

INCREASED INTRACRANIAL PRESSURE FOLLOWING REMOVAL OF INTRACRANIAL LESIONS

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After proper removal of intracranial space occupying lesions, the surgeon expects the intracranial tension to keep normal and the level of consciousness to improve rapidly. But there are occasions in which this does not happen and one has to pass through an anxious period, as the signs of intracranial tension persist or reappear. This may happen either during the immediate or early postoperative period or some days or weeks later. When it happens in the immediate postoperative period, the worry is greater as the possibility of an accumulation of a clot has to be thought of and the wound re-opened. This procedure in a patient who has already undergone a major surgery is not free from risk.

In about 850 intracranial operations, we have met with this complication in some from or other in 35 patients. Our experience is analysed and summarised below.

Supratentorial Lesions

The causes of increased intracranial tension in the immediate postoperative period are varied and may occur either in supra-tentorial or infra-tentorial operations. This rise of tension may be due to causes that were in existence before surgery. In advanced tumours where a tentorial herniation has already come into play (Johnson 4) removal of the

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tumour alone may not be sufficient in some cases to restore the tissues to the normal position and release of cerebrospinal fluid obstruction. The herniation persists and an immediate postoperative improvement due to tumour removal is followed by evidence of increased tension which worsens. In such cases if the unrelieved herniation is obvious at the time of the original operation, it can be relieved by injection of saline into the lumbar subarachnoid space after the tumour is removed. If this does not help, a tentorial incision (Vincent C. 7) is necessary as also inferior temporal lobectomy in some cases (Scoville 6). In some cases, the existence of a mild tentorial herniation may be over-looked. Some of these patients may show persistent increased tension in the postoperative period. When recognised, lumbar puncture and injection of saline should be tried; otherwise early tentorial incision would be a life-saving measure.

The site of the tumour also may predispose to the occurrence of increased postoperative tension. In one of our cases of parasagittal meningioma, excision of the sinus resulted in persistent intracranial tension. This may also happen in convexity meningiomas that occur near the sinus, where the cortical veins may have to be coagulated. The thrombus may extend into the sinus and may cause a partial sinus block. This occurred in one of our patients from whom a convexity meningioma was removed. Repeated lumbar punctures had to be done in these patients for two weeks, before the persistent symptoms of raised pressure would subside. A similar problem was also faced in a case where the tumour arising from the tentorial edge was removed. When it is certain that it is a spreading venous thrombus that has caused the trouble, repeated lumbar punctures are of benefit.

"The third day postoperative oedema":- This is a condition that is real and causes anxiety in the postoperative period. In some types of lesions, the patient improves the day after the operation, but begins to be drowsy on the second or the third day. Neurological symptoms also may worsen; for instance, a hemiparesis may become manifest.

Penfield met with this oedema in epileptic surgery and advised against unnecessary exposure of the cortex to the atmospheric air. He believed contact with the air led to local cerebral oedema.

The symptoms so resemble a clot accumulation that opening of the flap becomes essential. On re-opening, no clot is found and the brain is

oedematous. A day or two later the patient automatically improves. The occurrence of such postoperative oedema is more common in certain types of operations. Example: Subdural hematoma, Excision of tuberculomas and glioblastomas. If the existence of a clot is excluded, massive doses of Cortisone (Decadron) are of great benefit. This third day oedema may be due to biochemical causes - alteration in blood and in the cerebrospinal fluid. In our series of supratentorial operations, we have had one subdural hematoma, four glioblastomas and four tuberculomas which exhibited this postoperative oedema. In two of them, the flap was re-opened, in the rest, administration of decadron lead to rapid improvement.

In intra-ventricular operations, the occurrence of severe postoperative tension is a difficulty to be faced at times. In one case of Colloid Cyst of the third ventricle, two days after surgery, the patient became drowsy, a ventricular puncture was done.

This showed a very high intraventricular pressure. Repeated ventricular taps were necessary before the patient would improve.

This complication is also likely in excisions of tumours where the ventricles had been opened. A valvular opening may exist between the ventricle and the cavity left behind and this may act as a cause of pressure. It is worthwhile trying to close the ventricular ependyma whenever possible.

