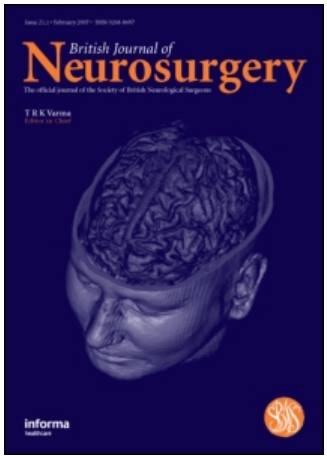

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Proceedings of the 149th SBNS meeting

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PROCEEDINGS

Proceedings of the 149th SBNS Meeting

This meeting was held on 6–8 September 2006, at the Low Wood Hotel, Lake Windermere, UK

Wednesday 6th September 2006
SESSION 1 – ONCOLOGY
Oral

1 – Oral
Selecting drug of choice in glioma chemotherapy: is *in vitro* testing the way forward?

R. V. Iyer, P. Roberts, R. W. Lea, T. P. Dawson, A. Golash & C. H. G. Davis (Lancashire Teaching Hospitals NHS Trust)

Introduction: The use of *in vitro* chemosensitivity assays to select a drug of choice has been demonstrated to improve survival in several non CNS cancers. There is overwhelming evidence to suggest that every glial tumour is unique in its response to a drug, and blanket treatment of all tumours based on cohort studies of populations may not produce the best result in an individual patient. Despite advances in molecular genetics such as demonstration of 1p/19q deletions in oligodendrogliomas, and MGMT promoter methylation in glioblastomas showing better survival, there is very little evidence to suggest that every tumour with the above genetic abnormalities will respond favourably to chemotherapy or that Temozolomide will produce a good response in every tumour.
Materials and methods: Short term primary cultures from 19 malignant gliomas (14 glioblastomas, 2 anaplastic astrocytomas, 2 anaplastic ependymomas and 1 anaplastic oligodendroglioma) were tested for an *in vitro* response to BCNU (1.0, 2.5, 10.0, 25.0 and 100 μg/ml), cisplatin (0.4, 1.0, 4.0, 10.0 and 40.0 μg/ml) and Taxol (1.36, 3.4, 13.6, 34.0 and 136.0 μg/ml), and 10 similar cultures (7 glioblastomas, 2 anaplastic astrocytomas and 1 anaplastic ependymoma) were tested for a response to Temozolomide (0.2, 0.5, 2.0, 5.0 and 20 μg/ml) *in vitro* using a sensitive luminescence-based ATP assay (Promega) to demonstrate cell death.
Results: All the 19 cultures showed at least a 50% cell death on exposure to cisplatin with a median *in vitro* concentration of 10.0 ug/ml, 14 cultures showed at least a 50% cell death on exposure to Taxol with a median *in vitro* concentration of 29.25 ug/ml and 6 cultures showed at least a 50% cell death on exposure to BCNU with a median *in vitro* concentration of 57.5 ug/ml. The remaining cultures with Taxol and BCNU showed less than 50% cell death. None of the 10 cultures tested with Temozolomide showed any significant cell death at any dose.
Conclusion: The *in vitro* response of every tumour to chemotherapeutic drugs is unique. Only 31% of the tumour cultures (6/19) responded to a commonly used drug like BCNU, while 74% of the tumour cultures (14/19) responded to an unconventional drug like Taxol, and all tumour cultures responded to cisplatin. None of the 10 tumour cultures tested showed any response to Temozolomide. This suggests caution in administering expensive and potentially harmful treatments like Gliadel wafers and Temozolomide to every patient with malignant glioma when a better response might be obtained by using an unconventional drug or drug combination shown to be effective in an *in vitro* setting.

2 – Oral
Dendritic cell vaccination following radiotherapy and concomitant Temozolomide for newly diagnosed glioblastoma

R. M. Prins, S. K. Odesa, M. Y. Yang, H. Khan-Farooqi, L. M. Alakandy, T. F. Cloughesy & L. M. Liau (David Geffen School of Medicine at UCLA, University of California Los Angeles; Los Angeles, California 90095, USA)

Background: The standard therapy for glioblastoma (GBM), which includes surgery followed by radiation therapy and concurrent chemotherapy with Temozolomide, creates a low tumour burden environment that could be ideal for immunotherapeutic approaches.
Objective: We conducted a study to assess the safety and immunologic responses of tumour lysate-pulsed dendritic cell (DC) therapy for patients with newly diagnosed GBM following radiotherapy plus concurrent and adjuvant chemotherapy with Temozolomide.

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Design: Phase I study.
Subjects: Ten patients with newly diagnosed GBM were immunised with autologous tumour lysate-pulsed DC with each patient receiving 3 vaccines at 2-week intervals.
Outcome measures: Toxicity, immune responses to tumour antigens, tumour progression, 2-year survival.
Results: Immunisations were well tolerated except for some minor side effects. Increased levels of CD8+ T cells, reactive against tumour-associated antigens (gp100, TRP-2, Her-2/neu & CMV antigens) were detected in three out of five HLA-A201+ patients. Increased T-cell infiltration into tumours was noted after DC vaccination. Median overall survival has not yet been reached in this trial. To date, two patients have died at 18 months and 34 months since initial surgery. Five of the 10 patients have not yet had evidence of tumour progression at a median follow-up period of 30.6 (10.1 to 37.8) months.
Conclusion: This study demonstrates the safety and clinical/immunologic effects of an autologous tumour lysate-pulsed DC vaccine for patients with newly diagnosed GBM. We demonstrate that this active immunotherapy strategy can generate antigen-specific immunologic responses in patients with brain tumour, following standard radio-chemotherapy.

3 – Oral
Cytokine imbalance in primary malignant brain tumours: is it secondary to steroid use? Does it occur in benign tumours?

D. J. Kamdar, R. Kumar, J. Greenman & D. O'Brien (Hull Royal Infirmary, Hull, UK)

Previously we have shown that skewing of the T-helper cell type 2 (TH-2) cytokines occurs in glioblastoma multiforme (GBM). We wanted to study the effect of benign tumours of the central nervous system (CNS) on the serum cytokine levels and what affect steroid administration has on the cytokine levels on patients with GBM.
Aim: 1. To compare the cytokine levels of patients with meningioma to non-tumoural controls. 2. To analyse the affect of steroids on serum cytokine levels of patients with GBM.
Study design: Pre-operative blood samples were collected from all patients referred to us with space occupying lesions. Serum was separated, alliquoted and frozen at -70° until histological confirmation of the diagnosis was obtained. Analysis was undertaken of a group of meningiomas (n = 26), and a smaller subgroup of patients with GBM (n = 4), who had blood samples taken prior to steroid administration as well as 24 and 48 hours after steroid administration. All samples were analysed using the Proteoplex multiarray kit and the cytokine levels were compared with levels from non-tumoural age and sex matched controls (n = 30).
Statistical analysis: Meningiomas were compared with controls using the Mann-Whitney U test for statistical significance. The analysis of the cytokine levels pre- and post-steroid was done using the Wilcoxon signed rank test.
Results: Comparing the cytokine levels of meningiomas with controls did not show any statistically significant changes. Analysis of the steroid samples also did not show any statistically significant changes between the pre- and post-steroid samples.
Conclusion: TH-2 skewing seems to occur only in GBM and not in meningiomas. Steroids do not seem to have any significant effect on the serum cytokine levels of patients with GBM. This implies that the TH-2 skewing seen in GBM is a primary effect of the tumour itself.

4 – Oral
Meningiomas causing focal neurological deficits: results of a surveillance strategy

A. Ray, H. C. Patel, G. Jackson, Q. Choudry & C. H. G. Davis (Royal Preston Hospital, Preston, UK)

Objective: Total aggressive surgical excision of complex basal, large and/or recurrent meningiomas is not without potential morbidity or mortality, and not always technically possible. Radiotherapy reduces recurrence rate, but is also not without complication. We describe our experience in managing a cohort of patients with a meningioma presenting with a focal deficit.
Design: Patients with focal neurological deficits due to a meningioma who were treated conservatively at first presentation were identified from clinical records. A retrospective review of patient records was performed. The age at presentation, tumour location, size, radiological progression, requirement for treatment and Karnofsky score at presentation and follow-up were recorded.
Subjects: Twenty-three patients with a median age of 60 yrs (range 43 – 92 yrs) were initially treated using a surveillance approach. Median follow-up was 6 years (range 1 – 12 yrs).
Outcome measures: The patients were assessed for evidence of increased growth and progression in symptoms. The Karnofsky score was monitored in clinic follow-up and compared to first presentation.
Results: Increased growth (4 patients) or symptoms (1 patient) were noted in 5 patients (21%), that resulted in patients undergoing surgery (2), radiotherapy (1) or radiosurgery (2). No significant difference in Karnofsky score (KS) was noted at follow-up (mean KS at presentation 82, mean KS at last follow-up 82).
Conclusion: The data supports the role for a conservative management approach for recurrent or radiologically proven meningiomas that are causing neurological deficits. This approach particularly benefits elderly patients that are at greater risk of morbidity from surgery and radiotherapy.

5 – Oral

CSF leak rate with and without routine use of fibrin sealant at trans-sphenoidal surgery in 283 consecutive operations

M. J. Tait, J. Bleyen, M. Murphy, S. F. A. Jaffri, N. W. Thomas & P. R. Bullock (Department of Neurosurgery)

Introduction: The role of routine reinforcement of the diaphragma sellae with fibrin sealant following trans-sphenoidal surgery is not established in the literature.

Aim and methods: A retrospective review of all trans-sphenoidal surgery undertaken by two experienced neurosurgeons between January 2001 and April 2006 was performed. In the absence of an intra-operative CSF leak one surgeon routinely used fibrin sealant, the other did not. Intra-operative leaks were managed using a combination of fat, fascia and fibrin glue or just fibrin sealant, with or without lumbar drain insertion.

Results: Two hundred and eighty three operations were performed on 264 patients (36 revision operations). An intra-operative CSF leak was noted in 44 cases (15.5%), 9 of which were revision operations (24.3%). Twenty-five postoperative leaks were identified (8.8%), 8 of which were noted intra-operatively. Of those with no intra-operative leak 98 had fibrin sealant applied and 124 did not. There were 5 post-operative leaks in the fibrin sealant group (5.1%) and 11 in the unsealed group (8.9%).

Conclusion: In the absence of an intra-operative CSF leak our series indicates that routine use of fibrin sealant results in a lower post-operative CSF leak rate. However, due to limitations of study design it is not possible to conclude that surgical factors are not also contributory.

6 – Oral

What are the major determinants of survival in surgically treated craniopharyngiomas?

M. K. Hossain-Ibrahim, J. D. Rippin, E. J. McGregor, A. A. Toogood, N. J. Gittoes & R. D. Mitchell (Queen Elizabeth Hospital, Birmingham, UK)

Objective: To review the effects of age at surgery, tumour clearance and radiotherapy (RT) on survival of craniopharyngioma patients.

Design: Retrospective review of all patients treated for craniopharyngioma since 1980 at a single centre. Subjects n = 70 (37 female); mean age 40.3 ± 20 yrs; mean follow-up 10.1 ± 6.6 yrs. Primary outcome measures 5 year survival.

Methods: Review of case-notes and electronic data.

Results: 67% patients underwent surgery alone and 34% received RT (22 surgery + RT, 2 RT alone). Overall 5 yr survival = 80%. However, if age at time of first surgery was >50 yrs, then 5 year survival = 59% (p = 0.002 for 50 yrs). 31% patients had no evidence of residual tumour on initial post-operative scan and a 5 yr survival of 100% compared to 73% if a residuum was identified (p = 0.01). 83% who received RT survived 5 yrs compared to 77% who did not. 44% of those with a post-op tumour remnant had RT with 82% 5 yr survival compared to 42% if no RT was given (p = N/S). Rate of tumour re-growth (detected on CT/MRI) was lower in those who received RT (20% compared to 43%, p = N/S). 86% of those treated with RT were panhypopituitary (defined as ACTH, TSH and gonadotrophin deficiency) vs. 63% with no RT (p = 0.08).

Conclusions: Major determinants of increased mortality for patients with craniopharyngioma were age at surgery >50 yrs and presence of residual tumour on initial post-operative scan. RT reduced rates of tumour regrowth and mortality, though not with statistical significance.

Wednesday 6th September 2006
SESSION 2 – NEUROVASCULAR
Oral and Poster

7 – Oral

Acute treatment with erythropoietin for subarachnoid haemorrhage: a randomised controlled trial

M. Y. Tseng, H. Richards, J. D. Pickard & P. J. Kirkpatrick (Addenbrooke's Hospital, University of Cambridge, UK)

Objective: In different models of cerebral injury, erythropoietin (EPO) has demonstrated neuroprotective effects. In this study, we wished to explore potential benefits from acute EPO therapy in patients following aneurysmal SAH.

Design: A randomised, double-blind, placebo-controlled trial.

Subjects: 80 SAH patients (age 24 to 82 years, ≤72 hours from ictus) were randomised to receive 3 doses of either intravenous EPO 30,000 units or 0.9% saline.

