which gave only transient discharges to maintained pressure, while those with larger fields fired repetitively. On the face the areas of skin represented most frequently were situated around the lips and on the nose; some of the larger receptive fields appeared to cross the midline. In the hand, the tips of the fingers and thumb were commonly involved. The latencies of 22 "hand" units, following electrical stimulation of the contralateral median nerve at the wrist, ranged from 13 to 19 msec. Preliminary single-unit studies had failed to demonstrate any gross changes in evoked potentials after various destructive procedures.

TUBERCULOUS OSTEITIS OF THE SKULL

JOHN MILES and BRODIE HUGHES (Birmingham) stated that tuberculosis affecting the skull had always been a relatively unusual occurrence, comprising only 1% of all tuberculous osteitis. Little had been seen of it in the Western hemisphere for perhaps 30 years. With the recent expansion of immigration to this country from areas where tuberculosis was still endemic, cranial osteitis, together with the more common forms of tuberculosis, was likely to be encountered more often.

Four cases of tuberculosis of the skull were described two of which were interesting because of neurological symptoms and signs, reputedly uncommon even when this condition was less rare. All four patients were immigrants: three presented with head pain and fluctuant swelling of the scalp. Radiographs revealed destruction of the underlying bone and they were treated by local craniectomy with appropriate antibiotics. A 15-year-old Pakistani boy developed intractable ulceration of the mouth and throat, became blind in the right eye, and lost the nasal field of his left eye. In addition he had extensive ophthalmoplegias and bulbar paresis affecting the palate, tongue, and vocal cords. Radiographs showed complete destruction of the basiphenoid with widening of the retropharyngeal space, and aspiration of the retropharyngeal abscess revealed the tuberculous nature of the infection.

Surgery for the removal of necrotic bone was still considered advisable and certainly in the treatment of massive extradural collections of pus. It was thought that chemotherapy alone would probably suffice in many cases and there was little alternative when the base of the skull was primarily involved.

Study of the literature had revealed that tuberculous osteitis was evidently a relatively benign condition, as 60 of the 87 cases operated upon up to 1933—that is, before effective chemotherapy—were said to be completely cured by surgery.

CEREBELLAR HEMANGIOBLASTOMAS

JOHN GLEAVE (Cambridge) reviewed those cases of haemangioblastoma which had been treated at Cambridge since 1963. He stressed the importance of vertebral angiography in diagnosis and in planning treatment and commented on certain problems of anaesthesia for posterior fossa surgery.

HYPERBARIC OXYGENATION: A TREATMENT IN NEUROSURGERY

K.-H. HOLBACH, F.-K. SCHRÖDER, G. DATENÉ, and H. DOHR (Bonn) reported their experiences in the use of hyperbaric oxygen (HO) in the treatment of traumatic post-operative and cerebrovascular cases. Their object was to institute HO therapy during the acute phase of concomitant brain oedema in an attempt to diminish secondary hypoxic damage. Patients were exposed to oxygen pressures between 2 and 3 atmospheres for periods from 30 minutes to one hour. Blood gases, pH, lactate and pyruvate concentrations were measured; ECG and EEG recordings were made and in some cases blood pressure, pCSF, and RCBF of the affected brain tissue. Fifty-two patients were studied; 23 who had suffered severe head injuries were submitted to HO therapy on 40 occasions. On 50% of these occasions some improvement clinically was noticed—in about half of these, a marked improvement. On the second day after treatment 11 patients continued to improve, five were unchanged, and seven deteriorated. Treatment of 21 patients suffering from cerebrovascular disease produced very similar results. The remaining groups of cases were too small for analysis, but in the total assessment 22 of 52 cases showed continuing improvement, while 30 remained unchanged or deteriorated.

In the cerebrovascular disease group apparent clinical improvement during HO therapy was comparatively rare, although a greater proportion showed improvement in the EEG record.

Although the ultimate outcome in the 42% of these patients who showed improvement with HO was strikingly better than in those who did not, the authors attributed this to a considerable extent to the great variability of cerebral damage and complications. They also called attention to the often transitory nature of the improvement following HO therapy and stressed the importance of a continuous EEG recording to monitor treatment.

The results of their biochemical investigations indicated that during HO therapy there was a rise of aPO4, while PCO2 and pH remained within normal limits. There was also a decrease in lactate and pyruvate concentrations indicating a reduction of anaerobic in favour of aerobic metabolism with greater energy production. Cerebral blood flow studies suggested that perfusion was influenced by varying degrees of cerebral vasoconstriction under hyperbaric O2. It was suggested that, in addition to a significant elevation of aPO4, cerebral vasoconstriction might at times be a favourable factor, as when brain swelling after injury had been associated with vasodilatation. In other circumstances, it was admitted that cerebral vasoconstriction might be a harmful influence.

