Proceedings of the Society of British Neurological Surgeons

The 110th Meeting of the Society was held at the University of Warwick in Coventry

THE COVENTRY SPREADER AND DOWEL INSERTER. AN APPRAISAL OF THE FUSION RESULTS USING KIEL BONE DOWELS
WJ Whatmore, Coventry
The author's technique was originally presented to the Society in 1983. The results were presented of 172 patients requiring anterior cervical decompression and fusion for degenerative cervical spine disease at or below C4.5. Over 200 levels had been fused using kiel or unilab animal bone dowels. The new instrumentation permitted the gentle insertion and accurate placement and alignment of a precisely cut dowel thereby facilitating even spreading of the disc space. The technique had proven effective and efficient in providing safety (no direct mortality), reducing operating time and enhancing early collar-free mobilisation. The neurological deficits in the majority of patients quickly improved. Patients had been followed with sequential cervical spine radiographs for up to one year to determine late changes in vertical height of the fused body and possible angulation. The risk of non-fusion was greatest where the dowel protruded anteriorly by 7 mm or more. Twenty nine patients required post-operative myelography: six were normal, seven required a second operation at another level, three remained abnormal at the fused level and went onto posterior cervical laminectomy and 13 demonstrated collapse of the graft. The nature of the "halo" appearance around kiel bone dowel on post-operative radiographs was discussed. It might be present in up to 40% of cases but was not a sign of potential instability—flexion/extension cervical spine radiographs demonstrated no movement in 27 patients. Histology obtained at a second operation in one patient revealed that the "halo" consisted of new bone invasion of fibrous tissue.

TRANSORAL OODINTODICTION AND POSTERIOR STABILISATION IN RHEUMATOID ARTHRITIS: AN ANALYSIS OF 34 PATIENTS WITH SYMPTOMATIC ATLANTO-AXIAL SUBLUXATION
A Jackowski, HA Crockard, AO Ransford (National Hospitals for Nervous Diseases and University College Hospital, London)
The results in 34 patients were presented with symptoms and signs due to rheumatoid subluxation at the craniocervical junction who underwent a combined transoral anterior decompresion and posterior stabilisation procedure. The patients presented (mean age 58 years, range 21–79 years) were operated upon over the four year period from December 1982 to December 1986 and had been followed for a mean duration of 16 months, range 2–48 months. Functional recovery of patients was monitored in terms of formal neurological status, mobility (bed bound, wheelchair bound, walking with aid, walking without aid) and various self-care areas (American Rheumatological Association Scale). The evolution of the posterior fusion technique was outlined with current use of a contoured Steinmann pin that obviated the need for a bone graft. CT reconstruction after contrast myelography was the pre-operative investigation of choice to assess the significance of the anterior mass. None of the patients died as a result of transoral surgery and complications were low. The best results were obtained in relieving occipital pain and paraesthesia; l'Hermitte's sign resolved in all cases. Recovery of motor weakness was more variable. Those patients in whom weakness was mainly confined to the upper extremities or with only a mild tetraparesis showed most improvement. Those with a long-established tetraparesis MRC grade 3/5 or worse did not show significant motor recovery. However, two patients in whom a severe tetraparesis MRC grade 2–3/5 had been present for less than two months had regained nearly full movements and mobility. Discussion revolved around the assessment of the significance of the anterior mass as removal of the posterior arch of the atlas, opening the dura and posterior fixation with a Hartshill rectangle had proved successful in some hands. The authors felt that posterior fusion alone should be reserved for patients with intractable pain and no significant anterior mass and made a special plea for early referral once motor symptoms started.

HAEMODYNAMIC ASSESSMENT OF THE CIRCLE OF WILLIS USING TRANSCRANIAL DOPPLER SCANNING
RJ Nelson, J Roberts, TK Hames, JD Pickard (Southampton)
The authors illustrated how the EME Transcan (a 2 MHz transcranial pulsed Doppler ultrasound scanner based on Aslind's pioneering work) could be used to produce anteroposterior, lateral and axial images of the basal cerebral arteries by bilateral transtemporal scanning. The system greatly facilitated accurate localisation of the main intracranial branches of the carotid and basilar circulations and avoided their misidentification. The collateral capacity of the Circle of Willis and the responses of anterior, middle and posterior cerebral artery blood velocities to hypercapnia had been assessed in 100 healthy, non-smoking, non-hypertensive volunteers between the ages of 20 and 80 years.
The time averaged mean blood velocities of the middle cerebral, anterior cerebral and posterior cerebral arteries were found to be 58, 49 and 38 cm/s with no variation observed due to age, sex or asymmetry. The presence of functional anterior communicating, posterior communicating and foetal-type posterior communicating arteries had been established by examining changes in the Doppler sonograms recorded from the proximal anterior and posterior cerebral arteries in response to carotid artery compression. The authors defined collateral capacity in terms of residual middle cerebral artery velocities following ipsilateral carotid artery compression. These fell steadily from a mean of 43 in the 20 to 29 age group to a mean of 28 in the 60 to 70 age group. Linear relationships were demonstrated between the percentage increases in the anterior and posterior cerebral artery blood velocities and the middle cerebral artery velocity during collateral flow. Changes in the pattern of collateral flow with age were described.
The authors then briefly described how this non-invasive technique might be applied to the investigation of patients with cerebrovascular disease and stressed the need for comparison with measurements of cerebral blood flow, a point that was further emphasised in discussion.