Outcome measures: Primary endpoints were the incidence and duration of cerebral vasospasm, and of impaired autoregulation. Secondary endpoints were the incidence of delayed ischaemic deficits (DID) and disability measured from the modified Rankin scale (MRS) and National Institute of Health Stroke Scale (NIHSS) on the 14th day since the first dose. Comparisons were made between the EPO and the placebo group.

Results: Both pre- and post-randomisation characteristics were balanced between the two groups, except the age (placebo vs. EPO, 53.8 ± 2.1 vs. 60.0 ± 1.9 years, t-test, p = 0.036). No treatment-related complication was observed. The incidence and duration of vasospasm were significantly reduced by EPO from 65 to 37.5% (log-rank test, p = 0.024) and from 3.8 to 1.7 days (t-test, p = 0.014),

respectively. Autoregulation impairment on the ipsilateral side was shortened from 6.6 to 3.6 days (t-test, $p < 0.001$) and DID was reduced from 40 to 7.5% (log-rank test, $p = 0.001$) by EPO. Patients treated with EPO had more favourable MRS (placebo vs. EPO, 40 vs. 67.5%, chi2 test, $p = 0.014$) and lower NIHSS (placebo vs. EPO, 11.4 vs. 5.1, t-test, $p = 0.006$).

Conclusions: Acute systemic treatment with EPO after aSAH is safe, reduces clinical complications associated with cerebral vasospasm and may improve early outcome with significant reductions in disability.

8 – Oral
Cost analysis of modern management of aneurysmal subarachnoid haemorrhage in a UK unit

S. Kuruvath, A. Salem, D. Parikh, P. Patel, M. Pfeiffer, S. Chawda, R. R. Vindlacheruvu & A. R. Aspoas (Essex Centre for Neurological Sciences, Oldchurch Hospital, Romford, Essex, UK)

Background: There is no published detailed study that has analysed the costs of aneurysmal subarachnoid haemorrhage (aSAH) in the UK.

Objectives: To investigate the direct costs of management of patients with aSAH in a neurosurgical unit (NSU).

Methods: Retrospective study of 114 consecutive cases of aSAH managed between April 2002 and 31st October 2003. The costs for the management of all patients who underwent treatment for aSAH, either by surgical clipping or endovascular coiling were studied. Detailed costing of all inpatient stays in intensive care, high dependency and ward were recorded. Costs of laboratory tests, radiological imaging, diagnostic angiograms, endovascular coiling, surgical clipping, additional surgical procedures were also noted. Costs of clinic, transport, non-neurosurgical in-patient stay (including rehabilitation) were excluded. Data was gathered from case notes, radiology and finance departments.

Results: The total cost of inpatient stay and treatment for those treated surgically (S ($n = 49$) range £2526-£44,842, median £15287) and endovascularly (E ($n = 65$) range £1263 – 37,773, median £15871). There was no significant difference in cost by modality of treatment (good grade S: £15029, E: £13684, ($p = 0.209$); poor grade S: £16216, E: £17848, ($p = 0.74$)). Cost was significantly greater for poor grade patients ($p = 0.006$). There was no significant difference in length of stay by treatment modality, but poor grade patients remained in the NSU for longer ($p = 0.003$). Analysis by favourable outcome at follow up revealed average cost per patient of £14612 for surgery, and £15628 for endovascular treatment including check angiography and re-treatment ($p = 0.57$).

Conclusion: The acute costs of care relate to patient grade. Additional endovascular costs relate to durability of treatment. Improving coil technology and availability of natural history data for recurrent aneurysms will alter management costs.

9 – Oral
Neurovascular coiling causes an acute inflammatory response and increased oxidative stress

L. Morgan, H. Montgomery, S. Humphries & N. Kitchen (The National Hospital for Neurology and Neurosurgery, Queen Square, London, UK)

Objective: To confirm that endovascular coiling causes an acute inflammatory response and to see if this is related to a quantifiable degree of oxidative stress.

Design and subjects: 10 Caucasian patients presenting with aneurysmal subarachnoid haemorrhage and who were due to be treated by coiling had pre-procedure, intra-procedure and post-procedure serum samples taken.

Outcome measures: Interleukin-6 (IL-6) levels were obtained as a measure of the inflammatory response. Total antioxidant status (TAOS) levels were obtained as an indirect measure of reactive oxygen species formation and hence oxidative stress.

Results: There was a significant increase in IL-6 levels over time ($p < 0.0001$). There was a significant difference between pre-coiling and intra-coiling levels ($p = 0.03$), intra-coiling and post coiling ($p = 0.02$) and pre coiling and post coiling ($p = 0.01$) levels. There was a trend for TAOS levels to decrease over time.

Conclusion: This is the first study to show that there is a significant inflammatory response during coiling. We have also shown that there is a trend for reactive oxygen species to increase during the coiling process and post procedure. Whether if this is related to worsening peri-procedure outcome, cerebral function or neurocognitive recovery is the subject of ongoing research.

10 – Oral
The prognostic value of serum S-100B protein in spontaneous subarachnoid haemorrhage

S. Korfias, P. Mitchell, D. E. Sakas & A. D. Mendelow (Regional Neuroscience Centre, Newcastle General Hospital, UK)

Objective: Despite the major progress in neurophysiological monitoring, there are still difficulties in the early identification and quantification of cerebral damage after a stroke. In this prospective study we correlate serum S-100B protein, a serum marker of brain injury, with initial neurological-neuroimaging severity, secondary deterioration, external ventricular

drainage (EVD: therapeutic intervention) and outcome in patients with subarachnoid haemorrhage (SAH).
Design – Subjects – Outcome measures: We recorded all pertinent clinical data of 52 patients with SAH and measured S-100B serum levels on admission and every 24 hours for a maximum of 9 consecutive days. Mann-Whitney U-test and Kruskal Wallis analysis were employed to assess the association of S-100B levels with all variables of interest. Log-rank test was used to evaluate survival and Cox's proportional hazard regression analysis to define the significant predictors of survival rate.
Results: Admission S-100B was correlated statistically with initial neurological status, neuroimaging severity, and one-year outcome ($p = 0.0002$, 0.001, and 0.017, Kruskal Wallis analysis). Admission S-100B above 0.3 μg/L predicted unfavourable outcome ($p < 0.0001$, log rank test) and constituted an independent predictor of short-term survival ($p = 0.035$ Cox's proportional hazard regression analysis) with a hazard ratio of 2.2 (95% C.I.: 1.06 – 4.6) indicating a more than doubling of death probability. Secondary neurological deterioration correlated with S-100B increase ($p < 0.0001$) and external ventricular drainage (EVD) with S-100B reduction ($p = 0.003$, Wilcoxon signed rank test).
Conclusions: Serum S-100B protein seems to be a reliable biochemical indicator of neurological – neuroimaging severity, secondary deterioration, EVD (therapeutic intervention), and outcome in patients with SAH.

11 – Poster
Establishing a new endovascular service for the treatment of aneurysmal SAH: experience of the first four months

A. Ray, M. N. Ansar, M. I. Bhatti, T. Patankar, R. Phadke, G. A. Roberts & N. T. Gurusinghe (Royal Preston Hospital, Preston, UK)

Objectives: A new endovascular service for neurosurgical patients was commenced at the hospital in January 2006. Prior to this, patients admitted to the unit with aneurysmal SAH were transferred to neighbouring centres for endovascular treatment. The aim of the study is to assess patient outcome in the first four months and describe our experience in establishing this new service. We intend to compare this cohort of patients to those preceding the commencement of the local endovascular service.
Design: Patients admitted with aneurysmal SAH were identified and a retrospective review of the case records was done. The patient outcome was recorded at discharge. Rebleeding, vasospasm and delay in treatment were classified as adverse events.
Subjects: 26 patients were treated for aneurysmal bleeding between January and April 2006. The mean age was 51 years (range 29 – 85 years). 20 patients were admitted with a good grade (WFNS Grade I-III) and 6 patients were poor grade (WFNS IV-V).
Outcome measures: Glasgow Outcome Score at discharge was used to grade patient outcome in the short term. Adverse events were documented.
Results: The unit serves a population of 1.6 million. The neurovascular service comprises two neurosurgeons and two interventional neuroradiologists. Twenty three patients were coiled, 3 had surgery. One patient rebled prior to treatment. Six patients developed vasospasm. Twenty two patients had a good outcome (GOS 4-5). Further data is being collected to monitor results for the first 6 months to compare with data from the 6 months prior to endovascular service in the unit.
Conclusion: Establishing an endovascular service has allowed for prompt treatment of patients in the unit. It reduces complications related to transfer and delay in treatment.

Thursday 7th September 2006
SESSION 3 – FUNCTIONAL AND MISCELLANEOUS
Oral

12 – Oral
A new target for tremor control – The caudal zona incerta

P. Plaha & S. S. Gill (Dept. of Neurosurgery, Frenchay Hospital, Bristol, UK)

Objective: The Vim nucleus of the thalamus is the commonly chosen target for deep brain stimulation (DBS) to alleviate tremor. However, it has poor efficacy in alleviating proximal tremor and patients may develop tolerance to the action component of tremor. Bilateral stimulation is also associated with a high incidence of dysarthria and dysequilibrium. We performed bilateral stimulation of the caudal or motor part of the zona incerta nucleus (cZI) to determine the safety and efficacy in alleviating all components of tremor affecting the axial, proximal and distal limb musculature.
Design and subjects: 5 patients with Parkinsonian tremor and 9 with a range of tremors (Holmes, cerebellar, essential, multiple sclerosis and dystonic tremor) affecting both the proximal and distal body parts underwent MRI guided, bilateral cZI DBS.
Outcome measures: Tremor was assessed by the Fahn-Tolosa-Marin tremor scale at baseline and at a mean follow up of 12 months. In the single patient with dystonic tremor, the dystonia was assessed by applying the BFMDS rating scale.
Results: Resting tremor in PD improved by 94.8% ($p = 0.006$); postural tremor by 82.2% ($p = 0.028$). Bradykinesia and rigidity improved by 62.1% ($p = 0.008$) and 77.4% ($p = 0.014$) respectively. In 4 patients with distal essential tremor, the total tremor score improved by 80.1%. In the single

patient with Holmes tremor, there was improvement in all three components of distal limb tremor with a 70.2% improvement in the tremor rating scale. In the single patient with proximal cerebellar tremor, the total tremor score improved by 60.4%. Two patients with proximal multiple sclerosis tremor showed a 68.2% improvement in the total tremor rating score. In the single patient with dystonic tremor there was improvement in both the dystonia and the tremor (BFMD movement score 65.1% improvement; disability score 61.5% and a 70.5% improvement in the tremor score). Patients required low voltages of high frequency stimulation and did not develop tolerance to it. One patient developed surgery related dysphagia, lasting for 3 months. Two patients developed transient stimulation related dysequilibrium that resolved in 8 weeks.

Conclusion: This prospective study suggests that the cZI is effective in suppressing all components of tremor affecting both the distal and proximal part of the body and could be an alternative target area to the Vim nucleus of the thalamus.

13 – Oral

A prospective analysis of visual field deficits in patients undergoing temporal lobe surgery quantifying our surgical morbidity and its impact on driving

N. U. O. Jeelani, T. L. Poon, P. Kabasele, L. Zrinzo, M. Galton, A. McEvoy, G. Plat & W. Harkness (The National Hospital for Neurology and Neurosurgery, Great Ormond Street Hospital, London, UK)

Objectives: Visual field deficits (VFD) following temporal lobe surgery have been reported in the literature. The ability to drive following surgery is reported as an important contributor to patient social rehabilitation. In this prospective study, we present our experience of visual field assessment in 90 cases of mesial temporal sclerosis undergoing resective surgery and their effect on driving.

Methods: 105 cases undergoing temporal lobe surgery for epilepsy, between March 1998 and June 2004 were selected. Of these 90 patients with a histologically confirmed diagnosis of mesial temporal sclerosis were included in this study. Pre- and post-operative visual field tests were obtained using the Humphrey Esterman binocular functional test. The test was set to stimulus white III, with a single intensity of 10 DB on the background of 31.5 ASB for all patients. The mean age of patients was 35 years (range, 19 – 60 years). A minimum follow up period of 12 months post surgery was employed.

Results: 82 patients remained seizure free (Engel 1), 2 showed an improvement in seizure frequency (Engel 2) and 6 patients some improvement (Engel 3). Sixty-three (70%) patients had completely normal or mild peripheral visual field deficits pre- and post-operatively. Their mean efficiency score was 97 both pre- and post-op. Eight (9%) patients had their efficiency score improved after partial temporal lobotomy, the improvement consisting in peripheral points. Nineteen (21%) patients had developed a VFD after they underwent temporal lobotomy. Of these patients, one had peripheral constriction; the remaining had a partial or complete quadrantanopia. Eight (9%) did not meet the UK driving licencing authority requirements.

Conclusions: A large prospective series of visual field deficits following resective surgery for mesial temporal lobe sclerosis at a single UK institution is presented and implications discussed.

14 – Oral

Percutaneous balloon compression of the trigeminal ganglion; does the duration of compression matter?

