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PROCEEDINGS

Proceedings of the 152 Meeting of the Society of British Neurological Surgeons

This meeting is being held on Crowne Plaza Hotel, Nottingham 10th–12th September and is hosted by the Department of Neurosurgery, Queen's Medical Centre, Nottingham.

These abstracts are published in advance of the meeting in the order of presentation. If any papers are subsequently not read to the Society or are withdrawn an addendum to this effect will be published in the next issue of the Journal.

W4-01: Outcome of temporal lobectomy in patients with hippocampal sclerosis related mesial temporal lobe epilepsy

K. Pang, M. Forame, I. Hamill, P. Littlechild, K. W. Lindsay & R. Duncan (Institute of Neurological Sciences, Southern General Hospital, Glasgow, UK)

Objective: The aim of the current study was to analyze the outcome of temporal lobectomy in patients with hippocampal sclerosis (HS) related mesial temporal lobe epilepsy (MTLE), paying particular attention to short and long-term seizure outcome, visual and psychological complications, and postoperative employment and driving status.
Method: 122 patients received surgery for MTLE between 1989 and 2006. 54 patients were identified to have MRI or pathologically proven HS prior to surgery. Clinical data were retrospectively recorded and analyzed.
Results: 81.5% were in Engel class I-II and 18.5% were in Engel class III-IV at the most recent follow-up (follow-up, range 6 months-15 years; Median 5 years) 16 (42.1%) patients were found to have quadrantanopia 6 months after surgery and these clinical findings was unchanged at 24 months. 6 (11.5%), 11 (21.2%), 2 (3.85%) and 4 (7.69%) patients were noted to have anxiety, depression, behavioural problems and other psychological problems respectively. 72.7% seizure free patients and 26.7% not seizure-free patients were employed or attending school ($p = 0.004$). 52.3% seizure free patients and 0% not seizure free patients were driving after surgery. There were no significant correlations between visual and psychological impairments, and employment and driving status.
Conclusion: Temporal lobectomy for HS-related MTLE provides excellent seizure outcome with uncommon visual and psychological complications. Despite the fact that HS is a predictor for seizure remission, relapse is still a problem in the long-term. Seizure free patients are most likely to be employed or driving postoperatively, independent on visual or psychological complications.

W4-02: Single institute prospective long term results of kyphoplasty in 211 consecutive pathological vertebral fractures

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Objective: Pathological vertebral fractures are associated with significant pain and disability. Kyphoplasty has been gaining popularity in treating such conditions.

The aim of the study wasto evaluate the long term results of kyphoplasty.
Methods: Prospective single arm interventional cohort study.

The outcome measures used were theVisual Analogue Scale (VAS) for pain, Oswestry Disability Index (ODI) for daily activities, reduction of pain prescription medications and radiological effects as Vertebral Body Height Restoration, Kyphoplasty and Wedge angle corrections.
Results: From August 2003 to January 2008, 158 patients with 211 pathological fractures were enrolled.The fractures were due to tumours in 51%, osteoporosis in 23.5% and traumatic in 25.5%. Age ranged from 19–90 years with mean of 66 years. Follow up ranged from 6 months to 4.2 years with mean of 22 months. All patients sustained

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improvement of pain and reduction of disability with mean reduction of Visual Analogue Scale (VAS) of 5.4 (Â ± 1.2) and mean reduction of Oswestry Disability Index (ODI) of 42 (Â ± 5.5) ($p < 0.001$). Pain prescription medications were stopped in 50%, reduced in 30%, unchanged in 17% and increased in 3% due to disease progression. The mean Anterior Vertebral Body Height Restoration, Kyphoplasty angle correction and Wedge angle correction were 5.8%, 3.82° and 3.65° respectively. The main procedure related complications consisted of one symptomatic extra-vertebral cement leakage resulted in foot drop and required open decompression, one nerve root contusion with transient radiculopathy and one wound infection.

Conclusion: Kyphoplasty significantly improves pain and disability with maintained long term results.

W4-03: Evaluation of percutaneous balloon kyphoplasty in the treatment of vertebral body compression fractures due to multiple myeloma

S. M. Joshi, M. Khan, N. K. K. King, H. Ellamushi & J. Yeh (Royal London Hospital, London, UK)

Objective: The aim of this study was to prospectively evaluate the clinical, radiographic and functional outcomes following percutaneous balloon kyphoplasty of vertebral body compression fractures due to multiple myeloma.

Methods: Symptomatic patients with back pain and a diagnosis of multiple myeloma were assessed with plain radiograph, computed tomography and magnetic resonance imaging with short tau inversion recovery (STIR) sequences. Of these, 68 patients (42 males, age range 30–80 years) underwent balloon kyphoplasty from August 2003 to April 2008. A total of 100 vertebral levels were treated. Outcomes were the visual analogue scale (VAS) for pain, radiographic evaluations of height restoration, kyphotic and wedge angle corrections, and Oswestry Disability Index (ODI). These were measured postoperatively on day 1, week 1, months 1, 3, 6 and years 1, 2 and 3. Follow-up was from 2 months to 4.2 years.

Results: VAS scores decreased from 6.9 preoperatively to 1.9 at last follow-up. Anterior height correction was 4.0% with kyphotic angle correction of 2.4 degrees and wedge correction of 2.6 degrees. ODI improved from 55 to 19. Three patients had asymptomatic cement extravasation, three had worsening of vertebral collapse and one had a foot drop. There was no procedure-related mortality.

Conclusion: This minimally invasive day case procedure can provide beneficial pain relief and improvement in functional outcome associated with radiological stabilisation of vertebral body height.

W4-04: STICH II trial – progress report

J. E. Crossman on behalf of the STICH II investigators (Department of Neurosurgery, Newcastle General Hospital, Newcastle upon Tyne, UK)

Objective: The STICH II trial seeks to discover if early surgery is better than initial conservative treatment for patients with superficial (<1cm) spontaneous supratentorial lobar haematomas. This subgroup was identified as having a better outcome in the first STICH trial[1].

Methods: To date (11th June 2008) 60 patients have been randomised from 50 neurosurgery centres.The blinded overall 2 week resultsare available for 55 patients and the 6 month outcomes including deaths are known for 28 patients.

Results: These data indicate that most patients randomised had a coma score of 14 or 15. The median volume was 28 ml and median time to randomisation was 21 hours. Favourable outcome was achieved in 44% of cases, indicating that the outcome in this group of patients is more favourable than those in the first STICH trial. Those randomised constitute less than 10% of all intracerebral haematomas but confirm that the inclusion and exclusion criteria are being applied as was intended.

Conclusion: More patients are needed to discover the answer to the question about early surgery and your involvement is encouraged. Contact can be made through the website (www.ncl.ac.uk/stich) or by emailing: STICH@ncl.ac.uk

Reference

1 Mendelow AD, Gregson BA, Fernandes HM, Murray GD, Teasdale GM, Hope DT, *et al.* Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomised trial. *Lancet* 2005;365:387–97.

W5-01: Meningioma recurrence; the efficacy and cost-effectiveness of current screening

J. Halliday & H. Fernandes (Department of Neurosurgery, Addenbrookes Hospital, Cambridge, UK)

Objective: To assess the efficacy of follow-up imaging timing to detect meningioma recurrence.

Methods: A retrospective analysis of surgical records of 283 patients that underwent meningioma excision between 1998 and 2003 in Addenbrookes Hospital, and their follow-up scans up to 9 years post-surgery. Age at surgery; Simpson grade of surgical removal; WHO histological grade; post-surgical radiotherapy; dates of meningioma recurrences; dates of post-operative CT and MRI scans up to present, were recorded for each patient.

Results: Using logistic regression we found that WHO grade and post-surgical radiotherapy were

the strongest predictors of meningioma recurrence. The timing of scans between patients of the same stage and grade was highly variable. Data suggests that current scanning frequency is unnecessary for the majority of patients. For example 54 scans were performed on patients with WHO grade 1/Simpson Grade 1 meningiomas up to 18 months post-operatively, with one recurrence detected at 18 months. The patient in whom this recurrence was detected had had multiple parafalcine and parasagittal meningioma excisions previous to this; such patients differ from the majority and would be placed under more regular surveillance on clinical grounds. Similar results were found for other low Simpson and WHO grade combinations.

Conclusion: The current system of scanning for meningioma recurrences is very cost-ineffective. Clear guidelines on scanning frequency for meningioma recurrence need to be developed and used in clinical practice.

W5-02: The value of Cavitron Ultrasonic Aspirator (CUSA) specimens in making histopathological diagnosis of CNS tumours

S. J. Camp, C. Uff, N. Kitchen, A. W. McEvoy, S. Brandner & G. Zadeh (National Hospital for Neurology & Neurosurgery, London, UK)

Objective: CUSA is a useful surgical tool commonly employed in the resection of brain tumours. Typically, CUSA material is not included when making histopathological diagnoses. We investigated whether CUSA specimens supplement the pathological diagnosis made using conventional biopsy material.

Methods: CUSA aspirate from 32 consecutive operations was collected and excess saline and serum filtered off. It was then smeared to paraffin blocks and reported alongside conventional specimens. Four neuropathologists (who were blinded) were involved in diagnosis.

Results: In six of 32 cases additional histopathological features were identified: increased vascular proliferation (3), more representative material (2), gemistocytic component (1), WHO grade IV glioma diagnosed exclusively on CUSA material (1). One tumour grade was changed from grade II to grade IV glioma. Similar or identical appearances were found in 17 cases, whilst in eight cases the CUSA material was non-contributory to the diagnosis. Final diagnoses comprised: glial tumours (20), meningiomas (5), schwanomas (2), metastases (3), lymphoma (1), and demyelination (1).

Conclusion: Assessment of CUSA material is useful in the diagnosis of CNS tumours, particularly heterogeneous lesions where non-representative sampling may occur. CUSA material can also supplement the diagnosis by revealing additional histopathological features. Specifically, they may grade tumours more accurately, with a significant impact on patient management. Also, CUSA material generates supplementary archival material which may prove useful in future studies such as genetic profiling of tumours.

[This work has been accepted for the CNS 2008 (Florida) meeting in digital poster format]

W5-03: Markers of the cell division cycle: Prognostic implications in Glioblastoma

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Objective: Minichromosome maintenance protein-2 (Mcm-2) is expressed exclusively in replicating cells and licenses DNA for replication. Geminin inhibits loading of Mcm-2 onto chromatin and thus acts as an inhibitor of DNA replication. These proteins have the potential in predicting both prognosis and response to adjuvant therapy in a variety of malignancies either individually or in combination with Cyclin A; a surrogate marker of S-phase. We aim to investigate the expression of Mcm-2, Geminin and Cyclin A in glioblastomas and correlate these with survival.

Method: A tissue micro-array, constructed from 25 patients (median age 61) diagnosed with glioblastoma (WHO, 2007; Grade IV), was stained using antibodies against Mcm-2, Geminin and Cyclin A. A semi-quantitative labelling index (LI) was calculated by expressing the percentage of positive cells in each array punch. Statistical analysis was performed with linear regression and Kaplan-Meier survival curves (SPSSv15).