**LUMBAR CANAL STENOSIS: AN ALTERNATIVE APPROACH TO SURGICAL DECOMPRESSION BY A BILATERAL FENESTRATION PROCEDURE**

S Young, R Veerapen, SA O’Laoire (Dublin)

The anatomical changes with lumbar canal stenosis were reviewed. Congenital narrowing of the lumbar canal was due to shortened pedicles and approximation of the posterior joints towards the midline, creating prominent postero-lateral impressions on the cross-sectional appearance of the canal. Further postero-lateral encroachment on the lumina of the spinal and root exit canals resulted from osteophytic enlargement of the inferior articular processes and buckled hypertrophied ligaments. The traditional lumbar laminectomy required removal of the posterior facet joints if decompression of the theca and roots was to be satisfactory.

There was a real risk of provoking further neural damage by introducing instruments into a tight canal and of causing subsequent instability of the lumbar spine. The authors described, with the aid of a video, how they used a bilateral fenestration approach to relieve the segmental pathology in this disease. The medial third of each posterior facet joint was first removed with an air powered drill, allowing access to the ligamentum flavum. Once incised, hyper trophyed ligament and bone was removed under microscopy until local decompression of the theca and spinal nerve was achieved. Extensive undermining of the remaining outer two thirds of the posterior joint might be required and disc material removed if necessary. At each level the spinous processes, interspinous ligaments and outer two thirds of the posterior facet joints were left intact. The early results in 31 patients suggested an improvement in post-operative mobility and a reduction in the length of hospital stay.

**RADIATION MYELOPATHY**

P Mariatos (Pireas, Greece)

The author emphasised the importance of the distinction between radiation myelopathy and cord lesion due to extra or intradural metastases so that forms of treatment that might aggravate this rare condition were avoided. He reviewed the presentation of the various forms of radiation myelopathy including the early transient form, the lower motor neuron syndrome, acute myelopathy and the more common chronic progressive variety. Over the past ten years, 17 patients had been seen in the Metaxas Hospital of Pireas, in whom the level of the neurological deficit corresponded to the segment of spinal cord included in the radiation field. All patients had a normal myelogram and negative CSF cytology. The time interval between completion of radiotherapy and the onset of neurological deficits ranged from 4 to 40 months (mean 16 months). The literature suggested an overall incidence of 2.9% rising to 6.4% for irradiation of nasopharyngeal carcinoma. The radiation myelopathy started with distal paraesthesias and weakness of one leg followed by progressive ascent of motor weakness and sensory loss leading to quadriplegia or paraplegia, with a sensory level usually well below that of the irradiated cord. Sphincter disturbances appeared early but tended to remain moderate. In several patients, the process arrested before the development of complete paraplegia and remained stable for years. Treatment was palliative. The tolerance of the spinal cord was time and dose dependent, and the author suggested that radiation to a cord segment longer than 10 cm should not exceed 3,100–4,000 rads over four weeks.

**TRANSCRANIAL DOPPLER ULTRASOUND IN THE PREDICTION AND DIAGNOSIS OF VASOSPASM FOLLOWING SUBARACHNOID HAEMORRHAGE**

JS Compton, S Redmond, L Symon (London)

The hand-held transcranial Doppler probe had been used to follow the evolution of narrowing in the middle cerebral artery following subarachnoid haemorrhage. Sixty patients were studied (20 with aneurysms; 20 patients without intracranial pathology; 20 patients having craniotomy for other than vascular pathology). Cerebral blood flow (initial slope index—intravenous $^{133}$Xenon) was measured with the Novo Cerebrograph. Doppler flow velocity (DFV) was found to correlate both with the size of vessels and the presence of vasospasm on cerebral angiography, but did not correlate with the clinical grade (Hunt-Hess) unlike CBF which fell progressively with declining clinical status. The ratio of cerebral blood flow to Doppler flow velocity correlated significantly with the clinical grade.

Patients with a new neurological deficit attributable to cerebral vasospasm tended to have higher Doppler flow velocities but there was no critical threshold velocity which defined patients who would develop fresh deficits. If the DFV rose by more than 40% of its previous day’s value, 75% of these patients would deteriorate. However, there was a significant false positive rate of 13%. A rise of less than 40% was followed by deterioration in only 2 of 100 patients. The authors found that they could not predict deterioration within 2 days of the haemorrhage and pointed out that even twice daily measurements might miss the peak increases in DFV.

**INTRACRANIAL CSF VOLUMES: NATURAL VARIATIONS AND PHYSIOLOGICAL CHANGES MEASURED BY MRI**

G Teasdale, R Grant, B Condon, J Pottersen, A Lawrence, D Hadley, D Wyper (Glasgow)

Intracranial CSF volumes, for the first time including CSF in the subarachnoid space, can be measured by Magnetic Resonance Imaging (MRI) (Condon B et al. Use of MRI to measure intracranial CSF volumes. Lancet 1986;1:1355–1357.) The MRI sequence causes signal from the grey matter and white matter to cancel and produces a contrast of 200:1 between CSF and brain.

