the Brain

E. A. White, A. S. Bienemann, H. Taylor & S. S. Gill (Frenchay Hospital, Bristol, UK)

Objectives: Convection-enhanced delivery (CED) is a promising technique for the direct intracranial administration of viral gene therapy vectors. In this study, we sought to develop equipment to facilitate CED in clinical practice and undertake a systematic examination of the distribution properties, cell tropisms and host inflammatory responses associated with infusions of key viral vectors.
Methods: Stereotactic equipment including implantable catheters were developed for use in both rats and pigs. Initially simple infusates, such as albumin and MRI contrast agents visualised by immunohistochemistry and MRI respectively were used to understand the mechanics of CED. Subsequently infusions of viral vectors expressing enhanced green fluorescent protein or ?-galactosidase were undertaken into the white and grey matter of both rat and pig brains. The distribution of transduced cells was determined using unbiased computational stereological methods. Immunohistochemistry was used to evaluate vector tropisms and the extent of inflammatory cell infiltration into the brain.
Results: Infusate distribution was shown to be critically dependent on the occurrence of tissue damage associated with cannula implantation. Threshold infusion parameters at which pressure-related tissue damage occurred were identified. Systematic comparison of the characteristics of viral vectors infused by CED demonstrated significant differences in the distribution properties, transductional tropisms and immune responses associated with infusions of vectors based on HSV-1, adenovirus, lentivirus and adeno-associated virus.
Conclusions: The use of equipment developed from this work, appropriate vector selection and the infusion parameters identified should facilitate the translation of gene therapy and RNA interference into successful clinical trials potentially revolutionising the management of numerous neurological diseases.

Neurovascular

TP1-1: Early CT perfusion for the prediction of cerebral vasospasm in aneurysmal subarachnoid haemorrhage

D. O. Bulters, V. Young, J. Gillard & P. J. Kirkpatrick (Addenbrookes Hospital, Cambridge, UK)

Objectives: A recent study has suggested that CT perfusion (CTP) within 72 hours of ictus can predict delayed cerebral ischemia (DCI) with a sensitivity of 75% and a specificity between 70 and 93%[1]. We set

up a study to assess if we could improve the prediction of DCI by repeating a second CTP after 5 days. The objective of this report, however, is to describe the findings of the first CTP after ictus.
Design: A prospective observational cohort study.
Subjects: 91 consecutive patients admitted with subarachnoid haemorrhage to a regional Neurosurgical Centre. 79 patients met the inclusion criteria and 65 had an early CTP.
Methods: All patients with subarachnoid haemorrhage underwent two CTP scans on day 1 and day 5 following ictus. These were reviewed by a consultant neurosurgeon subjectively for any evidence of perfusion deficits that may be predictive for delayed ischemia.
Results: The mean time from ictus to CTP was 31.5 hours (range 6-78). 41 were good grade and 23 poor grade patients. Excluding haematoma related changes only one patient had any perfusion changes. These were not evident on plain CT but were visible on CBF, MTT, TTP, TTD. These did result in a complete infarct on CT two days later and death of the patient. 17/65 (26.1%) developed DCI. None of these patients had any changes on their admission CTP.
Conclusions: Although changes on early CTP are specific for later infarction, they are rare and do not identify the majority of patients who later develop DCI.

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TP1-2: A Single Unit Assessment of Patients Referred with Intracerebral Haemorrhage, and Their Eligibility for Inclusion in the STICH II Study

S. Metcalfe & R. D. Strachan (James Cook University Hospital, Middlesbrough, UK)

Objectives: STICH II is an international multicentre randomised trial in spontaneous superficial intracerebral haemorrhage, comparing early haematoma evacuation with initial conservative treatment. We analysed our screening log data from July 2008 to December 2009 (18 months), to determine the number, and both clinical demographics and radiological characteristics of intracerebral haemorrhages referred to our department. We assessed how many patients were eligible for inclusion in the STICH II trial and why patients were excluded.
Design: Screening log analysis.
Subjects: During the 18-month period, 234 patients (124 female, 110 male) were referred with intracerebral haemorrhage. 27 of these were infratentorial, and were excluded, leaving 207 patients with supratentorial haemorrhages.
Methods: Screening logs were completed by a single Specialty Registrar. These included all patients referred to the unit with intracerebral haemorrhages, with data gathered from the unit's referral database, and analysis of the patients' CT scans.
Results: Only one patient was entered in the STICH II study. The most common reasons for excluding the other 206 patients were: haematoma extending outside the lobar region (58.7%), haematoma greater than 10mm from the surface (43.7%), hydrocephalus or IVH (40.8%) and GCS of $M<5$, $E<1$ (26.7%). 11 patients were recorded as being excluded for lack of equipoise, in which this was the only exclusion criteria in 7 (6 did not undergo evacuation, 1 did). 15 patients had no reason given, and none could be identified from patient data or CT analysis, suggesting a lack of clinical equipoise.
Conclusions: Our study highlights the difficulties of recruiting into STICH II, due to the inclusion and exclusion criteria. In our unit, only one patient was recruited over an 18-month period, and whilst 22 other patients appeared eligible for recruitment on clinical and radiological grounds, it is likely they were excluded because of a lack of clinical equipoise.

TP1-3: Outcome in all poor grade subarachnoid haemorrhage patients referred to a regional neurosurgical unit

S. Neilson, N. Singh, K. Abid, L. Dulhanty, J. P. Holland & H. C. Patel (Salford Royal Foundation Trust, Manchester, UK)

Objectives: That aggressive management of poor grade (World Federation of Neurological Surgeons (WFNS) grade 4 and 5) subarachnoid haemorrhage (SAH) results in improved outcome is widely reported. However these reports are of selected patients admitted to neurosurgical centres. The aim of this study is to report outcome in all patients presenting in poor grade.
Design: Retrospective review
Subjects: 174 poor grade patients referred over a 2 year period
Methods: We retrospectively reviewed records of all poor grade patients referred to our institution between July 2008 and June 2010. Data collected include age, sex, WFNS grade, Fisher grade, pupillary responses, intervention(s) performed, and Glasgow Outcome Score (GOS) at 6 month follow-up.
Results: 174 poor grade patients were referred (61 males, 113 females), median age 60 (range 10-96). 97 (55.7%) were admitted for neurosurgical care and 74 (76.3%) of these received definitive treatment. Good outcome (GOS 4 or 5) was achieved in 48 (49.5%) of those admitted. Main reasons for non-admission were fixed pupils (57.1%), and age,

co-morbidities (35.1%) driven. Overall, good outcome was achieved in 48 (27.6%). All patients not transferred died, with a median time to death of 1 day from referral.
Conclusions: Good outcome was achieved in 49.5% of admitted cases, and 27.6% overall. That most patients managed conservatively died within 1 day, suggests that current triage practices remain valid.

TP1-4: Large Basilar tip aneurysms – What is the ideal extent and route of occlusion?

M. Foroughi, L. Stevens, J. Bannister, D. M. O' Doherty, T. O' Doherty & R Hatfield (Department of Neurosurgery, Queen Elizabeth Hospital, Birmingham)

Objectives: To ascertain the ideal amount of occlusion & whether it is best to occlude at the inlet or outlet during endovascular obliteration of basilar tip aneurysms.
Design: A Novel study using Computational fluid dynamics (CFD) modelling was carried out by taking 3D co-ordinates from DICOM images of a large Basilar tip aneurysm. The CFD modelling was undertaken using Fluent 6.2, the geometry was built up using the Gambit software, the computation was run using unsteady inlet & outlet flow with a standard k-e turbulence model, and assumptions made that the arterial walls are solid & non-elastic entities & blood is an incompressible Newtonian fluid.
Subjects: An anonymous DICOM image set of a giant basilar tip aneurysm.
Methods: Analysing the WSS and turbulence at various regions of the aneurysm using coloured contoured plots.
Results: The optimum level of occlusion is between 80–90 percent with coils being inserted at the inlet. At lower levels of occlusion (50%) the WSS favour the outlet occlusion, however the turbulence is worse than the inlet equivalent and level of occlusion is suboptimal given the size of the residual neck.
Conclusions: It is clearly demonstrated using accurate CFD modelling that in order to minimise subsequent growth or rupture of such large basilar tip aneurysms, they should be occluded from the inlet and at levels of occlusion between 80–90%. Also such modelling can be done prior to treatment for specific aneurysms in order to optimise outcome.

TP1-5: A Clinical Synopsis of Modern Intracerebral Haemorrhage (ICH) Management

K. Abid, S. Arthur, H. Patel, A. King & A. Parry-Jones (Neurosurgical Department, Salford Royal Hospital, Salford, Gtr Manchester, UK)

Objectives: To compare ICH management against national standards in order to model ICH pathology in this population and subsequently to improve service delivery.
Design: Non-traumatic ICH patients admitted between January 2008 and May 2010 to a tertiary care centre were retrospectively analysed to identify aetiological factors, management techniques and outcome following ictus.
Subjects: 134 patients with ICH were managed by specialist medical or surgical services at Hope Hospital in Salford following direct admission or referral from outlying hospitals.
Methods: Patients had electronic and paper notes analysed to identify aetiological factors, descriptive statistics, transfer timings, management decisions and outcomes from their pathology. CT images were analysed to identify ICH site, bleed volume (calculated by the ABC/2 method)[1] and the presence of hydrocephalus or intraventricular extension.
Results: The majority of bleeds were found to be supratentorial (78%) complicated by hydrocephalus (31%), intraventricular extension (36%), antiplatelet (22%) or anticoagulant (8%) use. Average volume was 42 mLs with an intra-hospital mortality of 34.1%. DNAR status was recorded in 38% of cases.
Conclusions: The study modelled a wide population of patients with non-traumatic ICH. Neurosurgical referrals bore little relation to NICE guidelines and management of coagulopathy and hypertension was variable and sporadic. The study identifies a considerable number of clinical management issues with significant implications for service development in this group of neurosurgical patients.

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TP1-6: Endovascular salvage procedures using intra-arterial nimodipine for the treatment of clinical vasospasm

B. Zebian, S. Chakraborti, F. Hashemian, C. Tolias & D. Walsh (King's College Hospital, London, United Kingdom)

Objectives: Clinical vasospasm or delayed ischaemic neurological deficit (DIND) remains a challenging complication following aneurysmal subarachnoid haemorrhage (aSAH). Endovascular salvage procedures using angioplasty or intra-arterial papaverine have been widely reported whereas those using intra-arterial nimodipine less so. We report our early experience of the latter.