Results: The LIs in these glioblastomas (median +/− IQR) were: Mcm-2, 26.3% (15.3%–38.9%), Geminin, 5.76% (3.5% − 9.3%), and Cyclin A, 3.27% (2.1% − 4.7%). Kaplan-Meier curves showed that an elevated LI for Geminin and Cyclin A conferred a better prognosis ($p = 0.0031$ and $p = 0.0334$ respectively; Wilcoxon). Linear regression analysis showed a positive correlation with survival for all three markers (Mcm-2, $p = 0.021$; $R2 = 0.209$, Geminin, $p = 0.008$; $R2 = 0.265$ and Cyclin A, $p = 0.006$, $R2 = 0.296$).

Conclusion: Mcm-2, Geminin and Cyclin A, all show potential as independent prognostic markers in patients with glioblastoma. This may reflect the fact that Geminin and Cyclin A both estimate specific sub-populations of actively replicating cells which might represent suitable target cells for radiotherapy.

W5-04: Detection of MGMT hypermethylation in high-grade gliomas using methylation-specific multiplex ligation-dependent probe amplification (MS-MLPA)

K. Rankeillor, P. Roberts, L. Mavrogiannis, C. Loughrey, P. van Hille & P. Chumas (Leeds Teaching Hospitals NHS Trust, Leeds, UK)

Objective: MGMT methylation status has recently been established as a prognostic factor in high-grade gliomas and is increasingly being used in patient management and choice of treatment. The most widely used technique to detect MGMT methylation is methylation-specific PCR (MS-PCR). MS-MLPA is a recently described alternative to MS-PCR. This study explored the use of this technology with an aim to introducing into service.
Methods: Thirty glioma samples of various grades were tested using the ME002 kit from MRC-Holland: 22 grade IV, 5 grade III and 3 grade II.
Results: Reproducible results were obtained in all cases, with 9/30 showing MGMT hypermethylation: 2/3 with grade II, 3/5 with grade III and 4/22 with grade IV.
Conclusion: The ME002 MS-MLPA kit offers a robust, reliable, medium throughput and cost-effective method to assess MGMT methylation status in gliomas. Key advantages of MS-MLPA over other techniques include its simplicity, its potential for batch testing of samples and its capacity to detect dosage and methylation changes in several other key genes simultaneously. A comparison of G-banded cytogenetic analysis and MLPA for dosage alterations showed no full concordance, emphasising the need to assess dosage alterations by different methods MS-MLPA will be adopted as the technique of choice in our centre for patients with high-grade gliomas. Further studies into the role of MGMT methylation in low grade gliomas and other CNS tumours are likely to yield further information on the prognostic importance of MGMT methylation in a wider spectrum of tumours.

W5-05: Use of 3D ultrasound in resection of intracranial primary brain tumours

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Objective: Sonowand is a new 3D ultrasound image guidance system unique in the UK to Sheffield that is said to be useful in the resection of brain tumours. No study has yet been published that comments on the efficacy of intra-operative 3D ultrasound in achieving radical surgical debulking as defined by an early post-operative Magnetic Resonance Imaging (MRI).

The aim of the study was to assess the efficacy of 3D ultrasound in the extent of resection of primary brain tumours using early post-op MRI independently reported by a consultant neuroradiologist, when the surgeon's goal was radical tumour resection.
Methods: Patients with brain tumours undergoing possible gross total resection had sequential pre-operative images using 3D ultrasound with pre-operative MRI available on screen throughout the procedure. All patients underwent post-operative 1.5T MRI with and without contrast within 48 hours of surgery. MRI measured volume of residual disease was compared with the volume of residual disease present on the final intra-operative 3D ultrasound scan.
Results: 50 patients underwent resection of which 31 were grade 4 glioma, 16 were grade 3 and 3 were grade 2 tumours. Pre-operative volumes ranged between 4.7 to 77 cc (mean of 39 cc). Over 90% resection rate to date is 90.5%. No visible residuum was 50%.
Conclusions: 3D ultrasound guided glioma resection is fast, reliable and easy. To date no significant permanent morbidity has been encountered. Radical resection rates and over 90% resection rate is similar to that reported by Stummer et al.[1,2] using 5-ALA guidance.

References

1 Stummer W, Reulen HJ, Meinel T, Pichlmeier U, Schumacher W, Tonn JC, Rohde V, Oppel F, Turowski B, Woiciechowsky C, Franz K, Pietsch T; ALA-Glioma Study Group. Extent of resection and survival in glioblastoma multiforme: identification of and adjustment for bias. *Neurosurgery* 2008;62(3):564–76.
2 Stummer W, Pichlmeier U, Meinel T, Wiestler OD, Zanella F, Reulen HJ; ALA-Glioma Study Group. Fluorescence-guided surgery with 5-aminolevulinic acid for resection of malignant glioma: a randomised controlled multicentre phase III trial. *Lancet Oncol* 2006;7(5):392–401.

W5-06: Metastatic Low Grade Glioma: A condition in its own right?

G. Eralil, M. Cartmill & T. Jaspan (Queens Medical Centre, Nottingham, UK)

Objective: To discuss the incidence, radiological features, neuropathology and treatment options of Low Grade Gliomas (LGG) with leptomeningeal dissemination (LMD).
Methods: Leptomeningeal dissemination (LMD) of low-grade gliomas (LGGs) is being reported more and more frequently; and in association with almost all known subtypes of LGG. About 3–5% of all childhood LGGs present with LMD at diagnosis and 7–10% at the time of progression. It has been reported that "unusual" LGGs have been discovered amidst slow-growing brain neoplasms capable of LMD, which cannot comfortably be included in the current WHO classification of brain neoplasms.

We undertook a retrospective review of a series of seven cases of LGG with LMD.
Results: We report a series of seven children with features of LMD amongst LGGs. Of these three each were from pilocytic and Grade II astrocytomas; and one from an Optic nerve glioma. Histopathological examination has not revealed characteristics different from LGGs without LMD or distant/metachronous spread. However their radiological characteristics promote debate as to whether this spectrum of conditions should be looked at seperately from LGGs without LMD. It has been reported that young, non-neurofibromatosis type 1 boys with large hypothalamic-chiasmatic pilocytic astrocytomas seem to be at increased risk of LMD.
Conclusion: Although LMD in children with LGGs does not seem to have a negative impact on patients' long-term outcome, no firm guidelines for the treatment of these diseases are yet available. However, their radiological characteristics are distinct and further discussion is needed to clarify their place within the current clinico-oncological perspective.

T2-01: Dynamic Posterior Calvarial Augmentation in Syndromic Craniosynostosis: Report of a new technique in early-onset Intracranial Hypertension

G. Solanki, H. Nishikawa & M. S. Dover (Birminham Children's Hospital, Birmingham, UK)

Objective: Raised Intracranial Pressure (ICP) is multifactorial and presents early in Syndromic Craniosynostosis. Airway obstruction, hypercarbia with sleep apnoea, hydrocephalus and multi-suture/pansynostosis are risk factors. Early posterior skull release in raised ICP met with mixed reults. We developed a new technique of dynamically augmenting skull size and report our early experience over a 2-year period.
Methods: 7 children with syndromic craniosynostosis (5 Apert's and 2 Crouzon's) underwent Dynamic Posterior Calvarial Augmentation. The procedure involves application of 3 single-vector osseodistractors to the edges of an occpitoparietal in-situ craniotomy and distracting daily by 1mm to a maximum of 30mm. Outcomes were assessed by clinical examination and radiology.
Results: All children improved symptomatically with good calvarial shape. Papilledema improved post-operatively. 3DCT (3-months) showed disappearance of thumb-printing and new bone formation within the gap. MRI showed improvement in CSF flow, ventricular shape, parenchymal distribution and reduced tonsillar descent. The average distraction lasted 28 days and consolidation 76 days. Mean augmentation was 26mm. 5 of 6 patients completed their period of distraction and 3 also completed consolidation. 1 child had CSF leak, another wound breakdown and 2 had distractor-related problems. There were no relapses. Discussion: Reducion in ICP, improvement in CFS flow and parenchymal distribution was noted. Current distractors tend to loosen and need improvement. Our early lessons have led us to modifiy the surgical technique as well.
Conclusion: The technique is effective in reducing ICP and improves structural stability with reduced morbidity.

T2-02: Tecto-cerebellar dysraphism: Now an antenatal diagnostic possibility

G. Eralil, T. Jaspan & M. Cartmill (Queen's Medical Centre, Nottingham, UK)

Objective: To report and share the possibility of antenatal diagnosis of tecto-cerebellar dysraphism.
Design: Fetal MRI studies were extrapolated on two expectant mothers with suspicion on ultrasound of occipital encephaloceles.
Introduction: Tecto-cerebellar dysraphism (TCD) with occipital encephalocele is an uncommon syndrome of cerebellar vermian dysplasia. This may be associated with other midline and tectal defects, intracranial lipomas and spinal dysraphism. Antenatal diagnosis has not been possible to date using routine antenatal screening tests due to the rarity of the phenomenon. We report two such cases where this has now been possible.
Subjects, Methods and Findings: Apparent fetal occipital encephaloceles were detected on routine antenatal ultrasound examination of two mothers-at 16 and 19 weeks of gestation respectively. As per our protocol both parents underwent MRI imaging with fetal sequences which confirmed the presence of occipital encephaloceles, dysplastic posterior fossae, tectal beaking and, in one case-an enlarged fourth ventricular complex. Both parents underwent antenatal counselling and were told with reasonable surety of the diagnosis of TCD in their unborn children. Their pregnancies proceeded uneventfully and both babies were born vaginally at term. The diagnosis of TCD with midline occipital encephaloceles along with its characteristic features was confirmed in both babies. One child had a non-midline posterior fossa intracranial lipoma of uncertain functional significance. However this finding further adds to the cerebellar vermian dysgenetic topology and has been described in the literature. Both children underwent closure of their occipital encephaloceles and are currently doing well.
Conclusion: The morbidity of TCD is extensive and intra-uterine death has been described. Our experience with fetal MRI demonstrates that it is now possible to diagnose TCD antenatally, and more importantly deliver adequate counselling to expectant mothers.

T2-03: Fetal ventriculomegaly and its long term consequences: A meta-analysis of the current literature

K. Woon, A. A. Moussa, S. Solanki, A. McEwan & M. Cartmill (Queens Medical Centre, Nottingham, UK)

Objective: Fetal ventriculomegaly (VM) is defined as a ventricular atrium of greater than 10mm on standard fetal anomaly scanning. It is independent of gestation. Counselling parents regarding outcome is challenging as the cause, risk of progression, and long term consequences of fetal ventriculomegaly are uncertain. In our department, this counselling is a multidisciplinary approach between the Departments of Fetal Medicine, Radiology and Paediatric Neurosurgery. In order to help provide outcome probabilities to assist us in our counselling, we have performed a meta-analysis of the current literature.
Results: The prognosis is good in 90% of mild isolated VM, 75% of moderate and 50% of severe. Chromosomal abnormalities are present in 3.5% of non-severe isolated cases but this figure increases to 36% if a structural anomaly is identified. The majority are Trisomy 21. In severe cases of VM, with structural anomalies, the presence of chromosomal abnormalities is closer to 85%. The most common associated anomalies are neural tube defect, agenesis of the corpus callosum and Dandy Walker Syndrome. The risk of these and other anomalies in mild VM is 34%, moderate 79% and severe 90%.
Conclusion: While it is impossible to be specific for each individualwe can, however, use this information to counsel parents regarding the probability of outcomes. The parents may then decide whether that level of risk is acceptable to them, or indeed irrelevant, in view of their own personal beliefs and values.