S. Ushewokunze, S. Satish & J. Singh (Department of Neurosurgery, University Hospital of North Staffordshire, Stoke on Trent, UK)

Background: Percutaneous balloon compression of the trigeminal ganglion is a well established procedure in the treatment of trigeminal neuralgia. The technique as described by Mullan[1] involved compression times of 5 to 7 minutes and was later modified to 1 minute. The optimal duration of compression to achieve the best results has not been determined.

Objective: To establish whether a compression time of 7 minutes achieved satisfactory results and whether longer rates of trigeminal ganglion compression have an adverse effect on outcome.

Method: Twenty-three patients undergoing percutaneous balloon compression for trigeminal neuralgia between 1998 and 2005 were included in the study. The duration of compression time, clinical response to treatment and any adverse effects were noted.

Results: Thirty-five procedures were carried out. This included 9 second and 3 third procedures. The compression time ranged from 7 minutes to 9 minutes. The median compression time was 7 minutes for initial procedures and 8 minutes for subsequent procedures. There was 100% immediate relief of symptoms after the first procedure. Eight patients developed a recurrence of symptoms within 12 months. Six of these patients had a 7 minute compression time. Two patients developed permanent reduced corneal sensation after compression times of 8 and 9 minutes.

Conclusion: A compression time of 7 minutes provides good symptomatic relief with the risk of early symptom recurrence. Compression times of longer than 7 minutes appear to be associated with an increased risk of adverse effects. A randomised trial comparing compression times of 1 and 7 minutes is proposed.

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15 – Oral
Use of bone-mounted fiducials and the Edinburgh retractor system frameless image-guided craniotomy without skull fixation during two-stage 'awake' craniotomy

M. Murphy, H. Sethi & R. Selway
(Kings College Hospital, Denmark Hill, London, SE5 9RS, UK)

Objective: To avoid rigid skull immobilisation while using image guidance to perform 'awake' neurosurgery.
Design: Firstly an MRI, image-guided craniotomy is performed under general anaesthetic. A bone flap is fashioned and the lesion biopsied. Bioplate screws are inserted into the skull around the craniotomy. These subsequently act as bone-mounted fiducials for a further CT image-guided scan. The two image-guided scans are fused for use during the second operation, several days later. This involves 'awake', image-guided resection of the lesion using the active spinal arc mounted on the Edinburgh retractor system. Throughout the resection the patient is permitted to move his head for comfort.
Subjects: Ten patients with eloquently-located, low grade, intrinsic brain tumours.
Outcome measures: 1. Patient tolerance of the procedure 2. Ease of use of image guidance.
Results: All 10 patients tolerated the procedure very well. Image guidance was successfully used in all cases to maximally resect the lesion.
Conclusions: Use of the bone-mounted fiducials and the Edinburgh retractor system to perform frameless image-guided craniotomy without skull fixation during two-stage 'awake' craniotomy is effective and well-tolerated. This represents a significant technical advance to the armamentarium of those performing 'awake' neurosurgery.

16 – Oral
Intra-operative brainstem auditory evoked potential monitoring (BAEP) decreases incidence of hearing impairment during microvascular decompression (MVD) for hemifacial spasm (HFS) – a single surgeon series over 22 years

D. S. Jeyaretna, K. Aquilina, A. Tarnaris, N. Kane & H. B. Coakham (Frenchay Hospital, Bristol, UK)

Objectives: (i) To determine whether intra-operative BAEP monitoring during MVD for HFS reduces the incidence of post-operative hearing impairment; (ii) To determine whether significant changes in intra-operative BAEP are consistently associated with post-operative hearing impairment.
Design: Retrospective clinical study.
Subjects: All patients undergoing MVD for HFS between September 1982 and January 2006; all procedures were performed by the senior author.
Outcome measures: (i) Post-operative hearing, evaluated clinically; (ii) Intra-operative changes in BAEP.
Results: 146 patients underwent 155 procedures; 4 patients with severe pre-operative ipsilateral hearing loss were excluded, 33 had intra-operative BAEP monitoring, 14 demonstrated post-operative hearing impairment; 2 of these were monitored. No monitored patient sustained hearing impairment over the last sixteen years of the series. Incidence of hearing impairment correlated inversely with monitoring rates ($p = 0.01$). Hearing preservation was maintained on long-term audiometry. Five patients did not demonstrate BAEP changes intra-operatively, 20 showed an increase in wave V latency to over 1 ms; 9 lost over 50% of wave V amplitude. Changes normalised in all patients on termination of the procedure.
Conclusion: Intra-operative BAEP monitoring leads to higher rates of hearing preservation. Significant changes in BAEP do not necessarily imply deterioration in post-operative hearing.

17 – Oral
Neurosurgical critical care capacity and demand

J. T. Laban, A. Gobindram, D. Peterson & M. Smith (Charing Cross Hospital, London, UK)

Objective: To compare adult neurosurgical critical care (level 3) capacity and demand in London between 2003 and 2005. This study was carried out on behalf of the London Neurocritical Care Working Group.
Design: A one-month prospective audit capturing all the emergency neurosurgical referrals made to the seven London adult neurosurgical centres in 2005 was compared to data from 2003. Patients with GCS less than or equal to 8 and/or intubated and ventilated were assumed to require level 3 care.
Outcome measures: Percentage of referrals requiring level 3 care accepted by their local unit; Reasons for failure to accept a patient and time from referral to admission; Number of level 3 bed days ''lost'' due to delayed discharge.
Results: Of the 1384 referrals recorded in 2005, 89 patients required level 3 neurosurgical care. In 2003 the figures were 71 of 1071 referrals. 70% of level 3 patients were accepted by their local unit on first

referral in 2005, compared to 55% in 2003. In 2005, 11 (12%) level 3 neurosurgical patients were not admitted to a London neurosurgical unit. In 2003, all level 3 patients were eventually admitted to a London neurosurgical unit. For patients accepted on first referral, the mean (range) time between referral and arrival in the neurosurgical unit was 3 (0.5–6) hours. For those declined admission on first referral, the mean (range) time to admission was 10.5 (9.5–13) hours. 47 level 3 bed-days were lost because of delayed discharges, compared to 52 in 2003.
Conclusions: Despite improvement, 30% of level 3 neurosurgical patients are still refused admission because of insufficient capacity. These patients suffer prolonged transfer times, and some are never admitted to a neurosurgical unit. Delayed discharges continue to contribute to the disparity between capacity and demand.

18 – Oral
Audit of teleradiological facilities in neurosurgical units in the United Kingdom

S. Pushpananthan, W. Cato-Addison, V. Petrik, M. C. Papadopoulos & B. A. Bell (St George's Hospital, University of London, UK)

Objectives: Over the past decade an increasing number of referring hospitals have transferred scans in a digitised form to neurosurgical units (NSUs) to allow specialist opinions to be given on emergency referrals. We aimed to evaluate tele-radiological facilities and the availability of imaging to consultants out of hours in all NSUs in the UK.
Design: Telephone survey of all NSUs involving a semi-structured questionnaire.
Subjects: On call SpRs at all 34 NSUs in the UK were contacted in January 2006.
Results: 30 (88%) NSUs have ImageLink from local referring hospitals in a working format and 21 (62%) use PACS servers in their own units for the management and retrieval of radiological images. Only 4 (12%) have either ImageLink in consultants' homes or facilities to dial into their own hospitals' picture archiving & communications servers (PACS) and 3 (9%) units provide mobile phones with digital cameras for single images to be photographed and sent to consultants' phones.
Conclusions: Few specialties carry risk levels as high as neurosurgery, and few are as reliant upon radiological imaging for management of emergency referrals. NSUs nationwide fall short of the recommendations of the NHS Modernisation Agency report that neurosurgery should be a consultant-led specialty with tele-radiological facilities available in consultants' homes. All NSUs should aim to implement PACS and image transfer viewing systems in consultants' homes as an urgent priority.

Reference

1 Progress in Developing Services. Appendix 10: Neuroscience Critical Care report – NHS Modernisation Agency. Department of Health; Aug 2004.

19 – Oral
Infection in neurosurgical patients: annual surveillance

J. D. Plaut, K. S. O'Neill & M. Rollin (Charing Cross Hospital, London, UK)

Objective: A surveillance of the burden of significant infection in a single neurosurgical unit.
Design: A retrospective study of patients discharged from September 2004 to September 2005 with any infection that caused significant morbidity or an impact in their inpatient stay. Cases were identified from monthly morbidity and mortality data and microbiological data obtained from computer system. All organisms were identified and further studies done to ascertain nature of organisms and their antibiotic sensitivities.
Subjects: 31 patients identified from 1102 admissions over period monitored.
Outcome measures: Infection that caused significant impact on inpatient stay and thus recorded in the monthly morbidity data.
Results: 48 infections identified in 31 patients. Sputum was the most frequent site of infection, MRSA the most frequently occurring organism. Mean time to infection was 8.1 days from admission. Length of stay was increased to an average of 30 days compared to overall average of 3.1 days (elective) and 16.8 days (emergency). 50% of patients identified occurred in those with an ITU stay.
Conclusions: Only 0.03% of all admissions had significant infection impacting on inpatient stay. Those with infections had significantly higher than average length of stay.

Thursday 7th September 2006
SESSION 4 – SPINE 1
Oral and Poster

20 – Oral
The treatment of lumbar spinal stenosis. Four year results with the X STOP

J. Timothy[1], A. Brusch[1], M. Hannibal[2] & J. Zuchermann[2] ([1]Leeds General Infirmary, and [2]St Mary's Hospital, Almeda, San Francisco, California, USA)

Introduction: The X STOP is the first Interspinous Process Decompression (IPD) device that is proven to be superior to non-operative therapy in patients with neurogenic intermittent claudication secondary to lumbar spinal stenosis (LSS) in a multicentre

randomised study at 1 and 2 years. The clinical success rate in the X STOP IPD group was comparable to that reported for laminectomy. The goal of the current study was to compare the clinical effectiveness and direct hospital costs of IPD with the X STOP implant to those of laminectomy in patients with LSS.

Methods: Thirty patients with LSS treated surgically were matched for age and length of follow-up. Eighteen of 30 patients had X STOP implantation and twelve of 30 had laminectomy. The pre- and post-operative Oswestry scores and hospital charges for the two groups were compared. An absolute improvement of 15 ODI points was selected to define an individual patient success.

Results: Twelve of 18 X STOP patients (67%) were treated at one level and six of 18 (33%) at two levels. Three of 12 laminectomy patients (25%) were treated at one level and nine of 12 (75%) at two levels. The average age was 68 years (SD 12.5) for X STOP patients and 69 years (SD 7.9) for laminectomy patients. Six of the 18 X STOP patients (33%) had grade I degenerative spondylolysthesis at the treated level versus two of 12 patients (17%) in the laminectomy group. The minimum follow-up was 45 months in the X STOP group and 43 months in the laminectomy group. The average follow-up was 51 months in the X STOP group (SD 5.3) and 52 months in the laminectomy group (SD 5.3). Pre-operative average ODI score in the X STOP group was 45 vs. 36 in the laminectomy group ($p > 0.1560$). Post-operative average ODI score in the X STOP group was 15 and 24 in the laminectomy group ($p > 0.1159$). The absolute ODI change was 29 points for the X STOP group, and 12 points for the laminectomy group ($p < 0.0186$). The relative ODI change was 64% for the X STOP group, and 29% for the laminectomy group ($p < 0.0369$). Based on the selected success criterion (ODI improvement of at least 15 points), 14 of 18 (78%) X STOP procedures were considered successful and four of 12 (33%) laminectomy procedures were deemed successful ($p < 0.0243$). Average direct hospital costs for 1 level X STOP and 1 level laminectomy group were \$15,980 and \$45,302 respectively ($p < 0.0001$). Average hospital costs for 2 level X STOP and 2 level laminectomy groups were \$25,618 and \$46,752 respectively ($p < 0.0010$). The main savings in the X STOP group (cost drivers) were in OR costs (shorter operative time), hospital charges (X STOP is an outpatient procedure) and anaesthesia charges (X STOP is placed under local/MAC anaesthesia).

Discussion: The present study demonstrated that X STOP IPD is clinically at least as effective as laminectomy at 4 year follow-up based on the ODI scores. The subset of patients with degenerative instability (6 of 18) had equally good results with X STOP treatment and avoided fusion. The somewhat lower scores in the laminectomy group at 4 years could be due to the limited sample size and known deterioration of the success of surgical decompression with time. IPD with the X STOP implant was associated with significantly smaller direct hospital costs compared to laminectomy for the surgical treatment of lumbar spinal stenosis. A single level X STOP IPD is about \$29,000 less expensive than a single level laminectomy, and a double level X STOP IPD is about \$21,000 less expensive than double level laminectomy.

Summary: IPD with X STOP device for the treatment of LSS is clinically at least as effective as standard laminectomy at 4 years post-operatively and provides substantial direct cost savings compared to decompressive surgery.

21 – Poster
Clinical outcome of indirect decompression with interspinous process distractor (X STOP) for lumbar spinal stenosis: a prospective cohort

A. K. Bhadra, A. S. Raman, S. Tucker, A. T. H. Casey & H. H. Noordeen (Royal National Orthopaedic Hospital, Stanmore, London, UK)

Objective: To assess clinical outcome and efficacy of the X STOPTM interspinous implant.

