Proceedings of the Society of British Neurological Surgeons

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METABOLIC RESPONSE TO SUBARACHNOID BLEEDING
JASON BRICE, G. D'WYER, G. CRUIKSHANK, and B. STOTT (Southampton) had studied 40 consecutive cases of subarachnoid haemorrhage, each over a 15 day period. The clinical and cerebral angiographic states of the patients were compared with ECG changes, plasma cortisol levels, and normetanephrine excretions. Increase in urinary catecholamine output was thought to be due to increased sympathetic activity after subarachnoid haemorrhage. This was attributed to hypothalamic action on the sympathetic nervous system and on the pituitary-adrenal axis leading to increased adrenocortical activity and consequent high levels of plasma cortisol. A correlation was noted between the presence of cerebral vasospasm and high urinary catecholamine and plasma cortisol levels. Patients with abnormal ECGs were also found to have high urinary catecholamine and plasma cortisol levels. From this it was concluded that through serial ECGs clinicians can obtain useful information about the clinical condition and prognosis in patients who have sustained subarachnoid haemorrhage.

ABNORMAL CEREBRAL BLOOD FLOW REGULATION IN SUBJECTS WITH COMPLETE CERVICAL CORD TRANSECTION
J. L. CORBETT, B. H. EIDELMAN, and H. L. FRANKEL (introduced by J. M. K. SPALDING) (Oxford) criticized previous studies of cerebral blood flow (CBF) using a $^{133}$Xe inhalation technique to indicate an absent response to low arterial pCO$_2$ in tetraplegics, as it is theoretically possible for a normal reduction in CBF to be masked by a simultaneous large increase in extracerebral flow. A further study had therefore been made on controls and tetraplegics in whom CBF was simultaneously assessed by cerebral arteriovenous oxygen content differences and by an improved $^{133}$Xe inhalation technique. Observations at rest and during serial decreases in arterial pCO$_2$ confirmed the previously observed abnormal CO$_2$ responses in tetraplegics. In the controls there was a progressive decrease in CBF as the CO$_2$ level fell. The tetraplegics showed significantly less response.

Administration of CO$_2$ gas to inspired air resulted in a marked increase in CBF in both groups. These findings supported the theory that neurogenic, probably sympathetic, nervous factors affect the regulation of CBF and they confirmed the validity of the present $^{133}$Xe inhalation technique as a measure of cerebral blood flow.

REFERENCES

EFFECT OF AN INTRA-ARTERIAL ALPHA-BLOCKING AGENT (PHENOXYBENZAMINE) UPON THE CORTICAL BLOOD FLOW RATE IN MAN
H. B. GRIFFITH, B. H. CUMMINS, P. GRIFFITHS, R. GREENBAUM, G. STADDEN, D. WILKINS, and J. ZORB (Bristol) had devised a technique for carrying out repeated measurements of cerebral blood flow during operations upon cerebral aneurysms. Retrograde arterial catheterization through the superficial temporal artery was performed in order to carry out operative angiography, to administer alpha-blocking agents as a prophylaxis against vascular spasm, and to carry out measurement of cerebral blood flow. When the arterial CO$_2$ tension and systemic blood pressure were maintained at constant levels, the administration of phenoxybenzamine was followed by a well-defined increase in cortical blood flow in patients whose subsequent courses had revealed no evidence of damage to the brain or its vessels either by haemorrhage or by operative procedure. It was concluded that the cerebral blood vessels and cerebral blood flow were largely under neurogenic control, and that long term alpha-blocking agents might have beneficial therapeutic effects in cases where ischaemic cerebral damage had not yet taken place.

