IMPLANTATION OF HUMAN FETAL VENTRAL MESENCEPHALON TO THE BILATERAL CAUDATE NUCLEUS IN ADVANCED PARKINSON’S DISEASE
PO Byrne, Y Caglar, A Detta, ER Hitchcock. Birmingham, UK

Twelve patients had bilateral caudate nucleus implantations of late stage fetal mesencephalon as the fourth series of a study of experimental surgery for advanced Parkinson’s disease. Patients with an age range of 55–67 years were operated upon in the latter part of 1991. Subsequently they have been systematically followed up in terms of preoperative and postoperative clinical assessment and the results of those available for follow up to date were outlined. The results refer to timed motor performance tests, CAPIT core assessment. Northwestern University disability scores and Schwab and England ratings obtained preoperatively with drug regimens adjusted to maximum efficacy and then at time intervals postoperatively; in addition, complications occurring in individual patients were analysed.

The results of this fourth experimental series were discussed with reference to earlier series and factors important in human fetal cell transplantation for neurodegenerative disorders with their attendant problems were discussed.

DYNAMIC OXYGEN MICROPOLAROGRAPHY OF BILATERAL MESENCEPHALIC GRANULAR CELL TUMOURS: THE INFLUENCE OF OEDEMA ON TISSUE OXYGENATION
GS Cruickshank, R Rampling. Glasgow, UK

Dynamic oxygen micropolarography of malignant brain tumours has shown that a high proportion have a large hypoxic volume and that this correlates with the relative resistance of these tumours to radiotherapy. The spatial resolution of this technique allows a unique analysis of the factors affecting the oxygen supply at the microenvironmental level rather than other methods which integrate values over a large tissue volume.1 In this study we have used this technique to examine the oedematous peritumoral white matter to determine the influence of oedema on the local oxygen tension of this area, as this is the logical site for therapeutic intervention after surgery. Perioperative oxygen tension (pO2) measurements were made in 24 patients undergoing routine craniotomy for tumour decompression. A 300 μm micropolarographic probe with a 12 μm oxygen sensitive tip, was advanced under computerised step control using ultrasound guidance. A number of static probe measurements were also made to provide pseudosteady-flow assessments of relative oxygen consumption (VO2). Morphometric measurements on tumour and peritumoral biopsies were performed using standard techniques.

pO2 frequency histograms of 192 readings (six probe passes of 32 readings 700 μm apart) were plotted at 2.5 mmHg intervals. There was a surprisingly high incidence of low pO2 values (18% < 2.5 mmHg) by comparison with that reported in normal white matter (< 2% < 2.5 mmHg).2 Median and low pO2 values were correlated with intercapillary distance in peritumoral white matter (r = 0.87) but not so clearly in tumours. Maximum pO2 levels recorded in peritumoral white matter were equivalent or better than that seen in tumours. VO2 values varied between 6 and 12% only, in peritumoral white matter.

Higher percentages of low pO2 values in the peritumoral region are of clinical and therapeutic significance. Increased intercapillary distance correlates with lower pO2 values but the small variation in VO2 levels suggests that peritumoral hypoxia is more related to impaired capillary patency than altered or increased oxygen uptake in the expanded intercapillary space. Peritumoral oedema and its effects do not seem to be a limiting factor for oxygen supply to tumours, and thus a cause of tumour hypoxia.

DYNAMIC MAGNETIC RESONANCE IMAGING FOR MEASUREMENT OF REGIONAL HAEMODYNAMICS AFTER TRANSIENT CEREBRAL ISCHAEMIA
R Macfarlane, LM Hamberg, E Tasdemiroglu, JW Belliveau, B Rosen, MA Moskowitz. London, UK and Boston, USA

Because alterations in cerebral blood volume (CBV) are not necessarily coupled to those of cerebral blood flow (CBF) under pathological conditions, a noninvasive technique able to measure regional and temporal changes of each parameter simultaneously might aid investigation of perturbed cerebrovascular states.

Gadolinium-DTPA was injected as a bolus into the femoral vein of seven anesthetised cats placed in the bore of a 4.7 T MRI, while rapid sequence images were acquired every 1-3 s. After a baseline study, global cerebral ischaemia was induced for 10 minutes. Further imaging sequences were repeated at intervals after reperfusion. CBV changes were calculated relative to the baseline and, after direct measurement of vascular transit time (VTT), the CBF index (CBFi) was computed.

Relative CBV (rCBV) and CBF Fi were sharply diminished during the early reperfusion period. Both fell to near-basal levels at 45 minutes. Thereafter CBV rose slowly, whereas CBF continued to fall. At three hours, CBFI was still 60% of basal (p < 0.05), whereas CBF had returned to pre-ischaemic values. VTT fell from 4-4 to 1-6 s at 30 minutes, was near-normal at one hour, but increased to 6-7 s at three hours (p < 0.05). CBF results were comparable with those obtained in previous radionuclide studies.2

It is concluded that dynamic susceptibility-contrast MRI provides a noninvasive, in vivo method for determination of CBFi and rCBV.

Meningioma-Induced Fibrinolysis
PD Palmer, DA Francis, JI Francis, F Iannotti. Southampton, UK

Fibrinolysis enhances surgical bleeding. Brain tumours, particularly meningiomas, have a high content of tissue plasminogen activator (tPA) which can convert plasminogen into plasmin and hence stimulate fibrinolysis. Thus drugs such as aprotinin, which blocks plasmin, may reduce bleeding in neurosurgery. Brain also has a high content of tissue factor, which initiates blood coagulation. Surgery may release tissue factor into the circulation resulting in local activation of coagulation and secondary fibrinolytic activation with consumption of clotting factors and bleeding. Preoperative samples from 12 patients with a meningioma (group A) and five patients with an acoustic schwannoma (group B) were frozen to -70°C. Molecular markers of activation of coagulation (prothrombin Fl.2) and fibrinolysis (tPA, and total fibrinogen) were measured by enzyme linked immuno-sorbent assay (ELISA). The table shows that in nine of group A (75%) and in two of group B (40%) the total degradation products were markedly raised (bold figures). In five of group A (42%) there was evidence of raised tPA but in none of group B. In eight of group A (66%) and in none of group B (20%) the prothrombin Fl.2 was significantly raised.

This study demonstrates that activation of coagulation and fibrinolysis is present preoperatively in both groups which provides a rationale for the use of antiplasmin agents in neurosurgery.

Plain man’s guide to os odontoideum
HA Crowther, JM Stevens, BE Kendall. London, UK

Abnormalities of the odontoid process may be associated with atlantoaxial subluxation and neural compression. There have been numerous explanations, ranging from (a) anomalous segmentation during embryological development; (b) a congenitally short transverse ligament which, in effect, divides the odontoid process during development; to (c) fracture with subsequent remodelling. This last mechanism might not account for the abnormalities seen in young children delivered normally.