The authors had assessed the variations between normal individuals and investigated some of the factors that could influence cranial CSF volumes. Total CSF volumes were measured in 64 normal subjects, aged 18–64 years (mean 38). Ventricular, cortical sulcal and posterior fossa volumes were calculated separately. In 20 females with a normal menstrual cycle, CSF volumes were measured midcycle and premenstrually; 10 post-menopausal females and 10 males were rescanne after an interval of two weeks. Total cranial CSF volumes were calculated before and during inhalation of 7% CO$_2$ and before and during hyperventilation while breathing 60% O$_2$, in 12 normal subjects. The effect of lumbar puncture was also observed.

Total intracranial CSF volume ranged from 571–2865 ml. Total intracranial and cortical sulcal CSF volumes increased more steeply with age than ventricular or posterior fossa CSF volumes. Males had more cranial CSF than females. Total CSF volume increased premenstrually in 19 females but males and post-menopausal females did not have a significant change in CSF volume on repeat examination. CO$_2$ inhalation produced a mean increase of $p$CO$_2$ of 17–22 mm Hg and CSF volume decreased in all subjects (mean 9.4 ml). Cranial CSF volume increased in 11 subjects during 02 inhalation (range 0.5 to +26.7 ml; mean 10.9 ml).
Acute experimental occlusion of the basilar artery in primates: effects on CBF, autoregulation and CO₂ reactivity in the cerebral cortex, thalamus, brain stem and caudal pons

P Bentivoglio, NM Branstion, L Symon (London)

Temporary occlusion of the basilar artery (BA) is useful in the treatment of difficult basilar aneurysms, and gradual occlusion of the BA has been advocated in the treatment of inoperable aneurysms in this region. This study reported the effect of basilar occlusion in the baboon, in which the posterior inferior cerebellar artery does not arise from the vertebral artery and hence there is no cerebellar supply in this species from the vertebral artery.

In 18 baboons anaesthetised with alphachloralose and ventilated with pure oxygen, the BA was exposed by a trans-clival approach. A clip was placed just rostral to its origin and caudal to the inferior cerebellar artery. Flow was measured by the hydrogen clearance method bilaterally in cerebral cortex (average over 12 electrodes per animal), thalamus (4), brainstem (6) and caudal pons (2). Before and after BA occlusion (BAO), autoregulation to reduced mean arterial blood pressure (MABP) produced by steps of controlled exsanguination and reactivity to both increases and decreases of arterial pCO₂ were measured. Immediately after BAO, cortical flow was unaffected, but a decrease of 35% occurred in thalamus, 40% in brainstem and 48% in the pons. With imposed hypotension prior to BAO, flows measured in thalamus, brainstem and caudal pons commenced to decrease at a higher MABP, and more rapidly, than that in cortex. After BAO, autoregulation in all four regions was significantly altered, particularly in thalamus, brainstem and caudal pons in which flow and MABP were linearly related over the range 30–80 mm Hg.

CO₂ reactivity was demonstrated to increasing pCO₂ in all four regions, and was not significantly greater in thalamus and brainstem than in cortex. After BAO, while in the cortex CO₂ reactivity was preserved, in the other three regions it was completely abolished with intracerebral steal occurring above 55 mm Hg pCO₂.

These results demonstrate some differences in normal autoregulatory capacity of the cerebral cortex and the thalamus, brainstem and caudal pons, while after proximal BAO (in baboons at least) the collateral pathways of blood supply are inadequate to maintain normal flow patterns, reactivity to CO₂ and autoregulation in the regions supplied by the BA. Even in the region of the cerebral cortex principally supplied by the middle cerebral artery, impairment of such flow could be demonstrated.
DGT Thomas (Liverpool and London)
The principle was elucidated on which photodynamic therapy (PDT) of tumours is based: the concentration by tumours of the photosensitising dye and access of the exciting light wave length to tumour rather than brain. Selective tumour necrosis was possible only at depths where light was attenuated less than the concentration difference between tumour and the normal brain and if treatment parameters were used that did not damage the normal brain at the surface. Using a new, synthetic photosensitiser, sulphonated aluminium chloro-phthalocyanine (ALSPc) activated by 675 nm monochromatic red light supplied by a dye laser, the authors had studied the effects of PDT on the normal mouse brain by measuring the size of histological lesions produced in the parietal cortex directly exposed to external beam irradiation with red light. The brains of animals sensitised with a low dose ALSPc were only damaged by high doses of light. Using parameters that did not damage the normal brain (0-5 mg/kg ALSPc, 700 J/cm² 675 nm light) they treated VM mice with tumours inoculated beneath the surface of the parietal cortex and produced necrosis of the tumours without damaging the overlying brain histologically, thus demonstrating that selective necrosis with PDT was possible. However, survival experiments using these parameters failed to produce prolonged survival in treated animals, suggesting that further refinement of the treatment parameters was required before the method could be used clinically. The most important factor that was likely to limit the method clinically was the attenuation of light by the normal brain. Under conditions where light was uniformly scattered by myelin, effective light penetration only occurred to a maximum depth of 2 cm. Light penetration in the normal brain was, however, not uniform and the authors presented histological evidence that light transmission was enhanced by white matter tracts and therefore may penetrate deepest along the same planes as tumour cells.