INTRACRANIAL ARTERIOVENOUS MALFORMATIONS—A REVIEW
A. PATERSON and J. GARIBI (Glasgow) had analysed 202 intracranial arteriovenous malformations and assessed the criteria for surgical treatment and operability. Males predominated slightly over
females in this series and there was a wide age spread. The presenting features were haemorrhage and epilepsy occurring either singly or in combination. Other modes of presentation were hemiparesis of slow onset, headache, personality change, and raised intracranial pressure with papilloedema. An audible bruit was recorded in only 10 cases. A quarter of the patients had been submitted to bilateral carotid angiography and vertebral angiography. The advisability of this was discussed and it was pointed out that only 10 malformations had been shown to have a blood supply from both hemispheres but 21 aneurysms and two tumours had been revealed by angiography. It was, therefore, suggested that at least bilateral carotid angiograms should be carried out in every case of arteriovenous malformation. Nine patients were pregnant out of a total of 66 women considered to be of child-bearing age and it was suggested that there was a tendency for arteriovenous malformations to bleed during pregnancy. Treatments which had been suggested in the past had included total excision, partial excision, ligation of feeding vessels, deep x-ray therapy, and muscle embolization. Operation was carried out in 90 patients in this series. Seventy-seven underwent total excision of the angioma, the completeness of the excision being confirmed by postoperative angio-gram in 52. Simple haematoma removal only was carried out in 10 patients, and in two there was a negative exploration. The operative mortality was 14%. Nine patients in the total excision series died. Among the survivors there were 11 deaths among the unoperated cases and one from carcinoma of the bronchus among the total excision patients. In the 12 patients in whom only partial excision had been carried out four died from recurrent haemorrhage. The authors' conclusion was that total excision is the treatment of choice even in those patients who present only with epilepsy. Eight patients had been subjected to deep x-ray therapy and six of these had subsequent haemorrhages. One epileptic was worse after irradiation. It was concluded that size was no contraindication to surgery and that, if the feeding vessels of the angioma were accessible, then the angioma was probably operable. The value of operative angiography was stressed. If at all possible arteriovenous malformations should be completely excised. Partial excision was of little or no value.

**Upper Cervical Spinal Cord Compression with Symptoms and Signs of Lower Cord Dysfunction—Clinicopathological Explanation**

A. R. Taylor (Belfast) observed that compression of the cervical cord at the C2–3 level might cause symptoms and signs referable to cord segments C7–8 and T1. The clinical presentations in such cases were paraesthesiae in the fingers and palms of the homolateral hand or both hands, sensory loss to all modalities in a dermatome pattern in the forearms, and wasting of the small muscles of the hand. Hydroscopic plastic 'tumours' had been implanted at the C2–3 levels in rhesus monkeys which had then been observed over three and a half weeks. The animals had developed a mild monoparesis or hemiparesis on the side of the implanted tumour. Serial section of the spinal cord had shown, apart from surface indentation and local reaction; (1) progressive paracentral venous dilatation from the C5 to T1 levels; (2) periventricular petechial haemorrhages in the grey matter confined to the lower part of the cord and predominantly in the posterior horn; (3) changes in the anterior horn cells in the C7 to C8 segments only, predominating in the homolateral side with replacement by reactive gliosis.

These findings suggested that the cause of the false localizing signs in these cases was venous compression, and that the venous supply of the spinal cord was not the freely anastomosing valveless system that it is said to be. On the contrary, it was suggested that it appeared to be segmental in distribution both longitudinally and transversely. The importance of this observation on the treatment of compressive and traumatic conditions of the cord was stressed.

**Repair Mechanisms after Experimental Spinal Cord Compression**

R. F. Gledhill and B. M. Harrison (introduced by W. I. McDonald) (London) had investigated the mechanism of paralysis and recovery in cases of incomplete spinal cord lesions due to compression in cats. Controlled compression of the posterior columns produced a number of functional disturbances most of which were quickly reversible, but the postural reflexes mediated by the posterior parts of the spinal cords remained abnormal for at least a month. Demyelination was the predominant change observed. Remyelination took place in the third week. Complete, though abnormally short, internodes were formed with a true node at each end. The new myelin was produced by oligodendrocytes of central origin and Schwann cells of peripheral origin. Some of the factors which governed the entry of Schwann cells into the spinal cord were discussed. The conclusion drawn from these experiments was that demyelination which gives rise to conduction block was the main cause of the deficits which lasted longest. Remyelination was a major factor underlying the later phases of recovery and the relevance of these experimental studies to human cord compression was discussed.
THE CAPGRAS SYNDROME
(L'ILLUSION DES SOSIES)
L. A. LIVERSEDGE (Manchester) drew attention to a fascinating clinical picture which had primarily received attention from European psychiatrists and about which information in English literature was relatively scanty. The only case associated with neurological abnormalities previously described concerned a young Australian with cerebral damage after a road accident, the area damaged lying in the left parietotemporal area. The cardinal feature of the disorder was the patient's unshakeable conviction that one or more of his loved ones had been replaced by beings physically identical with, but entirely different in character from, the originals. This communication dealt with a case of this type in which a glioma of the dominant temporal lobe was ultimately discovered. The possible psychopathological features were discussed.