Study design: Prospective cohort.

Subjects and outcome measures: Thirty patients (17 male, 13 female) with mean age of 61.5 years (range 52–94 years) and radiologically proven lumbar stenosis, underwent X STOP implantation during the period of June 2004 to June 2005. Patients were assessed pre-operatively and post-operatively at 3, 6 and 12 months using the Back and Sciatica Questionnaire, the Oswestry Disability Index (ODI) and the SF12 questionnaire. Patient's satisfaction was assessed in each visit. Follow-up was up to 2 years (minimum 12 months).

Results: 62 levels of implantation – 10 three levels, 12 two levels and 8 had single level. Average operative time for multi-level procedure was 50 minutes, blood loss – minimal, and hospital stay – 2 days. 68% had significant improvement in the walking distance following the operation. With the Back and Sciatica Questionnaire the average pre-operative VAS of back and leg pain was 6.7 and 6.8 and improved to 2.7 and 2.8 postoperatively. 90% patient had improvement in their ODI score by 12% and more with average pre- and post-operative score 42% (range 10%–82%) and 16.4% (range 0%–58%) respectively. With the SF12 questionnaire 70% of patients had significant improvement in physical score (mean pre-operative- 11.31, post-operative- 16.04) and 80% in the mental score (mean pre-operative- 16.54, post-operative- 22.76). Consumption of nonsteroidal anti-inflammatory drugs and morphine derivatives had significantly decreased. At follow up 55% stopped taking any analgesic and another 35% took occasionally and

10% regularly. 82% were very satisfied or satisfied with the operation. Complication-Two superficial wound infections, settled with oral antibiotic. One case required revision surgery.
Conclusion: This new surgical technique for the treatment of lumbar spinal stenosis, is simple and effective with minimum complications. Although short term result is encouraging, longer follow up in a bigger cohort is needed.

22 – Poster
X STOP interspinous device – is success sustained?

K. S. Manjunath Prasad & F. P. Nath (James Cook University Hospital, Middlesbrough, UK)

Objective: To report our clinical experience and the outcome patterns with the use of the X STOP device in lumbar canal stenosis (LCS).
Design: Retrospective, observational.
Subjects: Over a 28 month period, 22 patients had an X STOP insertion with a clinical and radiological diagnosis of LCS. The mean age was 71 years (M:F::12:10).
Outcome measures: Success was evaluated using the Swiss Spinal Stenosis Questionnaire (SSSQ) as a whole and also according to its component domains. Operative time per level, hospital stay and complications were also assessed.
Results: The commonest level involved was L4-5 and the 12 mm implant was used most often (Range 8 – 16 mm). 17 patients had one level while it was at two levels in four and three levels in one patient. The mean operative time per level was 33 minutes and the average hospital stay was 3.3 days. One superficial infection was encountered. Using the SSSQ the overall success rate was 86%. In the component domains, the success rates were 91% each for Symptom Severity and Patient Satisfaction while it was 96% for Physical Function. No reversal of success has so far been observed in a mean follow up of 10.2 months (Range 1 – 26 months).
Conclusions: The success rates with the X STOP device compares very favourably with the published figures (64% good results) for lumbar decompression. No reversal of success has so far been seen.

23 – Poster
Indirect foraminal decompression: X STOP for lumbar radiculopathy secondary to foraminal stenosis

C. E. Gilkes, J. C. Hobart & T. Germon (Derriford Hospital, Plymouth, UK)

Objective: The X STOP interspinous process distraction system has been used to successfully treat neurogenic claudication secondary to lumbar canal stenosis. It has been shown to increase the cross sectional area of the intervertebral foramen and theoretically it provides indirect decompression of the exiting nerve root. We examined the efficacy of the X STOP in alleviating the symptoms of nerve root compression secondary to foraminal stenosis.
Design: A prospective study of patients under a single neurosurgeon undergoing X STOP implantation for lumbar radiculopathy secondary to foraminal stenosis.
Subjects: 14 patients with a clinical picture of lumbar radiculopathy and MRI evidence of foraminal stenosis with appropriate nerve root compression. In cases of diagnostic doubt a dorsal root ganglion block was performed.
Outcome measures: ODI (Oswestry Disability Index), SF-36BP (Short Form 36 bodily pain scale) and qualitative patient reports.
Results: The X STOP could not be inserted in one patient due to fusion of posterior elements and inability to distract the L5/S1 disc space. 12 of the remaining 13 patients reported a significant improvement in their symptoms. Pre- and post-operative rating scales data was available for 11 patients with up to 18 months follow up. The mean change scores were: ODI = 9.7; $p = 0.021$, (Wilcoxon signed ranks); SF-36BP = 38.9; $p = 0.017$. The effect sizes (mean change/sd change) for both scales were large: ODI = 0.91; SF-36BP = 1.14 indicating the clinical significance of improvement (criteria ES > 0.80).
Conclusions: X STOP is a safe, effective, less invasive procedure for patients with radiculopathy secondary to foraminal stenosis. The effect size is very large implying great clinical benefit. P-values imply less clinical significance but this may be related to small sample size.

24 – Oral
Determination of lateral mass screw trajectory using spinous processes in posterior subaxial cervical fixation

A. D. Horsch, M. Pluderi & J. Timothy (Leeds General Infirmary, UK)

Objective: To describe and evaluate a technique using the spinous processes to determine lateral mass screw trajectory in posterior subaxial cervical fixation.
Design: Prospective evaluation of patients treated with a new technique which employs lateral masses and spinous processes as intraoperative landmarks to determine insertion point and screw trajectory. No intraoperative X-ray was used after the first five cases not included in this study.
Subjects: In 13 patients treated with in total 66 lateral mass screws for posterior cervical fixation, trajectories were determined by this new technique and any complications were noted. The mean age was 59 years with a range of 21 to 88 years and male: female ratio was 1:1. Diagnosis was fracture dislocation in 3 cases, metastases in 3 cases, rheumatoid

arthritis in 2 cases, degenerative changes in 3 cases and tuberculosis and congenital abnormality both in one case. Most patients had an occipito-cervical decompression with posterior fusion performed. The number of screws per level was 18 in C3, 22 in C4, 16 in C5 and 10 in C6.

Outcome measures: Trajectories were evaluated intraoperatively and post-operatively by X-ray. Clinical evaluation for peri-operative complications and any further complication was noted.

Results: No complications were encountered. Especially no vertebral artery penetration, no fracture of the lateral mass, no nerve root injury, no screw breakage, no screw pull out nor broken hardware was observed. None of the patients needed a second procedure to remove or replace a screw and no facet joint violation was shown. Fusion and stability were excellent.

Conclusions: Insertion of lateral mass screw trajectory with guidance of the spinous processes and without X-ray, is a valuable, quick and safe technique without any complications in our series.

25 – Oral

Referral letters for low back pain and sciatica: content, quality and outcome

P. A. Bodkin, J. Tun & P. J. Kane (Dept of Neurosurgery, James Cook University Hospital, Middlesbrough, UK)

Objective: Low back pain (LBP) and sciatica make up a large proportion of referrals to neurosurgical outpatients. With the advent of 'Choose and Book' GPs have greater input in the appointment booking process. It therefore seems timely to identify shortcomings in referral letters so that remedial steps may be made to maximise the efficiency of the referral pathway.

Methods: One hundred consecutive referral letters for LBP $\pm$ sciatica were collected (excluding those already known to spinal surgeons). A list of details that might be useful in a referral letter was produced. This list was distributed among the five consultant neurosurgeons at this unit. They scored each detail from -1 (unhelpful) to 3 (essential). An average for each detail was used to mark the referral letters. The outcome of the referral was also followed up.

Results: Letters ($n = 100$) were received from 51 practices (53m:47f). Back pain without radiculopathy was reported in a minority ($n = 20$). The average total score was 37.8% (range 21.0 – 72.5%). Demographic data was complete in 98. Previous medical history was included in 48, drug history in 61, effect on mobility 22, activites of daily living 12. Side of sciatica was unclear in 6. The spine was examined in 26, reflexes in 20, straight leg raise in 17. Red flag signs were mentioned in 18, 63 had MRI scans, 38 case notes were followed up, 5(13.2%) had or were listed for surgery, 8(21.1%) were awaiting investigations, 21(55.3%) had been discharged, 4(10.5%) did not attend.

Conclusions: There is considerable discrepancy between the points neurosurgeons feel are important in a referral letter and those that are actually provided. We suggest a back pain template would be a useful addition to 'Choose and Book'.

26 – Oral

Assessment of cervical spine central motor conduction times in the normal population

M. Sitaraman, A. Golash, G. Lekwuwa, A. Ray & M. N. Ansar (Royal Preston Hospital, Preston, UK)

Objective: Central motor conduction time (CMCT) is the time taken for a nerve impulse to travel from the brain to a segment of the spinal cord. The aim of the study was to measure the CMCT in a wide cross-section of healthy volunteers to establish a range of normal values relevant to the local population.

Design: CMCT can be measured using transcranial magnetic stimulation (TMS). The magnetic coil in this device generates a pulse which enables deep nerves to be stimulated. Used in combination with peripheral electrical stimulation, the CMCT to target muscle can be ascertained. Values were obtained from healthy volunteers in different age groups to define a range of normative CMCTs.

Subjects: Total of 21 healthy volunteers were studied in 3 different age groups A, B and C (Grp A >60 yrs $n = 4$; Grp B 40 – 60 yrs, $n = 6$; Grp C 20 – 40 yrs, $n = 11$). Out of 21 subjects, 12 were male and 9 were female. Patients with known contra-indication to TMS were excluded.

Outcome measures: CMCT was measured in milli-seconds (latency). Various measures like age, sex, height and weight were used to define groups for which CMCT values were established.

Results: The average CMCT for Grp A was 8.5, Grp B was 8.6 and Grp C was 8. CMCT was independent of age, height, weight or sex.

Conclusion: It has been postulated that CMCT can be used as a prognostic indicator in cervical myelopathy patients. As the first part of our study, healthy volunteers had the CMCT level measured to define normative data; future work will aim at assessing whether CMCT values can be used as a prognostic indicator in cervical myelopathy.

27 – Oral

Neurosurgery for metastatic cord compression – is it worth it?

N. Dawe & J. Nissen (Newcastle General Hospital, Newcastle, UK)

Introduction: Spinal cord compression (SCC) develops in 10 – 20% of patients with spinal

metastases. A recent prospective randomised study by Patchell *et al.*, in a highly selective group of patients with MSCC, has shown direct decompressive surgery plus post-operative radiotherapy to be superior to radiotherapy alone.

Objective: To investigate presentation, management and outcomes of 35 unselected contiguous patients with SCC outwith the setting of a randomised trial.

Subjects: 35 patients presented to the neurosurgical unit with symptomatic SCC and were operated on by one surgeon, from September 2001 to end August 2004. All patients were referred for consideration of adjuvant treatment.

Outcome measures: Pre- and post-treatment ambulatory status, sphincter function. Post-operative survival.

Results: 35 patients, aged 62.9 ± 11 years (mean $\pm$ SD), ranging 37 to 88 years, had 42 procedures. Primary malignancies were mainly lung (20%), breast (20%), non-Hodgkin's lymphoma (17.3%), and renal (14.3%). 51.4% had no known history of malignancy prior to neurosurgical admission.

Distribution: Thoracic 68%, lumbosacral 19%, cervical 12%. 42 procedures were performed (12 decompressions, 23 decompression and instrumentation, 7 biopsy) Pre-treatment, 33% were ambulatory, 48% had sphincter dysfunction. Post-treatment, 73% were ambulatory, 20% had sphincter dysfunction. Median survival was 12 months. Of those with <6 months post-operative survival, fewer were ambulatory both at presentation ($n=4$, 25%), and post-operatively ($n=8$, 50%), than among those surviving $=6$ months, respectively ($n=9$, 37.5%) and ($n=21$, 87.5%).

Conclusion: In an unselected group of patients, neurosurgical management has an important role to play in improving ambulatory status and sphincter function.

Reference

1 Patchell RA, Tibbs PA, Regine WF, Payne R, Saris S, Kryscio RJ, Mohiuddin M, Young B. Direct decompressive surgical resection in the treatment of spinal cord compression caused by metastatic cancer: a randomised trial. *Lancet* 2005; 366(9486):643–8.

28 – Oral
Are patients deteriorating while waiting for spinal surgery?

Y. Z. Al-Tamimi, H. Seeley & R. Laing (Academic Neurosurgery Unit)

Objectives: To establish whether patients' symptoms and health status deteriorate whilst waiting for spinal surgery.

Design: Prospective cohort study in patients with spinal neurosurgical disorders offered surgery but placed on the waiting list because of capacity constraints. Patients completed a set of outcome measures when placed on the waiting list and again when they were admitted for surgery and three months after surgery. Outcome scores were analysed with the SPSS package and for SF36 compared to age matched, normative data. Statistical significance was evaluated using Wilcoxon's matched pairs signed ranks.

Subjects: 65 patients (35 men, 30 women). Mean age 57, inter-quartile range 47–69 years. Pathologies were grouped into cervical myelopathy ($n=30$), lumbar stenosis ($n=11$), lumbar and cervical radiculopathy ($n=13$) and other complex spinal pathologies ($n=11$).