Infratentorial Lesions

In infratentorial operations, oedema in the immediate postoperative period may cause fatalities. This is the reason why many neurosurgeons prefer to leave the dura open after removal of posterior fossa tumours. This is specially in conditions like acoustic neurofibroma (Balasubramaniam and Ramamurthi 1) where one may be forced to leave a small bit of tumour adherent to the brain stem. We have seen such oedema occurring after complete removal of large tuberculomas in the posterior fossa and also after removal of cholesteatomas. The practice of closure of the dura advocated by some (Hamby 3) though physiologically sound, may lead to trouble in such cases.

Late onset of Increased Intracranial Tension

The second group is the one when the signs of pressure come on late. This late onset of increased intracranial tension following tumour remo-

vals is a bothersome problem. This is much more common in posterior fossa surgery than in supratentorial operations. In our series, in one case of a pituitary tumour with extensive extrasellar extension, the patient developed signs of increased pressure two months after surgery. After surgery, she had been given postoperative irradiation. Re-exposure of the sellar region revealed a big cyst in the sellar region which was the cause of the trouble. The cyst contained fluid with a protein content of about 100 mgms%. Similar cyst formation may occur in other supratentorial tumour removals and cause late rise of pressure.

In posterior fossa surgery late onset of increased intracranial tension is commonly due to adhesions or cyst formations. When the dura is left open, a subarachnoid cerebrospinal fluid pouch forms in some patients (Balasubramaniam and Ramamurthi 1). This may get cut off from the subarachnoid space and form extra arachnoidal cysts (Pool and Pava 5). These may serve to increase the pressure in the posterior fossa. Similar cysts may occur at the site of tumour removals. Adhesions may form in the posterior fossa blocking the fourth ventricle or the tentorial hiatus.

All the above complications have been met with by us in posterior fossa surgery. The cases concerned were (1) Tuberculomas (2) Cholesteatomas (3) Sub-total removal of auditory Neurofibromas and (4) A cerebellar Astrocytoma.

In cases where after good surgery one expects rapid improvement, the occurrence of a bulge in the neck with increasing headache, comes as a disappointment.

To prevent pouch formation in the sub-occipital region, tight bandaging with a crepe bandage for some weeks has been tried and found successful. If despite this procedure, the symptoms persist, periodical lumbar puncture is tried to see whether the tension would clear. If this does not happen, it is necessary to do an air study to determine the cause of the trouble. The air may get arrested in the cisterna magna or just below the tentorial hiatus. In such cases incision of the tentorium through an opening made in the occipital region helps to restore the cerebrospinal fluid circulation. This procedure may not always succeed. In such cases we have done a variety of other procedures like (1) Cysto-Pluero-stomy in two cases (2) Cysto-Peritonostomy in two cases (3) Theco-Peritonostomy in four cases and (4) Third Ventriculostomy in one case.

Norman Dott has proved that blood in the subarachnoid space may initiate a reaction in the arachnoid and lead to a block in the arachnoid granulations resulting in a communicating hydrocephalus. This is more true of cases of subarachnoid haemorrhages from burst aneurysms than in cases of intracranial tumour removals. Dott has also found that when he was forced to leave a bit of acoustic neuroma behind, postoperative raised tension was a commoner problem.

In large acoustic neurofibroma, we practise removal of the acoustic neurofibromas in two stages. In these cases we normally give a time interval of about eight to twelve weeks between operations, when the second stage becomes easy. In one such case we were forced to operate early within three weeks, because of high tension due to the enormously increased protein secretion in the cerebrospinal fluid. Repeated lumbar punctures and removal of xanthochromic cerebrospinal fluid was necessary to keep the pressure low till the second operation. Increased protein in cerebrospinal fluid can keep up increased intracranial pressure.

Summary

Increased intracranial tension may occur in the early postoperative period after removal of intracranial tumours or the problem may arise some days or weeks after operation.