EPIDERMAL GROWTH FACTOR RECEPTOR (EGF-R) IN INTRACRANIAL NEOPLASMS
IR Whittle, RA Hawkins, E Killen, JD Miller (Edinburgh)
Previous work had suggested that expression of EGF-R may be related to the genesis of cerebral neoplasms and that EGF monoclonal antibodies conjugates may be useful in their therapy (Liberman TA et al, Nature 1985;313:144–7, and Epenestos AA et al, Br Med J 1985;290:1463–6). EGF-R was therefore assayed in 34 intracranial neoplasms (14 anaplastic astrocytoma, seven low grade gliomas, six meningioma and seven others) by measuring the binding of (125I)EGF. EGF-R levels were graded from high (+ + +) to low (+) or negative, and where appropriate the binding affinity of the receptor site for EGF evaluated. EGF-r levels were + + + or + + in 12 tumours and + in four tumours (10 anaplastic astrocytoma (70% of sample), four meningiomas (66%), one oligodendroglioma and one secondary). In only seven tumours (four anaplastic astrocytoma, two meningioma, one oligodendroglioma), however, was the binding affinity of the EGF-r site high (Kd < 1nM). When present EGF-r activity was found in all cellular fractions except the cytosol. Sixteen tumours, including six of the seven low grade gliomas, and four specimens of normal brain were negative. These preliminary studies confirmed that EGF-r like activity was present in the particulate fractions of intracranial neoplasms of both mesenchymal and neuroectodermal origin. In a large proportion of these tumours the EGF-r binding affinity was low, suggesting either a less specific or truncated binding site. The problems of using this receptor as a possible therapeutic target were discussed.

Implanted pump systems for treatment of spasticity
J Zierski, H Mueller (Giessen, FDR), B Williams (Smethwick)
In about one third of patients with violent spasticity due to spinal trauma, multiple sclerosis and diffuse brain injury, adequate control with oral antispastic medication cannot be achieved and successful rehabilitation is severely handicapped. In the past these patients were subjected to destructive chemical procedures or extensive surgery.
The pharmacokinetics of systemically and intratheceally administered baclofen were reviewed and the authors presented the results of management of uncontrollable spasticity by means of continuous intrathecal administration of baclofen with a total implantable gas driven pump system (Infusaid). Thirty patients were treated between June 1985 and January 1987. The main indication was incapacitating spasticity resistant to oral treatment with baclofen and caused by spinal cord injury or lesion (11 patients), multiple sclerosis (11 patients), infantile cerebral palsy (three patients), and cerebral injury, hypoxia or ischaemia (five patients). Clinical assessment including spasticity scores, integrated electromyography (ilemg) and motography were used for assessment of the results. Effective control of spasticity with mean reduction of ilemg by 44%, average decrease of Asworth's score from 3 to 0 and improvement of life quality was obtained in all patients with a daily dose of 10–800 mg of baclofen. Voluntary resting motoricity was not impaired and there were no untoward central side effects. The excellent effect of intrathecal baclofen in comparison with oral therapy was explained by local, spinal GABAergic inhibitory action of the drug which was delivered directly into the spinal subarachnoid space.

Dose finding and dose adjustment was performed prior to pump implantation by intermittent injections into a subcutaneous port. The complications of the procedure were minor (catheter displacement, disconnection) and easily correctable. The only limitation of this method of spasticity treatment was inability to reduce spasticity in selective muscle groups. Intrathecal long term infusion of baclofen is an alternative to surgery in the treatment of spasticity. Unfortunately, intrathecal baclofen is not yet readily available in Great Britain.

Computer based diagnostic and operations index
RSC Kerr, TA Cadoux-Hudson, PJ Topley, CBT Adams (Oxford)
The expanding workload over the past 30 years has stimulated the Oxford Neurological Unit to develop a micro-computer based method for the rapid recall of information regarding patient details, diagnosis and operations. For many years, this Unit had used the “Standard Nomenclature of Diseases and Operations” produced by the American Medical Association for indexing patient information. With the advancement of computer systems and the ease of their use, it had become apparent that such information could easily be stored on computer discs. The Oxford system was based on the database file of the Apricot system. The “Bible Class” program allowed details of each patient, the date of admission, region of referral, diagnosis and operation to be stored in such a way that retrieval of information about any of these variables was readily achieved. This ease of access facilitated not only internal audit but also the transfer of information between units. The authors proposed that a single such system be adopted by all the Departments of Neurosurgery in Great Britain, preferably before a diversity of programs were developed.