Outcome measures: SF36, Roland back pain score, neck disability index and visual analogue back and leg pain scores.

Results: Mean waiting time for the whole cohort was 207 days (inter quartile range 98–298 days and range 763 days). No patients deteriorated significantly whilst waiting for surgery. Waiting time for myelopathy patients was 210 days (98–303 days, 470 days) whilst that for radiculopathy and lumbar stenosis patients was 199 days (103–282 days, 402 days) and 197 days (55–309 days, 434 days) respectively. Patients with cervical myelopathy showed significant improvements in SF36 general health scores. Other significant changes include improvement in visual analogue scores for limb pain in the radiculopathy patients but there were no changes in the general health or condition specific measures of outcome. Post operative results in all groups showed significant improvements in most measures.

Conclusions: Once the decision to operate on a patient with spinal cord or root compression has been made surgical treatment should be offered without delay. Capacity constraints make this ideal hard to achieve. Our study provides some reassurance that patients with cervical myelopathy and lumbar canal stenosis do not deteriorate whilst waiting. Many of the patients with radicular symptoms due to disc prolapse improve their limb pain scores but remain with significant disability.

29 – Oral
Do systemic diseases affect outcome of surgery in cervical myelopathy?

R. Ramaswamy, I. Ughratdar, S. Panikar & C. H. Davis (Royal Preston Hospital, Preston, UK)

Objective: To assess if systemic diseases causing vasculopathy affect the outcome of surgery in cervical myelopathy.

Design: Retrospective study.

Subjects: Patients undergoing cervical laminectomy for myelopathy.

Outcome measures: Outcome analysed using 'Modified Japanese Orthopaedic Association score'.

Results and conclusions: Part of an ongoing project looking to analyse 100 patients. Present data avilable from 20 patients indicate that only 50% of patients who are smokers or have systemic diseases lsuch as diabetes mellitus (DM), hypertension, hypercholesterolaemia can expect any benefit from surgery for cervical myelopathy. Of the analysed factors, systemic illness like DM/hypertension/raised cholesterol seem to be more important than smoking, in affecting the final outcome.

30 – Oral
Prospective study of outcomes in primary lumbar microdiscectomy

M. R. Guilfoyle, D. Ganesan, H. Seeley & R. J. Laing (Department of Neurosurgery, University of Cambridge, UK)

Objectives: To establish the outcome of primary lumbar microdiscectomy.
Design: Prospective cohort of patients with lumbar disc prolapse. Objective data collected pre-operatively, at 3 months, and at late follow up at 12–60 months (median 24 months).
Subjects: 101 patients, 53% male, mean age 49 years.
Outcome measures: Visual analogue scales (VAS) for pain, parasthesiae, and numbness; Roland-Morris Disability Scale; Hospital Anxiety and Depression (HAD) scale; SF-36 Questionnaire.
Results: Mean VAS and disability scores were significantly reduced at early and late follow-up ($p < 0.01$). Back and leg pain improved in 80% and 83% of patients by 3 months, and in 86% and 87% by late follow-up. Back and leg pain were abolished in 37% and 44%. Pre-operatively 41% of patients were classed with poor functional status on Roland-Morris scores, falling to 5% at the end of the study ($p < 0.01$).

Mean scores in all domains of SF-36 were better at 3 months and continued to improve to late follow-up in six domains ($p < 0.01$). Pre-operatively 67% of patients had SF-36 physical summary scores below the reference range for age-matched controls, decreasing to 14% at late follow-up ($p < 0.01$).

The intensity of initial parasthesiae correlated with residual pain and disability after surgery ($p < 0.01$). Patients with poor disability and SF-36 physical scores at late follow-up had higher HAD score and lower SF-36 mental summary scores prior to surgery ($p < 0.01$).
Conclusions: Microdiscectomy is effective in the majority of patients and reductions in disease-specific symptoms are accompanied by improved generic health status. The intensity of parasthesiae is predictive of symptomatic and functional outcome. The minority of patients gaining only modest benefits from surgery are distinguished by greater psychosocial morbidity.

Thursday 7th September 2006
SESSION 5 – Spine 2 and Miscellaneous Posters

31 – Oral
Cauda equina syndrome: The timing of surgery does influence outcome

N. V. Todd (Newcastle General Hospital, Newcastle, UK)

Over 100 publications consider outcome following cauda equina compression; six are suitable for meta-analysis. These are studies where there is an internal comparison between early or delayed treatment (which eliminates institutional bias) and which are balanced, large and relatively recent (the results can be more easily generalised to current practice). A total of 142 patients were reported of which the vast majority had neurogenic retention of urine (CESR). The papers classified the timing of surgery into <24 hours cf >24 hours and <48 hours cf >48 hours after the onset of CESR. The outcome measure of this meta-analysis was recovery of socially normal bladder function. Forty-seven patients were decompressed <24 hours after the onset of CESR, 46 were decompressed beyond 24 hours. In the <24 hour group 41 recovered socially normal bladder function, 6 did not. In the >24 hour group 20 recovered 26 did not [Pearson's Chi square $= 19.721$ on 1 df: $p = 0.000$ (1 tailed); adjusted (using Yates' correction) $= 17.830$ on 1 df: $p = 0.000$ (1 tailed); Fisher's Exact Test: $p = 0.000$ (1 tailed)]. Sixteen patients were decompressed <48 hours, 33 were decompressed >48 hours after the onset of CESR. In the <48 hour group 10 recovered socially normal bladder function, 6 did not. In the >48 hour group 20 recovered, 13 did not [Pearson's Chi square $= 0.016$ on 1 df: $p = 0.449$ (1 tailed); adjusted (using Yates' correction) $= 0.000$ on 1 df: $p = 0.500$ (1 tailed); Fisher's Exact Test: $p = 0.576$ (1 tailed)]. Following CESR there appears to be overwhelming statistical evidence that decompression should take place within 24 hours. The creation of cut-off times (time intervals) is a mechanistic device which facilitates statistical analysis. If it is accepted that there is time-dependent effect then this probably represents a continuum of progressive benefit/disbenefit and the earliest point at which decompression could be achieved is preferable.

32 – Oral
Adult haematogenous MRSA spondylodiscitis

S. S. Al-Nammari, J. D. Lucas & K. S. Lam (St Thomas' Hospital, London, UK)

MRSA spondylodiscitis is an increasingly common phenomenon. Little is known about its aetiology, presentation and outcome. Our objective was to determine relevant demographics, clinical presentations and outcomes of this condition. We performed a retrospective review of patients presenting between

2000 to 2005. Thirteen cases were identified. The mean age was 65 years (range 36–92), 85% were male. All cases presented with back pain, spinal tenderness and systemic upset. Neurological deficit was present in 39% and a further 8% developed neurological deterioration during treatment. The thoracic spine (53%) was most commonly affected followed by the lumbar (33%), thoracolumbar junction (7%) and cervical spine (8%); 16% of cases were multilevel. The white cell count, ESR and CRP were elevated in all cases with means of $17.3 \times 10-9$/L, 102 mm/hr and 236 mg/L respectively. In satisfactorily treated cases, the white cell count, ESR and CRP normalised at a mean of 10 weeks, 14 weeks and 19 weeks respectively. Radiological diagnosis was established with MRI in all cases. The most common risk factors were diabetes mellitus (62%), malnourishment (54%), cirrhosis (31%), end stage renal failure (15%) and intravenous drug use (15%). Multiple risk factors were present in 76% of cases and 15% had no identifiable risk factors. The main sources of sepsis were intravenous catheters (23%), urinary tract (15%) and intravenous drug use (15%). Treatment consisted of intravenous vancomycin monotherapy for a mean period of four weeks followed by oral combination or monotherapy antimicrobials for a mean period of 8 weeks. Operative intervention was required in 38% of cases. At six months 54% of cases were clinically free of infection, 38% had died and 8% required ongoing treatment. Neurological deficit was present in 38% of survivors. This is a devastating condition. Clinical suspicion should remain high. Prompt diagnosis and treatment is essential.

33 – Oral
Percutaneous vertebroplasty – the early Hull experience

C. J. Rajaraman, D. O'Brien, D. Taylor, E. Middleton & S. Doherty (Hull Royal Infirmary)

Introduction: The National Institute for Clinical Excellence (NICE) recently recognised percutaneous vertebroplasty to be efficacious in the treatment of pain associated with vertebral compression fractures of osteoporotic, metastatic or myeloma aetiology and in haemangiomas. It appears safe with a low complication rate.
Aim: To review our recent experience with percutaneous vertebroplasty.
Method: Patient selection was through a monthly vertebroplasty multi-disciplinary team (MDT) meeting and strict inclusion criteria and investigations. The procedure was done in prone position under light sedation and local anaesthesia. Using an eighteen gauge needle a unilateral approach via the pedicle is done under fluoroscopic guidance and antibiotic cover. A few millilitres of Cortoss cement was instilled into the vertebral bodies. Patient then remains in bed for a few hours. Changes in pain and mobility were assessed using Oswestry Disability Index (ODI) pre-procedure and six months post-procedure.
Results: Twenty patients were treated in a period of nine months. Twelve had osteoporotic fractures, three had tumours (two metastasis and one plasmacytoma), four had trauma and one had haemangioma. Seventeen had single level, one had two levels and two had two levels treated in the same sitting. Of the data available (eight patients) to date, excellent relief of symptoms was seen in one, good relief in five, no improvement in one and the last had a complication of cement tracking into the nerve root foramen requiring surgical decompression. Data on the remaining twelve patients is being obtained.
Conclusion: Percutaneous vertebroplasty is a recognised effective treatment option with a low complication rate.

34 – Poster
Experience of revision craniotomy for debulking of high grade gliomas in 27 patients in a single UK centre, with and without insertion of carmustine wafers

M. J. Tait & G. R. Critchley (Hurstwood Park, West Sussex, UK)

Introduction: Surgical resection then radiotherapy has remained the mainstay of the management of high grade gliomas for 30 years. Recently there has been renewed interest in revision surgery as well as the development of implantable chemotherapeutic agents. We report four years experience with 27 consecutive cases with a minimum 6 months follow up.
Methods: All patients with radically treated high grade gliomas were followed up in a multidisciplinary clinic following their initial surgery and radiotherapy. On recurrence an immediate treatment plan including surgery and carmustine wafer implantation if appropriate was decided by the Consultant Surgeon and Consultant Oncologist. Outcome data were collected prospectively including Karnofsky scores, survival and complications.
Results: 27 patients underwent revision surgery. Nine had carmustine wafers inserted. The pre-operative mean KS for patients with carmustine was 86.7 and the mean age was 45.5y compared with 72.6 and 49.4y for those without. Overall, the mean Karnofsky score (KS) improved from 75.9 (pre-operatively) to 82.5 (post-operatively) with revision surgery. For those who underwent carmustine wafer insertion, the post operative KS showed a slight drop (pre-op 86.7 and post-op 85.5).
Survival: Mean survival post initial surgery was 885.5 days. Mean survival post revision surgery was 413 days. Mean survival post revision surgery was 442.3 days for those with carmustine and 383.6 for those without.

Complications: Patients with carmustine – 1 intracerebral abscess, 3 CSF leaks, 2 subgaleal CSF collections, 2 wound infections, 1 new epilepsy, 1 chemical meningitis and 1 stercoral perforation, 1 DVT. Patients without carmustine – 1 subgaleal CSF collection and 1 meningitis.
Conclusions: Mean length of survival following both initial and revision surgery was longer than usually expected for patients with high grade gliomas. The patients who underwent implantation of carmustine wafers had more peri-operative complications and less benefit in terms of KS with revision surgery. Survival times were better in the patients who had carmustine, although this may be due a higher pre-op KS and a younger patient group.

35 – Poster
Skull base meningiomas – outcomes over the last 11 years

D. S. Jeyaretna, L. A. Lee, E. F. Shenouda & H. B. Coakham (Frenchay Hospital)

Objective: To review the outcomes of the surgical management of skull base meningiomas operated upon by a single neurosurgeon.
Design: Retrospective study of patients operated on between 1995 and 2006.
Subjects: Sixty-eight patients with skull base meningiomas treated surgically.
Outcome measures: Duration of hospital stay, post-operative complications, extent of resection (Simpson Grade) and Glasgow Outcome Score (GOS).
Results: The commonest location for skull base meningiomas was the cerebello-pontine angle (22%). The average age at presentation was 56 (Range 21–81) with a female to male ratio of 2:1. The average inpatient stay was ten days. The average follow period was 42 months (Range 2–122 months). Thirteen (19.1%) patients had a Simpson Grade 1, 20 (29.4%) a Simpson Grade 2, eight (11.8%) a Simpson Grade 3 and 27 (39.7%) a Simpson Grade 4 resection. The recurrence rate was 23.5% (16 patients) with more than half requiring further treatment. Ten of the 16 patients had a Simpson Grade 4 resection. Twelve patients underwent post-operative gamma knife radiosurgery, three of them had cavernous sinus involvement and two had carotid artery involvement. Four patients developed a post-operative CSF leak. At the last follow up, forty-eight patients (70.6%) had a GOS of 1 and eighteen (26.5%) had a GOS of 2. There were no perioperative mortalities. Results of the current telephone follow up will be presented.
Conclusions: The surgical treatment of skull base meningiomas remains a challenge. With the refinement of microsurgical techniques, low morbidity and mortality can be achieved. There is a growing role for the gamma knife in the management of residual/recurrent tumour so as to avoid the unnecessarily high morbidity attended with more aggressive resections.