T2-04: Paediatric brain tumours in the first year of life – A 10 year review

G. Solanki, S. Ushewokunze, M. English, R. Walsh, S. Sgouros, A. Kay & A. D. Hockley (Birminham Children's Hospital, Birmingham, UK)

Objective: Brain tumours are uncommon in the first year of life, and are especially so when presenting symptomatically in the first two months of life (congenital tumours). The aim of the study is to review the presentation, management andoutcome of primary brain tumours in the first year of life in a single large paediatric neurosurgical unit.
Method: We retrospectively reviewed the case records of children with histologically-proven brain tumours between treated in our department between 1998 and 2007. Seventeen children (9 boys, 8 girls) were identified. The median age was 6months (birth-10months). Six had congenital tumours.
Results: There were 6 astrocytomas, 2 ependymomas, 1 pineoblastoma, 1 haemangioma, 2 PNET, 1 chordoma, 1 immature-teratoma, 1 lymphoma, 2 rhabdoid/teratoid tumours. 11 tumours were supratentorial, 6 infratentorial. 6 children had a complete resection, 6 debulking procedures and 5 had biopsy. 9 children received chemotherapy, 2 radiotherapy. Seven children died (4/5 congenital and 3/12 non-congenital group). The probability of death is 3-times greater in the congenital group (Risk-ratio = 3.2, 95% CI = 1.09 – 9.36, p = 0.033). The 12-month survival was 65% (congenital = 20%, older infants = 83%). Three children (all all non-congenital) survived > 9 years. Poor survival in congenital tumours (1/6) was associated with malignant lesions; The lone survivor was a child with metastatic clival-chordoma treated with endoscopic biopsy & chemotherapy. Other factors include delay in diagnosis (low suspicion index), large tumour volume and both from tumour progression and its treatment toxicity effects are more severe at this age.
Conclusion: Outcome of brain tumours in infants remains poor and depends on histological type and therapeutic options available. In those children presenting with congenital tumours the outcome remains very poor despite therapeutic advances.

T2-05: Outcome of Pilocytic astrocytomas excluding Pilomyxoid tumours

D. Bhargava, Y. Z. Al-Tamimi, F. Novegno, A. Shivane, A. Chakrabarty, D. Crimmins, P. Chumas & A. K. Tyagi (Leeds General Infirmary, Leeds, UK)

Objective: Pilocytic astrocytomas have an excellent prognosis although sometimes outcomes can vary. Pilomyxoid subtype may account for some of this variability. The aim of this study is to assess the clinical course and prognostic indicators for pilocytic astrocytomas excluding the pilomyxoid tumours.
Method: Grade 1 gliomas surgically managed in our department (1989–2004) were reviewed retrospectively. Pilocytic and pilomyxoid subtypes were separately analysed. Subgroup analysis was performed for location and extent of resection. Survival between subgroups was tested for significance using Log-Rank test. Binary logistic regression analysis was utilised to determine if extent of surgery, tumour location, age or histology could predict the risk of death or recurrence.
Results: Sixty patients in total. Median age 13 years (interquartile range 5–25 years, range 0–78 years). Overall 10-year cumulative survival was 0.85. Cumulative survival according to tumour location, extent of surgical resection and histological subtype did not reveal any statistically significant differences. Overall 10-year cumulative progression-free survival (PFS) was 0.71. Cumulative PFS was reduced in

pilomyxoid group (0.5 compared to 0.75 in pilocytic group), although this did not reach statistical significance ($p = 0.076$). No recurrence was noted in gross total resection group, 0.63 10-year PFS in subtotal resection group and 0.21 in biopsy only group. This was a significant difference ($p < 0.0001$). Dividing according to tumour location did not reveal any significant differences.

Results: From logistic regression analysis revealed that only type of surgery was able to predict likelihood of recurrence.

Conclusion: Our study generates survival statistics for typical pilocytic astrocytomas. Extent of surgery is able to predict the likelihood of recurrence in these tumours.

T2-06: A descriptive study of adolescent neuro-oncology patients

Y. Z. Al-Tamimi, D. Bhargava, L. Kalake, P. Sinha, D. Suresh, D. Crimmins, A. K. Tyagi & P. D. Chumas (The General Infirmary at Leeds, Leeds, UK)

Objective: Adolescent patients with intracranial tumours fall between paediatric and adult services. As a result, targeted support is often required but not available. We present a review of the literature and describe a cohort of patients presenting to our own institution.

Method: Patients aged between 16 and 25 years that had presented to our department between 1998 and 2006 with an intracranial space occupying lesion were identified. Age at presentation, location of tumour, surgical management, histology, survival and overall outcome (dichotomised Modified Rankin Score (MRS)) were obtained.

Results: Thirty-six patients were identified (21 males, 15 females), mean age 19.0 years (95% confidence intervals (C.I.) 17.8–20.2 years). Location of tumour: lobar ($n = 21$), cerebellar ($n = 4$), ventricular ($n = 4$), brainstem/thalamic ($n - 4$) and pineal ($n = 3$). Initial surgical management: gross total resection ($n = 13$), subtotal resection ($n = 10$) and biopsy only ($n = 13$). Histology: Low grade astrocytoma ($n = 11$), glioblastoma multiforme (GBM) ($n = 6$), ependymoma ($n = 4$), primitive neuroectodermal tumour (PNET) ($n = 3$), metastasis ($n = 3$), germinoma ($n = 3$), high grade astrocytoma ($n = 2$) and other histological types ($n = 4$) including medulloblastoma, neurocytoma, oligodendroglioma and yolk sac tumour. Overall 10-year cumulative survival was 0.7. A 5-year cumulative survival of 0.38 was noted for high grade tumours, compared to 1.0 for low grade ($p < 0.001$). In this small series, only high histological grade was a predictor of poor outcome (odds ratio = 11.27) (95% C.I. 2.22–57.2), $p = 0.003$).

Conclusion: These patients present with a mixed pattern of histologies between those expected in the paediatric group and those in adulthood but with a specific increase in intracranial germ cell tumours.

T2-07: Radiation-exposure in the management of shunted hydrocephalus – What can we do to reduce it?

G. A. Solanki, K. J. George, S. Majumdar & S. Chapman (Birmingham Children's Hospital, Birmingham, UK)

Objective: These include shunt-series and CT scans. There are no agreed protocols and while radiation exposure has not been quantified, it may be significant in a subset of children with frequent shunt problems. The aim of the study was to evaluate radiation exposure in children with shunts and discuss feasibility of alternative modalities. Episodes of suspected shunt malfunction or infection require multi-modality investigations.

Methods: Records and radiological investigations on 477 (183 girls, 294 boys) consecutive children presenting with shunt problems were reviewed retrospectively. Ages ranged from 1-day to 16-years. Measure of central tendency and chi-square statistics were performed and frequency of radiation exposure quantified. Outcome was measured by shunt function status at the last known review.

Results: 928 procedures were performed in the 477 shunted children. These included 886 Ventriculoperitoneal shunts, 22 endoscopic third ventriculostomies (ETV), 13 lumboperitoneal and 7 VA shunts. Revision frequency ranged from 0–28 revisions. Median revision per child was 1.6. An average of 3.25 X-rays and1.6 CT scans were performed for each revision.

MRI scans would reduce exposure by a factor of 2.56 over a 5-year period. However, additional resources would be required (sedation/GA, MRI availability). Guidelines on shunt-series would further reduce exposure. Impact of image-guided shunt-placements, ETV and antibiotic impregnated-shunts is discussed.

Conclusion: Awareness of radiation exposure risks in this subset of children should lead to alternative approaches for its reduction. We hope that this work will encourage further research and guidance on the subject.

T2-08: Is spontaneous CSF rhinorrhea a more frequent and predictable complication of medically treated macroprolactinomas?

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Objective: 1) To assess the presentation rate of spontaneous CSF rhinorrhoea in our macroprolactinoma patients over a 13 year period.

2) To look at the possible risk factors associated with this.
Methods: All patients attending our Joint Neuroendocrine Clinics are recorded on a clinical workstation database. Since 1995, 30 macroprolactinoma (>1 cm diameter) patients were referred. Clinical details such as prolactin levels were obtained from this database & case notes. Pituitary imaging was reviewed by three observers.
Data was analyzed for spontaneous CSF leaks; sphenoid sinus invasion by tumour; initial size of prolactinoma; initial prolactin levels and rate of decline of prolactin level whilst on medical therapy.
Results: Median prolactin level on initial presentation was 45000 μ/L. 62% achieved a normal prolactin on cabergoline therapy. Spontaneous CSF rhinorrhoea developed in 4 patients. The median prolactin level in these 4 patients was 140000 μ/L. All 4 patients had MRI evidence of sphenoid sinus invasion and a higher rate of prolactin decline whilst on medical treatment.
Conclusion: One of the few indications for surgical treatment in this group of pituitary tumours is the development of CSF rhinorrhoea. This is the first consecutive case series examining the possible risk factors for spontaneous CSF leak in macroprolactinoma. This study suggests that invasion of the sphenoid sinus leads to a high chance of developing CSF rhinorrhoea.

T2-09: External ventricular drain insertion accuracy: is there a need for change in practice?

A. Toma, S. Camp, J. Grieve, L. Watkins & N. Kitchen (The National Hospital for Neurology and Neurosurgery, London, UK)

Objective: Free hand insertion of external ventricular drain (EVD) is a common emergency neurosurgical procedure mostly done for critically ill patients. Although EVD complications have been studied thoroughly, accuracy of EVD positioning has been only occasionally audited.
Methods: Post-EVD insertion CT scans done over a 2 year period in our department were analyzed for EVD tip location and intracranial catheter length.
Results: 183post EVD insertion scans were reviewed. Of those, 73 (39.9%) EVD tips were in the frontal horn, 92 (50.3%) in other CSF spaces and 18 (9.8%) were within the brain parenchyma. The mean length of the EVD was 66 + 11.8 mm. The mean length of the EVD ending in the frontal horn was 59.2 + 8.7 mm while the mean length of the EVDs ending in other CSF spaces and cerebral parenchyma were: 70.2 + 10 mm and 75.4 + 13.1 mm respectively.
Conclusion: Free hand insertion of EVD is an inaccurate procedure. Further studies are required to assess accuracy and feasibility of the routine use of neuronavigation, ultrasound or other guidance techniques.