Design: We identified patients who underwent endovascular salvage using nimodipine from a log-book in the angiography suite.
Subjects: 30 patients were identified. 7 were excluded as they had only received nimodipine during coiling. The remaining 23 all presented with aSAH. 19 were female (83%). The mean age was 56.5. They had undergone a total of 29 procedures.
Methods: We retrospectively examined the patient notes. Modified Rankin Scale (mRS) was recorded at discharge and follow-up and extended Glasgow Outcome Score (eGOS) recorded at follow-up. DIND was defined as a new neurological deficit or a drop in GCS not attributable to any other cause.
Results: 19 out of 23 patients (83%) improved clinically (14 after 1 procedure and 5 after 2). Out of the 19 patients only 14 (74%) showed radiographic improvement.
11 patients (48%) were mRS 1-2 at discharge. Follow-up information was available for 18 patients. 13 out of 18 (72%) were mRS 0-2 and eGOS 7 or 8 (mean follow-up 11.4 months). None suffered complications from the procedures.
Conclusions: Endovascular salvage procedures using intra-arterial nimodipine for DIND are safe and were associated with clinical improvement in the majority of our patients. More work is needed to investigate and compare different types of endovascular salvage.

TP1-7: Vascular subspecialisation in neurosurgery may play a role in improving outcome after delayed ischaemic neurological deficit related to subarachnoid haemorrhage

B. Zebian, H. Hasegawa, P. Iosifidis, D. Walsh & C. Tolias (King's College Hospital, London, United Kingdom)

Objectives: Delayed ischaemic neurological deficit (DIND) is a major cause of disability and death following aneurysmal subarachnoid haemorrhage (aSAH). We sought to identify the incidence and outcome of DIND in our patient population in a one-year period after neurovascular subspecialisation was well established.
Design: The notes of patients with a coding of SAH at our institution in the period from 1/9/7 to 31/8/8 were reviewed retrospectively.
Subjects: 144 patients were identified. 60 patients were excluded (diagnosis other than aSAH in 54 and notes inaccessible in 6). A total of 84 patients with aSAH were therefore analysed.
Methods: DIND was defined as a new neurological deficit or a drop in GCS not attributable to any other cause. The results were compared with those from a similar review from 2005-2006 prior to the appointment of dedicated neurovascular surgeons.
Results: 26 out of 84 patients (31%) had DIND. 16 out of 53 (30%) who had coiling, 8 out of 23 (35%) who had clipping and 2 out of 8 (25%) who had no intervention.

19 out of 26 patients with DIND (73%) were independent (extended Glasgow Outcome Score 7-8) at discharge (4 patients) or follow-up (15 patients, median duration of follow-up 6.5 months). In our previous review we found that 55% of patients were independent.
Conclusions: The incidence of DIND in our population is similar to published figures in the literature. Most patients with DIND returned to independent living. Compared to a similar review performed in our unit during 2005–2006, more patients with DIND achieved favourable outcomes. This may be due to the formal introduction of vascular subspecialisation.

TP1-8: Lumbar puncture and the diagnosis of subarachnoid haemorrhage: Time for a new approach?

M. Ditta, J. Galea, J. Holland & H. Patel (Salford Royal Foundation Trust, Salford, UK)

Objectives: Objectives: Because of potential risks of poor outcome, lumbar puncture (LP) to exclude the presence of blood breakdown products is recommended in patients with suspected subarachnoid haemorrhage (SAH) and a normal CT scan. The aim of this study was to document how often this test proved useful.
Design: Design: A retrospective analysis of prospectively recorded data.
Subjects: Subjects: Patients with suspected SAH and a normal CT scan in whom LP was recommended between May 2008 and May 2010.
Methods: Methods:
Patients were identified from the neurosurgical referral database and CT scans; LP results, inpatient stay, investigations and interventions were recorded.
Results: Results: Of 163 patients in whom a LP was recommended, 14 had no LP, 22 had a specimen unsuitable for analysis, and in 30 patients the results were inconclusive. In the 52 patients with a poor or inconclusive LP, 50 were investigated further with 32 patients transferred and admitted (mean stay 7.8 days (6.6+/− SD)) to the neurosciences centre. In this cohort, 4 aneurysms (8%) were identified and treated. In the 36 patients that were LP positive 7 (19.4%) had evidence of SAH on the initial CT scan. Excluding these patients, 8 (8/29,28%) were found to have an aneurysm that was treated. An LP excluded SAH in 61 patients.
Conclusions: Conclusion: LP driven decision making in patients with a normal scan and suspected SAH is suboptimal in approximately 42%. Perhaps the advent of 5th generation CT scans and

contemporary non invasive techniques for identifying intracranial vascular malformations will lead to a different approach.

TP1-9: The value of screening for vasculitis in patients with angiogram negative subarachnoid haemorrhage

R. Zakaria, M. Stovell & P. R. Eldridge (The Walton Centre NHS Trust, Liverpool)

Objectives: In cases of angiogram negative, CT or LP proven subarachnoid haemorrhage a ''vasculitic'' screen is sometimes recommended to ascertain if there is an underlying aetiological factor. The yield of such screening investigations is generally poor. We investigated our series of such cases to attempt to determine the frequency of such diagnoses.
Methods: We searched for cases coded as ''non-aneurysmal SAH'' OR ''SAH – unknown cause'' in an electronic database of inpatient admission episodes (MDAnalyze, ver 3.11, Medtamic Ltd, USA) over the last 5 years. Traumatic cases were excluded. Patient details were cross-checked in the electronic blood results system (Molis, Citrix) for general tests of vasculitis such as ESR or CRP and specific antibody tests for autoimmunity.
Results: Over 90 cases were identified fitting the criteria of which 42 had only full blood count, urea & electrolytes and a clotting panel. In addition 55 patients had a CRP (42) or ESR (13) test within 48 hrs of admission. This was above the upper limit of normal in 27 cases (49% of those tested). In total, 11 patients had specific immunological blood tests for vasculitis including ANA, ENA, DS DNA, compliment and serum electrophoresis and none of these yielded positive results or significant titres.
Conclusions: Based on this observation there is no evidence to support screening tests for vasculitis in patients with non-aneurysmal, atraumatic subarachnoid haemorrhage. However with this sample size there is the possibility a significant effect was missed. A more complete analysis of this group of patients is needed to determine criteria for these type of investigations.

Posters selected for oral presentation

TOP1-1: Arterial blood gases and ICP. Is there a connection?

N. Tzerakis[1], P. Mitchell[1], B. Gregson[1], I. Piper[3], G. Citerio[4], A. D. Mendelow[1] & I. R. Chambers[2] on behalf of the BrainIT group ([1]Department of Neurosurgery, [2]Regional Medical Physics Department, Newcastle General Hospital, Newcastle upon Tyne, NE4 6BE, UK, [3] Department of Clinical Physics, Institute of Neurological Sciences, Southern General Hospital, Glasgow, G514TF, UK)

Objectives: To determine the statistical correlation of $ETCO_2$ and SaO_2 as it measured by capnograph and pulse oxymeter and the intracranial pressure readings from a large number of head injured patients.
Design: We analyzed the physiological and clinical data from the BrainIT group regarding head injured patients who require intracranial pressure (ICP) monitoring. The BrainIT project has become an international collaboration aiming at collecting data regarding patients with significant head injuries.
Subjects: In this study we present the results of $ETCO_2$ and O_2 sat measurements made in 200 patients who were being treated for severe head injury correlated with the ICP values. These data are part of the physiological parameters monitored during the treatment of severely brain injured patients and they were recorded with high time resolution as a result of the BrainIT project
Methods: The data are the result of the Brain IT project international collaboration and represent the continuous monitoring of patients with significant brain injury. The values of ICP, PCO_2 and $SatO_2$ from patients intubated and ventilated were measured and correlated. The database was created from anonymised data collected minute by minute and transferred to Glasgow to be converted into a standard form.
Results: There is no significant relationship between the SaO_2 and the ICP probably because all patients were intubated and ventilated and had SaO_2 above 98%. The analysis of the data showed that in patients with ICP higher than 20 mmHg, the increase in arterial PCO_2 value is associated with a tendency of higher ICP which is the result of the carbon dioxide-evoked arteriolar vasodilation. However, when the ICP is below 20 mmHg it seems that the vasodilation has the opposite effect and the increased PCO_2 is associated with decreased ICP. Possible pathophysiological mechanisms are discussed.
Conclusions: SaO_2 has little, if any effect in ICP and the results of our study are in accordance with previous literature[1,2,3]. The relationship of the PCO_2 with the ICP in our study confirmed that the hyperventilation is still an important therapeutic maneuver in cases of brain edema and intracranial hypertension. Nonetheless, random hyperventilation in early stages may be associated with vasoconstriction and ischemia which may deteriorate the cerebral edema.

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TOP2-2: Implementation of neuro-oncology service reconfiguration in accordance with nice guidance provides enhanced clinical care for patients with glioblastoma

C. Watts, S. J. Price & S. Thomson (Cambridge University Dept Neurosurgery, Addenbrookes Hospital, Cambridge and Dept Neurosurgery Leeds General Infirmary, Leeds)

Objectives: To evaluate the impact of service reconfiguration in accordance with NICE guidance on the delivery of care to patients with gliobalstoma
Design: Retrospective cohort analysis
Subjects: Patients were identified from the Eastern Region Cancer Information Centre (ERCIC) database queried for ICD-10 codes C71.* and/or ICD-O-3 codes 94**.
Methods: To evaluate change in practice resulting from the NICE Improving Outcomes Guidance we compared cohorts before, during and after implementation. Data were retrieved from the CNS-MDT database and supplemented with case-note data and radiology referring centres throughout the Anglian Cancer Network. Using the Trust business intelligence system we compared the number of clinical spells for elective and emergency admissions.
Results: Service reconfiguration and implementation of NICE guidance resulted in additional benefits in the management of patients. These included increased pre and post-operative evaluation by a multidisciplinary clinical team, reduced median length of stay, enhanced access to specialist imaging and significant cost savings.
Conclusions: We were able to show improvements in the management of neuro-oncology patients by moving from an emergency based system of patient referral and management to a more planned elective out-patient-based pattern of care.