36 – Poster
Patient satisfaction with video outpatient clinics in neurosurgery

A. Ahmad, A. Ray, R. Abeygunaratne & A. Golash (Royal Preston Hospital, Preston, UK)

Objective: To assess patient satisfaction with video outpatient clinics in neurosurgery.
Design: Three video-clinics were conducted in the neurosurgery outpatient department. A room was set up with video-consultation facilities where a registrar reviewed and examined the patient. The consultant observed the proceedings from a separate room via the video link and independently documented his clinical findings. Radiological investigations were relayed over the video and management plans were discussed with the consultant. After the consultation, patients were requested to fill out questionnaires regarding their level of satisfaction with the clinic format.
Subjects: 33 patients were seen in the video clinics. 27 were new patients and 6 were follow-ups. The age distribution was 20–83 years, with a mean of 58 years. There were 14 male and 19 female patients. Twenty-two patients presented with spinal-related complaints while 11 had intracranial symptoms.
Outcome measures: Patient satisfaction was assessed on the basis of the responses to the questionnaire. The study also compared the clinical findings from the patient examination done in person by the registrar to that done over the video-link by the consultant.
Results: Twenty patients considered the quality of the video link excellent, 9 reported it as good and 2 satisfactory. The quality of the consultation was deemed good by 24 patients and satisfactory by 7. 90% were happy to be seen again in video clinics. Comparison of findings by the two medical examiners showed no significant difference. Only mild discrepancies were noted in recording SLR and tendon reflexes.
Conclusion: Most patients appreciated video clinics and were satisfied with the process. Clinical findings were reproducible using the video link. Widespread implementation would save time and entail less travelling for both patients and neurosurgical staff.

37 – Poster
Metastases from unknown primary tumour

J. C. D. Leach, A. Patel, A. Demetriades, O. Ansorge & S. Bojanic (Radcliffe Infirmary, Oxford, UK)

Objective: To assess the prognosis of patients who undergo intracranial surgery for metastases from

unknown primary tumours. Emphasis is placed on correlation of immunohistopathology with final diagnosis, adjuvant therapy and survival data.
Design: Retrospective review over 4 years at a single institution. Patients were identified by pathology reports and case notes reviewed. Further information was obtained from GP and Oncology services.
Results: 40 patients underwent surgery for brain metastasis from unknown primary: M:F = 2.4:1; presenting symptoms were from focal neurology (59%), raised ICP (41%) or seizures (19%); 6 patients had multiple tumours; tumours were predominantly supratentorial (66%) and frontal (45%); CT Chest, abdomen or pelvis was performed in 1/3 but was rarely helpful; 75% patients underwent craniotomy rather than biopsy; lung primary was often suggested by immunohistochemistry (50%) and proved the most common primary tumour where one was found. 1 yr survival was 35% with 15% of patients surviving for longer than 24 months.
Conclusion: Implications for pre-operative work-up are discussed. Our data aid counselling prior to surgery and provide useful information for patients during the period of uncertainty following the diagnosis of brain metastasis from unknown primary tumour.

38 – Poster
Age and sex distribution of primary malignant gliomas – a 8 year single centre study

R. S. Abeygunaratne, V. Iyer, A. Ray, A. Ahmad & C. Davis (Royal Preston Hospital)

Introduction: Primary malignant brain tumours are a significant cause of morbidity and mortality in Great Britain. Accurate epidemiological information is essential for complete understanding of this disease process and this is of benefit in the management of the patient as well as planning the development of neurological service.
Materials and methods: Retrospective data was obtained from patients undergoing surgery for primary malignant brain tumours from the glioma database over an 8-year period, in one unit. The data was categorised on the basis of age, sex and tumour type. This data was analysed with statistical software to look at patterns of distribution.
Results: There were 723 patients over the age of 15 (m-448, f-275, m:f 1.6:1) with histologically confirmed primary malignant brain tumours from Jan 94 to Oct 04. Mean and median age for both sexes was 57 and 59 respectively. Highest percentage incidence was for glioblastomas (62%); this followed a normal distribution curve in both males and females. However, this curve was shifted to the right by a decade in females. WHO grade II and III tumour incidence showed a bimodal pattern of distribution. The percentage incidence of glioblastoama (WHO IV), anaplastic astrocytoma (WHO III), and low-grade gliomas (WHO II) was the same in males and females.
Conclusion: Overall national prospective information should be accumulated, but it is also of benefit to collect epidemiological information in smaller population groups catered for by individual units, as this information is also vital for patient management in that area.

39 – Poster
One year follow up of Synex-C expandable poly-ether-ether-ketone (PEEK) cervical vertebral body replacement device

A. D. Horsch, S. Ross, G. Towns & J. Timothy (Leeds General Infirmary)

Objective: To evaluate the experience with a new unique Synex-C expandable poly-ether-ether-ketone (PEEK) cervical vertebral body replacement device.
Design: Twenty cages were prospectively reviewed for clinical outcome and radiological fusion.
Subjects: In total 20 cages were inserted and 13 were available for clinical assessment and 12 for radiological evaluation. Age ranged from 28 to 80 with an average age of 65 years. Male/female ratio was 2:1. The diagnosis was degenerative spine in 11 cases, rheumatoid arthritis in 3 cases, tumour in 3 cases and fracture in one case. Four patients had previous cervical spine surgery. Eleven patients presented with myelopathy alone, 2 with brachialgia alone, 6 with both and one with kyphosis. The level was C4 in 5 cases, C5 in 9 cases, C6 in 10 cases, C7 in 2 cases. In 4 cases 2 levels were done and in 16 a single level. Anterior fixation was performed in all cases and in 3 also posterior fixation. Time since the operation varied from 10 to 23 months.
Outcome measures: Clinical Outcome as verbally reported by patient was assessed during the standard follow up clinic or by telephone assessment. Radiological fusion, bony growth, implant migration and subsidence into vertebral body were assessed by a radiologist.
Results: In 6 patients no clinical outcome was available but in the remaining a good clinical outcome was reported. One patient died of an unrelated cause. In one case the anterior plate was removed 8 months later because of subsidence and plate displacement. Subsequent flexion/extension views show good alignment and stability. One patient developed symptoms of brachialgia at a different level and was treated with a laminectomy and foraminotomy. Radiological evaluation shows that, in spite of a comparatively good clinical Outcome, radiological fusion only occurs in half of these patients.

Conclusions: This is the largest series of the use of Synex-C expandable poly-ether-ether-ketone (PEEK) cervical vertebral body replacement device to date. Despite the sometimes complex cases treated in this series the majority of cases show a good clinical outcome. Unlike titanium cages, this cage allows for excellent postoperative MRI evaluation and is easy to insert. Since the cage is solid only limited bone can be packed around the implant and this may account for the poor radiological fusion.

Friday 8th September 2006
SESSION 6 – HYDROCEPHALUS
Oral and Poster

40 – Oral
Bactiseal external ventricular drains: how can a study prove benefit?

C. Kaliaperumal & J. D. Palmer (Derriford Hospital, Plymouth, UK)

Objective: A prospective audit to assess the utility of Bactiseal external ventricular drains (EVD) in reducing CSF infection rates compared to standard EVD.
Design: On the introduction of Bactiseal EVD to our centre 80 sequential patients were divided into four blocks of 20 and alternately allocated Bactiseal EVD or standard EVD. A standard surgical protocol was followed. All patients with an established CSF infection were excluded.
Outcome measures: The primary outcome measures were: ventriculitis; suspected infection; catheter tip infection; and wound infection. Secondary outcome measures included the length of hospital stay and discharge outcome.
Results: Of the 80 patients entered 17 were excluded as the trial EVD was placed in the presence of established infection. Of the remaining 63 patients the infection rates were: Bactiseal 30%; standard 40%. When looking at the length of time the drain was in place the infection rate was 29% for 3–10 days and 57% for >10 days. On this basis further analysis excluded all patients whose duration of drain was 10 days. This left 40 patients (21 Bactiseal, 19 standard) with infection rates of: Bactiseal 19%; standard 42%. The median length of hospital stay was 11 days with Bactiseal and 15 days with standard EVD, mortality was: Bactiseal 20%; standard 23%. It took one year to recruit the 40 patients suitable for analysis.
Conclusion: This audit can be used to design a prospective trial of Bactiseal catheters. The study should be based on a potential reduction in infection rates of 50%, and will need to use similar exclusion groups as above. At an 85% power and 5% significance level we estimate the need to include a minimum of 120 patients. For a one-year recruitment at least 3 centres are needed.

41 – Oral
Preston normal pressure hydrocephalus study – predictors of shunt response

G. Balamurali, I. Bhatti & A. Golash (Royal Preston Hospital, Preston, UK)

Objective: The diagnosis and management of normal pressure hydrocephalus remains unclear. The value of supplementary tests to predict which patients would benefit a shunt operation has not been established. This study aims to investigate which of these supplementary tests are most valuable in determining successful surgical outcome.
Design: Patients with clinical and radiological suspicion of NPH had a battery of neuropsychological tests and gait assessments performed before and after CSF drainage of 100 mls per day for 2 days. Their CSF pressure and resistance to outflow pressure was measured. Shunting was determined by improvement in tests and criteria devised. All patients were followed up at 6 months, 1 and 2 years irrespective of their treatment outcome. Subjects: 40 patients were included in the study with a mean age 76, 40% males and 60% females. 36 had idiopathic NPH. Their symptoms averaged 22 months for gait symptoms, 15 months for memory and 7 months for urinary symptoms.
Outcome measures: Outcome was assessed on their clinical and radiological improvement. All patients had their supplementary tests repeated and scans at 1 year and 2 years. Programmable shunts were used.
Results: 23 patients (57.5%) were shunted and 17 (42.5%) were not shunted. These improvements were characterised by improved MMSE scores ($p = 0.005$), verbal fluency ($p = 0.005$), clock drawing ($p = 0.028$) and Rcsf ($p = 0.009$). Although there was improvement in gait it was not significant. During follow up these results seemed to be consistent with clinical improvement.
Conclusion: The disease is very complex in this group of patients. Patients showing improved neuropsychological tests and high Rcsf values also showed a clinical improvement at 1 year follow up. Various factors are being analysed to understand the disease. However, further assessments need to be undertaken before any firm conclusions can be reached.

42 – Oral
Does adequacy of ventricular catheter placement matter?

S. J. Price, T. Santarius, R. J. C. Laing & H. Richards (Addenbrooke's Hospital, Cambridge, UK)

Objective: Ventricular catheter blockage is the commonest indication for shunt revision. Placement of a ventricular catheter in a region free of choroid plexus prolongs catheter survival. Previous studies

suggest that the positioning of occipital catheters is poorer than frontally placed catheters. The question is whether this matters for shunt survival. In this study we aim to see whether the good positioning can reduce the rate of shunt revision.
Design: A 4-year follow up study of a cohort of patients prospectively assessed following VP insertion.
Subjects: 85 patients who had VP shunts inserted (57 occipitally placed and 28 frontally placed catheters) were assessed 4-years after shunt insertion.
Outcome measures: Revision rates were assessed for patients with occipital and frontal catheters and assessed for adequacy of placement.
Results: Frontal catheters were adequately placed in 67% of cases; occipital catheters were adequate in 52%. Frontal catheters were frequently too long, whereas occipital catheters commonly crossed the midline. Forty-three percent of the burr holes were incorrectly positioned; this may improve with experience. When the burr hole was too lateral, the catheter position was inadequate in 90% cases. The revision rate for inadequately placed occipital catheters was far higher than adequately placed catheters (54% vs 15% at 140 weeks), yet there was no difference for the frontal catheters (50% vs. 44% at 140 weeks).
Conclusions: Occipital catheters are more difficult to place adequately than frontal catheters. The accuracy of placement of frontal catheters could improve if the depth of insertion could be better controlled. Occipital catheter placement is poor, largely due to problems in placing the burr hole. The position of occipital catheters is more critical to shunt survival than frontal catheters.