The purpose of this study has been to evaluate a variety of abnormalities of the odontoid process, and, in doing so, we have developed a new simpler theory of its causation. Sixty-two patients were examined by high definition CT or MRI in flexion and extension. Some have been studied before and after surgery, and followed up radiologically for up to a decade. This has been combined with a detailed review of the phyllogenic and embryological literature. We have been able to show that in post-traumatic cases, the transverse ligament, wholly or in part, is interposed in the ununited lesion. In congenital malformations, the abnormality is also associated with soft tissue interposition and, in some, in whom posterior fusion has been carried out early, there is subsequent fusion of an apparently normal transverse ligament.

Our conclusion is that in os odontoideum: (a) the dens forms normally but ossifies abnormally because of abnormal motion; (b) the os is the result, rather than the cause of instability; and (c) hypoplasia of the intact dens is a different congenital malformation, associated with atlantoaxial assimilation and fusion of cervical vertebrae (the Klippel-Feil type of deformity).

Subparticular Fenestration for Lumbar Stenosis: Clinical Follow-Up
A Dalley, HT Marsh. London, UK

Subparticular fenestration or selective laminotomy has been advocated as an alternative to full decompressive laminectomy for lumbar canal stenosis. The goals are to reduce perioperative discomfort and maintain spinal anatomy. Over a five-year period, 44 patients with symptoms of lumbar canal stenosis and claudication were selected for microscopic lumbar fenestrations. The most common level of decompression was L4/5 with 29 patients (66%) undergoing surgery at this level. Multilevel decompressions were performed in 14 patients (32%).

Complete follow up including repeat patient interview, or review of current medical notes, was available in 39 patients (88%) and ranged from one to six years.

Nearly 90% had complete or near complete resolution of symptoms at six months. The preliminary results of long-term follow-up, however, show that over 50% (14/25) have suffered recurrence of their original symptoms from six months to five years after surgery. To date, 11 of these 14 patients have undergone complete re-investigation and five of the patients who had early relief of pain have gone on to laminectomy. The large number of patients with recurrent symptoms which show that fenestrations only briefly halt the degenerative processes and that full decompressive laminectomy provides a better long-term solution to the problem of lumbar canal stenosis.

Using the operating microscope and limited surgical exposures we have found that early mobilisation and short stays in hospital (less than four days) are easily achieved with laminectomy.

WHO IS TO BLAME FOR THE MORBIDITY OF ACUTE CAUDA EQUINA?
GC Stephenson, R Myles Gibson, VKH Sonntag. London, UK and Phoenix, Arizona, USA

Acute cauda equina compression by a lumbar disc may have a devastating effect on the quality of the life of those afflicted and its management is increasingly becoming the subject of patients’ complaints and litigation. The initial manifestations of this condition may remain unrecognised by the non-surgeon until severe neurological deficit or incontinence develops.

This study reviewed the records of 45 consecutive patients presenting over an eight-year period all of whom were surgically treated. The follow up ranged from 18 months to eight years (mean 4.5 years) and the average age at presentation was 41 years. Of the 45 patients, 21 deteriorated following admission to hospital or after having been seen at least once by a medical practitioner. The cause of the deterioration was examined and guidelines regarding early diagnosis and management were proposed.

Spina Bifida and Syringomyelia
C Hardwidge, B Williams. Haywards Heath and Birmingham, UK

Seventeen cases of syringomyelia associated
with spina bifida were presented. Thirteen patients had hindbrain herniation (HHB), four with Chiari type I and nine with type II. Eight of the HHB related cases also had hydrocephalus. Four of the patients had a distal form of syringomyelia with cord tethering but no HHB or hydrocephalus. Nine of the HHB related cases underwent surgical treatment; six had shunts for hydrocephalus alone; one had a shunt followed by HHB decompression; two had untheratting procedures of the cord followed by HHB decompression. Of the non-HHB related group, none underwent syringopleural shunting and the other three had been treated conservatively. All patients who underwent HHB decompression improved, except one who had untreated hydrocephalus. All patients who had treated hydrocephalus from birth and developed syringomyelia did poorly. The patient with the distal syrinx, treated with a syringopleural shunt improved.

It was concluded that, firstly, when syringomyelia and hydrocephalus are present, the hydrocephalus should be treated first, as the syrinx may improve with this alone and it may be dangerous to perform syringopleural shunting or HHB decompression if hydrocephalus is adequately treated, and, secondly, that in the distal syrinx group without HHB or hydrocephalus, the filling mechanism is likely to be the tethering of the cord itself. Up to 20 gauge wire, or a higher tensile strength (74-4 kg) compared with 20 gauge (35-3 kg) and 18 gauge (49-9 kg) monofilament. The loop’s tensile strength and fatigue-life exceeded 20 gauge flexible cable. Fifty-eight patients aged 10-79 years were selected for cable fixation on exactly the same basis as those who in the past would have had monofilament wire insertion. All had six monthly follow-up reviews, most had atlantoaxial rheumatoid disease (32 patients); 12 had spinal tumours. All had preoperative and postoperative radiography and at least three, six, 12, and 18 months to detect cable breakage, movement of implant, or signs of bone fusion. To date, 436 cables have been implanted at 233 levels and there have been no broken cables or slippage of a cinch cable construct. Fifteen patients had had 12- and four have had 18-month reviews after surgery. Most (34 patients) had occipitocervical instability or cervical fusions (14 patients). There were no changes in SSEP during the passage of wires and, postoperatively, no patient deteriorated neurologically.

It is concluded that, firstly, the new cable is less gauge monofilament stainless steel wire on biomechanical testing; secondly, that clinically, it has performed well up to 18 months postoperatively, even when no bone has been inserted; and finally: that there have been no neurological problems due to sublaminar passage of the cable.

NONOPERATIVE ADMISSIONS TO A REGIONAL NEUROSURGICAL UNIT: ARE THEY JUSTIFIED?

IK Pople, RJ Nelson. Bristol, UK

The aim of this audit was to find out how many patients are discharged from our neurosurgical unit without having an operation and whether these admissions are all clinically justified. During 12 months, 2509 patients were admitted, of whom 1637 (65%) had an operation. A further 530 (21%) patients had an inpatient neuroradiological investigation (CT myelogram, or cerebral angiogram). Of the remaining 342 patients, 119 had a head CT and 223 were admitted for assessment of spinal disease, intracranial malignancy, suspected ventricular shunt malfunction, secondary malignancy in the spine, cerebrovascular disorders, and other miscellaneous conditions. Last-minute cancellation of a planned operation (unfit for anaesthesia, no theatre time, patient refused operation, or spontaneous resolution of symptoms) occurred in 41 patients, and only 13 were admitted for nonsurgical care of a postoperative complication. After studying the nonoperative cases in detail, it was concluded that relatively few patients (1-2% of all admissions) were admitted for assessment of spinal disease, intracranial malignancy, secondary malignancy in the spine, cerebrovascular disorders, and other miscellaneous conditions. Last-minute cancellation of a planned operation (unfit for anaesthesia, no theatre time, patient refused operation, or spontaneous resolution of symptoms) occurred in 41 patients, and only 13 were admitted for nonsurgical care of a postoperative complication.