TOP2-3: Stereotactic radiosurgery for intracranial meningiomas

D. S. Jeyaretna, G. A. Tipper, J. D. Palmer, S. Pascoe, S. Kelly, W. Adams & P. C. Whitfield (Southwest Neurosurgery Centre, Plymouth, UK)

Objectives: Determine clinical and radiological outcomes of LINAC-based stereotactic radiosurgery (SRS) for intracranial meningiomas.
Methods: Intracranial meningiomas were treated with either conformal SRS or fractionated stereotactic radiotherapy using a M3 LINAC based system and data prospectively collected. Localisation was frame ($n = 35$) or mask-based ($n = 23$). Tumour volumes were measured blinded, pre and post-treatment. Tumour regression was defined as $>20\%$ reduction in volume, progression as a $>20\%$ increase in volume and stable disease as an increase or decrease of $<20\%$.
Results: 54 patients (42 female 12 male) with 58 tumours were treated. 45%, 21% and 2% of tumours were WHO histological Grade I, II and III respectively. No histology was performed on 33%.
Median gross tumour volume (GTV) at start of treatment was 5.1ml (interquartile range 2.5 to 9.4ml). The mode dose to the isocentre was 15Gy and 1.8Gy (typically in 25-28 fractions) for frame-based and fractionated mask-based SRS respectively. The mode dose to the tumour was 12Gy and 1.62Gy respectively for frame and fractionated therapy. Patients were reviewed over a median of 24 months; most recent GTV was 2.5ml (interquartile range 1.2 to 6.5ml). Tumours demonstrated an overall mean volume reduction of 43% (interquartile range -63% to -8%). 69% regressed, 8% progressed and 23% exhibited stable disease. 3 patients died, 2 from progression of Grade II and III tumours and one from unrelated causes.
Conclusions: Early follow-up data demonstrates overall good tumour control, suggesting SRS as a valuable treatment modality for meningiomas. Longer term follow-up will allow evaluation of the utility of these treatments as first line approaches for surgically ''curable'' meningiomas.

TOP2-4: A Profile of Vestibular Schwannoma Surgery in the Gamma Knife Era

R. Nash, K. Deniz, N. Kitchen & M. Gleeson (The National Hospital for Neurology and Neurosurgery, London, UK)

Objectives: Current therapeutic options for vestibular schwannomas include observation, gamma knife stereotactic radiosurgery, and surgical resection. We audited the patients undergoing surgical resection at our centre over a four year period subsequent to the availability of gamma knife stereotactic radiosurgery as a management option.
Design: A retrospective review of case notes was performed and relevant information regarding the surgery, patient demographic, presentation, audiological data, tumour characteristics, and complications was extracted.
Subjects: 71 patients undergoing vestibular schwannoma surgery in the study period. The surgery was performed by three consultant surgeons, either individually or in collaboration.
Methods: Retrospective analysis of case notes identified by the coding department.
Results: Patient ages ranged from 25.8 to 82.1 years, with the mean age being 50 years. The median size of tumour operated upon was 25mm. 7% of patients had prior gamma knife radiosurgery. 32% underwent translabyrinthine excision, and 65% were performed using a retrosigmoid approach. The median length of inpatient stay was 8 days. There was no inpatient mortality. Facial nerve paresis was the most notable complication.

Conclusions: This audit supports the ongoing practice of vestibular schwannoma surgery in our centre for carefully selected patients. Despite the advent of alternative treatment modalities, surgery continues to be performed on a broad range of patients, with good outcomes.

TOP2-5: Gamma Knife Radiosurgery for the treatment of Chordoma and Chondrosarcoma

S. Murahari, H. I. Sabin, P. N. Plowman, J. Wadley, T. P. D. Blackburn, St. Bart's Hospital London (Gamma Knife/Neurosurgery St. Bartholomews Hospital, London, UK)

Objectives: To evaluate the effect of Gamma Knife Stereotactic Radiosurgery (GKS) on Chondrosarcoma or Chordoma.
Design: Retrospective analysis
Subjects: Nineteen consecutively presenting patients with chondrosarcoma (n = 6), or chordoma (n = 13)
Methods: Patients were treated by GKS either primarily, or adjuvant to other treatment. Mean age = 44 years (19 - 89). Sixteen patients had had previous debulking on one or more occasions, and one patient had had LINAC radiotherapy prior to GKS. Mean tumour volume at treatment by GKS was 11.7cc (1.6–78.5), median marginal dose = 18Gy, mean = 16.9Gy (8–20).
Results: Mean follow up period = 49 months, median 46 (6–110). One patient died from tumour progression at 24 months. Three patients progressed at 12, 84, and 26 months respectively, requiring a 2nd GKS treatment, one also requiring further debulking prior to repeat GKS. The remaining 7 chordomas have remained stable. No progression has been observed in 5 of the 6 chondrosarcomas. One showed very minimal enlargement at 6 months post GKS, 2 demonstrated radiological shrinkage, and the remainder were stabilised. No adverse effects of GKS were observed in any patient. Two chordoma patients were lost to follow up.
Conclusions: Multimodality treatment is essential in the management of these locally aggressive tumours. Stereotactic Radiosurgery is an important adjuvant, and in combination with other techniques throughout what may be a long natural history, it is both safe and effective.

TOP2-6: Clinicopathological review of patients with and without multiple sclerosis treated by partial sensory rhizotomy for medically refractory trigeminal neuralgia: a 12-year retrospective study

K. Abhinav, S. Love, G. Kalantzis, H. B. Coakham & N. K. Patel (Departments of Neurosurgery and Neuropathology, Institute of Clinical Neurosciences, Frenchay Hospital, Bristol, UK)

Objectives: Trigeminal nerve root entry zone (REZ) demyelination is implicated as a cause of trigeminal neuralgia (TN) in multiple sclerosis (MS) and with nerve root vascular compression[1,2]. Characteristics in patients with and without MS presenting with intractable TN and treated by partial sensory rhizotomy (PSR) were examined.
Design: Retrospective study.
Subjects: 70 TN patients treated between 1992–2004.
Methods: Case record examination identified presence or absence of visible vascular compression at surgery; post-operative satisfaction and pain scores; and electron microscopic findings from examination of 2-3 mm wedge biopsies taken from the point of maximal vascular compression or caudal sensory REZ.
Results: 23 MS and 47 non-MS patients were identified. Both groups had similar ages of onset of TN (mean: 50.0 and 50.3 years respectively), duration of symptoms (7.7 and 6.7), age at surgery (57.7 and 57.1), and proportions with typical and atypical symptoms. Demyelination was present in 16 MS and 23 non-MS patients ($P = 0.129$), and neurovascular compression in 5 MS and 23 non-MS patients ($P = 0.039$). Demyelination was associated with vascular compression in only 3 MS compared to 15 non-MS cases ($P = 0.008$). Pain and satisfaction scores were similar in both groups. Recurrent TN was more common with persistent vascular compression ($P = 0.019$). Only one MS patient developed anaesthesia dolorosa.
Conclusions: These findings provide further evidence that nerve REZ demyelination is associated with TN secondary to both MS and vascular compression. TN in MS and non-MS has similar characteristics and both groups respond well to PSR, with low risk of anaesthesia dolorosa.

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TOP2-7: Ventricular access device simulation training

B. Nurboja, J. T. Laban, S. Broughton & D. Walsh (King's College Hospital, London, UK)

Objectives: To assess the validity of the use of simulation in training junior doctors to use ventricular access devices
Design: Junior doctors were trained in the set up and care of ventricular access devices, including intrathecal drug administration and emergency scenarios, using a medium fidelity paediatric simulator (Meti PediaSim).

Subjects: 13 junior doctors (5 neurosurgical, 4 neurological and 4 neuro-HDU doctors) enrolled in the King's College Hospital neurosurgical induction programme
Methods: All trainees watched the faculty demonstrate four simulated scenarios. Each participant then performed one of the scenarios. On occasion, the simulated physiology was changed to demonstrate an acute rise in intracerebral pressure; the trainees then had to perform team resuscitation. All participants completed an anonymised course evaluation form.
Results: 11 of the participants were not very confident in managing ventricular access devices before the session. All participants by the end of the session understood what a ventricular catheter was; agreed the session introduced new concepts important for patient safety; and felt more confident at administering intrathecal antibiotics, and maintaining and reviewing ventricular catheters. All participants agreed that simulation was a valuable tool in training, a good learning experience for clinical skills and knowledge including team working and communication, and a useful adjunct to learning from real patients. They also agreed that the session was enjoyable and they would benefit from annual simulation courses.
Conclusions: Simulation is a useful training tool that can be used in the training of junior doctors who care for patients with ventricular access devices.

TOP2-8: Patient and staff satisfaction with the introduction of 'day of admission surgery'

A. Sofela, J. T. Laban, R. C. Chituku & R. P. Selway (King's College Hospital, London, UK)

Objectives: To evaluate patient and staff satisfaction with day of admission surgery in a neurosurgical unit and its effect on theatre start times.
Design: Patients were admitted to a Neurosciences admission lounge (NAL) for neurosurgery on the morning of their operation if deemed appropriate by their neurosurgical consultant. All patients in the NAL, and staff involved in their care, were asked to complete a satisfaction questionnaire. Theatre start times were compared with those whose patients had been admitted prior to the day of surgery.
Subjects: 378 patients undergoing 'day of admission surgery', and 16 doctors and 5 nurses involved in their care.
Methods: 378 patients undergoing 'day of admission surgery', and 16 doctors and 5 nurses involved in their care.
Results: 83% of patients felt positive on arrival in the NAL and 88% felt positive on being seen by the doctors and nurses prior to surgery. Overall 79% of patients gave positive responses throughout their patient pathway. 90% of staff were positive about day of admission surgery and all staff members were satisfied there were no negative effects on surgical outcome. Theatre start time was on average 41 minutes earlier in patients admitted on the day of surgery.
Conclusions: Neurosurgical patients, when appropriately selected, can be admitted on the day of surgery with high staff and patient satisfaction and appears to be highly efficient in reducing theatre delays and hospital stay.

TOP2-9: Complications of titanium cranioplasty

S. Hettige, S. Butt & A. J. Martin (Dept of Neurosurgery, St George's Hospital, London, UK)

Objectives: To describe our experience with custom made titanium cranioplasty in the last 5 years and examine its complication rate.
Design: Retrospective case note review.
Methods: Of the 104 titanium cranioplasties that had been custom made in the last 5 years we could only obtain the full clinical record for 52 patients and have reported these. The literature was reviewed.
Results: Of these 52 patients 28 were male (54%) and the age range was 17-73, mean 40.4years. The indications for previous craniectomy were for trauma, tumour, infection or evacuation of haematoma.There was no mortality. Three patients ultimately refused cranioplasty. Ten suffered morbidity (20%) with 1 extradural haematoma (2%), 3 infections (6%), and seizures in 3 (6%). Three were cosmetically unsatisfactory (6%), of which one required revision. The overall rate of prosthesis removal was 10.2% ($n = 5$). There was a higher incidence of complications in patients that had craniectomy for trauma (45% vs 6% non-trauma, $p < 0.05$), and also for those who had delayed insertion post craniectomy (12% under 12 months vs 44% over 12 months, $p < 0.05$).
Conclusions: Cranioplasty following decompressive craniectomy is associated with a high complication rate. Trauma prior to craniectomy maybe associated with skull base injury, csf leaks, sinus injuries and orbitofacial fractures, which can predispose these patients to infection. Delayed insertion can relate to problems with cosmesis.
Our overall complication rate of 20% and the postoperative infection rate of 6% is consistent with rates reported in the literature 16-34% and 7% respectively[1,2].