43 – Oral
A review of radiographic shunt-series in the detection of paediatric shunt malfunctions

R. Joseph, M. Almond, G. Chawda, S. Chapman, A. Kay, A. R. Walsh, S. Sgouros & G. A. Solanki (Birmingham Children's Hospital, UK)

Introduction: Shunt series have been used variably in the evaluation of shunt malfunctions particularly in the paediatric population. In some centres they are used routinely while other centres are selective. In order to minimize the potential risks of biological effects associated with radiation, dose limits and guidelines have been established. Regardless, we must strive to keep radiation exposure well below these through the principle of ALARA, 'as low as reasonably achievable' radiation exposure. We report the role of the shunt series in our practice.
Aim and objectives: We aim to assess the relative usefulness of a shunt series at detecting a shunt malfunction and to identify potential criteria for its use.
Patients and methods: The records of children presenting with shunt malfunction between January 2004 and May 2006 were reviewed. All children who underwent a shunt series were identified and they were the focus of this study. 120 children, 68 boys and 52 girls. Their age ranged between 3 months and 18 years, median of 8 years. These children had undergone shunt series as part of their assessment for shunt obstruction or malfunction.
Results: The 120 children underwent 180 shunt series. Thirty-two (17.7%) studies showed one or more abnormalities. Roughly one-third (11) of the abnormalities occurred above the valve while two-thirds (21) occurred below the valve level, the majority occurring in the neck (10), followed by the abdomen (6) and the chest (5). The commonest abnormalities were fractures/tears (17), followed by disconnection (10) and migration (1).
Conclusion: In the current series, 17.7% of abnormalities were detected by the shunt-series, suggesting a complementary and useful role in selected cases. Determining clinical indications and improving criteria for performing a radiographic study will optimise yield while minimising radiation exposure. A prospective study based on improved selection criteria is now planned.

44 – Oral
Surgical treatment of Chiari I malformation – indications, technique and results

S. Kenny, S. D. Bucur, C. Holton & A. K. Tyagi (Leeds General Infirmary, UK)

Objective: To determine the outcome and complications rate of craniocervical decompression for Chiari I malformation.
Design: Retrospective study of all craniocervical decompression for Chiari I malformation performed at Leeds General Infirmary between 1997 and 2006 was performed. A total of 59 patients were identified in the database. The presenting symptoms, indication for surgery, preoperative and postoperative investigations, operative approach, days of hospitalisation and outcome of surgery were evaluated.
Subjects: 59 patients with Chiari I malformation and an average age of 34 (range 4–67) were identified in the unit database and analysed.
Outcome measures: outcome measures were: symptom relief, neurological deficit, modified Karnofsky score compared pre- and post-operatively. The complication rate was evaluated and discussed in relation to the operative approach and symptoms relief.
Results: The clinical presentation of the 59 patients was: headaches (30 patients), weakness/numbness of limbs (21 patients), scoliosis (4 patients), swallowing problems (1), dizziness (1), unsteady gait (1) and progressive spastic tetraparesis (1). 31 (53%) patients were noted to have a syrinx pre-operatively. This

resolved in 21 (68%) of patients post-operatively. Thirty-five (59%) patients had dural patches and 10 (17%) patients had CSF leaks post-operatively. The outcome results based on questionnaire is to be evaluated.

Conclusions: Surgical treatment of Chiari I malformation depends on surgeon preference of approach and clinical and radiological presentation of the patient. In this study we have evaluated the advantages and disadvantages of each approach, complication rate and which approach is associated with the best outcome.

45 – Oral
Lumboperitoneal shunts and low-pressure symptoms – experimental factors affecting catheter flow rates

D. Rodrigues, S. Prakash & R. D. Strachan (James Cook University Hospital)

Objectives: The insertion of lumboperitoneal shunts for idiopathic intracranial hypertension (IIH) has a high complication rate, particularly over-drainage leading to incapacitating low pressure symptoms. Our objective was to measure flow rates through catheters of different lengths with different pressure heads (simulating intrathecal pressure when standing) and vertical drops (simulating the effect of siphoning), to ascertain the extent of these differences and make conclusions about the optimum catheter length and placement in patients with IIH.

Design: A bench test was constructed to enable flow rates to be recorded using 3 catheter lengths (60; 83; 100 cm), each at 3 different pressure differentials (15, 25 and 35 cm H2O) and 3 different vertical drops (10, 20, and 30 cm). This involved a minimum data set of 27 experiments, repeated 3 times, thus totalling 81 separate measurements. Flow rates were calculated by the collection, weighing and volumetric calculation of isotonic saline over a fixed time period.

Results: For the same catheter length and pressure head, increasing the vertical drop by 20 cms increased flow between 46% and 70%. For the same vertical drop, increasing the pressure head by 20 cms H2O increased flow from between 40% and 63%. For the same pressure head and vertical drop, the rate of flow decreased by up to 57% between catheters of 60 and 100 cms in length. The difference in flow between the longest catheter with the smallest drop and pressure head, and the shortest catheter with the highest drop and pressure head was 1.15 mls and 5.4 mls, or a factor of 4.69.

Conclusions: All three factors have a significant effect on the rate of drainage. Rates of flow often far exceeded what would be acceptable in the clinical situation. Catheters need to be much longer, and more novel ways of preventing over-drainage have to be considered.

46 – Oral
Prospective review of cerebellar tonsillectomy for syringomyelia associated with Chiari I hindbrain hernia

C. F. Schwindack & R. J. C. Laing (Addenbrooke's Hospital, Cambridge, UK)

Objective: Chiari I hindbrain hernia with associated syrinx is managed in our unit by cerebellar tonsillectomy and this audit reviews our outcome data for this procedure.

Design: Ongoing prospective audit of all patients operated upon for symptomatic syrinx. Surgical intervention involves a minimal posterior fossa craniectomy allowing excision of the cerebellar tonsils. Clinical follow up is at 3 and 12 months with a post operative MRI at 6 months.

Subjects: 24 patients, 8 male, 16 female, median age 37 (range 2–77). Patients present with a classical syndrome of head and neck pain and neurological symptoms in the limbs.

Outcome measures: Primary outcome measure is collapse of the syrinx on post-operative MRI, secondary outcome measure is clinical improvement. Analogue pain, anxiety & depression, neck disability and SF-36 data is available in a subgroup of 11 patients. Data is evaluated using Wilcoxon signed ranks test.

Results: Twenty-three patients have had post-operative MRI scans which all show collapse of the syrinx, one is lost to follow up. Surgical complications include two CSF leaks and one superficial wound infection. Clinically 6 patients have resolution of symptoms, 9 show improvement, 7 have stable symptoms, none are worse. Two are not available at 1 year review. The average analogue pain and the anxiety scores are significantly improved ($p = 0.005$ and 0.009). The neck disability index, depression scores and SF-36 values are improved but do not reach statistical significance ($p = 0.198$, 0.28, 0.182). The pre-operative SF-36 values are significantly below the population control ($p = 0.05$) whereas they are not significantly different post-operatively.

Conclusions: Tonsillectomy for syrinx is a safe procedure well tolerated by patients. Objective imaging evidence of syrinx collapse has been demonstrated in all patients. No neurological deterioration due to the primary pathology is noted in any patient but quality of life scores improve only marginally.

47 – Poster
Spontaneous spinal CSF leak with cranial complications – a report of 3 cases

D. Lees & J. Nissen (Dept of Neurosurgery)

Introduction: Spontaneous spinal CSF leak is rare and only a few cases have been reported in the literature. We present our recent experience of 3

patients with spontaneous spinal CSF leaks with cranial complications.
Patients: Patient 1 presented with a history of low pressure headache. MRI brain demonstrated a large subdural haematoma. MRI whole spine demonstrated epidural CSF and a small T8/9 disc prolapse. Burr hole drainage was performed. CT myelography failed to isolate the source of leak. He continued to suffer low pressure headache. A thoracic blood patch cured the persistent low pressure headache for 1 year but relapse has lead to formal open repair of the dural defect. Patient 2 presented with a history of low pressure headache. CT brain scan demonstrated an isodense subdural haematoma which was evacuated via burr holes with resolution of his headache. MRI whole spine demonstrated epidural CSF but no other abnormality. Myelography failed to demonstrate the site of leak. There was no recurrence of headache nor subdural haematoma. Patient 3 pesented with low pressure headache. This was made worse by lumbar puncture at the referring hospital. MRI demonstrated cranial subdural haematomas, spinal epidural CSF but no other abnormality. His headache resolved with conservative management and myelography has not been performed.
Conclusion: Spontaneous spinal CSF leak is a rare entity. All 3 of our patients presented with classical low pressure headache and had subdural haematomas on cranial images. Two patients required evacuation of the subdural haematoma. One patient was treated conservatively. Myelography confirmed leakage of CSF into the epidural space but failed to demonstrate the site of the leak in 2 patients. A thoracic blood patch gave temporary relief of persistent headache in 1 patient but formal dural repair at the site of the thoracic disc prolapse is awaited.

48 – Poster
External ventricular drain (EVD) infection rates

C. Gavin, S. Ilyas, V. A. Elwell, M. Hofer, M. Tisdall, K. Ashkan & L. Watkins (The National Hospital for Neurology and Neurosurgery)

Aim: To assess EVD infection rates and to establish whether recommendations from previous studies have been implemented and to compare our results with the literature.
Introduction: CSF infection remains a serious complication resulting in increased morbidity, mortality and cost. A review of the literature yielded a mean infection rate of $10.4 \pm 6.3\%$ (mean $\pm$ SD). At our institution two studies were carried out to investigate infection rates following EVD insertion between July 2004 to February 2005 and February 2005 to November 2005, respectively. A total of 127 procedures were recorded. The infection rate rose from 16.1% to 19%. Several recommendations were made including distal port site CSF sampling as well as a trial use of silver impregnated EVDs.
Methodology: In this retrospective study, patients undergoing EVD insertion from December 2005 to April 2006 were identified from theatre records. In addition, type of EVD, type of procedure, presence of pre-existing CSF infection and microbiology results were collected.
Results: 19 patients underwent 24 EVD insertions. The infection rate was 12.5%. We identified a number of areas for future improvement. For example, the type of EVD used was not clearly recorded and port-site use for CSF sampling remains inconsistent between nursing staff and doctors.
Recommendations: An updated protocol for CSF sampling and EVD monitoring is proposed. An electronic database has been created to facilitate future studies. Greater trial use of silver impregnated catheters is to be encouraged so as to assess their effectiveness.
Conclusion: Although the current study infection rate was lower and is comparable with published data from the medical literature, its power is limited by the smaller cohort of patients. The impact of silver impregnated catheters on infection rates could not be assessed. A prospective database will be invaluable in evaluating trends in EVD infection rates within this neurosurgical department.

Friday 8th September 2006
SESSION 7 – TRAUMA AND PAEDIATRICS
Oral and Poster

49 – Oral
Is case fatality following severe head injury decreasing?

H. C. Patel, O. Boumara, A. T. King & F. Lecky (Greater Manchester Neurosciences Centre and The Trauma Audit and Research Network, Manchester, UK)

Objective: National mortality data suggest that deaths following trauma overall are reducing. Severe head injury (SHI) accounts for over 50% of all trauma death, and limited data suggest that deaths following SHI are reducing. This reduction in mortality observed has been put down to improvements in prevention of injury rather than improvements in case fatality. The aim of this study was to document the temporal trends in case fatality for SHI.
Design: Retrospective analysis of prospectively collected data from the TARN (Trauma Audit and Research Network) database (1989 – 2004).
Methods: The temporal course (from 1989 – 2004) of the adjusted odds of death was studied for patients with SHI (GCS < 9). A logistic regression model

based on the new TARN outcome prediction model was used to calculate the 95% confidence intervals for the odds of death. The odds of death for each year (1990–2004) were compared with the 1989 baseline all SHI patients. Linear regression was used to seek a yearly trend in the log odds of death for each group.

Results: Only 6.2% of the patients on the database had sustained a SHI, although SHI accounted for 54% of all trauma deaths. A significant reduction in adjusted odds of death (52%) was observed for SHI patients (3.3% reduction per year $p = 0.005$) from 1989–2004. No significant gains in the odds of death were observed over the last decade.

Conclusions: These data demonstrate that there has been an overall improvement in case fatality following SHI in over the last 16 years, but these gains have plateaued over the last decade.

50 – Oral
Mortality and financial cost of major head injury requiring intensive care in the United Kingdom

J. A. Hyam, C. A. Welch, D. A. Harrison & D. K. Menon (Department of Neurosurgery, Charing Cross Hospital, London, UK, Intensive Care National Audit and Research Centre, London, UK)

Objective: Major traumatic brain injury (TBI) is a common neurosurgical problem and usually necessitates intensive care unit (ICU) admission. This patient group requires extensive medical and nursing care and has a high mortality. We describe the case mix and mortality of major head injury requiring ICU and estimate the financial cost of inpatient care in the UK.

Design: A secondary analysis of a high quality clinical database, the Intensive Care National Audit and Research Centre Case Mix Programme Database, on 374,594 admissions to 171 critical care units in England, Wales and Northern Ireland from 1995 to 2005. Based on mean lengths of stay, Department of Health estimates of cost per day in England and Wales, and an estimated number of TBI admissions per year, financial cost per year was calculated.

Results: 11,021 admissions following traumatic brain injury were identified, representing 3% of all admissions. ICU mortality was 23% and in-hospital mortality 33.5%. Amongst severe TBI, mortality improved as GCS increased from 3 to 8 with a mortality of 48% and 24%, respectively. Mean length of stay in ICU was 3.2 days for survivors and 1.6 days for non-survivors. Median length of stay in hospital was 24 days for survivors and 3 days for non-survivors. The estimated in-hospital cost was £182 million in England and Wales in one year.

Conclusions: Traumatic brain injury requiring intensive care is associated with a high mortality. This study has provided a realistic estimate of the financial demand of this patient population on health services in England and Wales and has demonstrated the high costs of their in-hospital care.