Discussion revealed that similar experiments were underway in other units and there was considerable interest in the concept of a universal system for neurosurgery
The main stumbling block appeared to be acceptance of a uniform coding system; the new ICD9 classification may be no more acceptable to neurosurgeons and the results of the SBNS working party were awaited.

EQUESTRIAN INJURIES—A PROSPECTIVE SURVEY IN THE WEST MIDLANDS
M Whitlock (Coventry)
The author pointed out that horse riding was one of the most dangerous sports in the United Kingdom. There were no accurate statistics of the number of head injuries in relation to the total number of riding injuries. A prospective multicentre survey of all riding injuries was undertaken in the West Midlands (population 6 million) over a fourteen month period. Head and facial injuries constituted approximately one third of the total number, with limb injuries being the most common. Neurological intervention was uncommon although most of the deaths were the result of a head injury. Major injuries to the spine were also rare, although soft tissue injuries often took a long time to recover. A questionnaire was given to the patient or relative in order to determine the mechanism of injury. Jumping accidents were common and it is apparent that some riders had insufficient training and the horses not schooled adequately.

The design and effectiveness of the riding hat had been investigated and faults had been found in even the safest hat (BSI 4472). The British Standards Committee were now modifying these safety requirements.

LOW GRADE SUPRATENTORIAL GLIOMAS—PROBLEMS OF MANAGEMENT
JS Garfield (Southampton)
The dilemmas in managing these tumours were outlined, namely, the correlation between histology, with its inherent sampling problems, CT scan appearance and outcome. The natural history, indications for surgery and place for radiotherapy were poorly defined. Seven hundred patients with histologically verified supratentorial gliomas were seen from 1965 to 1985, of whom 78 were classified as oligodendroglioma (51 anaplastic, 27 low grade) and only 49 as astrocytoma Grade 1/2. Conventional management of the anaplastic oligodendroglioma patients mirrored those for astrocytoma grade 3/4. For the small number of low grade oligodendroglioma patients, "total" removal was no more effective than partial removal or biopsy, and any benefit from radiotherapy was unproven.

The need for careful histological definition was illustrated in the 49 patients with low grade astrocytoma. "Total" removal was possible in only five patients and all survived. After partial removal or biopsy in 44 patients, 37 were alive one month after surgery. Overall, radiotherapy had no beneficial effect upon time to death, or duration of survival in those still alive. Only when enhancement, however slight, was present on CT scan did radiotherapy appear to have a beneficial effect. Hence, the author suggested that patients with possible low grade astrocytomas, that are accessible, should be explored and multiple biopsies taken for histology. Where "total" removal appeared to have been achieved, no radiotherapy should be given. Following partial removal, radiotherapy should be reserved for patients with evidence of enhancement on CT scan.

STEREOSCOPIC BIOPSY OF INTRACRANIAL BRAIN LESIONS
R Bradford, CH Davis, DGT Thomas (London)
The management of intrinsic brain stem lesions remains controversial. Empirical treatment continues to have advocates who warn of the hazards of biopsy as well as the assumed poor prognosis of the patient. Despite improved imaging of the brain stem with high resolution computed tomography (CT) and magnetic resonance imaging (MRI), a diagnosis requires histological verification. Using the Brown-Roberts-Wells (BRW) stereotactic system (Radioson Inc, Burlington, Mass, USA) a series of ten patients with brain stem lesions had been submitted to CT or MRI-directed biopsy. Vertebral angiography had been performed in all patients, to avoid both aneurysms and major vessels. Biopsies were carried out through burrholes via a transfrontal approach, using a side cutting cannula. Histological examination was performed by immediate smear and paraffin sections of multiple biopsies from one or more targets. A positive diagnosis was obtained in nine cases, only three of which were found to have a neoplastic condition. There were two granulomas and four pontine haematomas. There was no significant morbidity from the procedure and no operative mortality.

Since a definitive pathological diagnosis avoids the complications of inappropriate therapy, the authors suggested that guided stereotaxic biopsy be considered in the management of all intrinsic brain stem lesions. In discussion the problem of intrinsic brain stem arteriovenous malformation was raised—they are not usually visible on angiography nor can they be excised by stereotaxic technique, but equally their tendency to rebleed is poorly defined.

CT GUIDED STEREO TACTIC BIOPSY ON A SHOESTRING
HT Marsh, BA Bell, AE Richardson, R Howard, J Britton (London)
The combination of computed tomographic imaging and stereotax allows the accurate biopsy of previously inaccessible lesions. Most neurosurgical units have, however, been unable to use stereotaxic biopsy because of the cost and complexity of the new CT-compatible frames. Patients with small, deep-seated mass lesions must, therefore, be referred to units with CT stereotactic equipment or have their lesions left unverified.

The authors developed a simple but reliable method of CT-guided stereotaxic biopsy based on a standard Leksell frame that had been used at Atkinson Morley's Hospital since 1974. Minor modifications allowed patients to be scanned with the frame in place to measure the target co-ordinates. These were directly computed from a normal GE 9800 scan using the standard region of interest facilities on the scanning console. The procedure took less than ninety minutes and had been used in 22 patients with only one case of a temporary hemiparesis. The authors suggested that their technique brought stereotaxic biopsy into the repertoire of many neurosurgeons who might previously have been deterred by its cost and complexity. A similar modification had been tried in Cambridge but abandoned in favour of the commercially available stereotactic system particularly for brain stem stereotaxic biopsy.