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TOP2-10: Outcome and morbidity of external ventricular drainage for basal ganglia haemorrhage: What do we achieve?

I. Jalloh, F. Ali & P. O. Byrne (Queens Medical Centre, Nottingham, UK)

Objectives: External ventricular drainage (EVD) for the management of hydrocephalus associated with basal ganglia haemorrhage (BGH) is common practice. Experience of treating hydrocephalus caused by other pathologies implies that drainage is a worthwhile intervention that results in acceptable outcomes. However, patients with BGH frequently have significant co-morbidities and the haemorrhage, as well as the hydrocephalus, contributes to this group's morbidity.
We reviewed the outcomes of patients treated with EVD for the management of primary BGH.
Design: A retrospective analysis of 30 patients treated at a single centre with EVD following BGH.
Subjects: 30 patients (16 male) (age range 31 to 88 years).
Methods: Case notes were reviewed to determine morbidity and outcomes. BGH volumes were estimated using the formula for ellipsoids (A X B X C/2, with A, B, and C representing radii in 3 dimensions). The bicaudate index and temporal horn diameters were used to assess the degree of hydrocephalus.
Results: Patients presented with a GCS ranging from 5 to 15. CT demonstrated BGH volumes of between 1 to 44 ml. Inpatient mortality was 23%. Only 4/22 patients with follow-up data had a good outcome (mRS 1–3). A low GCS and larger BGH volume were associated with a poor outcome although this did not reach statistical significance. There was no significant difference in outcome in those patients treated with early EVD (<48 hrs) versus late EVD (mean 16 days; range 7–28 days). 6 patients suffered EVD associated complications.
Conclusions: Clearly EVD has a role in the management of hydrocephalus whatever the cause. This case series serves to highlight the morbidity and poor outcomes associated with this patient group.

TOP2-11: Audit of External Ventricular Drain (EVD) insertion accuracy

G. A. Blackman, H. U. Qureshi, A. Wilbraham, K. Hossain-Ibrahim, L. Senthil & S. P. Harland (Queen Elizabeth Hospital, Birmingham, UK)

Objectives: Insertion of an EVD is a common neurosurgical procedure for treatment of hydrocephalus. This study aimed to determine the accuracy of free hand EVD insertion in our unit. Secondary aims were to determine association between placement accuracy and EVD length, seniority, revision rate, infection and bleeding.
Design: Retrospective study.
Subjects: Adults with an EVD inserted at the Queen Elizabeth Neurosurgery Unit in Birmingham over a thirteen month period. Inclusion criteria: frontal approach; inserted in theatre; post-operative CT/MRI available. Exclusion criteria: EVD revisions.
Methods: EVD insertions were identified using theatre logbooks. Post-operative scans were analysed to determine catheter tip placement, length and EVD related haemorrhage. Electronic records were examined for evidence of infection. We used a new grading system to classify EVD tip position: target (ipsilateral frontal horn), acceptable (ipsilateral body, third ventricle) and suboptimal (contralateral frontal horn, contralateral body, intraparenchymal).
Results: A total of 59 out of 134 EVDs met the inclusion criteria. EVD tips were placed in the target position in 19 (32%), acceptable position in 26 (44%) and suboptimal position in 14 (24%) subjects. EVDs placed in the target position were significantly shorter than those placed in an acceptable position ($p < .01$). There was not a significant association between EVD position and reinsertion rate, haemorrhage, infection or seniority.
Conclusions: Free hand accuracy of EVD insertions was comparable to previously published studies. However, we recommend accuracy can be further improved by the use of guidance techniques.

TOP1-12: Actual performance of the rechargeable Medtronic implantable pulse generator (Activa-RC) for Deep Brain Stimulation (DBS) therapy in dystonia

M. J. Naushahi, S. O'Riordan, P. G. Bain, C. T. Hopkins & D. Nandi (Imperial College Neuromodulation Group (ICNG), London, UK)

Objectives: The advertised battery life for the newly developed Activa-RC for DBS therapy is up to nine-years, with daily or weekly recharge options[1]. We describe our experience with the first ten Activa-RC implanted for the treatment of generalised non-DYT1 dystonia with bilateral GPi-DBS.
Design: Clinical audit.
Subjects: All ten patients underwent successful bilateral GPi-DBS and subsequently the IPG (Kinetra) was cumulatively replaced 57 times in the 7.9 ± 1.5 years (mean $\pm$ SD) prior to Activa-RC implantation, owing to high parameter settings.
Methods: The Activa-RC recharging frequency requirements were audited using a two-weeks diary.
Results: Recharging of the stimulator was required once or twice per day and for 80.3 (range: 15–180) minutes (mean $\pm$ SD) per day. Excluding the costs of surgery and/or its complications, the cost for 57 IPG replacements required in the preceding 7.9 ± 1.5 years (mean $\pm$ SD) amounted to €473,100 (at 2010 prices). During the same period the cost would have been €144,000 if as expected, only one Activa-RC would have been required by each of the ten patients.

Conclusions: Activa-RC has the potential to greatly decrease the cost of treating dystonic patients with GPi-DBS but may require more frequent recharging than previously believed. This has lifestyle implications for the patient and may potentially have an effect on Activa-RC battery life.

Reference

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Hydrocephalus

TP3–1: Systematic Review of the outcome of shunt surgery in idiopathic normal pressure hydrocephalus

A. Toma, M. Papadopoulos, S. Stapleton, N. Kitchen, L. Watkins (The National Hospital for Neurology and Neurosurgery, London, UK)

Objectives: to estimate the outcome of shunt insertion for normal pressure hydrocephalus in terms of improvement rates and associated mortality and morbidity.
Design: Systematic review.
Subjects: studies that objectively assessed the outcome following shunt insertion in idiopathic normal pressure hydrocephalus.
Methods: Bibliographic search.
Results: 64 studies of 3063 patients were reviewed. Positive improvement following shunt insertion occurred in an average of 71% of patients with an average 1% mortality. Results from studies published in the last 5 years showed 82% improvement following shunt insertion, mortality of 0.2%, and combined common complications rate of 8.2%. Improvement is long lasting, with an average 3–7 years post shunt improvement rate of 65%.
Conclusions: When patients are properly selected, shunt insertion is a safe and effective management of idiopathic normal pressure hydrocephalus with prolonged positive outcome.

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TP3-2: Recurrent symptoms following craniovertebral decompression for Chiari malformation: the role of disturbed CSF dynamics

G. Kulkarni, A. Tarnaris, H. Murphy, M. Czosnyka, Z. Czosnyka & G. Flint (Queen Elizabeth Hospital, Birmingham, UK)

Objectives: Craniovertebral decompression (CVD) is a well established method of treating Chiari malformations. In a minority of patients, however, despite a good anatomical result, recurrence of symptoms occurs, albeit usually of reduced severity.To quantify the occurrence of persisting or recurrent symptoms following CVD and investigate underlying abnormalities of CSF dynamics.
Design: A retrospective review of patients undergoing primary CVD in our institution between 1993 and 2009.
Subjects: 222 patients.
Methods: Symptoms of headache, motor, somatosensory or vestibular disturbance were recorded. Lumbar puncture (LP), with or without saline infusion, was performed. Symptomatic responses were recorded and pressures compared with aged matched patients diagnosed with hydrocephalus or idiopathic intracranial hypertension but with clearly normal CSF dynamics ($N = 29$).
Results: 222 patients underwent primary CVD for uncomplicated Chiari I malformations. Of these 1 in 4 cases returned, at varying intervals, with recurrent symptoms. At LP the mean pressure was 13.8 mmHg. Symptoms were relieved by lowering this pressure in 75% of patients. Separate analysis of cases undergoing infusion studies ($N = 26$) revealed that both mean CSF pressure and its dynamics caused by slow vasogenic waves were significantly higher than in a control group (mean CSF pressure in CVD: $14.5+/-4.1$mmHg, controls: $8.1+/-2.3$ mmHg, $p = 3.5 \times 10\text{-}7$; vasogenic slow waves: $1.47+/-1$ mm Hg in CVD versus $0.63+/-0.3$ mmHg in controls; $p = 0.002$). Other compensatory parameters, including resistance to CSF outflow and craniospinal elasticity, were normal.
Conclusions: Recurrence of symptoms following anatomically successful CVD is linked with a higher than average CSF pressure and its elevated dynamics with no evidence of disturbed CSF circulation.

TP3-3: Endoscopic Third Ventriculostomy in the Treatment of Childhood Hydrocephalus: Validation of a success score that predicts long-term outcome

A. J. Durnford[1], F. J. Kirkham[2], N. Mathad[3] & O. C. E. Sparrow[3] ([1]Department of Neurosurgery, University Hospital Coventry and Warwickshire, UK, [2]Paediatric Neurology, Department of Child Health, Southampton University Hospitals NHS Trust, Southampton, UK, [3]Department of Neurosurgery, Wessex Neurological Centre, Southampton)

Objectives: To externally validate the Endoscopic Third Ventriculostomy Success Score[1] (ETVSS), predicting success based upon age, aetiology and previous shunt implantation.
Design: Retrospective identification of consecutive paediatric ETV cases at a single centre, with

verification of success from review of case notes, and of operation and electronic records.
Subjects: All paediatric ETV cases from 1994 to 2010.
Methods: Success was defined as survival and no subsequent surgical procedure for definitive CSF management. We compared actual success, at 36 months, with mean predicted probabilities for low, moderate and high chance of success strata based on the ETVSS, calculating long-term success using Kaplan-Meier methods.
Results: 166 primary ETVs were performed at a median age of 39 (range 0.03-230) months. At 36 months mean predicted probability of success was significantly higher in those with a successful ETV ($n = 99$) than for failed cases ($n = 67$) ($p = 0.001$). The ETVSS low, moderate and high chance of success strata had mean predicted probability of [and actual] success in 82% [76%], 63% [66%], and 36% [42%] respectively.
Conclusions: The ETVSS closely predicted actual success rates in high, moderate and low chance of success groups. Our study confirms the ETVSS can aid clinical decision-making by reliably predicting long term outcome.