T2-10: A retrospective analysis of revisional endoscopic third ventriculostomy

S. Surash, A. Tyagi, D. Crimmins & P. Chumas (The General Infirmary at Leeds, Leeds, UK)

Objective: Endoscopic third ventriculostomy (ETV) has gained favour as an effective treatment for obstructive hydrocephalus. However, the efficacy of revisional ETV is uncertain. Some authors have described their operative findings at revision surgery but the long-term outcome has not been reported. The aim of the study was to evaluate the outcome of revisional ETV undertaken in our department.
Methods: A retrospective review was performed of patients undergoing revisional ETV between 1999–2007.
Results: Ten patients underwent revisional ETV (6% of all ETVs performed). Age ranged from 2 months to 32 years (mean 10.1 years) with 7 patients under 18 years of age. Indications for ETV included obstructive lesions in the pineal region (4), posterior fossa (3) and thalamus (1). Two patients had aqueduct stenosis. A tumour biopsy was performed at the time of the initial ETV in 2 of the patients with pineal lesions. The revisional ETV was performed at a mean of 9 months after the first procedure (range 1–31 months). The stoma was closed in 7 patients, narrowed in 1 patient, and a second membrane found under the original patent stoma in a further 2 patients. In 2 patients, a third ETV procedure was performed (both at 1 month after second ETV) and the stoma was closed in both these patients. Complications included 2 CSF leaks-from the wound. No patients required a shunt. At last follow-up (mean 2.5 years, range 4 months – 10 years) all patients remain well.
Conclusions: Providing there is clinical evidence that the primary procedure was initially effective. Revisional ETV appears a safe and effective means of managing recurrent hydrocephalus.

T4-01: Potential adverse effects of incorrect centre of rotation placement in cervical disc arthroplasty devices

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Objective: Concern about the putative acceleration of adjacent segment degeneration following fusion for degenerative disc disease (D.D.D.) has led to the growth of dynamic reconstruction of degenerative functional spinal units (F.S.U.) using disc arthroplasty devices. However, little data is available on the significance of biomecha-

nical differences between various arthroplasty devices.

The aim is to study the in vivo centre of rotation (C.O.R.) of several cervical disc arthroplasty devices combined with finite element analysis (F.E.A.).

Methods: *In vivo* and *in vitro* analysis of six disc arthroplasty devices. Radiological analysis of pre and post-operative dynamic lateral radiographs using customised computer software (ClaritySmart) to evaluate finite centre of rotation (C.O.R.) *in vivo*. Computer models used for *in vitro* finite element analysis (F.E.A).

Radiographic study of routine pre and post-operative flexion/extension radiographs. Ten patients of each of the following arthroplasty devises were studied; Discover (DePuy Spine), Bryan (Medtronic), PCM (Cervitech), Prestige (Medtronic) Neo-Disc (Nuvasive) and Cervidisc (Scient'x). The patients' pre-operative dynamic radiographs were used as controls combined with established published normal control values.

Results: Centre of rotation (C.O.R.) varied significantly in all the different arthroplasty devices.

Conclusion: There are interesting theoretical clinical implications for these different arthroplasty devices. Kinematic conflict of the vertebral body and facet joint C.O.R seen in some of these devices may accelerate facet joint degeneration. Other devices more accurately replicate natural C.O.R, but may have less inherent stability. These factors should influence the clinician's choice of disc arthroplasy device.

T4-02: Modified Magerl C1-C2 Trans-articular Screw Fixation for Rheumatoid Arthritis: post-operative radiological analysis of sagittal alignment

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([1]Department of Neurosurgery, Regional Neurosciences Unit, Royal Victoria Hospital, Belfast, Northern Ireland, UK and [2]Department of Neurosurgery, Beaumont Hospital, Dublin, Republic of Ireland)

Objective: Satisfactory clinical results of various procedures for antlanto-axial (AA) instability have been reported, yet some patients have shown radiographic progression of subaxial kyphosis.[1] We report observational, retrospective data, in what, to our knowledge, is the first study of radiographic sagittal alignment pre- and post-Magerl-type C1-C2 trans-articular screw (TAS) fixation in Rheumatoid Arthritis (RA) patients.

Methods: For 15 RA patients operated on between 2000 & 2004, with a minimum follow-up of 2 years, measurements from lateral imaging pre- & post-operatively were carried out & statically analysed. Parameters of interest were: AA, sub-axial & whole C-spine angles, atlanto-dens & posterior atlanto-dens intervals (ADI & PADI), adjacent segment to fusion disc height (ASFDH), srew breakage/pull-out & basilar invagination (i.e., as measured on magnetic resonance imaging).

Results: Mean angles (degrees) & standard error of means (SEM) pre- & post-operatively for AA, sub-axial & whole C-spine were, respectively: 22.3 & 22.5 +/− 3.8 & 3.9; 24.3 & 26.0 +/− 4.8 & 6.3 & 45.5 & 42.1 +/− 5.3 & 6.9. Mean distances (millimeters) & SEM pre- & post-operatively for ADI, PADI & ASFDH were, respectively: 6.6 & 3.4 +/− 0.5 & 0.4; 15.5 & 17.2 +/− 0.8 & 0.7 & 4.5 & 4.5 +/− 0.5 & 0.7. 2 patients developed sub-axial kyphosis at C5/C6 & 1 of these patients also developed C2/C3 spondylolisthesis. None of our patients developed late screw failure or basilar invagination. All patients had C1/C2 bony fusion at follow-up.

Conclusion: Our experience with C1-C2 TAS fixation in RA suggests sub-axial & cranio-cervical alignment tends to be preserved post-operatively, though sub-axial kyphosis or spondylolisthesis can be observed, on occasion, for reasons not yet fully understood.

Reference

1 Yoshimoto H, Ito M, Abumi K, *et al*. A retrospective radiographic analysis of subaxial sagittal alignment after posterior C1-C2 fusion. *Spine* 2004;29(2):175–81.

T4-03: Management of Spinal Arachnoid Fibrosis

G. Sivakumar, I. Ughratdar & B. D. White
(Queen's Medical Centre, Nottingham, UK)

Objective: To demonstrate the difficulties of treating patients with spinal arachnoid fibrosis and make suggestions for simplifying their care.

Methods: Retrospective case note review of patients with symptomatic spinal arachnoid fibrosis under the care of one neurosurgeon. The clinical presentation, cause, radiological appearance, surgical management, and clinical outcome were analysed. A literature review was conducted identifying relevant papers since the first report in 1979.

Results: Fifteen patients were identified during the last ten years, aged between 30–77 years. No cause was apparent in 8; 7 had previous intradural events including myelography, meningitis or spinal surgery. Most presented with progressive spinal cord failure secondary to compression, congestion, or syrinx formation. Interventions designed to decompress the cord and re-establish CSF flow included attempts at complete resection of complex arachnoid fibrosis, lumbar puncture, lumbar drain, LP shunt, cord cyst aspiration and no treatment. Most required more than one treatment. Overall 6 patients improved, 6 were stabilised and 3 continued to progress. Complications were common and included CSF leak (1), pseudomeningocele (1), chest infection (1), bladder

disturbance (2), and brain haemorrhage leading to death (1).
Conclusion: This is an apparently rare but probably under recognised condition, which left untreated causes severe progressive disability. Operation to resect the arachnoid scar tissue is technically demanding with unpredictable and often disappointing results, and may need repeating. The principle is to establish a good CSF flow across the spinal arachnoid space with least demands on the patient and clinician. We have become less heroic with experience.

T4-04: Failed back syndrome and benefit back: role of functional back restoration programme

S. M. R. Kabir, R. Dyal, J. M. Stanworth & P. A. Stanworth (Walsgrave Hospital, Coventry, UK)

Objective: To determine the role of a back functional restoration programme in patients with failed back syndrome and those on benefits.
Method: This was a prospective study and consisted of a three week full-time programme. Failed back syndrome was defined as patients who failed to improve satisfactorily following surgery. Any patient with new symptoms or symptoms suggesting involvement of a different level than the operated one was not included. Patients who were unable to work because of their symptoms and on benefits were included in the second group. A new scoring system called the Higham-Grange functional scoring system was used based on employment, household activities, activities of daily living and work. Patients were scored 0–100 based on individual activities. Patients were assessed prior to the course and then approximately 6 weeks after discharge.
Results: 125 patients with failed back syndrome and 72 patients in the ''benefit back'' group were included from June 1994 to January 2002.

In the failed back syndrome group, the average age was 46.31 and the average pretreatment score 52.48.The average post treatment score was 84.12 showing significant improvement. This improvement was noted in all four categories of the scoring system. However, results in the benefit back group were disappointing. The average age was 43.5 and the average pretreatment score 38.65. The average post treatment score was only 48.71. In the work category, the score actually worsened from 16.09 pretreatment to 10.65 post treatment.
Conclusion: Our results show that patients with failed back syndrome can benefit significantly from a back functional restoration programmed. However, this type of programme has little role to play in patients who are unable to work because of their symptoms and are on benefits.

T4-05: Discrepancy in surgical and radiological reporting of lumbo-sacral Magnetic Resonance Imaging

M. F. Hassan[1], H. Thambinayagam[1], W. Adams[2] & T. Germon[1] (Departments of Neurosurgery, Derriford Hospital, Plymouth, UK[1] and Neuroradiology, Derriford Hospital, Plymouth, UK[2])

Objective: There are a few standardized criteria for attempting to quantify the degree of lumbosacral nerve root compression demonstrated by radiological investigations. However, these are not validated and are not commonly employed. It is possible that the interpretation of films by surgeons is different to that by radiologists. We sought to determine any difference which may exist between the interpretation of nerve root compression demonstrated by Magnetic Resonance Imaging (MRI) as assessed by a radiologist compared to a spinal surgeon.

We sought to investigate this potential discrepancy.
Methods: Data from consecutive patients undergoing lumbo-sacral nerve root decompression, by a single surgeon, between 2002 and 2005 was prospectively analysed. Inclusion criteria were: 1. uni- or bilateral single level nerve root decompression 2. Three month post-operative visual analogue scores (VAS, 10 = maximum pain, 0 = no pain) of less than 2 was required as an indicator that the pre-operative diagnosis had been correct (i.e. the surgery had significantly improved the patient's pain). The MRI report of these patients was then scrutinised to see if the decompressed nerve root had been reported as significantly compressed on the pre-operative scan.
Results: 54 patients who underwent successful nerve root decompression were included in this study in which 25 male and 29 female. We could only find evidence of a formal report in 79% of cases. Of those that had been formally reported 22% had not reported the surgical target. This rose to 33% for L5 nerve root compression. Formal reports correctly predicted disc pathology in more than 50% cases but failed to identify lateral recess and exit foraminal stenosis in 52.6% and 80% cases respectively. In our study a total of 31(57.4%) reports did not comment on these areas even though some of the reports predicted the correct level of nerve root compression but most of them did not comment on severity of nerve root compression.
Conclusion: Consideration needs to be given to the potential placebo effect of surgery, the nature of the compressive pathology, the clinical details supplied to the radiologist and how the surgical decision making was made. However, in this sample a large minority of MRIs had no formal report. Of those that were reported, there was underreporting of potential surgical targets by radiologists. This implies that there could be a high incidence of false negative MRI reporting with potentially treatable conditions being unrecognized.