51 – Oral
A mechanism-based MRI classification of traumatic brainstem injury and its relationship to outcome

R. Mannion, J. Cross, P. Bradley, J. Coles, D. Chatfield, A. Carpenter, J. D. Pickard, D. Menon & P. J. Hutchinson (Addenbrooke's Hospital, Cambridge, UK)

Objective: Following severe traumatic brain injury (TBI), to use acute MRI to examine the types of brainstem injury and their relationship to supratentorial injury. To correlate these findings with outcome at 6 months (Glasgow Outcome Score (GOS)).

Design: A prospective cohort study of patients admitted to a regional neuro-critical care unit with TBI requiring ventilation who underwent CT and MRI scanning within three days (median 1 day) of injury.

Subjects: Forty-six patients (mean age 34 years, range 16–70, 76% male) with TBI.

Outcome measures: CT and MRI were reported by a consultant radiologist blinded to the patient's history and clinical condition. Outcome was assessed using the GOS ascertained by outpatient interview.

Results: Brainstem lesions were detected in thirteen patients by MRI, only two of which were detected by CT. Eleven out of thirteen patients with brainstem injury had an unfavourable outcome (death, vegetative state or severe disability), of whom five died. Of the 33 patients without brainstem lesions, eighteen had an unfavourable outcome, of whom four died. The direct relationship between brainstem lesions and unfavourable outcome was statistically significant ($p < 0.05$). With regard to supratentorial injury, all but two brainstem lesions were seen either in the context of severe diffuse axonal injury or a significant mass lesion, and all of these patients had a poor outcome. However, the two patients with brainstem injury and good outcome had relatively few supratentorial abnormalities. From these observations we have devised a simple classification system that is useful clinically and has potential associations with outcome.

Conclusions: Poor prognosis is common following major TBI but is more common in those with brainstem injury. However, brainstem injury is not an absolute indicator of poor outcome. Understanding the anatomy and extent of brainstem injury, as well as its relationship to supratentorial abnormalities will facilitate a more accurate use of early MRI as a prognostic tool and assist in the counselling of families.

52 – Oral

Transfer times for patients requiring surgery for extradural and subdural haematomas

J. M. Evans, P. Leach & A. T. King (Greater Manchester Neurosciences Centre, Manchester, UK)

Objective: It has been shown that a delay in the transfer of patients with extradural or subdural haematomas requiring definitive neurosurgical evacuation has a detrimental effect on outcome. We set out to ascertain the delays in the transfer of such patients in our region.
Design: We prospectively collected and analysed data on the transfer times of patients with these conditions requiring emergency surgery over a 30 month period. We looked at time from injury/deterioration to CT scan, time from CT to arrival at our unit and time from arrival to definitive surgery. All data was collected within 24 hours of admission. Information was taken from A & E records, ambulance transfer documents, CT hard copies and theatre/anaesthetic charts.
Subjects: Adults (>16 years) with acute extradural or subdural haematomas that required emergency evacuation of the clot at our unit. Patients were excluded if they were admitted from our own A & E department, managed conservatively or if transferred for conservative treatment and then deteriorated thus requiring surgery. We therefore analysed 39 patients with extradural and 42 patients with subdural haematomas.
Outcome measures: Median time from injury/deterioration to CT, time from CT to arrival at our A & E and time from arrival to surgery.
Results: Median time from injury/deterioration to CT, CT to arrival and arrival to surgery for extradural haematomas was 2, 2.5 and 0.75 hours respectively. The equivalent times for patients with subdural haematomas were 2.25, 2.38 and 0.75 hours.
Conclusion: Transfer times for such patients in our region are unacceptable at present. We must work more closely and effectively with our colleagues in A & E, General Surgery, Orthopaedics, Anaesthesia and Intensive Care if we are to reduce these delays and improve patient outcome.

53 – Oral

Comparison of prenatal and postnatal MRI findings in the evaluation of intrauterine CNS anomalies

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Abstract background: To assess the diagnostic capability and prognostic value of fetal magnetic resonance imaging (MRI) in children suspected antenatally to harbour CNS defects.
Materials and methods: Between 2003 and 2005, 13 foetal MRI scans were performed in mothers suspected on ultrasound scans to have foetuses with congenital CNS defects. Of those, 10 children have been born and assessed with postnatal MRI scans. Comparisons between antenatal and postnatal scans were made with particular emphasis on accuracy of diagnosis and consequent prognostic value of the antenatal examinations.
Results: All mothers were scanned using heavily T2-weighted fat-saturated sequences, which allowed rapid acquisitions to avoid movement artefacts. Imaging quality was satisfactory in all 10 patients. Diagnoses made antenatally were: myelomeningocele in 6, diastematomyelia in 1, occipital encephalocele in 1 and isolated hydrocephalus in 2 children. Of the 6 children with antenatal diagnosis of myelomeningocele, 1 proved to have spinal lipoma postnatally. This was one of the early antenatal MRI scans. Antenatal diagnosis of hydrocephalus was made in 4 of the 5 confirmed myelomeningocele patients, which was verified postnatally. Antenatal diagnosis of Chiari II malformation was made in all 5 confirmed myelomeningocele patients but in 1 baby this was not verified postnatally. The antenatal diagnoses of occipital encephalocele and isolated hydrocephalus were verified postnatally.
Conclusion: Foetal MRI scanning is an effective, non-invasive method of assessing *in-utero* CNS abnormalities. After an initial learning curve, accuracy of diagnosis has improved dramatically. While diagnostic accuracy of antenatal foetal MR scans may not be perfect still to allow counselling for termination of pregnancy, prediction of clinical outcome and counselling for possible necessary treatment can be very effective and has been appreciated by all mothers.

54 – Oral

Predictive value of ventricular size volume on the need for permanent treatment of hydrocephalus immediately after resection of posterior fossa medulloblastoma in children

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Aim: To establish whether the ventricular size in children with posterior fossa medulloblastoma can predict the need for permanent treatment of hydrocephalus.
Material: Ventricular volumes were measured on pre- and immediate postop MR scans of 15 children who had resection of posterior fossa medulloblastoma between 1999–2005. The ratio of postop/preop volume was calculated to assess the rate of ventricular change following tumour resection. Comparison of mean values was performed using one-way ANOVA.

Results: All patients had obstructive hydrocephalus pre-operatively. Post-operatively 4 patients required shunting. Pre-operative mean ventricular volume was 250 cm^3 for those who required shunting and 110 cm^3 for those who did not ($p = 0.004$). Post-operative mean ventricular volume was 210 cm^3 and 113 cm^3 respectively, larger than normal in both groups. Mean postop/preop ratio was 0.75 for those who required shunting and 1.02 for those who did not ($p = 0.195$), indicating that following tumour excision, those who later required shunting had bigger ventricular volume reduction than those who did not, but the difference was not significant.
Conclusion: Pre-operative ventricular volume has predictive value for the later need for shunting, but in clinical practice it may be difficult to appreciate this, as all patients have significant hydrocephalus at presentation. The rate of ventricular size reduction in response to excision of the posterior fossa tumour does not have predictive value. It appears that removal of medulloblastoma which obstructs the fourth ventricle converts hydrocephalus from obstructive to communicating, which is handled by the absorptive mechanisms in the first few days after surgery.

55 – Poster
Midline nasal dermoid sinus cyst – a review of surgical outcomes and suggested best practice

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Objectives: Nasal dermoid sinus cyst is a rare congenital anomaly. Pre-operative imaging is required to define potential intracranial extension. Where imaging techniques are unable to rule out intracranial extension, surgery is indicated to both explore and excise the tract.
Design: This retrospective study analyses the clinical presentation, CT, MRI and surgical findings in eleven nasal dermoids treated from 2001 – 2005. All cases underwent pre-operative imaging and surgery within a multidisciplinary team setting. Surgical approach was via a bicoronal incision, with or without frontal craniotomy.
Results: Surgery was performed in 10 children (mean age 2 years 9 months) and one adult. Presentation ranged from a visible pit (4 patients), palpable mass (2 patients) to recurrent superficial infection (5 patients). Nine patients underwent both CT and MRI pre-operatively, 2 having MRI only. Craniotomy was performed in 7 of the patients and the dura was opened in 3 cases. There have been no recurrences of the tract at mean follow up time of 3 years 3 months.
Conclusion: Current imaging techniques offer essential preoperative information, and allow operative planning. We recommend a surgical approach that allows therapeutic craniotomy to be performed if indicated intra-operatively. This unusual condition with potentially devastating complications can be, and should be treated within a multidisciplinary team setting.

56 – Poster
Review of graphic user interfaces used in referrals to a neurosurgical unit

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Objective: To review the format of radiological imaging accompanying acute neurosurgical referrals and to evaluate the ease of image retrieval from different viewing software encountered on CD-ROM.
Design: A prospective audit of all radiological imaging accompanying acute referrals over a 28 day period to our unit, and review of all software encountered on CD-ROM referrals.
Subjects: Four subjects (2 SpRs, 2 SHOs) reviewed the different graphic user interfaces (GUIs) sent on CD-ROM.
Outcome measures: The ease and speed of image retrieval from the viewing software encountered.
Results: 205 acute referrals were received with accompanying imaging: 72 (35.1%) by ethernet ImLink, 54 (26.3%) as hard copy, 53 (25.9%) as CD-ROM, 26 (12.7%) as PACS imaging from our host hospital. Six types of CD-ROM viewing software were received. Each offered similar functionality but had a different GUI. The median time to open the desired image using the CD-ROM software ranged from 31s to 323s. This compared to 15s for a dedicated ImLink, and 17s for PACS. The ease of opening and reviewing the CD-ROM images varied from very easy to difficult, with 3 (12%) not being able to be opened at all requiring the referring hospital to print hard copies causing delay in neurosurgical opinion and patient transfer.
Conclusions: Digitised images have the advantage that they are cheaper than hard copies, and provide long-term means of storage of high quality images. However, users are increasingly having to learn to use many different GUIs and the quality and speed of image retrieval varies according to the operating system platform and specification of the computers within a unit. Problems with opening CD-ROM referrals can hamper patient care and delay patient transfer and treatment.

57 – Poster
Factors implicated for late presentations of gross congenital anomaly of the nervous system in a developing nation

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Background: Gross congenital lesions of the nervous system are obvious at birth and usually present early for management and corrective surgery. However in tropical and developing nations, late presentations are common.
Aims: To determine the factors responsible for very late presentations of such gross anomalies.
Methods: We conducted a prospective study of all cases of congenital CNS anomalies that presented very late (>6 months after birth) to our neurological and neurosurgical clinics over a six-year period (2000–2005).
Results: A total of 58 patients were seen during the study period. The age ranged from 6 months to 47 years. Hydrocephalus accounted for about half of the cases 28(48.3%). The others were spina bifida 12 (20.7%), encephalocele 6 (10.3%), neurofibroma 6 (10.3%), subgaleal inclusion dermoid cyst 4 (6.9%), and craniosynostosis 2 (3.5%). Reasons given for late presentations were ignorance, poverty and in some cases the expectation that the baby would die. Other reasons for late presentation were the patient was either about to start school or get married.
Conclusion: Late presentations of congenital CNS lesions are associated with many complications most of which could have been avoided with early medical treatment. Health education should include issues regarding congenital malformations delivered by trained experts.

58 – Poster
Assessment of zero drift in the Codman ICP monitor: a study from two neurointensive care units

Y. Z. Al-Tamimi, A. Helmy, S. Bavetta & S. J. Price (Department of Clinical Neurosciences)

Objectives: Intraparenchymal monitoring devices play a pivotal role in the daily management of head injury and other critically ill neurosurgical patients. Although data exists for zero drift for the Camino system (1), for the Codman system only *in vitro* data exists (2). The aim of this study was to assess the extent of zero drift for the Codman ICP monitor.
Design: A prospective study in two neurointensive care units.
Subjects: 88 patients who presented to two neurosurgical departments, centres 1 and 2 (n = 48 and n = 40 respectively).
Outcome measures: Duration of ICP monitoring was noted. On removal of ICP bolt, result of ICP measured (zero drift).
Results: Mean zero drift for the total group is 1.32 (95% confidence interval 0.61–2.03, range 21). The mean for the data collected from centre 1 is 0.48 (CI −0.469–1.43, r 17) whilst that for centre 2 is 2.33 (CI 1.33–3.33, r 21). This is significantly different (p = 0.01). Mean time *in situ* for centre 1 is 110 hours (CI 86–134 hours, r 390 hours) whilst that for centre 2 is 173 hours (CI 139–207 hours, r 432 hours). This results in mean drift per day of −0.07 at centre 1 and 0.41 at centre 2. These figures are significantly different (p = 0.02). A significantly positive correlation was found between drift and time of probe spent *in situ* (Spearman's correlation coefficient 0.342 (p = 0.001)).
Conclusions: This data has demonstrated that a small amount of zero drift does exist in ICP monitors and that this drift does increase with time. There were significant differences in the drift found between the two centres. These differences were still demonstrated once corrected for time *in situ*. The large range in the data demonstrates that some drift readings are quite excessive. This reinforces the school of thought that although intracranial pressure readings contribute significantly to the management of neurosurgical patients, they should be interpreted carefully and in conjunction with clinical and radiological assessment of patients.

References

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