Reference

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TP3-4: Cerebrospinal fluid leaks after transphenoidal surgery in 161 patients over 30 months – effect of a polyethylene glycol hydrogel dural sealant (Duraseal)

V. A. Nowak, E. A. Pereira, H. Ingale, P. Plaha & S. A. Cudlip (The West Wing, John Radcliffe Hospital, Oxford, UK)

Objectives: To investigate cerebrospinal fluid (CSF) leak rates after microscopic and endoscopic endonasal transphenoidal surgery with and without polyethylene glycol hydrogel dural sealant (Duraseal) in a specialist pituitary centre.
Design: Single-centre case series with retrospective review of prospectively collected information.
Subjects: 161 consecutive patients scheduled for transphenoidal hypophysectomy or biopsy over 30 months from August 2007 to December 2009 inclusive.
Methods: Prospectively recorded clinical databases were used to obtain information including patient demographics, pituitary pathology, type of surgery (microscopic or endoscopic), whether Duraseal used, lumbar drain insertion and CSF leak.
Results: 161 patients were identified (90 male, 71 female; median age 50 years, range 14-82). 132 patients received Duraseal (81%). 57 (35%) had intra-operative dural breach and 9 (5.5%) developed post-operative CSF leaks (3 without intra-operative dural breach) requiring lumbar drainage or formal repair. Of this group 2/161 (1.2%) patients required a formal repair. Postop CSF leak was seen in 5/128 (3.9%) patients with pituitary adenoma, of these 4/27 (14.8%) were in cases undergoing revision surgery. 4/9 (44.4%) patients who developed a CSF leak presented with either rathke's cleft cyst or craniopharyngioma. 1/29 patients not receiving Duraseal leaked (3.4%) whereas 9/132 patients receiving Duraseal leaked (6.8%). 37 patients (23%) received intra-operative lumbar drains, none developing subsequent CSF leaks, in contrast to 9/124 (7.2%) of patients without intra-operative lumbar drains who later developed CSF leak.
Conclusions: In this series the rate of post-operative CSF leak requiring re-exploration and repair was low (1.2%) in this mainly endoscopic case series without statistical benefit from Duraseal. Intra-operative and postoperative lumbar drainage appears beneficial in patients at higher risk of post-operative CSF leak.

TP3-5: Transition from Microscopic to Endoscopic approach - Surgical outcome and long term follow up in patients with Ratkes Cleft Cyst

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Objectives: Objective: The aim of this study was to review the clinical presentation, surgical outcome and long term recurrence associated with microscopic endonasal and endoscopic endonasal resection of ratkes cleft cysts(RCC).
Design: Retrospective analysis of surgical outcome. Single Institution experience
Subjects: 26 consecutive RCC patients with complete data on 20 patients.
Methods: We retrospectively reviewed a series of 26 consecutive patients of which 20 had complete follow up data and a diagnosis of RCC after microscopic/endoscopic resection between Jan 2004 and Oct 2010.
Results: The average patient age was 46 years (range 25-91years), and the average follow up was 43 months (range 13-82months). All patients underwent complete removal of cyst contents.

Headache was a presenting symptom in 8/20 patients (40%) with 7 of 8 having postoperative improvement in their headaches. 9/20 initially presented with pituitary dysfunction and 5 out of 9 had postoperative normalisation of their pitiutary function. 10/20 had preoperative visual field deficit with 7/20 improving post surgery. 1 required a reoperation due to reaccumulation of cyst contents.

5 patients underwent endoscopic drainage and the rest microscopic drainage. 2 patients had temporary pituitary dysfunction postoperatively, although there was no permanent pituitary dysfunction. 6/20 patients had an intraoperative CSF leak which stopped with a fat graft repair and lumbar drain All 6 had a microscopic resection, 2 however required a second operation for a persisting leak. There were no complications in the endoscopic group.
2 patients had a recurrence and required reoperation.
Conclusions: Microscopic/endoscopic drainage of RCC is an effective treatment with low morbidity. Although our numbers are small, a purely endoscopic approach holds promise. We discuss the advantages/disadvantages and difference in outcomes between the two surgical groups.

TP3-6: The Nasoseptal Flap for Skull Base Defects: An Institutional Experience

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Objectives: Endoscopic expanded endonasal approaches have become popularized over the past decade for exposure and resection of skull base and intradural lesions. These resections carry with them a significant risk of intraoperative CSF leak and post-operative CSF leaks following reconstruction. A vascularized nasal septal pedicled flap, based on a branch of the posterior septal artery was developed for reconstruction of these dural defects.
Methods: A retrospective review of patients who underwent endonasal skull base surgery between the years 2005 and 2010 at the University of Toronto was performed to identify patients that were reconstructed with the nasoseptal pedicled flap. Risk factors for flap failure were identified.
Results: Sixty-nine patients had dural defects reconstructed with the nasoseptal flap. Three of these patients (4%) had postoperative CSF leaks one of which was transient and did not require further intervention. Two of the 3 patients who developed leaks had undergone prior radiotherapy.
Conclusions: Compared to pre-existing strategies, the use of the nasoseptal flap delivers a low CSF leak rate. The rate reported here (4%) is consistent with recently published series as was the association with prior radiotherapy. Given this data, the nasoseptal flap has proven to be a reliable reconstructive approach for skull base defects. Quality of life and patient satisfaction studies are required to further determine its role and are the subject of on-going research.

TP3-7: The expanded endonasal approach: Birmingham's early experience

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Objectives: The Expanded Endonasal Approach (EEA) is an endoscopic transnasal technique facilitating access to the entirety of the anterior skull base. We report our early experience of its utilisation in the management of a variety of skull base pathologies.
Design: An on-going case series review commencing from May 2010 of patients undergoing the EEA for anterior skull base lesions.
Subjects: Between May 2010 and November 2010, 6 patients have successfully undergone a total of 7 EEA procedures at our unit. There were four female and two male patients. The mean age was 58 years with age range 32–71 years. Pathologies were 1 clival and 2 suprasellar meningiomas, 1 clival chordoma, 1 olfactory neuroblastoma, and 1 plasmacytoma.
Methods: Endoscopic techniques developed by the Pittsburgh group were utilised[1]. Anterior skull base defects were reconstructed using the Hadad Nasoseptal flap and the reverse Caicedo septal flap. Resection rates and surgical complication rates were recorded. Postoperative resection was classified radiologically from early post-operative MRI as total (100%), near total (90-99%), or subtotal (0-89%).
Results: Total resection was achieved in 1 patient. Near total resection was achieved in 3 patients. Subtotal resection was achieved in 2 patients. In these 2 patients however, total tumour resection was not the primary surgical aim; the intention was to only obtain a biopsy. There were two complications. One patient had a CSF leak requiring a repeat EEA for surgical repair. Another patient developed a small area of columella erythema which resolved spontaneously.
Conclusions: The anterior skull base team has been impressed by the EEA technique and wishes to share its experience with other units. Our initial impression is that the EEA technique is safe and effective in the management of a wide variety of anterior skull base lesions.

Reference

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TP3-8: A prospective analysis of pre and post-operative surgical and neurocognitive outcomes in patients undergoing surgery for colloid cyst removal

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Objectives: Surgical removal of a colloid cyst from the third ventricle can lead to particular neurocognitive deficits. The variability of impairment appears to be related to the extent of fornix damage. We present our experience treating third ventricular colloid cysts to determine the morbidity and efficacy of endoscopic and transcallosal approaches.
Design: see below.
Subjects: see below.
Methods: Patients who underwent surgical removal colloid cysts between January 1999 and June 2010 were included. Along with clinico-radiological details patients were grouped into those undergoing transcallosal or endoscopic surgery and mode of clinical presentation. Except in emergent cases patients underwent pre and postoperative neuropsychological assessment utilising the Wechsler Adult Intelligence Scale (WAIS-III and Memory Scale (WMS).
Results: 24 patients underwent trancallosal surgery – mean follow-up 36 months. 20 patients underwent endoscopic surgery – mean follow-up 37 months. All patients in the transcallosal group remained shunt independent. 17 in the endoscopic remained shunt independent. Total excision was achieved in all patients within the transcallosal group with 1 recurrence. Total excision was achieved in 13 patients within the endoscopic group with 1 recurrence. For all patients there was no change in their general intellectual function. However the majority of patients demonstrated either no clinical change or significant improvements in all / or some aspects of memory function independent of the operative approach.
Conclusions: Transcallosal and endoscopic colloid cyst removal are safe and effective operative methods. Our results do not demonstrate a significant additional neuropsychological morbidity associated with the transcallosal approach. Neuropsychological function can improve postoperatively compared to baseline preoperative testing.

Spine

FP1-1: Posterior approaches for thoracic disc herniations - is anterior surgery necessary? Experience with 24 consecutive cases

R. Sivakumaran, C. Wigfield & N. R. Patel (Department of Neurosurgery, Frenchay Hospital, Bristol, United Kingdom)

Objectives: The optimal surgical approach for thoracic disc herniations is open to much debate and controversy. We present our experience of the posterior transpedicular and transfacet pedicle sparing approaches for all types of thoracic disc protrusions.
Design: Between 2001 and 2010, the senior author performed posterolateral discectomies in 24 consecutive patients with 25 thoracic discs. Clinical data was retrospectively analysed and all patients were followed up (range 4–36 months).
Subjects: 17 women & 7 men (mean age 56 years {range 36–79}) were included. All discs were located between T6/7 & T11/12. Pre-operative symptoms included myelopathy, radicular pain, axial pain, sensory disturbance and bladder dysfunction. 11 discs were calcified (including 3 intradural).
Methods: A total of 26 operations were performed. 18 unilateral and 4 bilateral approaches were performed as single procedures and 2 patients required 2 operations. Complete cord decompression was achieved in all patients.
Results: Following surgery, there was improvement of myelopathy in 14 (83%), radicular pain in 8 (53%), axial pain in 4 (50%), bladder dysfunction in 12 (92%), and sensory disturbance in 9 (69%) patients. No major complications occurred and overall, 20 patients (83%) improved.
Conclusions: In our experience, posterior transpedicular or transfacet pedicle sparing approaches are suitable for all thoracic discs including large centrally calcified herniations. This approach has a low complication rate with good clinical outcomes and avoids the morbidity of anterior approaches.