STEREO TACTIC LINAC IRRADIATION
E Hitchcock, G Kitchen, E Dalton (Birmingham)
A simple system had been devised to transfer computed tomographic information to a radiotherapy planning computer. Both operative and non-operative fixation systems had been integrated with the CT scanner to give complete lesion co-ordinates using the CT scanners internal computer. The lesion co-ordinates were referred and attached to a stereotaxic instrument which permitted the subsequent focal irradiation of the lesion at a single short session on a linear accelerator. The authors gave details of the instrumentation and experience with the system. It had been used for tumour irradiation but was also suitable for irradiation of arteriovenous malformations. The advantages and disadvantages of irradiation by linear accelerator over cobalt irradiation were discussed. This new technique was received with enthusiasm particularly with reference to how it might complement the stereotaxic system available in Sheffield.
THE MANAGEMENT OF POSTERIOR CIRCULATION ANEURYSMS
DA Lang, S Galbraith (Glasgow)
One hundred and twenty eight patients had been studied retrospectively with posterior circulation aneurysms admitted to the Institute of Neurological Sciences between 1979 and 1986, including those who had a necropsy in the Institute, but who died before admission to the hospital. There were 55 (43%) at the basilar tip and 27 (21%) at the posterior inferior cerebellar artery. At six months, 70 (55%) patients had made a good or moderate recovery, 16 (12%) were severely disabled and 41 (33%) had died or were vegetative.

Subarachnoid haemorrhage was the presentation in 104 patients of whom 17 (16%) developed delayed ischaemia and 18 (17%) rebled. Overall, 36 (35%) of these patients died or were vegetative, 11 (10%) were severely disabled and 57 (55%) made a good or moderate recovery. Sixty seven (64%) of the patients with subarachnoid haemorrhage were operated on and nine (13%) of them died.

In this series the overall management outcome of patients with posterior circulation aneurysms was similar to that in patients with anterior circulation aneurysms management concurrently in Glasgow.

CEREBRAL MEDULLARY VENOUS MALFORMATIONS (MVM) REPORT OF FOUR CASES AND DISCUSSION ABOUT THEIR MANAGEMENT
PS Dias, DMC Forster, U Bergvall (Sheffield)
The historical controversies surrounding the existence of purely venous cerebral malformations were reviewed. The authors described four patients with medullary venous malformations who presented from the North Trent region in 1986. The three patients with supratentorial MVMs presented with epilepsy and the patient with an infratentorial malformation presented with diplopia and posterior fossa symptoms and signs in addition to a documented history of subarachnoid haemorrhage. The neuro-radiological features were reviewed and included either round enhancing lesions or linear transcerebral enhancement on CT scan. By definition, on angiography, no fistulous component could be demonstrated. At the present time with limited understanding of the natural history and aetiology of MVMs, it is difficult to determine the ideal treatment. While it appeared logical to try to prevent rebleeding by promoting thromboangiitis obliterans by stereotactic radiosurgery when there was a high flow or a fistulous malformation, this lacked credibility if the cause of the abnormality itself was an obstructed or congenitally absent venous channel. The diagnostic and therapeutic dilemmas presented by these lesions provoked considerable discussion.

COSTOTRANSVERSECTOMY FOR HERNIATED THORACIC DISCS: RESULTS IN 14 CONSECUTIVE CASES
G Kaar, S Young, SA O’Laoire (Dublin)
Herniations of thoracic intervertebral discs are an uncommon, but potentially reversible cause of cord compression. Early symptoms are often mild, making early diagnosis and hence prompt, effective surgical decompression, a difficult goal to attain. For many years, laminectomy was the only treatment offered, despite uniformly bad results. In 1960, Hulme reported the results of costotransversectomy, a lateral, extrapleural approach, in four patients with central thoracic disc herniation. Three patients were cured, and one showed marked improvement. Since then, there have been small series revealing equally encouraging results with transthoracic, transpleural and transpedicular approaches.

The authors described their experience with 14 consecutive patients with spinal cord compression due to herniated thoracic discs, treated by costotransversectomy. Most of the patients had severe neurological deficits prior to surgery. The importance of preoperative radiological markers was emphasised, and in all cases the disc excision was carried out under microscopy as demonstrated on a short video. Follow up was from six months to six years, and the results were analysed. The operation was generally well tolerated, and complications few. One patient, with a calcified intradural disc, experienced transient worsening of paraesthesia postoperatively. Another developed an intrathoracic extrapleural meningocoele as a delayed complication.

The authors believe this to be the largest recorded series of thoracic discs treated by costotransversectomy.