SPINAL FIXATION USING A NEW FLEXIBLE CABLE (SOFTWIRE™)

D Peterson, HA Crockard. London, UK

Stainless steel monofilament wire of varying thickness is widely used, but non-conformability, difficulty in reproducing consistent tensioning and, most importantly, nerve damage during sublaminar wire passage are major drawbacks. It is against this background that alternatives have been developed. The stainless steel cable (SoftWire™) is 60 times more flexible than 20 gauge wire. It has a higher tensile strength (74-4 kg) compared with 20 gauge (35-3 kg) and 18 gauge (49-9 kg) monofilament. The loop’s tensile strength and fatigue-life exceeded 20 gauge flexible cable. Fifty-eight patients aged 10-79 years were selected for cable fixation on exactly the same basis as those who in the past would have had monofilament wire insertion. All had six monthly follow-up reviews, most had atlantoaxial rheumatoid disease (32 patients); 12 had spinal tumours. All had preoperative and postoperative radiography and at least three, six, 12, and 18 months to detect cable breakage, movement of implant, or signs of bone fusion. To date, 436 cables have been implanted at 233 levels and there have been no broken cables or slippage of a cinch cable construct. Fifteen patients had had 12- and four have had 18-month reviews after surgery. Most (34 patients) had occipitocervical instability or cervical fusions (14 patients). There were no changes in SSEP during the passage of wires and, postoperatively, no patient deteriorated neurologically.

It is concluded that, firstly, the new cable is less gauge monofilament stainless steel wire on biomechanical testing; secondly, that clinically, it has performed well up to 18 months postoperatively, even when no bone has been inserted; and finally: that there have been no neurological problems due to sublaminar passage of the cable.

Preoperative shunts were performed in 25% of children and 14% of older patients. Subtotal or radical surgical removal was achieved in 50% of patients irrespective of age. Five patients died in the first month after primary surgery and two patients after revision surgery. There was no significant difference in the number of surgical explorations in the three age groups (mean: 1-98, median = 2, range: 1-6). Lasting visual improvement occurred after surgery in 25% of patients. Radiotherapy was given postoperatively in 33%.

At follow-up, 65% of patients in the series are alive. Thirteen patients had hypopituitarism; 34% have abnormal function and 53% have frank panhypopituitarism. Forty-two per cent are functionally blind. Children had significantly worse vision post-operatively (p = 0.037). Adjuvant DXT did not significantly improve outcome nor increase the chance of panhypopituitarism or visual loss.

It was concluded that the management of craniopharyngioma still remains a real challenge.

ENDOSCOPIC MANAGEMENT OF PINéal TUMOURS

HB Coakham, IK Pople, DR Sandeman. Bristol, UK

The histological nature of pineal region tumours critically determines optimal treatment. Most authorities argue that all pineal tumours should be biopsied initially and subsequently be treated by stereotactic biopsy which can occasionally be hazardous in the pineal region, or by direct open surgery which may not always be necessary, particularly in cases of undifferentiated germinoma. Many cases of pineal tumour are admitted with acute hydrocephalus as emergencies.

We have developed a management system using transvenous endoscopic biopsy and third ventriculostomy. This one step procedure is minimally invasive and achieves two goals of safe adequate biopsy and immediate treatment of hydrocephalus while definitive histology and CSF marker studies are awaited. During this period immunohistology and electron microscopy is also performed.

A 30-YEAR AUDIT OF THE MANAGEMENT OF CRANIOPTHYNGIOMA IN NORTHERN IRELAND

I Bailey, B Mathew, D McAuley, D Haddren. Belfast, UK

Sixty-two patients have been diagnosed as having a craniopharyngioma in Northern Ireland in the last 30 years (population 1.6 million people). Fifty-seven patients had surgery and five had a presumptive diagnosis based on skull radiography.

The sex incidence was equal. Thirty-five per cent presented aged 14 or younger, 17% between 15 and 25 and 48% were older than 25. Seventy-seven per cent of the children presented with symptoms of raised intracranial pressure compared with only 48% of patients above 25 years (p = 0.05). Visual deterioration was the presenting symptom in 61% of cases. No patients presented with endocrine problems. Changes on the skull radiograph were more common in patients aged less than 25 (p = 0.0026). Air studies in the early series revealed no false positives or negatives. The first generation of CT scanners missed 12% of craniopharyngiomas which were subsequently discovered on air studies. Thirty-three (58%) patients had preoperative endocrine investigations and found to be without hormonal abnormalities.
CLINICOPATHOLOGICAL EXPERIENCE OVER 30 YEARS WITH PINEAL REGION TUMOURS IN NORTHERN IRELAND

B Mathew, B Herron, B Clements, M Mirakhor, T Pannin. Belfast, UK

Pineal region tumours constitute only 0-4-1% of intracranial tumours. In Northern Ireland there are 1-6 million people served by one neurosurgery unit. Up to 26 patients with pineal region tumours have been identified and carefully followed up.

The purpose of the present retrospective review was to establish a clinicopathological correlation of survival with histological type of tumour. The paraffin blocks had been stored and were re-studied using H&E, immunocytochemistry and electron microscopy. Tumours were classified according to the 1990 WHO classification.

There were a total of 24 pineal region tumours and two suprasellar germinomas which are frequently classified with pineal region tumours because of their common germ cell origin. There were 22 men and four women. The mean age was 27-5 (range 6-62) years. All 24 pineal region tumours had symptoms/signs of raised intracranial pressure and required initial shunting. The two patients with suprasellar germinomas presented with visual loss.

In 22 patients a tissue diagnosis was obtained, 16 by craniotomy, three by stereotaxy, one by cytology and two by post-mortem examination. Open biopsies were performed in the prone position by the suboccipital transtentorial approach. On six occasions biopsy via the open approach was abandoned because of difficulty with retraction. There was minimal operative morbidity but two patients died postoperatively (one stereotactic biopsy causing haemorrhage from a hypertensive secondary pineal transtentorial approach). All patients except one with a teratoma received radiotherapy. The table shows histology and three-year survival (where available).