(This data was presented as a poster presentation at Britspine – 2008)

T6-01: United Kingdom cranioplasty options review

N. D. Haden & B. Mathew (South West Neurosurgical Unit, Derriford Hospital, Plymouth, UK)

Objective: Storing cranioplasty bone flaps was allowed under the Human Tissue Act of 2004 but has the potential to contravene European Union (EU) directive: 2004/23/EU. Sterilising treatment of human bone flaps may also be in breach of current regulations. The United Kingdom (UK) Cranioplasty Options Review aims to help define national policy/guidance.
Method: The study was undertaken by a telephone survey of current practice in each unit, examining the details of the European Human Tissue and associated Acts, assessing its impact in detail at one representative neurosurgical unit, and quantifying the costs of each alternative.
Results: 4 methods of autologous and 3 categories of synthetic cranioplasty are presently in use. The survey of 27 units in the UK and Ireland revealed that 15 units (55%) are performing only autologous cranioplasty, of which 7 units are storing bone flaps in the abdomen, thus over 50% of autologous users are still storing them externally. 12 units (45%) are using either acrylic, titanium, or custom-made plates of varying types. Considerations Infection: For autologous cranioplasty the patient should undergo tests as for an allogeneic donor to rule out risk of infection from contamination during storage or identification error on issue.

The ''Use, Commissioning and Testing of Autoclaves'' HTM 2010 has significant implications for current autoclaving practices. Cost: A bone bank licence costs £10 000. Many synthetic plates are available but costs can be as high as Â£8000 per patient.
Conclusion: As costly synthetic alternatives are developed, options include abandoning autologous cranioplasty entirely, and perhaps negotiating costs as a group, or outlining reproducible guidelines that satisfy modern requirements.

T6-02: Review of blood transfusion requests and peri-operative usage for 1195 procedures at a single neurosurgical institution

M. C. Sharp, R. Sinha & P. O. Byrne (Queen's Medical Centre, Nottingham, UK)

Objective: There is considerable variability between transfusion requests and blood usage. This study reviews this practice at a single neurosurgical unit prior to the commencement of electronic issuing.
Methods: Retrospective review of transfusion requests for all neurosurgical procedures performed in the neurosurgical theatres over one year at a single neurosurgical unit.

1459 neurosurgical procedures performed in 2006 were included in the study. Craniotomies for acute subdural haematoma and intracerebral haematoma were excluded (n = 122). Of the remaining 1337 neurosurgical procedures, data was not available for 142 (10.6%).

Data for pre-operative transfusion requests for 1337 neurosurgical procedures, and the requirement for peri-operative blood transfusion, were obtained from the hospital Blood Bank computer system. Procedures were categorized to allow comparison of transfusion practices for individual procedures. From the available data, an estimated cost analysis was performed, based on the direct costs for group and save testing, cross matching and actual red blood cell transfusion.
Results: Data was available for 1195 procedures. In total, 1261 units were cross-matched, but only 61 units were transfused peri-operatively. This equates to a crossmatch to transfusion ratio of 20.6:1 (4.8% of all requests). Of the 1195 procedures, only 46 required a peri-operative blood transfusion (3.8%). Data will be presented for individual procedures.
Conclusion: This audit has identified excessive cross-matching for neurosurgical procedures in a climate of chronic national blood shortage. We have recommendations for review of blood ordering for specific operation types.

T6-03: The role of thromboprophylaxis in elective spinal surgery

V. A. Elwell, N. Koo Ng, D. Horner & D. Peterson (Imperial College Healthcare NHS Trust, Charing Cross Hospital, London, UK)

Objective: The reported incidence of symptomatic thromboembolic disease in spinal surgery is estimated between 0.5 to 3.0%. The use of thromboprophylaxis is demonstrated to improve survival outcomes and is recommended by NICE. However, on a practical level, these guidelines have not been universally implemented as the perceived complications of anticoagulation have outweighed the potential benefits. Therefore, its routine use is not standard practice. As venous thromboembolism remains a serious complication resulting in increased morbidity, mortality and cost, we have investigated the incidence of symptomatic thromboembolism after elective spinal surgery in patients given postoperative thromboprophylaxis and analysed the complications.

The aim of the study was to investigate and establish whether patients undergoing elective spinal surgery benefit from thromboprophylaxis and to analyse the effects of low molecular weight heparin on patient outcomes.
Methods: In this retrospective study, 200 patients who underwent elective spinal surgery from March

2007 to March 2008 were analysed. A review of case notes and electronic database was performed. All patients were given mechanical prophylaxis and low molecular weight heparin (enoxaparin 40 mg OD) on their operative day. Treatment continued until they were fully mobile. High-risk patients were included and treated in a similar fashion. Symptomatic thromboembolic disease was diagnosed when there was clinical signs or symptoms. In the cases of suspected deep venous thrombosis (DVT), diagnosis was confirmed by a lower limb duplex scan. In cases of suspected pulmonary emboli, diagnosis was confirmed by Computerised Tomographic Pulmonary Angiography (CTPA).

Results: We report no thromboembolic disease in this population. 5 patients showed clinical signs of DVTs; however, all had negative duplex scans. 3 patients were investigated for symptomatic pulmonary embolism (PE), but their investigations revealed lobar pneumonia, pulmonary effusion, and pulmonary oedema respectively. Moreover, there were no reported deaths. 7 patients had direct complications of anticoagulation: minor bleeding (Hb drop = 2g/dL or blood transfusion = 2 units) and local skin reaction (irritation, pain, eccyhmosis and erythema). All complications were reported in the posterior lumbar approach. 1 patient was investigated for a spinal haematoma for evolving neurological signs, which was excluded. Patients receiving the first dose of enoxaparin = 12 hours post-operatively had significantly fewer complications ($p < 0.05$).

Conclusion: We report no incidence of clinically symptomatic thromboembolic complications following elective spinal surgery. However, complication following the administration of low molecular weight heparin related to the level of spinal surgery, surgical approach and delayed mobilisation. Moreover, we identified future areas of improvement. Treatment should commence at least 12 hours following surgery, injection sites should be rotated to minimize local skin reactions, and early mobilization should be encouraged. It would be beneficial to risk stratify patient prior to surgery. In light of our findings, enoxaparin should be given to patient undergoing elective spinal surgery to prevent mortality and morbidity associated with thromboembolic disease.

T6-04: Trauma who cares? An increasing consultant workload

K. Woon, S. Solanki, A. A. Moussa & B. D. White (Queens Medical Centre, Nottingham, UK)

Objective: The National Confidential Enquiry into Patient Otcome and Death Deaths (NCEPOD) document 'Trauma: who cares, 2008'[1] is an invaluable account of current acute care of trauma including head injured patients in England, Wales, and Northern Ireland. It found that consultants were present at 19% of operations requiring major neurosurgery, and called for this to be increased. We reviewed our working practice with regards to head injuries in this unit.

Methods: We undertook a retrospective review of clinical records relating topatients with head injuries referred to and operated on in our unit in the last 20 years We compared the data to the NCEPOD recommendations.

Results: In 2007, over 800 patients with head injuries were referred. 79% of these were minor head injuries, 7% were moderate head injuries and 14% were major head injuries. 8.5% (69 patient/year) required major neurosurgery. Consultant presence in major neurosurgery was 33% in 2007 (gradually increasing from 0% in 1987).

Conclusions: The NCEPOD report was retrospective and already out-dated on publication. The apparent challenge to increase consultant presence prior to its next publication is easily in hand. Consultant presence at major cases has increased over the years and seems likely to continue. This is due to changes in training and experience of juniors as a result of Modernising Medical Careers and European working time directives.

Reference

1 Trauma: Who cares? A report of the National Confidential Enquiry into Patient Outcome and Death (2007) http://www.ncepod.org.uk/2007report2/Downloads/SIP_report.pdf

T6-05: A Revisit of Teleradiological Services at United Kingdom Neurosurgical Units

W. B. Cato-Addison, S. Pushpananthan, V. Petrik, M. C. Papadopoulos, B. A. Bell & M. Murphy (The Royal Free Hospital, London, UK and Academic Department of Neurosurgery, St George's Hospital, London, UK)

Objectives: Over the past 10 years there has been a dramatic shift away from the use of printed radiological images towards digitized images. In 2005 we assessed the practice at all 34 United Kingdom neurosurgical units (NSU), to assess compliance with National Health Service Modernisation Agency report recommendations. We recorded which form of imaging was used at each unit, access to a dedicated image link and consultant home access to images. In 2008 we revisited these questions and we present the changes in practice over this time period.

Methods: A telephone survey of all NSUs was performed using a structured questionnaire in November 2005 and again in May 2008. The outcomes are compared in light of recommendations

made after the first survey. On-call specialist registrars at each NSU participated in the survey on both occasions.

Results: In 2005, 30(88%) of NSUs used a dedicated imagelink and 21(62%) used in-house PACS servers. This compared to 32(94%) and 33(97%) respectively in 2008.

In 2005 4(12%) NSUs had consultant home access to digitized images. This has improved to 11(34%) in 2008.

Conclusion: Few specialities are as reliant on radiological imaging as neurosurgery.

PACS is now the predominant in-house radiological medium at NSUs.

There has been a steady increase in the number of NSUs with home consultant image access. However, there is further room for improvement as 2/3s of NSUs still do not have this facility.

NSUs are still falling short NHS Modernisation Agency report recommendations that neurosurgery should be a consultant-led speciality with teleradiological facilities available in consultants' homes.

T6-06: Payment by Results – Are tertiary referral centres paid for what they do?

D. T. Holsgrove, N. J. Johnston, S. A. Rutherford, A. T. King & J. R. S. Leggate (Salford Royal NHS Foundation Trust, Manchester, UK)

Objective: Since the introduction of Payment by results (PbR) in 2005 trusts have received funding per patient treated, according to a national tariff set by diagnosis or the procedure carried out. Over the last two years we have noted an increase in the amount of time taken by junior and consultant medical staff and support staff in dealing with on-call emergency referrals. Despite the time taken to review scans and advise on further investigations or treatment, if patients are not admitted to our trust our time is not financially rewarded. We have analysed the numbers of emergency referrals and admissions over the last two years to assess the working time spent at a loss to the trust.

Methods: Dr Foster Intelligence and our referrals database were used to retrieve information related to admissions and on-call referrals.

Results: From quarter one in 2006 to quarter 4 of 2007 we have seen a 42% increase in the number of emergency referrals. Non-elective admissions increased by 16% from a mean of 270 per quarter in 2006 to 313 in 2007. Each patient referred has their scans reviewed by a Consultant Radiologist and a Consultant Neurosurgeon. They have a letter dictated and faxed back to the referring team with details of the neurosurgical management plan. This results in 2.5 consultant sessions and 3.5 days of secretarial time per week being devoted to the on-call patients, 76% of which attract no income to the trust.