SURGICAL MANAGEMENT OF GLOMUS TUMOURS
L Symon, AD Cheesmen, B Kendall (London)
A historical review of these tumours dating from 1840 was presented. Twenty five patients with 27 glomus tumours of the base of the skull had been treated by the authors between 1979 and 1986. There were 16 females and nine males, ages ranging from 18 to 66 years, with a mean of 42. Sixteen tumours occurred on the left side and seven on the right. There were two bilateral tumours, and one case having associated carotid body tumours. Three patients had catecholamine secreting tumours. Principal presenting features were hearing loss (86%), a middle ear mass (71%), pulsatile tinnitus (67%) and posterior cranial nerve deficits (52%). The Fisch classification has been used to describe these cases: Type A: middle ear and tympanic area, 2; Type B: tympanomastoid area, 3; Type C: infralabyrinthine and apical compartment causing temporal bone destruction, 11; Type D: intracranial extension, 9. One further case presented in the retromaxillary area, an extremely rare site probably arising from the otic ganglion. Axial CT scanning had proven most effective and the need for careful endocrine assessment with selective catecholamine measurement was emphasised as the patients may have more than one tumour. Preoperative embolisation with Lyodura was recommended with operation following one week later. The postero-lateral-transtentorial approach had been used for the neurosurgical lesions with two deaths and two incomplete removals. The management of facial nerve and swallowing problems was discussed. Discussion confirmed that these lesions are operable and that early operation avoids the development of multiple cranial nerve palsies.

MEASURING INTRACRANIAL PRESSURE IN THE HIMALAYAS
BH Cummins (Bristol)
As part of an expedition to ascend the unclimbed mountain Hagshu (22,000 ft) in Ladakh, the intracranial pressure (ICP) was measured by telemetry to study the effects of altitude upon two climbers and the expedition doctor. Daily recordings were made at rest and under reproducible physiological stress from sea level to 16,500 ft. CT scans were taken of the entire group to determine whether small ventricles were associated with a susceptibility to acute mountain sickness (AMS) and cerebral oedema. Symptoms of AMS were charted each day according to the scoring method of Fletcher. ICP was measured by (1) lying horizontal, head straight, then turned to right and then left; (2) lying 30° head up and then 30° head down; (3) lying horizontal, breath held for 40 s, then overbreathing for 30 s; (4) in a sustained press up for 30 s, with the breath held for final 15 s.

The pulse rate was measured at the beginning and end of each session. Seven hundred and seventy six measurements were made, and below 15,500 ft the ICP remained within normal limits, varying as anticipated with stress, that is, rising with head turned, head
down, breath held and press-up; falling with head up and overbreathing. Above 15,500 ft although in two cases the resting ICP remained the same, in another the pressure rose to the limits of normal, and when cerebrospinal fluid for study was obtained, the ICP proved volatile, associated with a high pulse rate, requiring a return to base camp.

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<th>Below 15,500 ft</th>
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<td>MR 9.5 ± 3</td>
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<tr>
<td>BC 7 ± 3</td>
<td>6.5 ± 3</td>
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</tbody>
</table>

Of 10 climbers, those scoring high for headache and ataxia, all had small ventricles on CT scan at sea level, while those with normal or large ventricles were little affected. Acetazolamide (Diamox) benefitted the climber with the smallest ventricles, who was severely incapacitated by AMS.

**NEUROSURGERY IN THE FALKLANDS CAMPAIGN**

Lt Col PA Stanworth, RAMC (V)

Following the Argentinian invasion of the Falklands Islands on 2 April 1982, a British Task Force set sail three days later, under the Codename "Operation Corporate". After sea, air and land battles the Argentinians surrendered on 15 June 1982. During the campaign, 256 members of the Task Force were killed and 777 injured. Of the Army series, just over half (52%) were penetrating wounds, 21% burns, and the remainder blunt injuries or medical problems. A large number of casualties at sea were transferred to the Hospital Ship HMS Uganda, and casualties occurring on land were generally dealt with by the Field Hospital at Ajax Bay on East Falkland, having been evacuated directly or via Regimental Aid Posts or one of the Dressing Stations.

The total injuries, 14% were to the head and neck but only nine were traced with brain or skull injuries. The majority had primary surgery in the field but five required further definitive surgery on return to the UK. All nine surviving one had an overt infection, some had focal neurological sequelae and seven developed post-traumatic epilepsy. Two casualties made a good recovery and continued in the Armed Services but seven were moderately disabled and were discharged mainly as a result of epilepsy. Discussion again emphasised the need for early adequate debridement and primary dural closure.

**MRI AND THE MANAGEMENT OF SYRINGOMYELIA**

R Grant, D Hadley, D Lang, R Johnston, B Condon, I Bone, GM Teasdale (Glasgow)

Magnetic resonance imaging (MRI) has made the anatomical localisation of intramedullary spinal cord lesions more sensitive and specific. The severity and distribution of signs in syringomyelia are considered to be dependent on the cyst size. The authors studied 15 patients with syringomyelia to discover if the dimensions of the syrinx related to the clinical findings or degree of disability. In seven of the patients who underwent surgery to decompress the syrinx, its size was reassessed after operation (foramen magnum decompression four, cysto-subarachnoid shunt four, two patients had both, and myelotomy one).