<table>
<thead>
<tr>
<th>Histology</th>
<th>No (%)</th>
<th>3-year survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineal parenchymal</td>
<td>11 (50)</td>
<td>71 (n = 7)</td>
</tr>
<tr>
<td>Pineoblastoma</td>
<td>6 (27)</td>
<td>60 (n = 9)</td>
</tr>
<tr>
<td>Pineocytoma</td>
<td>4 (18)</td>
<td>100 (n = 2)</td>
</tr>
<tr>
<td>Pineocytoma/blastoma</td>
<td>1 (5)</td>
<td>100 (n = 1)</td>
</tr>
<tr>
<td>Germ cell tumours</td>
<td>7 (32)</td>
<td>40 (n = 5)</td>
</tr>
<tr>
<td>Germinoma</td>
<td>4 (18)</td>
<td>50 (n = 2)</td>
</tr>
<tr>
<td>Teratoma</td>
<td>3 (14)</td>
<td>100 (n = 2)</td>
</tr>
<tr>
<td>Astrocytoma</td>
<td>1 (5)</td>
<td>100 (n = 1)</td>
</tr>
<tr>
<td>Ependymoma</td>
<td>2 (9)</td>
<td>50 (n = 2)</td>
</tr>
<tr>
<td>Metastatic</td>
<td>(hypernephroma)</td>
<td>(n = 0)</td>
</tr>
</tbody>
</table>

n = Number with three year follow up.

The low incidence of germinoma and the longer survival for pineal parenchymal tumours is notable. The management of patients by 'blind' irradiation without a histological diagnosis needs to be questioned.

MENINGIOMAS OF THE CEREBELOPONTINE ANGLE: A REPORT OF 41 CASES

NWM Thomas, TT King. London, UK

Meningiomas of the cerebellopontine angle (CPA) are rare. This retrospective study presents 41 cases from a total of 625 tumours operated upon by one surgeon with the surviving patients noted. The tumours were classified based upon their anatomical distribution and correlating this with outcome.

Tumours were divided into six groups: lateral, internal auditory meatal, midpetrosal, inferior, Meckel's, and petroclival. Four different approaches were used either singly or in combination. Twenty-six patients had a total removal, 10 subtotal, and three were treated conservatively. There were no operative deaths. A good result (return to normal life) occurred in 30 cases, a fair outcome in seven, and a poor outcome in five. There were two deaths from late recurrence. Median follow up was 8-5 years.

Most tumours lateral to the internal auditory meatus had a complete removal, with a good outcome. Tumour removal and cranial nerve deficits were more common with medial tumours but incomplete removal did not correlate with early recurrence. Poor outcomes were seen to cranial nerve deficits and brainstem damage.

LATERAL APPROACHES TO FORAMEN MAGNUM TUMOURS

B George, G Lot. Paris, France

Foramen magnum tumours are operated on via three main approaches: anterior (transoral), posterior (midline posterior) and lateral approaches (anterolateral and posterolateral approaches). The anterolateral approach is also used to expose the vertebral artery in the neck. The vertebral artery is displaced medially, giving access to the condyle, C1 lateral mass, and C1-C2 joint. The posterolateral approach is a lateral enlargement of the standard posterior opening, allowing control of the vertebral artery in its C1 groove, which provides access to the condyle and C1 lateral mass. The anterolateral approach was mainly reserved for osseous (n = 18) and extradural nonosseous (n = 14) tumours. The posterolateral approach was used for intradural tumours (n = 42).

The benefits of the lateral approaches were discussed from a series of 230 foramen magnum tumours.

ACUTE INTRAOPERATIVE BRAIN HERNIATION COMPLICATING ELECTIVE NEUROSURGERY: NEURORADIOLOGICAL FINDINGS, PATHOPHYSIOLOGICAL MECHANISMS AND MANAGEMENT CONSIDERATIONS

R Vinwanthan, IR Whittle. Edinburgh, UK

Profound and acute intraoperative brain herniation is most commonly seen following evacuation of a post-traumatic acute subdural haematoma. The pathophysiological mechanisms probably relate to dysautoregulation of cerebral blood flow and hydrostatic brain oedema and the outcome in such cases is invariably death. Acute intraoperative brain swelling through an elective craniotomy is, however, a much rarer event. The aim of this report, which describes seven such cases, is to describe mechanisms and treatment of profound brain herniation during elective surgery, recommend some management guidelines, and describe the postoperative complications encountered.

Preoperatively four patients with anterior circulation aneurysms were WFNS grade I or II; two patients with tumours (pineoblastoma and astroblastoma) had, despite preoperative steroids, fixed focal deficits, but no impairment of conscious state; one patient with cerebellar AVM (with minimal mass effect) had a Glasgow Coma Score of 15 but general psychomotor slowing. Intraoperative monitoring of multiple parameters, by a consultant neuroanaesthetist, was unavailable before open brain herniation. Herniation occurred following intraoperative aneurysmal rupture, before arachnoidal dissection (three patients) and during clip placement (one patient); following resection of a recurrent, very vascular hemispheric astroblastoma; after resection of the pineal tumour, and after an un complicated AIDS lesion biopsy. In all cases brain herniation was immediately abandoned, acute medical measures to reduce intracranial pressure undertaken, the scalp closed in a single layer over the herniating brain, an intracranial pressure monitor inserted, immediate postoperative CT performed and the patient transferred to the intensive care unit for elective ventilation and monitoring.

Postoperative CT scans revealed intraventricular and subarachnoid haematomata with paradoxically minimal or no intraparenchymal haematomata, acute brain swelling, or midline shift. Intracranial pressure monitoring was generally unremarkable. All patients recovered from the acute ictus. One patient with an aneurysm rebled and died three days later. Three had successful aneurysm clipping with two patients resuming their prior employment. The other three patients all recovered, although one had a field defect from occipital lobe damage. Two patients required a second procedure ( duroplasty and closure of posterior subarachnoid space) due to recurrence. Overall outcome was remarkably good considering the dramatic and apparently catastrophic nature of the open brain herniation. It is postulated that closure of the scalp to limit brain herniation and prevent pial rupture together with optimal postoperative control of intracranial pressure minimised postoperative morbidity. It would appear that these are fundamental in pathophysiological mechanisms, neuroradiological findings, and outcome between open brain herniation occurring in posttraumatic and elective neurosurgical patients.