SPASM FOLLOWING ANEURYSM SURGERY:
A WORKING HYPOTHESIS BASED ON FLUIDICS
JULIAN L. ROBINSON and A. ROBERTS (Quebec) described boundary wall effects in fluid flow. When a jet of fluid entered a wide vessel containing similar fluid, it entrained this and became broader as it moved downstream. Removal of fluid from the layer of liquid surrounding the jet lowered the pressure between the jet and the side walls of the container, producing a low pressure zone which induced a backward flow from the downstream area which was at a relatively high pressure. If a disturbance caused the jet to move towards one wall of the vessel, then the upstream area for replenishing the flow and the counterflow were reduced. The opposite effect occurred on the other side so that the jet was deflected until it was forced completely against one wall. This was known as the boundary wall or Coanda effect. It was postulated that, during clipping of an aneurysm, distortion of a parent vessel might produce a Coanda effect causing diversion of blood almost entirely down one limb of a nearby bifurcation. Retrograde flow from a limb of a bifurcation might also be caused, thus increasing the risk of ischaemic damage to brain. The clinical, radiological, and postmortem appearances produced by this mechanism might well be attributed to postoperative vasospasm. The application of this hypothesis to surgery of the internal carotid, anterior communicating, middle cerebral, and basilar arteries was discussed.

UNCOMMON EPISODIC PHENOMENA IN YOUNG CHILDREN
B. D. BOWER (introduced by PROF. J. P. M. TIZARD) (Oxford) used the term 'infantile spasms' to describe a characteristic form of epilepsy arising in infancy. A better term than 'infantile spasms' was thought to be 'Blitz, Nick, and Salaam-Krampfe'. The importance of differentiating these attacks from colic was stressed. In 112 cases the EEG was normal in only one. Some of the patients were considered to be suffering from cytomegalovirus infection, some from tuberose sclerosis, and some from West's syndrome. Mention was made of 22 patients with Aicardi's syndrome, the characteristics of which are infantile spasms, choroidoretinopathy with the appearance of neat round holes in the retina, and vertebral abnormalities. In one personal case there had been agenesis of the corpus callosum and cortical heterotopia. In this syndrome there was complete independence of the activity of the two hemispheres. Eleven cases of the 'happy puppet' syndrome were described. The clinical features of this unusual condition were frequent bursts of uncontrollable laughter, a stiff puppet-like gait, a large mouth which was usually open and laughing, and a large mandible. The characteristic EEG tracing shows orderly slow spike and wave activity.

One hundred and fifty patients with infantile spasms had been followed-up for a period varying between two and 12 years. There had been no long-term benefit from the administration of ACTH or steroids.

Three non-epileptic benign conditions which could cause diagnostic difficulty were then described. Syncope in otherwise healthy infants was thought to be fairly rare, but to be a possible cause of cot death. Benign paroxysmal vertigo in infancy was better known and carried a good prognosis. Lastly, the importance of recognition of gratification episodes was stressed.

A FUNDAMENTALLY DIFFERENT APPROACH TO RADIOLOGICAL DIAGNOSIS—COMPUTERIZED X-RAY SCANNING
D. UTLEY (London) described a technique which provided a fundamentally different approach to radiological diagnosis. The limitations of conventional x-ray systems were contrasted with the advantages of this new method. The head was scanned in the transverse axial plane with a narrow collimated beam of x-rays. During each linear traverse of the head 160 readings of x-ray intensity were recorded by sensitive crystal detectors relaying information to a computer. The x-ray gantry was then rotated through one degree and the scan was repeated in the opposite direction. This procedure was repeated through 180°. The resulting 28,800 readings were then reduced by computer to 6,400 adsorption coefficients, which were then plotted on a suitable matrix and presented either as a numerical
paper print-out or as a cathode ray tube display, which could be recorded by Polaroid photography. This process took 12 minutes to complete and in this time two continuous sections of brain parallel to the orbitomeatal line were produced. Bone was shown as peak white and the intracranial contents were shown in varying shades of grey. Analysis of the lesions in terms of density revealed three categories. The first were those with adsorption coefficients greater than brain, such as haematomas and tumours containing calcium. Second were lesions with a tissue density less than that of brain such as cranio-pharyngiomas, malignant neoplasms, and infarcts. Lesions with a density similar to that of normal brain required enhancement techniques for the demonstration of the positions and dimensions of the abnormalities.