FP1-2: Epidural Fentanyl for Pain Relief After Lumbar Laminectomy

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Objectives: To determine the efficacy of intraoperatively administered epidural Fentanyl for post-operative analgesia following lumbar laminectomy.
Design: Two-centre patient-blinded randomised controlled trial.
Subjects: Adults undergoing lumbar laminectomy for canal stenosis.
Methods: Patients were randomised to receive either Fentanyl (100μg in 10ml saline) injected in the epidural space via a catheter inserted 10cm above the operated level, or nothing, after the decompression was completed. Patients were blinded to group allocation. Peri-operative analgesia was otherwise comparable. Visual analogue pain scores (0-10) were obtained before surgery, in recovery, and on the first two post-operative days.
Results: Sixty patients were randomised: 29 to Fentanyl and 31 to control. Two patients did not receive Fentanyl as assigned but were included in the intention to treat analysis. There was no significant difference in age, sex, number of levels operated, duration of surgery, or pre-operative pain score between groups.

In recovery, reported pain scores were significantly reduced in the Fentanyl group (mean [SEM]: 2.6 [0.51] vs. 4.4 [0.46]; $p = 0.003$, T-test). Pain scores on the two days after surgery were similar.

Three patients treated with Fentanyl had temporary insertion of a urinary catheter post-operatively; none were required in the control arm ($p = 0.11$, Fisher's Test). Length of post-operative hospital stay was not significantly different between groups (median: 2 days for both; $p = 0.96$, Mann-Whitney Test).

Conclusions: Epidural Fentanyl can reduce early post-operative pain following lumbar laminectomy. More patients in the treatment arm required catheterisation but this did not affect length of stay. Larger studies of epidural analgesia in spinal surgery are warranted.

FP1-3: Posterior cervical microforaminotomy for hypertrophic cervical spondylitic radiculopathy in elite rugby players

R. J. Nelson & M. Milne (Department of Neurosurgery, Frenchay Hospital, Bristol, UK)

Objectives: To assess the outcome of posterior cervical microforaminotomy and discectomy in elite rugby players presenting with disabling radiculopathies.

Design: Single surgeon, prospective consecutive cohort study.

Subjects: 29 international and premiership rugby players: mean age 27.3 years (range 20–33 of which 8 players <25 yrs old).

Methods: Assessment: clinical examination supplemented by cervical kinematics, peripheral dynamometry, MRI (100%), CT (24 %) and EMG (20%). Surgical intervention: posterior cervical radicular decompression by an oblique, under-cutting and facet-sparing microforaminotomy +/− discectomy.

Principle outcomes: operative complications, motor recovery, return to play, same site re-operation, new site operation.

Results: 37 procedures were performed (62% in front row forwards; 31% in other forwards and 7% in backs) of which 8% were at C4/5; 38% at C5/6; 46% at C6/7 and 8% at C7/T1.

There were no peri-operative complications or same site re-operations. Motor recovery to $>75\%$ power occurred in all players. One player did not return to play due to persisting neck symptoms and one player took elective retirement. 93% returned to play at a mean of 11 weeks post-op. One player took delayed retirement in first two years due to other problems. 2 operations were performed at new sites.

Conclusions: Elite rugby players develop a distinct hypertrophic variant of cervical spondylosis at a young age due to repetitive high axial loading and contact stresses. The consequent radiculopathies may be managed by posterior cervical microsurgery without the structural consequences of anterior approaches, achieving good functional recovery in over 90% of cases.

FP1-4: A retrospective study into the rates of recovery of lower limb myotomal paresis following lumbar decompression or discectomy

A. Williams & P. Fewings (South West Neurosurgery Department, Plymouth, UK)

Objectives: Whether lumbar nerve root decompressive surgery improves myotomal paresis has been a controversial topic. Given anecdotal evidence that with modern surgical practice, the improvement of motor deficits may be more significant, we sought to investigate this further.

Design: A retrospective cohort study incorporating a four year period between 2006 and 2010.

Subjects: All patients undergoing primary decompressive, non-instrumented, lumbar surgery or microdiscectomy, with documented pre-operative myotomal paresis.

Methods: Patients were identified by searching the electronic operative logbooks and case-notes review. Pre-operative and post-operative clinical examination was carried out by the senior author, except in nine cases, and myotomal deficits were considered with reference to the radiological findings to ensure there was anatomic correlation.

Results: 40 patients had a pre-operative paresis. Complete motor recovery occurred 62.5%, 2.5% had a partial recovery and 35% had no improvement.

We studied patients' age with regards to their motor recovery. The differences approached significance ($P = 0.07$) if the null hypothesis was younger aged patients were more likely to recover. The duration of pre-operative motor deficit did not affect outcome. Logistic regression analysis demonstrated that, in patients with a short duration of symptoms, young patients were more likely to recover ($p = 0.046$).

Conclusions: We have shown that 65% of patients do demonstrate an improvement in their paresis, in keeping with earlier research. Our data tend towards a greater likelihood of recovery in the young. More research, with greater numbers, will be needed to elucidate the pre-operative criteria that might dictate a greater probability of paresis resolution.

FP1-5: Syringomyelia Surgical Treatment with Forman Magnum decompression: Time for Trial?

A. S. Nadig, D. W. K. Ng & N. Tzerakis (Greater Manchester Neurosciences Unit, Salford, UK)

Objectives: Conventionally, Chiari 1 malformation with Syrinx, is treated with foramen magnum decompression. We reviewed retrospectively collected clinical and radiological data of our patients after surgical decompression over a period of 5 years. The clinical presentation, radiological appearances, operative data, post op radiological appearances and clinical outcome in follow up were analysed

Results: 38 patients with radiological evidence of Chiari 1 malformation and Syrinx underwent Foramen magnum decompression with durotomy. 9 cases (23%) had dural substitute at the time of closure. 28 patients (73%) had post operative MR scan at 6 months and 6 patients (15%) at 2 years. 28 people (73%) had 6 months follow up, 22 patients (58%) at 1 year and 10 (26%) patients had follow up at the end of 2 years. 23 patients (60%) were reported to have improved at various post operative periods and 10 (26%) remained clinically static. 20 patients (52%) had radiologically improved scans post operatively. Among the dural substitute group, 8 out of 9 improved (89%) clinically, whilst 6 out of 9 (67%) showed radiological improvement of the syrinx. There were 8 complications in 8 patients (1 seizure, 1 chemical meningitis, 6 pseudomeningoceles, 3 of them with new hydrocephalus requiring VP shunt insertion)
Conclusions: Our results indicate that dural substitute is possibly associated with better outcome. We recommend a bigger study with dural substitute and longer follow up. Possibly, there is scope for a double randomized trial to compare the results of foramen Magnum decompression with and without durotomy

FP1-6: Metastatic Spinal Cord Compression: Single Unit Experience

B. Vaqas, V. Wykes, K. M. David & J. E. Brecknell (Queen's Hospital, Romford, Essex, UK)

Objectives: In 2008 NICE recommended guidelines for the management of metastatic spinal cord compression (MSCC, CG75). The co-ordination of services and timing to imaging and intervention (neurosurgery or oncological treatment) are highlighted as key areas to ensure early diagnosis and swift treatment. In this study we assess how these recommendations are implemented in our unit.
Design: A retrospective observational study.
Subjects: Patients referred with MSCC to Queen's Hospital Romford between 01/11/2008-01/11/2009.
Methods: Patients referred with MSCC to Queen's Hospital Romford between 01/11/2008-01/11/2009 were identified retrospectively from the emergency referral database and operative cases from the theatre logbook. Post operative histopathology records were checked to ensure only metastatic lesions were included. Time from presentation to imaging and neurosurgical or oncological intervention was calculated. Actual referral route for treated cases was established
Results: 87 patients with MSCC were referred to the neurosurgical registrar on call (MSCC co-ordinator). Over 95% had an MRI whole spine within 24 hours of presentation. 16 were operated on for spinal cord decompression within a median time of 3 days (range 1-7) but of these the majority were referred via an alternative route.
Conclusions: The majority of patients referred with MSCC do not undergo surgical treatment. Despite NICE guidelines, and a clearly specified MSCC co-ordinator a single point of referral is not being employed.

FP1-7: Early Mobilisation of Patients Suffering Noticed Incidental Durotomies During Spinal Surgery

I. S. Grewal, C. Barrett & R. Pillay (Walton Centre For Neurology and Neurosurgery, Lower Lane, Liverpool, L9 7LJ)

Objectives: A culture still exists in the practise of some spinal surgeons to keep patients who are noted to suffer incidental durotomies during spinal surgery on prolonged bedrest. We aimed to assess whether mobilising patients immediately post-operatively had any detrimental effect on the number developing ongoing CSF leaks, and requiring further intervention to stop this.
Design: Retrospective case series review.
Subjects: 113 adult patients who underwent elective or emergent spinal surgery.
Methods: Retrospective analysis of all spinal surgery recorded on IT system. The operation notes were then searched for key words to establish which patients underwent incidental durotomy and whether or not this was formally repaired. The case notes were then reviewed to see when they were mobilised and if they developed a persistent CSF leak requiring intervention.
Results: 100 patients were mobilised within 24 hours of operation and of these only 11 developed a persistant CSF leak. All but one of these had been glued intra-operatively. Only 11 patients were kept on prolonged bedrest but of these 3 developed persistent CSF leaks.
Conclusions: The sample size of prolonged bedrest is small, and the study is retrospective. But there appears to be no detrimental effect to mobilising this patient group immediately post-operatively. We would conclude that in the case of simple noted incidental durotomies our practise of mobilising immediately is justified.

FP1-8: Trigger point injection for treatment of Low back pain - Single unit's experience

M. F. Hassan, M. B. Mohamed, H. L Sinar & E. J. Sinar (The James Cook University Hospital, Middlesbrough, UK)

Objectives: Facet joint injection is a well known treatment modality in treating mechanical low back pain. But recent NICE guideline recommends not to consider it as a treatment option. Here we try to find out the efficacy of injection in facet joint with a

tender trigger point in reducing low back pain in our department.
Design: Retrospective study.
Subjects: All the patients included in the study were suffering from low back pain for more than a year with failure of normal conservative treatment and had radiological evidence of degenerative facet joint disease. Clinically all the patients had a tender trigger point exacerbating the back pain in or around the affected facet joint.
Methods: A questionnaire was set and a telephone interview was performed in all the contactable patients who received image guided injection under the care of a single spinal surgeon.
Results: A total of 58 patients received 78 facet joint/ trigger point injection. Data available from 50 patients receiving 70 injections were analysed. 51(72.8%) injections resulted in reduced back pain following the procedure. Mean VAS score prior to injection was 7.45 which was reduced to just 4.15 post procedural period. Average duration of pain relief was 124 days with 16 injections resulted in pain relief of more than 6 months.
Conclusions: With careful patient selection this short, relatively cheap and simple procedure can be an effective way to treat back pain in patients not undergoing surgery.