SHORT-COURSE ANTIMICROBIAL THERAPY FOR BRAIN ABSCESS AND SUBDURAL EMPYEMA

EM Brown, G Strangelis, A Jamjoom, HB Griffith. Bristol, UK

It is widely (and empirically) recommended that patients with intracranial sepsis (brain abscess and subdural empyema) should receive antibiotics for eight weeks or longer. Although there is no theoretical, experimental, or clinical evidence to justify these prolonged courses, neither have there been reliable, objective criteria that enable the patient's response to be monitored and which indicate when treatment should be discontinued. We use the Clinical Response Parameter (CRP) and the patient's clinical response for this purpose; when the fever resolves and CRP falls to within the normal range, the antibiotic(s) are stopped. In our patients, 12 with brain abscess and nine with subdural empyema (one with both),...
have been treated according to these criteria; all underwent 19 neurosurgical procedures. Of the 19 patients who were evaluable, median duration of treatment was 14 days (range 11-75 days); the follow-up period ranged from 18-54 months, during which time there were no relapses. One patient died from a massive pulmonary embolism before completing the course of treatment and in three patients, therapy was prolonged because of undiagnosed deep vein thrombosis (one patient), failure to eradicate the underlying aural pathology (one) and intercurrent infection (one). It was concluded that patients with intracranial sepsis can be treated successfully with courses of antibiotics which are administered for significantly shorter periods than those currently recommended.

ANTIMICROBIAL PROPHYLAXIS IN NEUROSURGERY AND FOLLOWING HINDBRAIN INJURY


Antibiotics are extensively used within neurosurgical practice in an effort to reduce the rate of postoperative infection. Uniquely, because of the nature of prophylactic antibiotics does not exist. This is not because there have been too few attempts to resolve the issue, but because virtually all of the many clinical trials suffer from flaws in design or execution, the most important of these being the failure to achieve statistical significance. Against this background, the benefits of prophylactic antibiotic use in neurosurgery need to be assessed. The Working Party, comprising members of the Society of British Neurological Surgeons and the British Society for Antimicrobial Therapy, reviewed the extensive literature on the use of prophylactic antibiotics in three areas of neurosurgery: (a) clean non-implant procedures; (b) CSF shunt surgery; and (c) skull fractures. Our conclusions and recommendations are as follows: (1) The weight of evidence suggests that antibiotics exert a protective effect in clean nonimplant surgery; a single dose of a first or second generation cephalosporin is an appropriate regimen. (2) For CSF shunt surgery not even a tentative recommendation can be made regarding the use of prophylactic antibiotics. (3) There is no conclusive evidence in the literature to support antiotopic prophylaxis in patients with skull fracture and CSF leak. The risk of CNS infection due to resistant organisms led to the conclusion that antiotopic prophylaxis should be withheld in this situation.

THE EFFECT OF CSF PROTEINS UPON BACTERIAL ADHESION TO SHUNT MATERIAL

HL Brydon, R Hayward, W Harkness, R Bayston. London, UK

The role that proteins play in bacterial adhesion to prosthetic materials has not been proven. For each paper that states that certain proteins promote bacterial adhesion, there is another that draws the opposite conclusion. All of this work has been performed using plasma proteins, however, and the effect of CSF upon neurosurgical prosthetic infections has not been studied.

There is some evidence that the concentration of the protein may alter the result, therefore a correlation between work on plasma and CSF cannot be assumed. In this study the effect of individual protein solutions (in CSF concentrations) and patient's CSF upon the adhesion of various bacteria to silicone rubber catheters was analysed. Lengths of sterile catheter were incubated with CSF, protein, or a control solution and were then exposed to a standardised suspension of radiolabelled staphylococci. The adherent organisms were dissolved and the activity measured by scintillation counting. The results indicate that all of the protein solutions and CSF inhibit bacterial adhesion to shunts, with the effect being greater with CSF than for the individual proteins. CSF from children with intraventricular haemorrhage was also compared with that from idiopathic and tumour hydrocephalus and no difference between them could be detected.

AN ANALYSIS OF OUR EXPERIENCE WITH THE VARIABLE PRESSURE SOPHY VALVE SYSTEM AND VENTRICULOJUGULAR SHUNTING AGAINST THE DIRECTION OF BLOOD FLOW

G O'Reilly, B Williams. Birmingham, UK

A series of 22 patients with hydrocephalus were treated by a shunt system incorporating a variable pressure Sophy valve or by ventriculojugular shunting against the direction of blood flow using the Eli-Shafei system. One patient had sequential insertion of two Sophy valves and an Eli-Shafei conduit. Patient selection was reserved to those whose hydrocephalus was such that shunting with conventional unipressure valves was deemed hazardous. None of the eight patients who had ventriculojugular shunting by the Eli-Shafei method demonstrated clinical or radiological improvement subsequent to shunt insertion. Of the 16 Sophy devices inserted only seven resulted in a satisfactory clinical outcome. It was suggested that the value of the Sophy and Eli-Shafei shunt systems in treating difficult cases of hydrocephalus remains to be proven.

UNITED KINGDOM CSF SHUNT REGISTRY AND SHUNT EVALUATION UNIT

JD Pickard, RD Ashpole, H Whitehouse, M Czosnyka. Cambridge, UK

Approximately 3000 shunt operations are performed in the United Kingdom per year (1500 new, 1500 revisions) at a total cost of over £6 million. Some 80% of shunts fail by 12 years. Many patients cases reviewed in vitro do not behave consistently nor according to the manufacturer's own specifications. If liability for product failure is to fall only on the manufacturer, strict record keeping is crucial under the Consumer Protection Act. On behalf of the Council of the Society of British Neurological Surgeons, the Executive Committee of the British Association of Paediatric Surgeons, the United Kingdom Hydrocephalus Group and the Association of Spina Bifida and Hydrocephalus, funding has been secured from the Department of Health and the East Anglian Regional Audit Committee to establish the following. (1) The United Kingdom CSF Shunt Registry, equivalent to the United Kingdom Heart Valve Registry, based on completion of a simple card at the time of operation for entry into the Dendrite Patient Analysis and Tracking System. (2) The United Kingdom CSF Shunt Evaluation Unit, which will prepare detailed evaluation reports of the hydrodynamic properties for every type of shunt valve currently available and also has the facilities for the testing of explanted valves with appropriate safety precautions. The way in which each initiative will function was outlined to encourage feedback by the Society.

RECURRENT CRANIOSYNOSTOSIS

AD Hockley, M Briggs. Birmingham and Oxford, UK

After an apparently successful correction for craniosynostosis, a small but significant number of patients later develop recurrent deformity needing reoperation. Analysis of 219 cases treated in the Birmingham and Oxford craniofacial units since 1979 demonstrates a higher re-operation rate in syndromal or unilateral coronal synostosis treated below the age of six months. In total, 15 patients underwent repeat fronto-orbital advancement. For single suture involvement the re-operation rate was 5% and for multiple it was 8%. In Apert's syndrome the re-operation rate was 16%. With initial surgery performed in the first three months of life there is a significantly higher re-operation rate of 23% falling to 17-9% for surgery between ages three and six months. After six months of age the rate did not exceed 5%.