SPECIFIC ANGIOGRAPHIC CHANGES IN ACUTE HERPES SIMPLEX ENCEPHALITIS

P. W. G. Sheldon (Oxford) drew attention to reports of angiograms of patients with acute herpes simplex encephalitis showing evidence of avascular space occupying lesions, usually in the temporal areas. The author had carried out angiograms on a number of patients with this disease and had found in several that there were specific angiographic changes pointing with considerable certainty to the diagnosis. The changes noted had not only been those of a space occupying lesion, but also of an intense venous engorgement or ‘venous plethora’.

BLADDER DYSFUNCTION AND DEGENERATIVE LUMBAR SPONDYLOSIS—THE CLINICAL ASPECTS

M. Sharr (introduced by P. K. Robinson) (Southampton) described the poorly recognized and under-emphasized entity of neurogenic bladder dysfunction due to degenerative lumbar spondylosis. There were 17 patients of whom 10 were female and seven male. Ages ranged from 39 to 81 years. Nine presented to the neurologist and eight to the urologist. The neurological presentation consisted of low back pain in 12, claudication syndromes in 11, weakness in nine, and saddle sensory loss in four. Only six patients had significant deficits and six had no abnormal neurological signs at all, from which it was concluded that neurogenic bladder dysfunction could occur in the absence of other significant neurological deficit. Presenting urological features were incontinence in nine, urinary tract infection in six, and retention of urine in two. Incontinence and retention were found both in males and females, but all the patients with urinary tract infection were women. It was stressed that incontinence in males due to prostatism is very uncommon in the absence of retention, and it was also felt that any patient who was incontinent without knowing it had a neurogenic bladder until proved otherwise. Urological investigations consisted of urine examination, cystometry, intravenous pyelo-graphy, micturition cystography, and cystoscopy. Both atonic and hypertonic bladders were found on cystometry, but some of the patients with neurogenic bladder disturbances had normal cystometrograms. Neurological investigations consisted of x-ray examination of the lumbar spine and myelography. Indications for surgery were the presence of a neurogenic bladder, with or without other neurological disturbances, and presence of a significant myelo-graphic abnormality. The last was considered particularly important. Findings at laminectomy were hypertrophy of the posterior interlaminar joints, thickened bone, thick ligamenta flava, and bony bars in the disc spaces. Follow-up of 17 patients submitted to laminectomy showed a return of bladder function to normal in 13. The condition of the other four patients was unchanged.