FP1-9: The first reported case of posterior spinal cord herniation at the thoracolumbar junction following marsupialisation of an intramedullary cyst

R. Zakaria, J. Ellenbogen, I. Grewal & N. Buxton (The Walton Centre for Neurology and Neurosurgery, Liverpool, UK)

Objectives: Posterior or dorsal spinal cord herniation is an uncommon phenomenon and has never been reported in the thoracolumbar spine before.
Design: Case report and review of the literature.
Subjects: A 57 year old male patient underwent marsupialisation of a benign intramedullary cyst at the T12-L1 level and subsequently returned with symptoms of spinal cord compromise. He was found to have a posterior herniation of the cord into a pseudomeningocele at the level of the previous surgery. The hernia was reduced surgically and the defect directly closed leading to a full recovery.
Methods: Methods: MEDLINE was searched (from 1966 to November 2010) using keywords ''posterior'' OR ''dorsal'' AND ''cord'' AND ''hernia'' OR ''herniation'' OR ''prolapse''.
Results: Two cases of herniation of the thoracic cord posteriorly into pre-existing arachnoid cysts are described. Both made a good recovery with neurological improvement after reduction of the hernia at surgery via a posterior approach. There are several cases of posterior cord herniation following surgery in the cervical spine and all of these involved opening the dura. These cases commonly noted a long delay between primary surgery and presentation.
Conclusions: Spinal cord herniation is rare but may theoretically occur in any case where a dural defect is created at surgery. Any change in neurology or symptomatology of a postoperative patient mandates fresh imaging and prompt surgical reduction of the hernia is advised as in this instance, to prevent neurological deterioration and potentially reverse any deficit.

Neuroncology

FP2-1: The 18 kDa Mitochondrial Translocator Protein in Oligodendrogliomas; The Biomaker of Outcome

Shami Acharya, Federico Roncaroli & Nelofer Syed (Imperial College, London)

Objective: Oligodendrogliomas are characterised by the LOH 1p/19q, which is ssociated with a more favourable prognosis than diffuse astrocytomas. Currently, there is no marker of disease progression in oligodendrogliomas. The translocator protein (TSPO) is a mitochondrial protein known to have high expression in diffuse astrocytomas, however its relevance in oligodendrogliomas has never been investigated.

Our previous laboratory work demonstrated low TSPO levels in oligodendrogliomas, but highlighted a case with high TSPO expression and a poorer prognosis than the others. The aim was to specifically see if TSPO-positive oligodendrogliomas have a worse outcome than where TSPO is transcriptionally silenced.
Methods: We had 51 cases of both grade 2 and grade 3 oligodendrogliomas and performed immunohistochemistry (peroxidase) using the iba1 and the anti-TSPO antibodies. We extracted DNA from paraffin sections and performed methylation specific PCR. We then received the 1p/19q status of the patients and reviewed their follow up.
Results: Our results demonstrated that high levels of TSPO were associated with no LOH 1p/19q. Low TSPO expression was linked to epigenetic methylation of the promoter region of the gene and was seen in over two thirds of our cases. A relationship was also seen between high TSPO and a less favourable prognosis.
Conclusions: At present TSPO radio-ligands (PK11195) are being used in PET imaging. Our results indicate that high TSPO is associated with a poorer prognosis and therefore can be used as a valuable biomarker of disease pre-operatively. As the first study of it's kind in oligodendrogliomas, there is scope for new imaging biomarkers and possibly therapy.

FP2-2: The validity of EORTC GBM Prognostic Calculator on survival of GBM patients in the West of Scotland

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Objectives: It is now accepted that the addition of temozolomide to radiotherapy in the treatment of patients with newly diagnosed glioblastoma multiforme (GBM) significantly improved survival. In 2008, a subanalysis of the original study data was performed, and an online ''GBM Calculator'' was made available in the European Organisation for Research into Treatment of Cancer (EORTC) website allowing users to estimate patients' prognoses. We tested this calculator against actual local survival data to validate its use in our patients.
Design: Prospectively collected clinical data.
Subjects: Prospectively collected clinical data were analysed on 105 consecutive patients receiving concurrent chemoradiotherapy following surgical treatment of GBM between December 2004 and February 2009.
Methods: Using the EORTC online calculator, predictive survival for these patients were generated and compared to their actual survival.
Results: The median overall survival for the entire cohort was 15.31 months (range 2.83 to 50.5 months), with 1-year and 2-year overall survival of 65.7% and 19% respectively. This is in comparison to the median overall predictive survival of 21.27 months, with 1-year and 2-year survival of 95% and 39.5% respectively. Case per case analysis also showed that the survival was overestimated in nearly 80% of patients. Subgroup analyses showed similar overestimation of patients' survival.

Despite the over estimation of patients survival using the Stupp calculator, 5 of our patients survived beyond 3 years, which was not accounted for using the predictive model.
Conclusions: Use of the EORTC GBM prognostic calculator would have overestimated the survival of the majority of our patients with GBM. Local socioeconomic factor might play an important role, and we are working on a corrective model for our patients' survival prediction.

FP2-3: The Rate of Recurrence of Non Functioning Pituitary Adenomas in a Large Series over 25 years

C. E. Gilkes & M. P. Powell (National Hospital for Neurology and Neurosurgery)

Objectives: To describe the incidence of non functioning recurrent pituitary adenomas and factors common to their recurrence.
Design: A retrospective review of recurrent pituitary adenomas over a 25year period. Non functioning tumours were isolated as their management is based on volume, location and growth and not influenced by biochemical activity.
Subjects: Pituitary patients who have undergone surgery under the senior author over the past 25y.
Methods: Pituitary patients undergoing surgery are logged on a contemporaneous data base and their long term follow up is discussed at the weekly Pituitary MDT. The database was interrogated and those with non functioning recurrent adenomas were identified. Recurrences were defined as 'radiological' or 'symptomatic'. Particular note was made of radiological and histological features.
Results: 2500 patients with pituitary disease, 3220 operations. 164 patients were identified with recurrent non functioning pituitary adenomas. The original operations date as far back as 1959. The longest interval between first operation and recurrence is 33 years. The incidence of recurrent tumours amongst pituitary patients undergoing surgery was 12% 1985-1990, 6-7% 1990-1995, 1995-2000 and 2000-2005. The factors influencing this including surgical experience, the development of the pituitary service, radiology and histological features eg ACTH expression and Ki67 will be discussed.
Conclusions: The exact recurrence rate of pituitary adenomas remains unknown as their behaviour and surgical management is influenced by multiple factors. However a management strategy has been devised as a result of the experience of this large series, highlighting the generally extremely benign nature of this disease.

FP2-4: A 3-D Hi-Spot Culture System for Studying the Microenvironment of Glioblastoma Cancer Stem Cells

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Objectives: Recently, our understanding of the biology of brain tumours has been reconceptualised, with emerging evidence for the concept of ''brain cancer stem cells''. Identified brain cancer stem cells from human brain tumours have been reported to possess a marked capacity for proliferation, self-renewal and differentiation, with some expressing neural stem cell markers. Consequently, their role in the formation of tumours has been under extensive investigation. However, progress has been held back by inadequate understanding of the mechanisms controlling the differentiation, survival and integration of these cells and their progeny, especially with regard to cell-microenvironment interactions, which

are lost in 2D cultures. In order to maintain this structural microenvironment and explore the control mechanisms of tumour tissue development, we aim to develop a three-dimensional (3-D) in-vitro model (Hi-spot) of human glioblastoma.
Methods: Tissue was disaggregated from surgical samples of adult human glioblastoma tumours, before being seeded sequentially onto a hydrophobic membrane and cultured under liquid-air interface for 7,14, 21, or 28 days. At the different time points, the maturation, histogenesis and differentiation was characterised. Phenotypic induction was examined morphologically, immunologically and molecularly.
Results: Our preliminary data showed that glioblastoma Hi-spots are viable in cultures at 28 DIV. We have also demonstrated expression of neuronal markers and astrocytic markers by these tumour cultures.
Conclusions: This novel 3-D Hi-spot system, once fully characterised, will provide a useful in-vitro model to investigate the mechanisms controlling tumour stem cells. This approach has the potential to provide new platforms for testing stem cell modulating drugs, and ultimately anti-tumour treatments.

FP2-5: Assessment of visual failure in suprasellar meningiomas using logMAR as a measure of acuity

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Objectives: To assess the benefits of using the logMAR scale instead of Snellen measurements when reporting visual acuity in a longitudinal follow-up of patients with suprasellar meningiomas.
Design: Retrospective study of case records.
Subjects: 42 patients with suprasellar meningiomas and visual failure presenting 2004-2010
Methods: Patients with suprasellar meningiomas and visual failure were offered either microsurgical removal or conservative management, depending on co-morbidity and the history of visual impairment. Visual acuity using logMAR was recorded at presentation and last follow-up.
Results: 10 patients had complete pre and post data - 5 microsurgical(MS) and 5 conservative(C). The average age in the operative group was 60.2y (53y median) vs 80.6y (81y median) in the conservative group. Length of visual impairment was on average 22.8m and median 6m in the operative group. An average 25m (24.5 median) was shown in the conservative group. Pre-operative visual acuity came to 1.11 logMAR and a post-operative acuity was 0.87 logMAR. Acuity in the conservative group was 0.52 logMAR on diagnosis and the most recent acuity was 1.00 logMAR
Conclusions: Statistics were facilitated by the use of logMAR since a linear scale is obtained rather than a geometric sequence. There was a favourable outcome for the patients in the operative group with an improvement of acuity by 0.24 logMAR.