Unless there is major raised intracranial pressure or exorbitism, it is recommended that fronto-orbital advancement is deferred to 6-12 months of age. In the presence of raised pressure, a preliminary posterior skull release can be helpful in allowing a planned anterior correction later with less risk of recurrent deformity.

AETIOLOGY OF HERNIATION OF THE HINDBRAIN IN CRANIOSYNOSTOSIS: PRELIMINARY OBSERVATIONS

DNP Thompson, RD Hayward, WJ Harkness, BM Jones. London, UK

Herniation of the hindbrain is recognised in association with craniosynostosis. Moreover the concept of acquired hindbrain herniation is reported and has been observed in our practice. This retrospective study aimed to identify some of the aetiological factors responsible for this deformity. The results of MRI and continuous intraparenchymal intracranial pressure monitoring were reviewed in a total of 33 patients. Two groups were identified; group 1 (n = 21) where there had been no previous vault surgery and group 2 (n = 12) where vault expansion surgery had been performed. Hindbrain herniation was identified in eight (38%) of patients in the unoperated group—all of whom had abnormal intracranial pressure. Among the operated group hindbrain herniation had only been seen in one patient in group 1 and in seven patients in group 2; furthermore, herniation of the hindbrain was an invariable accompaniment to all these cases of hydrocephalus.

An index of posterior fossa size relative to
the rest of the cranial vault was developed using the distance from the foramen magnum to the torcula expressed as a percentage of the distance from the foramen magnum to the nasion assessed on midline sagittal MRI scans. In group 1 the posterior fossa size was 13-1% in cases with herniation of the hindbrain compared with 16-1% in those without. In group 2 the values were 12-4% and 14-2% respectively.

The results confirm the high incidence of hindbrain herniation in craniosynostosis. Furthermore they suggest the incidence may be higher in children who have undergone vault expansion surgery. The anatomical constraints imposed by posterior fossa size, raised intracranial tension, and impaired cerebrospinal fluid circulation all appear to predispose toward herniation of the hindbrain. Potential underlying mechanisms were discussed.

**ACCURATE 3D COMBINATION AND DISPLAY OF MR, CT, AND MRA IMAGES FOR SURGICAL PLANNING**


Magnetic resonance (MR), x-ray CT, and angiographic images respectively depict soft tissue, bone, and blood vessels. None on its own is sufficient for the preoperative assessment of skull base lesions. We have developed and evaluated a computational technique for the 3D combination and display of multimodality images for planning skull base surgery.

Sixteen patients (seven with acoustic neuromas, one with a plasmacytoma, six with meningiomas (five subfrontal and suprasellar, one petrous apex) and one with a glomus jugulare tumour underwent MR, CT, and, where appropriate, MR angiography (MRA). The images were acquired using an anatomical landmarks rather than an external frame. Two techniques were used for displaying the resulting images: (a) multiple slices of overlaid bone from CT and soft tissue from MR; (b) pseudo-3D movie sequences showing bone from CT, lesions, and optic nerves from MR, and blood vessels from MRA. Possible advantages of the combined images compared with conventional viewing were investigated. For the first eight patients, the overlaid slices were evaluated retrospectively by independent observers. For the second eight, overlaid slices and 3D rendered displays were assessed prospectively, both by the operating and by independent surgeons, and the results validated with operative findings.

In the first eight patients there was an improvement in clarity of the image information and hence in the surgeons' confidence. A more rigorous assessment of the second eight showed a significant improvement in the depiction of tumour-bone relationships (overlaid slices) and of tumour-vasculature relationships (3D rendered displays), both at p < 0.05. The operative findings confirmed this.

The combined images provide a clearer representation of anatomical structures, further indices need to be devised for an objective assessment of the impact of this.
ICP for all patients is presented in the top figure. AMP increases with mean ICP until 45 mmHg, above this breakpoint it starts to decrease significantly (p < 0.05). The patients were divided into three groups according to Glasgow outcome score: GOS 1 and 2 (26 patients), GOS 3 (16 patients), GOS 4 and 5 (10 patients). The AMP pressure relationship in these groups is presented in the lower figure. The positions of the upper breakpoints differ significantly (p < 0.01). The groups with worse outcomes have upper breakpoints at lower ICPs.

It was concluded that the upper breakpoint of the amplitude-pressure relationship correlates with outcome in patients with head injury.


**THERAPEUTIC WINDOW FOR INTRAVENOUS CALCITONIN GENE-RELATED PEPTIDE IN A RAT MODEL OF FOCAL CEREBRAL ISCHAEMIA**

**JH Holland, SGC Sydersef, BA Bell.**

London, UK

We set out to determine the therapeutic window for an intravenous infusion (100 ng/kg per minute) of calcitonin gene-related peptide (CGRP) in a rat model of focal cerebral ischaemia. Intracerebral blood flow (CBF) was measured using hydrogen clearance and the volume of ischaemic neuronal injury was quantified using conventional histological techniques. When initiated one hour before the ischaemic insult, CGRP maintains local CBF at higher levels (35-6 (SD 1-9) ml/100 g per minute compared with 13-3 (SD 1-8) ml/100 g per minute in untreated animals) and reduces the volume of ischaemic neuronal injury by 57%. When started one hour after the onset of ischaemia, CBF increased significantly to 27-6 (SD 2-1) ml/100 g per minute and ischaemic neuronal injury was reduced by 40%. When the CGRP infusion was begun two hours after the onset of ischaemia, however, although CBF improved to 23-9 (SD 3-3) ml/100 g per minute, there was no significant improvement in the volume of ischaemic neuronal injury.

These findings confirm the efficacy of an intravenous infusion of the peptide provided it is given within one hour of the onset of a focal cerebral ischaemic event.

**EFFEKT OF TREATMENT OF DELAYED CEREBRAL ISCHAEMIA IN ANEURYSMAL SUBARACHNOID HAEMORRHAGE WITH PROSTACYCLIN DERIVATIVE (ILOPROST)**

PA Stanworth, DN Taylor, J Barham. Coventry, UK

One of the complications of aneurysmal subarachnoid haemorrhage is the associated syndrome of delayed cerebral ischaemia (DCI) in which patients deteriorate neurologically after an interval and may die or be left seriously disabled. Cerebral angiography frequently shows focal arterial narrowing ("vasospasm") and cerebral blood flow studies demonstrate an ischaemic brain. Numerous drugs have been used to attempt to reverse the vasospasm and improve the cerebral ischaemia. None have been shown to have any effect on either, although nimodipine, a calcium antagonist, has been shown to improve the clinical outcome.1 The prostaglandins are a relatively new series of drugs with vasoactive properties. One of the family, prostacyclin, is a very potent vasodilator. A pilot study using iloprost, a stable derivative of prostacyclin, was described assessing results clinically and with isotope cerebral blood flow measurements. Eleven patients were treated. There were no deaths. Clinical deterioration was reversed in eight or halved in three patients. In one patient a focal weakness became worse. Cerebral blood flow studies all showed a focal defect before treatment excluding one who did not have a pretreatment scan. All improved; three returned to normal, two showed hyperperfusion. Improvement in cerebral blood flow has never been previously reported.