The authors concluded that HO therapy had been shown to be useful in certain cases and was a method deserving further study.

OPERATIVE ANGIOGRAPHY

J. W. TURNER and K. W. GROSSART (Glasgow) have employed angiography in selected cases during the course of cerebrovascular surgery. A radiolucent headrest was
used whenever there was the likelihood of angiography and a mobile image intensifier linked to a videotape recorder was available. Catheterization angiography was favoured. Four instances in which this technique was used were described to illustrate its value.

1. For localization of intracranial vascular lesions—for example, a small, deeply placed arteriovenous malformation.
2. To increase the precision and to reduce the time taken in dissecting the lesion.
3. To check the stages of a procedure, such as embolization of a carotico-cavernous fistula.
4. To obtain immediate information on the efficacy of the surgical procedure, particularly (a) where the surgery was of more than usual magnitude, as in the anterior approach to an aneurysm of the basilar artery, and (b) where there was reason to suspect inadequate occlusion, as in some cases of aneurysm.
5. The immediate recognition of complications of surgery—for example, the inadvertent occlusion of a major vessel with an aneurysm clip.

The authors mentioned the following potential disadvantages of operative angiography: (1) an increased operating time (angiography took 20 to 70 minutes) which might be offset by facility in localizing the lesion; (2) the recognized hazards of angiography; (3) an increase in theatre personnel and equipment.

They concluded, in the light of their experience of this technique and from the reports of others, that it could play an important part in the surgical management of A-V malformations, aneurysm, carotico-cavernous fistula, obliterator vascular disease, and of vascular tumours.

**AN OBSERVATION ON POST-OPERATIVE SPASM AND ITS POSSIBLE SIGNIFICANCE**

Jason Brice (Southampton) showed a series of immediate post-operative angiograms in cases of aneurysmal subarachnoid haemorrhage, demonstrating little or no arterial spasm in the period of an hour or so after operation. During the next few days arteriography revealed an increasing proportion of such cases with intense vaso spasms. He suggested that this late, or secondary, spasm, was the principal factor responsible for post-operative morbidity and mortality in this group of cases. It could be avoided by increasing the interval between subarachnoid haemorrhage and surgery with a corresponding loss of patients from recurrent haemorrhage.

The author speculated on the significance and possible causes of this biphasic post-operative vasospasm. A comparable observation had been reported in the animal experiments of Brawley, Strandness, and Kelly (J. Neurosurg., 1968), in which the consequences of damage to cerebral arteries had been followed for longer periods than in the more common acute preparations. It was suggested that the first phase results from the release of normally occurring vasoconstrictive substances (catecholamines) from the large adrenergic fibres in the walls of the arteries of the circle of Willis, previously shown by the fluorescent histochemical studies of Nielson and Owen. He quoted Yasargil that this material was seen in abundance only in the anterior half of the circle of Willis, was sparse in the vertebro-basilar system, and absent from the vessels of A-V malformations. This observation correlated well with the occurrence of spasm as judged clinically and on angiography.

A variety of possible aetiological factors were considered in relation to the secondary phase and it was suggested that partial ischaemia of large segments of brain tissue might release a vasoconstrictor substance which could diffuse along the fine perivascular spaces to the basal subarachnoid cisterns giving rise to a self-perpetuating cycle of both local and distant spasm. Suggestions for future lines of investigation of this problem were made as follows:

1. An attempt to counteract the first phase with alpha-blockers or by drugs depressing catecholamine release, using the experimental models of Brawley, Strandness, and Kelly.
2. A search for effective vasodilator substances in the second phase, repeating the experiments of Odom on dogs and the trials of Pribram on humans during angiography.
4. An extension, eventually, of such studies to the human in an endeavour to block this biphasic system in its earliest stages.

**ECHOENCEPHALOGRAPHY WITH SIMULTANEOUS A- AND B-MODE DISPLAY**

E. Kazner (München) described the combination of simultaneous one- and two-dimensional echoencephalography in the diagnosis of intracranial lesions. Although this method did not have such a large field of indication as the simple A-mode—since it was unsuitable for the examination of restless head-injured patients, for example—it did increase the objectivity and the information of echoencephalograhic findings in many cases. The best results had been achieved in infants and in children where the skull was relatively thin. Here it was frequently possible to display soft tissue structures which were almost impossible to demonstrate using neuroradiological methods. Already in its present form, combined A-B-mode echoencephalography as a screening test in children and as a method of progressive observation of patients having had tumour or shunt operations was an important additional investigation which could be carried out on an out-patient basis.
Operative angiography.

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