FP2-6: Stereotactic Radiosurgery for the Treatment of Melanoma and Renal Cell Carcinoma Brain Metastases

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Objectives: Renal cell carcinoma (RCC) and melanoma brain metastases are traditionally considered radioresistant. However, stereotactic radiosurgery (SRS) is becoming more accepted as a treatment option. The aims of this study were to evaluate the role of SRS for local control for these lesions both with and without prior whole brain radiotherapy (WBRT), and to identify predictors of response.
Methods: All RCC and melanoma patients treated with Gamma Knife SRS between July 2006 and September 2010 were reviewed. Clinical, radiological and dosimetry parameters were examined as predictors of response to SRS
Results: Ninety-nine lesions (41 RCC, 55 melanoma) in 33 patients were analysed. Median age was 57 years. 56% of lesions had been treated previously with WBRT while the remainder received SRS alone upfront. Median prescription dose was 21 Gy (range, 15-24). Median target minimum dose was 20.2 Gy (range, 11.62-31.85). Median and mean tumour volumes were 0.39 cm3 and 1.3 cm3, respectively (range, 0.003 to 13.36 cm3). Median follow-up was 5 months (range, 1-41 months). Median RTOG conformality index was 1.96 (range, 1.04-9.76). Local control rates were 93%, 91%, 85%, 72%, and 57.4% at 3, 6, 12, and 18 and 24 months respectively. Three (3.1%) lesions required local salvage therapy (surgical resection). Twenty-four (25%) lesions received WBRT 2 to 21 months after SRS for distant brain failure.
Conclusions: : Stereotactic radiosurgery is a valuable option for local control of RCC and melanoma brain metastases. Based on our institutional data, delay of WBRT is safe without significant difference in local control rates. We also report on the factors that are predictive of response to SRS for RCC and melanoma metastases.

POSTER TITLES

Trauma

In a developing country delay in head injury referal nullifies good outcome
D. T. Hope[1] & U. P Devkota[2] ([1]Queens Medical Centre, Nottingham, UK; [2]National Neuroscience Unit Kathmandu, Nepal)

Intraoperative bullet migration
A. J. Leggate & A. Abou Zeid (Salford Royal Hospital, Manchester, UK)

Primary decompressive craniectomy for traumatic mass lesions: the radiological sequelae
A. G. Kolias, M. R. Guilfoyle, I. Timofeev, A. Helmy, E. A. Corteen, D. K. Menon, P. J. Kirkpatrick, J. D. Pickard & P. J. Hutchinson (Addenbrooke's Hospital & University of Cambridge, Cambridge, UK)

Penetrating orbitocranial injury with wooden foreign body: radiological characteristics and clinical sequelae
K. Abhinav, A. Amit, P. J. Revington, N. R. Patel & V. Iyer (Frenchay Hospital, Institute of Clinical Neurosciences, Bristol, United Kingdom)

Oxford Head Injury Evaluation and Audit Database
T. P. Lawrence, J. Tailor, C. Sweasey, H. Sitsapesan, H. Madder & R. S. C. Kerr (John Radcliffe Hospital, Oxford, UK)

Can we predict which patients with traumatic brain injury will require CSF drainage to manage raised intracranial pressure?
A. Bacon, W. G. B. Singleton & D. G. Porter (Department of Neurosurgery, Frenchay Hospital, Bristol, UK)

Epidemiology of Road Users and Traumatic Brain Injury in the Republic of Ireland
Philip J. O'Halloran, K. McEvoy, N. Collins, L. Geoghegan & J. Phillips (Beaumont Hospital Dublin 9.National Neurosurgical Centre in Republic of Ireland)

Does delayed neurosurgical discharge affect outcome and quality of life of patients with traumatic brain injury?
A. D. Narula, J. Ling & C. Tolias (King's College Hospital, London, UK)

A review of car safety design pertinent to head and cervical spine injuries
R. Dardis, D. Kamdar, S Roberts & J. Mabey (University Hospitals Coventry and Warwickshire. Car Safety Jaguar Landrover)

Spine

New pedicle screw and plate system- Preliminary experience
P. D. Kulkarni, S. Winkler & R. W. Gullan (Kings College Hospital NHS Foundation Trust, London, UK)

Acute disc herniation in the elderly
M. C. Werndle, C. Palmer, K. Wong & M. C. Papadopoulos (St Georges University of London, London, UK)

An uncommon cause of an uncommon condition - Brown-Sequard syndrome from cervical disc herniation –case report and literature review
N Carleton-Bland & K Ghosh (Department of Neurosurgery, Greater Manchester Neurosciences Centre, UK)

Are headaches a pain in the neck?
K. T. Tsang, J. C. Hobart & T. J. Germon (Derriford Hospital, Plymouth, UK)

Acute deterioration of a Chiari I Malformation: an uncommon neurosurgical emergency
B. Pettorini & D. Rodrigues (Paediatric Neurosurgery, Birmingham Children's Hospital, Birmingham, UK)

3D image guidance for spinal surgery - early experience in the NHS
D. Bhargava, A. Alalade, H. Chan, H. Ellamushi, J. Yeh & R. Hunter (Royal London Hospital, London, UK)

High Intensity Focussed Ultrasound (Hifu) For Recurrent Sacrococcygeal Chordoma
M. J. Gillies, S. Bojanic, R. Ritchie & T. Leslie (The HIFU Unit, Churchill Hospital, Headington, Oxford, OX3 7LJ)

Paediatric/Hydrocephalus

Endoscopic Third Ventriculostomy for the treatment of Osteopetrosis related Hydrocephalus: a case-based update
B. Dhamija, B. L. Pettorini & G. A. Solanki (Birmingham Childrens Hospital, Birmingham, UK)

Rapid brain shift causing remote site haemorrhage and a spinal haematoma after craniotomy for large arachnoid cyst
A. Bahl, D. Connolly, J. McMullan, H. Zaki & S. Sinha (Department of Neurosurgery, Sheffield Children's Hospital, Sheffield, UK)

Metopic Synostosis in association with Klinefelter's Syndrome: First report of a rare craniosynostosis association
B. Dhamija, C. J. Siegmund & G. A. Solanki (Birmingham Childrens Hospital, Birmingham, UK)

Natural history of idiopathic normal pressure hydrocephalus
A. Toma, M. Papadopoulas, S. Stapleton, N. Kitchen & L. Watkins (The National Hospital for Neurology and Neurosurgery, London, UK)

Optical Image Guided Shunt Placement Tool: Our Early Experience
C. Parks, D. Holsgrove & I. Kamaly-Asl (Salford Royal Hospital and Royal Manchester Childrens' Hospital, Manchester, UK)

Oncology/Radiosurgery

Metabolism of 5-FU, deoxyuridine, and dUTP in brain mitochondria: Implications for current treatment options in glioma
K. E. McCann & E. McKee (Indiana University School of Medicine)

An Audit of survival following stereotactic radiosurgery for brain metastasis
A. Jenner, T. McGreene, K. Hill & A. Cameron (Bristol haematology and Oncology Centre, Bristol, UK)

Reoperation for recurrent glioma after adjuvant radiotherapy and temozolomide – A retrospective study
S. R. M. Qadri, A. O'Keefe & S. Bojanic (John Radcliffe Hospital, Oxford, Headington, Oxford, UK)

The Dexamethasone Dilemma: effects of pre-op corticosteroids on diagnosing primary CNS lymphoma
N. K. Prasad, K. M. Kurian & V. Iyer (Frenchay Neurosurgical Department, Bristol, UK)

Intracranial extension of Temporomandibular Joint Synovial Chondromatosis: A rare complication of a rare condition
C. S. S. A. Mansi, B. Zebian & C. Hardwidge (Hurstwood Park Neurological Centre, Haywards Heath, Sussex)

Literature review of a novel treatment to fight Glioblastoma multiforme (GBM)
S. M. Ninan & U. Patel (Royal Hallamshire Hospital, Sheffield, UK)

Treatment of intracranial tumours
R. Skomorac, A. Jusic & H. Beculic (Canton Hospital Zenica, Zenica, Bosnia and Herzegovina)

Neurovascular

Operative treatment of intraventricular perforator aneurysms associated with avm's responsible for IVH
U. J. Patel (Royal Hallamshire Hospital, Sheffield, UK)

Cerebellar haemorrhage in a 12 year old girl with giant dural sinus malformation
T. Land[1], M. Teo[1], J. Bhattacharya[2] & J. Brown[1] ([1]Department of Neurosurgery, [2]Department of Interventional Neuroradiology, Institute of Neurological Science, Glasgow, UK)

Trends Of Change In Management Of Dissecting Aneurysm In A New Tertiary Neurosurgical Unit In Kolkata
S. Purakayastha, S. Basu, K. Sil & L. N. Tripathy (Medica Superspecialty Hospital, Kolkata, Westbengal, India)

Brainstem Cavernomas: A Management Algorithm
U. J. Patel (Royal Hallamshire Hospital, Sheffield, UK)

Functional

Efficacy and complications of vagal nerve stimulators in 24 children with medically intractable epilepsy: a single centre experience
N. Carleton-Bland & V. A. Josan (Department of Neurosurgery, Greater Manchester Neurosciences Centre, UK)

Review of the current evidence for surgical treatment of Refractory Mesial Temporal Lobe Epilepsy
R. Chelvarajah & N. Muhammed (Royal Free Hospital, London)

Miscellaneous

An Audit of Post Craniotomy Driving Advice
D. N. Wright, R. Corns & A. J. Martin (St. Georges Hospital, London, UK)

The impact of a national radiology archive on neurosurgical services in Scotland
P. A. Bodkin[1], P. M. Bhatt[1], G. Potter[2] & J. Steel[3] ([1]Dept of Neurosurgery, Aberdeen Royal Infirmary, UK, [2]Dept of Neuroradiology, Vancouver General Hospital, Canada, [3]Dept of Information Technology, Aberdeen Royal Infirmary, UK)

Choosing to be a neurosurgeon: Trainee perceptions of what run through training should provide

G. A. Fellows[1], N. Haliasos[2], J. Brecknell[3], L. Watkins[4], K. Ashkan[1] & D. Walsh[1] ([1]King's College Hospital, London, UK, [2]Great Ormond Street Hospital, London, UK, [3]Queens Medical Centre, Romford, Essex, [4]National Hospital for Neurology & Neurosurgery)

A Careers day in Neurosurgery: does it well inform medical students?

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Looking at neurosurgery from the dark side: A neurosurgeon's experiences in neuroradiology

I. A. Anderson, T. Goddard, T. Patankar & A. K. Tyagi (Department of Neurosurgery, The General Infirmary at Leeds, Leeds, UK)

Non attendance at general neurosurgical clinics

E. McIlveen, A. Saxena & E. J. St.George (Institute of Neurological Sciences, Southern General Hsopital, Glasgow, UK)

Management of intracranial Rosai-Dorfman disease: an unusual case with multiple bilateral intracerebral lesions

S. J. Camp, V. Apostolopoulos, M. Weatherall, A. Mehta, F. Roncaroli & D. Nandi (Charing Cross Hospital, London, UK)