**EXPRESSION OF INTERLEUKIN 1β AND ACTIVATION OF INFLAMMATORY CELLS DURING FOCAL CEREBRAL ISCHAEMIA IN RATS**

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Interleukin 1β (IL-1β) plays a central role in inflammation by causing activation of inflammatory cells. This study was designed to determine whether IL-1β is involved in the response of the brain to ischaemia. Rats were anaesthetised with halothane, the middle cerebral artery was occluded, and animals were sacrificed 0.5, 4, 24, 48, and 72 hours later. IL-1β was measured in tissue extracts using an enzyme-amplified immunometric assay that was specific for rat IL-1β. In separate animals, the brains were perfusion fixed and inflammatory cells were identified using immunostaining with ED-1 for microglia and ED-2 for perivascular cells. The IL-1β content of brains from sham-operated controls was 63 (SD 4) pg/mg protein. Tumor cells did not activate microglia and approximately 15 perivascular cells per section. In cortical tissue surrounding the ischaemic core, IL-1β showed an initial peak of 195 (SD 35) pg/mg protein at 0-5 hour and a later peak of 41.4 (SD 142.8) at 48 hours (n= each four). Perivascular cells increased to 50-60 by four hours and remained at this level. ED-1 positive microglia were first detected at 24 hours and increased to 200-300 by 72 hours. Thus, IL-1β is expressed in cerebral tissue where progressive ischaemic damage is known to occur. Its presence before the appearance of increased perivascular cells on immunohistochemistry suggests that it could play a role in activating these inflammatory cells.

**INDUCTION OF IL-1 IN HUMAN CEREBRAL CORTEX FOLLOWING ANEURYSMAL SUBARACHNOID HAEMORRHAGE**

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Activation of the immune system may occur in patients with delayed ischaemic neurological deficit (DIND) after aneurysmal subarachnoid haemorrhage.1 Astrocyte proliferation is promoted by IL-1 (IL-1); macrophage class II human leukaocyte (HLA) antigens are also involved. Protein kinase C is activated during subarachnoid haemorrhage and it induces macrophage secretion of IL-1.2 Therefore patients with subarachnoid haemorrhage were tested for intracerebral HLA Class II antigens and local formation of IL-1α (a subtype of IL-1).

Perioperative or postmortem brain biopsies from eight patients with subarachnoid haemorrhage were used. Consecutive tissue sections were stained using antibodies to HLA-DR (class II HLA), IL-1α and the astrocyte marker glial fibrillary acidic protein (GFAP). In situ hybridisation with probes for the IL-1α gene identified IL-1α messenger RNA, thus localising active IL-1α production. In two patients areas rich in HLA Class II antigens and astrocytes were identified. IL-1α (messenger RNA and protein) was also detected in these two patients. Findings were compared with clinical outcome; one patient died after onset of DIND and the other after a recurrent haemorrhage. IL-1α messenger RNA was...
detected in a third patient who had a good outcome. These preliminary findings demonstrate intracerebral IL-1α production in some patients after subarachnoid haemorrhage which may account for the astrocyte proliferation sometimes observed.


RADIOSURGERY FOR ARTERIOVENOUS MALFORMATIONS: A HEMODYNAMIC FOLLOW UP STUDY
AH Huneidi, C Nimmon, F Afsihar, PN Plowman, KE Britton. London, UK

This study had two objectives: (a) haemodynamic assessment of cerebral arteriovenous malformations (AVM); (b) to predict the response an AVM to treatment with stereotactic radiosurgery (SRS). Seventy patients (age range 37-5-6 years) were treated. In one patient, a cerebral AVM, had dynamic cerebral blood flow measurements using radiolabelled human serum albumin (125Te-HSA; 500 MBq; iv; SA:1 GBq/ml; QC:0-95). Axial (M) and transit (T) times were measured in real time. Patients were assessed before SRS (LINAC) and at three to six month intervals thereafter, for a period of 18 (SD 7) months at a rate of 3-2 (SD 1-3) studies per patient. Response to SRS was indicated by changes in the "steal index" and "cerebral reserve" as functions of appearance (M) and transit (T) times respectively.

Two types of AVM were identified: (a) Fast Flow AVM (61% with affected to non-affected flow ratio of 1:31 (SD 0-04) and a mean transit time ratio of 0 85 ± 0 03, (p < 0-001); and (b) Slow Flow AVM (39%) with a flow ratio of 0-92 (SD 0-06) and a mean transit time ratio of 1-13 ± 0 03, (p < 0-001). Fast flow AVMS showed a better response according to the steal and reserve indices. Slow Flow AVMS; however, showed a different pattern. Two conclusions were made: slow flow AVMS are less responsive to SRS. A haemodynamic follow up of cerebral AVM can be of value in predicting the response to stereotactic radiosurgery.

INTRAOPERATIVE CONFIRMATION OF FUNCTIONAL MRI OF MOTOR CORTEX
VGR Kumap, WJ Harkness, A Connelly, GD Jackson. London, UK

The extent of surgical removal of lesions in or adjacent to the motor cortex is usually restricted by concerns to limit the potential postoperative functional deficit. Intraoperative functional mapping using cortical stimulation under either general or local anaesthesia is one answer to this. Methods for identifying the location of the motor cortex in relation to the lesion preoperatively have, until now, been unavailable. Two cases were reported in which preoperative functional MRI was carried out using a Siemens 1-5 T system. Imaging was performed using a flash sequence with data being obtained in the resting state and during motor activation. Activation images were obtained by subtracting resting state images from those during motor activity. Cortical stimulation using an Ojemann

stimulator at the time of surgery verified the preoperative localisation. This preoperative cortical mapping allows more accurate surgical planning, reduced surgical morbidity and improved preoperative patient counselling.


A SIMPLE EX Vivo TECHNIQUE FOR TEACHING IMAGE GUIDED STEREOTACTIC NEUROSURGICAL METHODOLOGY
MG O'Sullivan, R Sellar, J Ironside, IR Whittle. Edinburgh, UK

Most surgeons learn the practical aspects of image guided stereotactic neurosurgery using the classical apprenticeship approach to surgical teaching. Unfortunately such an approach may have limitations. A simple teaching model that allows an ex vivo "hands on" type approach to the learning of the technical, computerised, and executive aspects of image guided stereotactic surgery. This simple model uses a cadaver skull, a specially prepared cadaver brain, and a modified stereotactic probe that enables deposition of 1-8 mm diameter ball bearings at target points. Using this technique trainees can familiarise themselves with application of a stereotactic frame, fiducial and target point acquisition, and computation of both arc and probe depth settings.