Conclusion: (PbR) was designed to encourage efficiency within NHS trusts. It does not take into account the workload related to non-admitted patients. If tertiary neurosurgical units are to deliver an improved quality and breadth of care to their patients, commissioners must recognise the need to fund this service.

T6-07: Healthcare Resource Group codes in neurosurgical practice. Time for change

N. Haliasos, K. Rezajooi, N. Mendoza, D. Peterson & J. Van Dellen (Imperial College NHS Trust, London, UK)

Objective: Healthcare Resource Group (HRG) codes are the framework of payment for all clinical activity in NHS hospitals. An understanding of this payment method within a neurosurgical unit is therefore vital for resource planning and management. To our knowledge, there has been no systematic assessment of the accuracy and practical relevance of the of current coding and payment systems used within neurosurgical practice in the NHS.

Methods: Systematic retrospective audit of clinical coding of all patients treated in our neurosurgical unit over a three month period. The notes for all 378 patient events between October and December 2007 were systematically reviewed with a clinical coder. We compared the original HRG codes with our reassessment from the medical notes. We also detailed the reasons for incorrect coding and patterns of errors.

Results: 42 of the 378 patient events (11%) were found have been 'inaccurately' coded. 29 of events (69%) required upgrading of coding while a total of 13 required downgrading (31%). The projected difference in income for the three month period was £47,157.

Conclusion: The current coding process at our hospital reflected a reduced income of £47,157 in a three month period, equating to an annual loss in budget of £188,628. None of the amended HRGs were due to an inaccuracy of clinical notes or operation sheets. We further noted that other specialities are able to code for co-morbidities which increase the HRG, which is not the case in neurosurgery and has significant negative financial implications for all neurosurgical units.

T6-08: Modified CRABEL score – a tool for basic surgical trainee appraisal

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Objective: The CRABEL Score[1] is an accepted and reproducible numerical scoring system for note

keeping, which allows a standardised comparison of a consultant's team's performance. The European Working Time Directive has changed the way junior doctors work. There is now no designated junior doctor attached to a consultant, hence making the CRABEL score an ineffective way of monitoring note keeping. A previous audit carried out by the author shows that junior doctors were predominantly responsible for poor note keeping. Aim: We propose a modified CRABEL scoring system, which lays more emphasis on junior doctors' note keeping.
Methods: A retrospective case review of patient records, selected randomly with entries from each neurosurgical junior doctor, were assessed using the modified CRABEL score. The audit was repeated four weeks later to assess impact. The modified CRABEL score differs from the original CRABEL score, in that consent and discharge letters do not contribute to the score (as these were roles held by senior doctors in which they performed well), however more emphasis is placed on initial clerking and subsequent entries.
Results: There was a poor level of record keeping. Poor modified CRABEL scores were down to missing patient details, no timed entry, no management plans, and no results.
Conclusion: The modified CRABEL score can focus training for the junior doctor, identify their needs, and can be used as part of an appraisal.

Reference

1 Crawford JR, Beresford TP, Lafferty KL, The CRABEL score – a method for auditing medical records. *Ann R Coll Surg Engl* 2001;83:65–8.

T6-09: Survey of perceptions of post-craniotomy pain

B. Cheserem, A. Solth & D. Kotak (King's College Hospital, London, UK)

Objective: We undertook a survey of neurosurgeons (19), neuroanaesthetists (8), intensivists (8), and neurosurgery high dependency nurses (27) in our institution (total = 62) to ascertain what their perceptions were of post-craniotomy pain as part of a review of post-operative analgesia on the neurosurgical HDU.
Methods: We asked the following questions:

1. How would you rate the pain severity of a craniotomy? (score 1–5) Mild (1) mild-moderate (2) moderate (3) moderate-severe (4) severe (5).
2. What percentage of patients experience mild, moderate, or severe pain?

Results: The average pain score of the 3 groups was 2.6 showing that the general perception was slightly less than moderate. Ranking the different groups average perception of pain: Nurses (2.9) > Neuroanaesthetists/Intensivists (2.6) > Neurosurgeons (2.3). Ranking the different groups assessment of percentage of patients suffering severe pain: Nurses (24%) > Neuroanaesthetist/Intensivists (15%) > Neurosurgeons (10%).
Conclusion: Contrary to the prevailing view, up to 70% of patients undergoing elective craniotomy may experience moderate to severe pain postoperatively.[1] Nurses are more aware of this than the doctors who prescribe the analgesia. Greater recognition, particularly amongst doctors, that post operative pain is significant and warrants treatment, should lead to more effective analgesic prescribing and a consequent reduction of the detrimental effects of pain (sympathetic stimulation and agitation) and an improvement in patient satisfaction.

Reference

1 Gottschalk A, Berkow LC, Stevens RD, Mirski M, Thompson RE, White ED, Weingart JD, Long DM, Yaster M. Prospective evaluation of pain and analgesic use following major elective intracranial surgery. *J Neurosurg* 2007;106:210–6.

T6-10: Post-craniotomy analgesic practices in British neurosurgical centres

A. Solth, B. Cheserem & D. Kotak (King's College Hospital, London, UK)

Objective: An audit of post-craniotomy analgesia in our unit demonstrated wide variation in analgesic prescribing practices. Before introducing a formal analgesic regime, it was decided to undertake a survey of analgesic practice in other neurosurgical units to see if a consensus was developing regarding standardization of pain control given that there is a lack of good evidence based guidelines.
Method: Telephone questionnaire with a senior nurse of 30/31 of UK adult neurosurgical centres regarding current analgesic practice for post-craniotomy patients.
Results: 23% of units had a standardized analgesic regime/protocol. 63% of units routinely assessed pain post-operatively. 70% of the units used codeine phosphate or dihydocodeine as the first line opiate. 30% of the units used morphine as the first line opiate. 97% of the units used paracetamol. 43% of the units used tramadol. PCA was used in 3 units. 43% of units used NSAID's occasionally and 10% used NSAID's routinely.
Conclusion: No consensus regarding standardised post-craniotomy analgesia emerged from the 23% of units that had post-operative analgesic regimes. With only 63% of units routinely assessing post-operative pain, the majority having no formalized analgesic regime, and codeine phosphate being the preferred opiate, many patients may be receiving ineffective analgesia given that recent evidence, in contrast to prevailing assumptions, suggests that most patients experience moderate to severe pain in the first two days post operatively.

F2-01: Interaction of neuroprotective effects of acute erythropoietin therapy with statins and sepsis following aneurysmal subarachnoid haemorrhage: a randomised controlled trial

M. Y. Tseng, P. J. Hutchinson & P. J. Kirkpatrick (Addenbrooke's Hospital, Cambridge, UK)

Objective: We have demonstrated that acute systemic erythropoietin (EPO) therapy reduces delayed ischaemic deficits (DID) following aneurysmal subarachnoid haemorrhage (aSAH). In this post-hoc analysis, we aimed to investigate potential interactions between EPO, statins, and sepsis.
Methods: Eighty patients (age >18 years) within 72 hours of aSAH were randomised to receive intravenous EPO-Ãÿ 30,000 IU or placebo every 48 hours for a total of 3 doses. Endpoints were outcome at discharge measured with modified Rankin Scale (mRS) and absolute reticulocyte count (ARC) reflecting haematopoiesis. Interactions related to concurrent statin therapy or sepsis were analysed using t-test and/or ANOVA for repeated measurements.
Results: Randomisation characteristics were balanced except for age, with the EPO group being older (mean age 59.6 vs. 53.3 years, $p = 0.034$). The EPO group had higher ARC from days 3 to 12 ($p < 0.05$). Thirty patients had sepsis (12 placebo, 18 EPO, $p = 0.17$). Fourteen patients were taking statin (6 placebo, 8 EPO, $p = 0.56$). In the EPO group, the ARC was lower in those with sepsis (non-sepsis vs. sepsis 143.5 vs. 105.8×10^9/L, $p = 0.01$), who also were more likely to have unfavourable outcome (mRS 4–6, non-sepsis vs. sepsis 24% vs. 56.3%, $p = 0.003$). None of the statin users in the EPO group suffered DID ($p = 0.17$) and the statin users also had persistently higher ARC on day 15 ($p < 0.05$), suggesting statins may enhance the neuroprotective and haematopoietic effects of EPO.
Conclusion: EPO-related haematopoietic and neuroprotective effects seem to be attenuated by sepsis but enhanced by statins, an important finding in designing phase III studies.

F2-02: Quantitative cerebral blood flow analysis during and after STA-MCA revascularisation surgery in patients with moyamoya disease: correlation with clinical outcome and post-operative complications

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Objective: Moyamoya disease is a chronic stenoocclusive disease of the terminal internal carotid arteries. We present here our analysis of intraoperative blood flow, regional cerebral blood flow (rCBF) and cerebral vascular reserve (CVR) in patients with moyamoya disease undergoing direct superficial temporal artery branch to middle cerebral artery branch anastomosis (STA-MCA).
Methods: A retrospective study of 273 patients undergoing 436 procedures for moyamoya disease between 1991 and 2008 was reviewed. rCBF and CVR analysis was performed using Xenon CT and intra-operative cerebral blood flows were measured using transit-time ultrasound flowmetry (Transonic systems). The data was statistically analyzed and probability values of less than 0.05 were considered significant.
Results: Pre-operative rCBF and CVR in the ACA, MCA and PCA territory were 39.9, 43.1 and 44.4 ml/100g per min and 9.0%, 6.3% and 20.4%, respectively. Mean intra-operative blood flow through the recipient MCA branch was 4.4 ml/min pre-anastomosis and 22.2 ml/min post-anastomosis ($p < 0.0001$). High intraoperative flows was associated with increased risk of post-operative stroke (31.2 vs. 21.6 ml/min, $p = 0.0451$) and hemorrhage (32.1 vs 21.6 ml/min, $p = 0.0448$). rCBF was not significantly different after revascularization surgery but there was a significant increase in CVR in the ACA (27.9%), MCA (28.9%) and PCA (38.8%) territories ($P = 0.0027$). Increased CVR correlated with improved clinical outcome.
Conclusion: STA-MCA revascularization surgery in moyamoya disease is effective at increasing CVR and is correlated with improved clinical outcome. High intra-operative flow rates through the recipient MCA vessel was associated with a higher risk of post-operative stroke or hemorrhage.

F2-03: Excimer Laser Assisted Nonocclusive Anastomosis (ELANA) cerebral vascular bypass – Review of the first United Kingdom experience

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Objective: Cerebral revascularisation is an important tool for the neurovascular surgeon, but intra-operative ischaemia remains a major risk. The Excimer Laser Assisted Nonocclusive Anastomosis (ELANA) modification was developed in the early 1990's as an attempt to reduce such risks and has become more widely available over the last 5 years. We present the United Kingdom's first experience of this technique in neurovascular practice.
Methods: Between May 2006 and April 2008, 8 patients were selected for this procedure. 7 harboured giant cerebral aneurysms and I had a skull base tumour involving the internal carotid artery. All patients failed balloon occlusion tests. All procedures were performed by a single vascular neurosurgeon

(CT) with the help of the pioneer of the technique and a general vascular surgeon. During the same period, 6 conventional superficial temporal-middle cerebral (STA-MCA) bypasses for cerebral ischaemia and 2 pial synangiosis were also performed.