Using a 0.15T resistive magnet, 8 mm sagittal and axial selected-axial MRIs scans of the head and spine were obtained. Syrinx site, length and diameter were measured after enlarging × 4, the area of interest on the viewing console. Clinical findings and MRI measurements were reported independently.

Seven patients had imaging performed between 2–6 months after operation.

Ten of the 12 patients had tonsillar herniation, one had a posterior fossa arachnoid cyst and one patient with a post-traumatic syrinx had a normal posterior fossa. The upper limit of all syringes was at or above C2 and small cysts tended to have a small cyst diameter. There was not a significant relationship between the dimensions of the syrinx and clinical features such as muscle wasting or weakness, distribution of sensory loss, degree of disability or distress. All cases had inadequate to some degree post-operatively, irrespective of the type of operation performed.

These findings support the role of tonsillar herniation in the pathogenesis or maintenance of the syrinx. MRI assessment of syrinx dimensions pre- and post-operatively, will be important in future studies of outcome following surgical treatment.

**FRACURES OF THE THORACO-LUMBAR SPINE WITH NEUROLOGICAL INVOLVEMENT—RESULTS OF COMBINED ANTERIOR DECOMPRESSION AND POSTERIOR STABILISATION**

JG Christie, SA O’Laoire, R Bendall (Dublin and London)

Six cases (all males aged 19–52 years) of fracture of the thoraco-lumbar spine were presented who were seen 10 days to 13 months after their injury. All patients had bony compression of the conus medullaris or cauda equina with resultant lower limb weakness and/or sphincter disturbances. All were treated operatively with anterior decompression via a posterolateral approach combined with posterior stabilisation and fusion using Harrington rods.

There was complete recovery of leg weakness in three patients and partial recovery in one. One patient’s weakness was temporarily increased postoperatively. There was complete recovery of sphincter function in two patients and no change in two patients. One patient’s sphincter problems were increased postoperatively.

The authors considered that appropriate decompression procedures for these injuries could result in neurological improvement. In addition, the stabilisation and fusion allowed for early mobilisation, and prevented the development of spinal deformity which could cause later neurological deterioration. The authors advocated that if any residual compression was seen on early myelography or CT scanning the operation should be recommended. The paper provoked considerable discussion with reference to the natural history of recovery, method and timing of investigation, surgical approach and method of stabilisation.

**CONGENITAL ORBITAL AEROCOELE—AN UNUSUAL COMPLICATION OF EXCESSIVE PNEUMATISATION OF THE SPHENOID BONE**

FA Strang (Manchester)

An air filled sac in the orbit is a rare cause of axial proptosis. The case of a 17 year old school boy was described who presented with a painless swelling in the left temple of three months’ duration. The swelling varied spontaneously in size. He was found to have symptomless left axial proptosis in addition to the swelling in the left temporalis muscle, both of which varied with jaw opening and clenching, as demonstrated on video. Investigations showed that there was excessive pneumatisation of the sphenoid bone extending into the middle fossae, associated with a defect in the lesser wing of sphenoid, an air filled cavity in the left temporalis muscle and air in the left orbit. Following surgery his symptoms were relieved and the proptosis disappeared.

There are a number of congenital variations in the anatomy of the sphenoid bone and sinus such as aplasia and pneumosinus dilatans which form the basis for different clinical syndromes. It was concluded that the author’s case was a unique pathological sequel of excessive pneumatisation of the sphenoid bone.
TRIGEMINAL NEURINOMA: HAS THE “NEW TECHNOLOGY” MADE ANY DIFFERENCE?
RD Page, RH Lye (Manchester)

The authors considered that the availability of new technology, in particular computed tomography and magnetic resonance imaging might be expected to detect trigeminal neurinomas while they were still small, thus facilitating earlier surgical extirpation and improved prognosis. Unfortunately, review of the case histories of five patients with trigeminal neurinomas presenting from 1954 to 1985, demonstrated that access to CT and MRI diagnostic facilities had not appreciably altered the detection of these tumours in favour of smaller lesions.

The three patients presenting since the advent of CT did so with large neurinomas confirming that these tumours may be relatively asymptomatic until large. There was a very low incidence of neurinomas in patients with trigeminal neuralgia, and presenting symptoms were those of cranial nerve or brain stem compression. However, recent advantages in diagnostic radiology had facilitated considerably the logical planning of the operative approach and a fascinating demonstration was given of the use of three dimensional CT reconstruction and magnetic resonance imaging when planning surgery.

“HOW DOES YOUR ANEURYSM GROW?”
TF Buckley (Cork)

A 29 year old married hospital nurse suffered a subarachnoid haemorrhage during exertion. Angiography revealed a large left middle cerebral and a smaller right middle cerebral aneurysm. At craniotomy, eight days following the haemorrhage, while exploring the left middle cerebral artery, another aneurysm was observed to grow from the anterior aspect of the internal carotid artery as confirmed on subsequent angiography. Ultimately, all the aneurysms were successfully clipped. Considerable discussion ensued with regard to the management of abrupt, novel “thunderclap” headache in patients with normal CSF and a negative CT scan.