BLADDER DYSFUNCTION AND DEGENERATIVE LUMBAR SPONDYLOSIS—RADIOLOGICAL ASPECTS

G. M. Roberts (introduced by P. K. Robinson) (Southampton) reviewed the radiological features of 17 patients with bladder dysfunction due to lumbar spondylosis. Radiography of the lumbar spine showed a variety of features—single disc space narrowing, mild to severe spondylosis, old vertebral crush injury, and congenital neural arch anomaly. The myelograms showed a complete block in three patients, temporary block in four patients, and segmentation of the contrast column in two. Eleven patients had large posterolateral impressions and in six the anteroposterior diameter of the Myodil column was not greater than 5 mm. The space available for the dural sac within the lumbar spinal canal depends on the dimensions of the canal in the sagittal and coronal planes, and on its shape. The latter is determined by the position and configuration of the posterior intervertebral joints. Short pedicles and medially situated superior facets produced a trefoil-shaped canal with acute angles and lateral recess formation. This contrasted with the configuration of the normal canal which was ovoid or smoothly triangular. Spondylosis with accompanying soft tissue changes, particularly thickening of the ligamenta flava, significantly reduced the available space in a trefoil-shaped canal, particularly if its diameters were small. In this series eight patients had significant narrowing of the canal in the sagittal plane, 10 had canals with very small cross-sectional areas, and eight had trefoil-shaped canals. The high incidence of these radiological features explained the severity of dural compression.
POSTERIOR COMMUNICATING ANEURYSMS AND OCULOMOTOR PARALYSIS
S. R. SONI and C. LAMGMAID (Cardiff) had investigated 174 patients with posterior communicating aneurysms. In this series there were four times as many women as men, and 59 patients (34%) had an oculomotor paresis. Some had experienced as many as four episodes of headache. Patients with palsies had pain localized round the eye and had significantly more attacks of pain and a greater delay between the first attack of pain and operation. Five per cent of the aneurysms were bilateral, and those associated with an oculomotor palsy were found on angiography to be larger and to have more loculi than those without a palsy. Overall mortality in hospital was 27% and this figure increased significantly with each attack of pain (19-8% for one attack and 66-7% for four). The mortality rate was 37% in those patients who had been unconscious and 13-5% in those who had not. The mortality rate was higher, but not significantly so, if a palsy were present (30-5% compared with 25-2%). Thirty-seven patients with an oculomotor palsy underwent intracranial surgery and 18 with a follow-up period between two and 18 years were studied. In four the eye had returned to normal. In these the palsy had been present for less than 10 days before craniotomy, and recovery was complete within about two years. Persistent abnormalities were restricted to movements of the globe, ptosis, and a dilated pupil. Six patients had minor and eight had major residual defects. Of the nine patients with residual signs seen four or more years after operation, all showed evidence of aberrant regeneration of the nerve. In these the eyeball adducted on attempted elevation, three had a pseudo-Graefe sign, and other abnormal lid movements were noted in three.

ERGOTAMINE TARTRATE IN THE TREATMENT OF MIGRAINE
M. WILKINSON (London) discussed the use of ergotamine tartrate in the treatment of migraine and described experiences at the City Migraine Clinic. It was thought that ergotamine tartrate should not be used if headaches were well controlled with analgesics such as aspirin and paracetamol, and that it was hardly ever necessary to give the drug to children. Ergotamine tartrate might be given by mouth, by suppository, by inhalation, or by injection. The recommended dose in any one week was 10–12 mg and for any one attack 1–4 mg. One thousand five hundred patients had been studied in the past three years at the City Migraine Clinic. Two-thirds of these had classical or common migraine. It had been found that an intramuscular dose of 0.5 mg tended to produce nausea and vomiting. 0.25 mg was as successful as the larger dose in curing headache and produced no side-effects. The recommended oral dose was 1 mg. Twenty-four patients were diagnosed as having ergotamine tartrate overdose symptoms. All these complained of almost daily headache, 22 experienced nausea, and four vomited. The duration of consumption of the drug varied from less than three months to over two years. Three patients were having 7 mg or less in a week, six were taking 10–14 mg a week, 15 took over 40 mg a week, and one patient had a weekly intake of over 60 mg. Recovery from symptoms occurred within four weeks of stopping consumption of the drug.

THE NEUROLOGICAL CHANGES ASSOCIATED WITH SUBFORAMINAL OSSSEOUS DISEASE IN CHRONIC RHEUMATOID ARTHRITIS
D. O. HANCOCK, A. HILL, N. RANA, AND A. R. TAYLOR (Stoke Mandeville) carried out a two year study on 49 patients with chronic rheumatoid arthritis. Forty-one had atlanto-axial subluxation and eight had an upward translocation of the odontoid process of 1 cm or more.