Results: One ELANA bypass was abandoned intraoperatively, as it was found to be unnecessary. Proximal anastomosis included 5 standard arteriotomies (3 at the external carotid and 2 at the STA) and 2 ELANA arteriotomies (M1 and internal carotid). The distal anastomoses were all ELANA arteriotomies. Flow in the bypass at the end of surgery was satisfactory in all 7 cases (confirmed with Doppler flow probe). One intraoperative thrombosis was cleared by embolectomy. Three bypasses were found occluded on the 4th postoperative day (prophylactic) without any complications. One patient died of a left MCA stroke 3 days postoperatively, not directly related to the procedure. 3 bypasses were patent 6 months post surgery. No late complications have been reported so far.

Conclusion: The ELANA cerebral vascular high-flow bypass is an important, safe technique for the neurovascular surgeon, although there is a very steep learning curve.

F2-04: A continued role for surgery in treatment of intracranial aneurysms after the ISAT trial: a single-centre experience

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Objective: To review the activity of a multidisciplinary team of one neurosurgeon and two interventional radiologists over a 22 month period in 2005–07 and compare it to the activity of the same unit in 2001–2002.

To consider the impact of the International Subarachnoid Aneurysm Trial (ISAT)[1] and current role for open surgery for intracranial aneurysms.

Methods: A retrospective review of all patients undergoing endovascular or open therapeutic procedures for 281 intracranial aneurysms during a 22 month period at a single large centre, and all patients undergoing surgery for aneurysms in a sample year 2001. We assessed the number and proportion of patients undergoing open surgery and endovascular treatment for different groups of aneurysms; neurological outcomes of surgery.

Results: Our comprehensive endovascular service treats the majority (87%) of acute ruptured intracranial aneurysms, with only a small proportion (13%) now treated with surgery. Approximately half of primary elective aneurysm treatments are open surgery (43%), with the other 57% endovascular. Overall 84% of aneurysm interventions were endovascular with 16% open surgery. The pre-ISAT year of 2001–02 saw 92% of 185 aneurysms treated endovascularly with 8% open surgery.

Conclusion: Our multidisciplinary team has a tendency to use endovascular treatment more frequently in acutely ruptured or recanalised previously coiled aneurysms, according to recent evidence-based practice. Our outcomes towards the more elective end of the spectrum justify a greater role for open surgical techniques especially for the unruptured aneurysm. We have demonstrated a continuing use of open surgery despite the increased confidence in endovascular treatment since ISAT, and justified that approach by the good outcomes associated with this patient group.

Reference

1 Molyneux A, Kerr R, Stratton I, Sandercock P, Clarke M, Shrimpton J, *et al*. International subarachnoid aneurysm trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised trial. *Lancet* 2002;360:1267–74.

F2-05: Management of Ruptured Intracranial Aneurysms: Review of a single institution experience over 1 year

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Objective: Regular audit of management patterns and outcomes for SAH remains important in the post ISAT era. We report aneurysm location, time from bleed to coiling/clipping, post-procedure stay in the neurosurgical unit and modified Rankin score for first follow-up.

Methods: A retrospective review of clinical case notes, discharge and follow-up letters on a one year single institution experience of ruptured intracranial aneurysm [RIA] management between October 2005 and September 2006.

Results: Over the period of review, 108 patients were treated for RIA. Endovascular coiling of was performed in 86 patients [80%] and 22 patients had clipping [20%]. The most common aneurysm locations were ACOM [31.5%] and PCOM [19.8%]. Time from bleed to clipping/coiling in the majority of cases was less than 72 hours [77.4%] and the post procedure stay in the neurosurgical unit was less than two weeks in the majority [66.6%]. There were 11 deaths (10%). Clipping was performed: (a) if aneurysm anatomy was unfavourable for coiling [7/22] (b) when evacuating a clot with mass effect [10/22] and (c) if coiling was tried but failed [5/22]. In the coiling group 70% had a good outcome (mRankin 0-2). In the clipping group 64% of those clipped at WFNS 1–2 had a good outcome, but none of those in poor grade achieved good outcome Rankin scores.

Conclusion: The results show a contemporary 1-year caseload of RIA management. In the clipping group, 50% were in poor neurological grade due to

clot with mass effect and this had a significant influence on the overall clipping results.

F2-06: The management of subarachnoid haemorrhage patients in a regional neurosurgical unit remains a safe proposition

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Objective: Neuroradiological advances and changes in the patterns of healthcare delivery have raised questions regarding the best management of patients with subarachnoid haemorrhage (SAH). This study aimed to determine whether satisfactory outcomes could be achieved for SAH patients presenting to a regional neurosurgical centre in which 3 consultant neurosurgeons were responsible for the management of these cases.
Methods: Patients with a spontaneous SAH presenting in 2007 were identified. The Extended Glasgow Outcome Score was determined from clinic follow-up records or by telephone consultation. Logistic regression analysis was performed to evaluate the relationship between possible risk factors and outcome.
Results: 116 cases of spontaneous SAH were identified. Of 97 patients with aneurysmal SAH, 54 underwent coiling and 23 were clipped. A favourable outcome was observed in 87% of operated cases and 85% of coiled cases ($p > 0.05$). EVD insertion ($p = 0.012$) and aneurysm diameter >10 mm ($p = 0.045$) were identified as risk factors for an unfavourable outcome. Rebleeds were uncommon and did not independently predict a poor outcome. 26 (27%) of the aneurysmal patients developed delayed ischaemic neurological deficits. Of the 25 deaths, 72% occurred in poor grade patients who did not undergo treatment. The inpatient mortality was 9.3% and 4.3% for coiled and clipped cases respectively. The National Audit figures were 7.2% and 6.9%.
Conclusion: Concerns about the availability of clinical expertise require a vigilant approach to clinical governance issues. This study shows that a regional neurosurgical unit with a 3 surgeon cover system can achieve satisfactory outcomes for patients with SAH when compared with national audit data. Poor outcomes were associated with hydrocephalus and larger aneurysm size.

F2-07: Delay in Repatriation of Neurosurgical Patients

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Objective: To measure the time taken to transfer patients back to their original hospital and to assess the impact of new procedures and new roles for allied health care professionals pertaining to this process compared with the audit carried out in 2003.
Methods: The audit was carried out prospectively at Morriston Hospital Neurosurgery Department from August 2007 to February 2008. All patients referred back to hospitals in the Morriston Hospital catchment area from August 2007 to February 2008 were eligible. For the purpose of this audit any transfer taking longer than 48 hours to take place was classified as ''delayed''.
Results: During the period of the audit 29 patient transfers were delayed. Altogether, these delays resulted in 258 ''blocked bed days'' in 6 months. This figure is increased by 119 compared to the previous audit in 2003. At a conservative estimate of 300 GBP per hospital bed per day the loss of 516 bed days per year amounts to a cost of 154.800 GBP.
Conclusion: The NHS loses money through delayed transfers of patients back to their original hospitals. The introduction of ''Bed Management Teams'' has in our Trust reduced neither the time taken to repatriate a neurosurgical patient nor the nurses' or junior doctors' work load in the process.

F5-01: Do patient information leaflets improve the current informed consent process on a neurosurgical ward?

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Objective: Recall rates of the consent process by patients undergoing neurosurgery have been found to be low previously. Patient information leaflets were given as an intervention with the prospect of improving these rates.
Methods: 78 patients undergoing spinal or cranial neurosurgery were recruited; 53 of which were issued a relevant patient information leaflet regarding their surgery. 1–4 days post consent, patients recalled the operation and its benefits and risks, and rated their satisfaction of the treatment and information given.
Results: Percentage of risks recalled improved from 26.9% in the control group to 37.4% being issued leaflets ($p = 0.049$). If normal distribution is not assumed and a 1-tailed Mann Whitney test is applied $p = 0.033$. Craniotomy patients ($n = 14$) improved from 13.3% of risks recalled to 31.4% ($p = 0.017$). No association was found between the percentage of risks recalled and age, education or occupational status. Patient satisfaction with information improved to 9.4/10 and treatment 9.2/10 (from 8.9/10 and 9.0/10 respectively).
Conclusion: Patient information leaflets increase the percentage of risks recalled. Risks recalled improved most significantly in the craniotomy group of patients. Patient satisfaction improved with patient information leaflets but was already high.

F5-02: What is the quality of internet sites providing information on pituitary tumours?

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Objective: At least 50% of patients access medical information via the internet, which may influence choice of treatment. The aim of the study was toevaluate the quality and accuracy of information provided on pituitary tumours.
Methods: Using the Google® search engine, the top 30 sites found in response to the enquiry ''œpituitary tumours''/''œpituitary tumors'' were assessed. Quality assessment was performed using the DISCERN® instrument, an established questionnaire for health consumers to assess the quality of information on treatment choices.
Results: Of the 60 sites obtained only 18 were relevant. The remainder were references to books, scientific articles or repetitions. None had commercial bias or belonged to an individual. All mentioned the different treatment options. Only 4(22%) scored highly overall, whereas 6(33%) had inadequate scores with ~extensive shortcomings''™. No site clearly offered information on the potential outcomes in the absence of treatment, as defined by the DISCERN instrument, and only 3 discussed complications of treatment. 9(50%) referred to support groups for patients and multidisciplinary management was mentioned only by institutional websites. Where most sites scored low was the lack of description of different treatments; of information on their potential complications; and the absence of citation on the information provided. Of the 4 best-scoring sites, only 2 were in the top 10 search hits, and another in the next 10.
Conclusion: The information on the internet on pituitary tumours is variable with less than 25% of websites scoring highly. Only 2 of these were in the top 10 hits. Neurosurgeons treating pituitary disorders need to be aware of the quality of this information that patients have access to, especially the lack of comparison between different treatments and potential complications.

F5-03: Informed Consent in Neurosurgery

J. Pararajasingham, D. Rodrigues, C. Barrett, H. Narayanamurthy & P. Mitchell (Newcastle General Hospital, Newcastle Upon Tyne, UK)

Objective: To evaluate the consenting process, patients' ability to recall information and patient satisfaction of the process.
Methods: A prospective audit of 75 consecutive patients undergoing elective surgery for degenerative spine disease. Consent papers were checked and patients were interviewed prior to discharge.
Results: Data was completed adequately in 100% of cases for the procedure name, laterality, date and benefits of the procedure. Risks were incompletely documented in 5% of lumbar consent cases and 14% of cervical cases. There was missing data with regards to named organisation (4%), responsible consultant (4%), name of person taking consent (10.6%), permission to obtain records (99%), permission for students attending (99%) and re-verification of consent (100%). Patient recall of information was 100% with regards to diagnosis and benefits of procedure. Alternative management options could not be recalled in 24% of cases. Patients had good recall for non-specific and specific risks (92% and 96% respectively) and poor recall for additional risks (12%). The patient was not satisfied with the consent procedure in 11 cases (14.7%). All patients who were pre-assessed and consented prior to admission were fully satisfied with the consent process.
Conclusion: The consent process is quite adequate but can be improved. Patient recall was high, but better in those attending pre-admission clinic. Risks and alternative management options need to be mentioned more clearly. We suggest written information at preadmission clinic may be advantageous.