The technique was initially developed for an experimental study evaluating the accuracy of thalamic and pallidal target localisation using the functional-response axial GE8800 CT imaging.1 It was found, however, to be particularly useful for teaching trainee neurosurgeons "hands on" stereotactic methodology. The model could be applied to any stereotactic system and exercises such as stereotactic ventricular cannulation, estimation of the anterior and posterior commissural points, and the location of functionally important thalamic and pallidal nuclei can be performed. The last exercise, in combination with study of a human brain stereotactic atlas, provides excellent teaching and topographical familiarisation of the functionally important thalamic nuclei. Other additional practical teaching exercises were described.


VALIDATION OF CT TARGETING FOR FUNCTIONAL STEREOTAXIS WITH POSTOPERATIVE MRI
RD Page, JB Miles. Liverpool, UK

CT imaging has been common neurosurgical practice since the early 1970s, but its acceptance for use as functional stereotactic surgery has been surprisingly slow, with few units actively practising the technique. The stereotactic facility in our unit was specifically designed for use with CT, including its use for functional work. It would appear necessary to justify this choice and the added expense of MRI has enabled us to assess the accuracy of lesion placement postoperatively.

In this study 13 patients underwent thalamotomy for movement disorders using the Dervin Miles Dervin (DM) frame. The accuracy of the thalamotomies was determined by measuring the centre of the lesions on MRI scans. For the anterior-posterior co-ordinate, the centre of eight of the lesions was within 1 mm, two within 3 mm and three outside 3 mm. For the lateral co-ordinate, six were within 1 mm, five within 3 mm and two outside 3 mm. For the height co-ordinate six were within 1 mm, four within 3 mm and three outside 3 mm. It should be noted, however, that it is still of paramount importance to test for the appropriate site with functional testing and the electrode moved away from the standard target if necessary.

The results confirm that CT guidance is accurate enough for functional work and it is feasible to conclude that this is the logical justification for continuing the use of ventriculography with its acknowledged disturbing effect on patients when CT offers a satisfactory and less upsetting alternative.

EFFECTS OF CORPUS CALLOSUM DIVISION ON MEDICALLY INTRACTABLE EPILEPSY
DE Sakas, JP Phillips. Dublin, Eire

A series of 20 patients who underwent corpus callosotomy for medically intractable epilepsy was reported. The mean age of patients at the time of onset of seizures was nine years and at the time of callosotomy it was 26 years. The most common seizure types were generalised tonic-clonic (90%), akinetic or tonic-atactic associated with falls (drop attacks) (65%), absences (60%), and complex partial seizures (40%). The most common EEG abnormality was general multiple spike and wave activity in seven patients (35%), generalised or multifocal spike and slow wave activity in six patients (30%), one EEG normal (5%), and other abnormalities occurred in six (30%). The follow up was 5-6 (SD 0-9) years. Fourteen patients (70%) experienced significant sustained reduction in the severity and frequency of their seizures and five of these patients have remained free of generalised and partial seizures. The types of seizure associated with improved outcome were drop attacks 85%, generalised tonic-clonic seizures 78%, complex partial seizures 63%, and absences 60%. No definite relationship was established between preoperative EEG patterns and callosotomy-induced seizure control in this series, and the relationship between the EEG and MRI data did not carry prognostic value. There was no mortality and the most frequent complication was a transient mild left hemiparesis in 35% of cases. This study confirms the efficacy of corpus callosal division as a surgical option for selected patients with medically intractable epilepsy. Furthermore, our results suggest that the history and clinical classification of the seizures is of prognostic value and are valid selection criteria for patients referred for this operation.
STEREOTACTIC GUIDED CRANIOTOMY FOR Cavernous Angiomas Presenting with Epilepsy
ATH Casey, N Kitzen, DGT Thomas, WH Harkness. London, UK

With the wider availability of MRI, angiographically occult vascular malformations are being recognised with increasing frequency in those patients with medically refractory epilepsy. Surgical resection is the best treatment, but because these lesions are usually small and can be located in eloquent areas, stereotactic resection should be considered. Stereotactically guided resection of pathologically verified cavernous angiomas was performed in nine patients presenting with epilepsy (seven men, two women, mean age 34 years). Eight patients presented with medically refractory epilepsy (five complex partial seizures, three grand mal seizures) and the other patient presented with repeated intracerebral haemorrhages and epilepsy. All patients had normal neurological examinations, and were assessed by CT, MRI angiography, Wada, and neuropsychological testing. Operative resection was guided by stereotactic localisation using the Leksell or CRW stereotactic systems. Peroperative electrocorticography, cortical stimulation with speech mapping, and ultrasonography were employed in selected cases.

MRI findings typically consisted of mixed T1 and T2 signals with a rim of low density suggestive of haemosiderin deposition. Pathological findings were also indicative of previous haemorrhagic episodes. Following resection of these lesions all patients experienced improved epilepsy control (mean follow up 19.6 months). It was concluded that stereotactically guided resection offers significant advantages in the management of angiographically occult vascular malformations. Surgical indications would include medically refractory epilepsy, repeated haemorrhage and those cases where there is diagnostic uncertainty.

IMAGE-GUIDED INTRACRANIAL ANEURYSM SURGERY
TAD Cadoux-Hudson, RJ Nelson, HB Coakham, DR Sandeman, E Cause, T Lewis. Bristol, UK

Most intracranial aneurysms have a well defined anatomical position and may be approached via standard surgical exposures. Rarer aneurysms of the distal anterior and posterior circulations may be difficult to locate using conventional angiography alone, often necessitating extensive dissection in the subarachnoid space and cerebral fissures. These problems may be partly overcome by the use of stereotactic angiography. We describe an alternative method of aneurysm localisation using an image-guided mechanical arm registered intraoperatively to three-dimensional reconstructions of conventional CT or MRI scans (ISG Technologies). Using this system, intracranial localisation can be achieved with an accuracy of ± 2 mm.

We report the management of five patients with distal aneurysms of the middle cerebral, pericallosal, superior cerebellar, and anterior inferior cerebellar arteries. Intraoperative image guidance allowed for accurate planning of the surgical approach, minimal brain exposure and retraction, identification and control of proximal vessels before exposure of the fundus, and a shorter operating time. All five patients made an uncomplicated recovery with no increased postoperative neurological deficit.
123rd Meeting of the Society of British Neurological Surgeons. Birmingham, United Kingdom, 3-6 November 1993. Abstracts.

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