IMMUNOGLOBULIN G SPECIFIC FOR MEASLES IN SERUM AND CSF IN MULTIPLE SCLEROSIS
K. B. FRASER, MARGARET HAIRE (introduced), and J. H. D. MILLAR (Belfast) found a significant increase in titre for measles IgG and herpes simplex IgG in the sera of 57 patients suffering from multiple sclerosis (MS), compared with normal controls. No change was found for mumps, vaccinia, varicella zoster, and rubella. Examinations for measles and herpes simplex IgG in CSF were carried out in 30 consecutive MS cases, 30 neurological controls, and 30 ‘normal’ controls. In the MS series 19 fluids were positive for measles and 11 for herpes simplex. In the neurological controls two were positive for measles and seven for herpes simplex. In the ‘normal’ controls one was positive for measles and two for herpes simplex. In 77 MS patients the cerebrospinal fluid had been positive for measles in 50.

CERVICAL PERCUTANEOUS CORDOTOMY FOR THE RELIEF OF INTRACTABLE PAIN AND SUFFERING
J. TURNER and M. R. BOND (Glasgow) considered that cervical percutaneous cordotomy which was first described by Mullen and others in 1963 had definite advantages over the open procedure. It might be performed under local analgesia and it was associated with a lower morbidity and mortality rate. The results of cordotomy in 25 patients with intractable unilateral pain were presented. Eighteen patients had...
immediate and total relief of pain, two died, and two developed fresh pain on the untreated side. Three cordotomies were unsuccessful because of technical difficulties. In evaluating response to treatment, measures not previously reported were used. The subjective assessment of pain using an analogue scale was highly successful. Analgesic requirements were dramatically reduced after surgery in terms both of potency of drugs given and frequency of administration. Pain perception and severe pain thresholds were significantly increased over the treated half of the body without producing any alterations on the untreated side. Although raised thresholds and analgesia to pin prick were obtained, patients could still experience dull diffuse pain if heavy pressure were applied to the tibial surface of the lower limb on the treated side of the body. Using the Eysenck Personality Inventory, it was possible to demonstrate that personality structures were restored to a more normal pattern by cordotomy. Evidence was given for lessening of anxiety as a result of pain relief. The tendency towards introversion and reduced sociability remained unaffected.

GAS MYELOGRAPHY IN THE INVESTIGATION OF SPINAL DYSRAPHISM

P. L. COOK (introduced by P. K. ROBINSON) (Southampton) drew attention to gas myelography in the investigation of spinal dysraphism. He described a series of 29 children with suspected spinal dysraphism who underwent gas myelography to demonstrate abnormalities of the conus and of the cauda equina. The technique was not always easy and myelographic demonstration of abnormalities in children with spinal dysraphism if the condition were recognized at an early stage. Clinical diagnosis was not always easy and myelographic demonstration of abnormalities of the conus and of the cauda equina was difficult. A series of 29 children with suspected spinal dysraphism was described with reference to the use of gas myelography in the demonstration of underlying abnormalities.

OCCIPITAL CRANIOTOMY FOR TRANSIENT VERTEBROBASILAR INSUFFICIENCY

B. CRYMBLE (Haywards Heath) drew attention to the possibility of compression occlusion of carotid or vertebral arteries during certain neck movements. These phenomena had been demonstrated both by arterial perfusion in cadavers and by angiography in living subjects. Vertebrobasilar insufficiency was usually characterized by visual disturbances, vertigo, and sudden weakness of the legs. Of these symptoms vertigo was probably the most common and it could be disabling in otherwise healthy subjects. Three patients, all of whom had consistently experienced vertigo on neck extension, were investigated and treated. Two complained of visual disturbances during attacks and the third had leg symptoms. Labyrinthine function was normal in all, there were no undue excessive bone changes from spondylosis, and healthy arteries had been demonstrated by vertebral angiography. The patients were treated by suboccipital craniectomy to an extent sufficient to decompress the final extracranial portions of both vertebral arteries. Bone removal was carried laterally as far as the lateral limits of the atlanto-occipital joints, but the first cervical arch was left untouched in each case. All three patients had had complete relief of symptoms, the longest follow-up period being 12 months. Although the decompression was effected by the removal of bone, it was probable that the transient vertebral artery compression was the result of the bunching-up of soft tissue or possibly atlanto-occipital membrane distortions during extension. This method of treatment was suggested by noting the fortuitous relief of similar symptoms of long standing in a woman who underwent occipital craniectomy as part of the operation of medullary tractotomy, which was performed to abolish more recent and intractable pain resulting from carcinoma of the soft palate and fauces.