F5-04: Patient satisfaction with informed consent for elective neurosurgery

A. G. Kolias, C. Derham, S. D. Bucur, P. D. Chumas & A. K. Tyagi (Department of Neurosurgery, Leeds General Infirmary, Leeds, UK)

Objective: Doctors have a duty to work in partnership with patients in order to enable them to reach informed decisions about their treatment. The duty to inform is primarily an essential step in the management of patients but it can also protect surgeons against litigation.[1] The aim of the project was to assess patient satisfaction with the procedure for obtaining informed consent for elective neurosurgical operations.
Methods: A prospective questionnaire survey of 43 consecutive patients undergoing elective neurosurgery at a regional centre. Local research ethics committee confirmed that ethical approval was not needed.
Results: 42 patients completed the questionnaires (23 males, 19 females; median age was 52.5 years, range 26–87). Most underwent a spinal operation (n = 30); the rest cranial. Consultants obtained consent from 8 patients, specialist registrars from 34. 40 patients felt that they were given enough time to discuss the proposed operation before signing the consent form. About thee-quarters of the patients (n = 32) discussed the proposed operation for 5–10, or more than 10 minutes with the surgeon. Only 2 discussed for less than 1 minute. Four patients felt that the surgeon used medical terms without

explaining their meaning. Finally, 39 out of 42 patients (over 90%) were satisfied or completely satisfied with the process which led to the signing of the consent form.
Conclusion: To our knowledge, this is the first study of its kind in the field of neurosurgery. The present consent-taking process is deemed satisfactory by the majority of the patients.

Reference

1 Garfield J. Report of the activities and its results of the Ethico-Legal Committee of the EANS. *Acta Neurochir (Wien)* 1992;116:83–93.

F5-05: Invasive electrode insertion for epilepsy: associated complications and a method for highlighting potential infection

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Objective: Invasive intracranial-EEG recordings are often performed prior to definitive epilepsy surgery requiring insertion of electrodes for a variable number of days. It was hypothesized that increased duration of monitoring was associated with an increased risk of infection and that skin flora could predict the organism responsible.
Methods: A 5 year retrospective study evaluating the complications associated with invasive intra-cranial monitoring was performed. 46 patients (range 19 to 58) were included in the study. During removal of invasive recording equipment a series of microbiological swabs were taken. Other complications were also documented.
Results: One patient was treated for infection necessitating removal of electrodes and a course of antibiotic treatment. Another patient raised suspicions of an infection but no treatment was given. Two patients developed a post-operative haematoma requiring surgery. 20% of all skin swabs, 0% of subgaleal swabs, 3% of extradural swabs, 7% of subdural swabs, 22% of grid electrodes, 10% of strip electrodes and 10% of depth electrodes demonstrated growth on primary culture. All complications were seen in patients with subdrual grid electrodes. The 2 cases of infection were the only ones to have positive extradural and subdrual swabs and the organisms grown matched those on the electrodes.
Conclusion: In our study infection was not associated with increased length of monitoring. Taking skin swabs during surgery is unlikely to be helpful but we would recommend that extradural and subdural swabs be taken during surgery as this may highlight a potential infection. Invasive intra-cranial monitoring is associated with certain morbidities so close observation in these patients is important.

F5-07: Never go to sleep on undrained pus: a study of intraparenchymal cerebral abscess

S. J. Smith, I. Ughratdar & D. C. MacArthur (Queens Medical Centre, Nottingham, UK)

Objective: Cerebral abscess is a neurosurgical emergency requiring urgent drainage either via craniotomy or burrhole aspiration. Management centres on treating raised intracranial pressure (ICP) and obtaining microbiological diagnosis. Despite therapy abscesses may reaccumulate and require repeat procedures. We examine whether initial method of drainage affects outcome, which patients are treated with each method and epidemiology.
Methods: This is a retrospective analysis of all 62 patients operated on in our unit with a loculated infected cerebral collection in the years 2003 to 2007 inclusive. Case notes/imaging were analysed using the Stata package (data appropriate tests including logistic regression).
Results: Burrhole and craniotomy groups were evenly matched with no difference in age ($p = 0.897$), abscess location ($p = 0.958$), diameter ($p = 0.512$), presenting GCS ($p = 0.401$) and CRP/WBC. Surgical method made no difference to rate of re-operation ($p = 0.276$), duration of antibiotics ($p = 0.648$), discharge GCS ($p = 0.509$), length of stay ($p = 0.647$) or Glasgow Outcome Score ($p = 0.968$). Surgery usually occurred within 1 day of scan but in some was delayed because the diagnosis was not appreciated. Outcome/length of stay were adversely affected by such delays to operation ($p = 0.027$). Patients requiring longer duration of antibiotics had worse outcomes ($p < 0.005$). S. milleri was the most common isolate and only 21% of patients had no predisposing factor.
Conclusions: Method of surgical treatment did not have a significant effect on outcome in patients undergoing surgery for cerebral abscess, so burrhole aspiration with its advantages in terms of speed and scale of surgery should be strongly considered. Delay adversely affected outcome so operation should be as expeditious as possible whenever the differential diagnosis includes abscess. Advanced magnetic resonance imaging techniques offer the possibility of more diagnostic certainty ensuring that patients can be treated quickly.

F5-08: Intracranial infections in children: Are outcomes improving? Evidence from a Regional Neurosurgical Unit

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Objective: Intracranial infections can be a potentially lethal complication in children. Mortality in recent

series varies between 7–20% and morbidity is estimated at 13–28% in the developed countries. We report our experience in reducing mortality and morbidity with emergency multidisciplinary treatment.
Methods: All consecutive cases of intracranial infections admitted between January 2000 to May 2008 to a major paediatric neurosurgical unit were retrospectively reviewed. We identify trends and outcome following diagnosis of epidural abscess (EDA), subdural empyema (SDE) and intraparenchymal abscess (IPA).
Results: 55 cases (35 males and 20 females) with Male: Female ratio 1.75 were identified. The median age was 8 years. The case distribution was EDA in 16, SDE in 13 and IPA in 27. Sinus infection was directly responsible for 94% EDA, 39% SDE and 43% IPA. Non-sinus and systemic causes (meningitis, encephalitis, congenital heart diseases, thalassemia, leukemia and trauma) accounted for 62% SDE and 27% IPA. Positive cultures were identified in 58% with Streptococcal isolates in 55%. 54 patients underwent surgical intervention while 1 patient was treated conservatively with long term antibiotics. With multidisciplinary approach 96% had a good neurological outcome. There were no deaths in our series.
Conclusion: Improved outcome with reduction in mortality can be achieved by prompt diagnosis. Emergency evacuation of the collection and treatment of the source of infection along with multidisciplinary input can prevent mortality and reduce long term disability.

F5-09: Safety and efficacy of glycerol injections for trigeminal neuralgia

A. M. Harries & R. D. Mitchell (Queen Elizabeth Hospital, Birmingham, UK)

Objective: To confirm the safety and efficacy of glycerol injections for trigeminal neuralgia.
Methods: A retrospective study of all glycerol injections for trigeminal neuralgia undertaken from 1999 to 2008.
Results: 133 glycerol injections were undertaken in 57 men and 76 women with an age range of 37–84. There were 20 patients with multiple sclerosis, one with systemic lupus erythematosis. The glycerol injections were all performed under sedation, with radiologicalguidance and the patient supine. 126 cases were performed without complication. Fourcases were abandoned due to bleeding, Other complications includedone temporary asystole on needle insertion, one post procedure bleeding from the ear, and one retrobulbar and periorbital haematoma. There were no cases of anaesthesia dolorosa. Eleven patients had temporary facial numbness. 108 patients (81%) had improvement in pain following the operation. 76 patients had the procedure repeated more that once without complications.
Conclusion: Glycerol injections are low morbidity, repeatable operations with excellent results.

F5-10: Image-guided percutaneous retrogasserian glycerol rhizotomy for trigeminal neuralgia

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Objective: Percutaneous retrogasserian rhizotomy with glycerol injection under radiographicguidance has been a method for achieving analgesia in patients suffering from trigeminal neuralgia since 1981. We present a series of 7 patients in whom we used computer-assisted image-guided technology to achieve the same result.
Methods: A pre-operative computed tomogram (CT) of the base of skull with the images protocolled for use on the StealthStation Navigation System was arranged preoperatively. The AxiEM^{TM} Cranial software was used on the StealthStation. Excellent outcome was pain-free status during follow-up with or without medication. Satisfactory outcome was pain-free status with the patient retaining his preoperative medication. A recurrence was defined as recurrent pain refractory to maximum medical treatment medication.
Results: Mean follow-up was 7 months (range: 2–12 months). The results in all 7 patients were satisfactory, and four had excellent outcome. All seven patients had immediate postoperative pain relief. No complication from any other cranial nerve was observed during the present follow-up.
Conclusion: All patients had satisfactory analgesic outcomes to today's follow-up. We suggest that this system maybe used safely for the above procedure with similar outcomes to the traditional fluoroscopic method.

F5-11: Hospitalised Paediatric Head Injuries: A review of 854 children

S. Kuruvath, B. S. Jassar & G. A. Solanki (Birminham Children's Hospital, Birmingham, UK)

Objective: To Report the regional incidence of hospitalized paediatric head injury in the West Midlandsand toidentify specialties involved in primary care of head injuries. To Report the cause and outcome of significant head injury.
Methods: Retrospective analysis of hospital departmental and theatre database records of patients with a primary diagnosis of head injury (HI) (ICD-10 codes S00–S09) treated at a regional paediatric neurosurgery unit between January–December 2007. Severity of HI measured by the Glasgow Coma Scale.

Results: 854 children (570 boys), median age 4.4 years (6 days–16 years). Majority of head injuries occurred in the summer. Most head injuries are managed by other specialities, 10% neurosurgically. In the neurosurgery group HI were mainly caused by road traffic accidents (RTA) (40%), falls (34%), non-accidental injuries (NAI) (8%) and assault (7%). RTA and NAI had more severe HI. 81% of severe HI were due to RTA (57%) and falls (24%) alone. Pathology included skull fracture (35%), acute subduaral haematoma (ASDH) (24%), extradural haematoma (EDH) (18%), cerebral contusions (17%) and diffuse axonal injury (DAI) (9%) but 75% of severe HI were associated with ASDH, DAI and Contusion. Surgical intervention was needed in 60% (craniotomy and ICP bolts were commonest). In the neurosurgery group 84% had Glasgow Outcome Score of 5 and 4. Overall mortality was 0.5%, while mortality in severe HI requiring neurosurgery care was 4.4%. Mean LOS was 9.5 days. Efforts at prevention of RTAs and Nice guidelines are discussed.

Conclusion: RTA is the most common cause of head injury and accounts for 57% of severe head injury and deaths. The majority of minor paediatric head injuries are managed by other specialties. 84% of significant head injury has a good outcome.