In the immediate postoperative period such increased tension raises the possibility of a clot formation and forces the decision for reopening. Unrelieved tentorial herniation, extension of a thrombus into a major vein, or the so called third day postoperative oedema, are the common causes of such raised intracranial pressure. When the ventricle has been opened, oedematous blockage of ventricular system may have to be tackled by repeated ventricular puncture.

In posterior fossa surgery, the fear of this postoperative oedema is the reason why many neurosurgeons leave the dura open.

Late onset of increased intracranial pressure is commoner in posterior fossa operations specially after sub-total removal of neurofibromas or after excision of tuberculomas. The cause is cyst formation at the site of surgery or adhesions blocking the cerebrospinal fluid pathway. Following air studies, a shunt procedure or a tentorial incision would be indicated.

Résumé

L'hypertension intracranienne peut se voir dans les suites opératoires immédiates d'exérèse tumorale, ou quelques jours ou semaines après l'intervention.

Dans les cas de suites opératoires immédiates la possibilité de formation d'hématome est grande et la décision d'une reintervention peut se poser. L'engagement tantoriel non réduit, extension d'une thrombose dans une grande veine, ou l'oedème du 3ème jour sont les causes communes d'HIC. Quand le ventricule a été ponctionné, un oedème du système ventriculaire peut amener a de nombreuse ponction ventriculaires.

Dans les interventions sur la fosse postérieure la crainte de cet oedème post opératoire amène certains neurochirurgiens de laisser la dure mere ouverte.

L'apparition d'HIC tardive est plus commune dans les interventions de la fosse postérieure plus particulièrement dans les cas d'exérèse incomplète du neurinome ou l'exérèse du tuberculome.

La cause sont soit la formation kystique au niveau du foyer opératoire, ou le blocage du système d'écoulement du L.C.R. Après l'étude gazeuse, l'ouverture de la tante du cervolet ou un shuntage est a effectuer.

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SURGICAL TREATMENT OF TEMPORAL LOBE EPILEPSY ★

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For several years some of my colleagues in neurology, pathology, and psychiatry at Guy's Hospital and the Maudsley Hospital in London have collaborated with me in the surgical treatment of intractable temporal lobe epilepsy. Today I propose to discuss with you some aspects of surgical treatment as seen in 100 consecutive patients operated upon and since followed up for from 2 to 10 years. A detailed report of this has recently been published (Falconer and Serafetinides, 1963).

Selection of cases

Temporal lobe epilepsy is common. In the British Isles probably 4 persons per thousand suffer from epilepsy, and possibly a third to a quarter of these from temporal lobe epilepsy. When patients show marked psychiatric disturbances of various types in association with epilepsy, the epilepsy is usually arising in the temporal lobe. Fortunately most patients with temporal lobe epilepsy respond to medicinal therapy. Consequently, in selecting our patients for operation we relied upon three sets of criteria, as follows:-

- 1) The epilepsy was of long-standing and resistant to drugs.
- 2) Neuroradiological studies including air-encephalography as a routine were either normal or indicative of a mild atrophic process, but not a space-occupying lesion.
- 3) Repeated electroencephalographic (EEG) examinations employing on at least one occasion sphenoidal electrodes under intravenous Pentothal (thiopentone) narcosis had activated a focus of spike discharges that were confined to, or if bilateral, were strongly predominant in the temporal lobe which was subsequently resected.

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Essentially, therefore, our EEG, criteria were the critical ones, and we still do not know whether they require further refinement or broadening, or whether we always interpreted them correctly. Thus we estimate that only about 1 in 9 to 1 in 10 of the patients with chronic intractable epilepsy who were referred to us for operation fulfilled these criteria. Most of our patients also showed psychiatric disturbances and such disturbances were not regarded as a contra-indication, because at the time when we commenced this study, there was little indication in the literature as to what effect, beneficial or otherwise, surgery would have upon these disturbances.

With one exception, a child aged 2½ years, our patients were not operated upon until after the age of 16 years, even although more than half of them had had epilepsy since the first decade of life and often from infancy. The eldest was 56 years.

Operative technique

A description of our operative technique has already been published. When patients had tumours or other focal lesions that could be demonstrated either by radiography or were visible on the surface of the exposed brain, we merely removed the tumour, and such cases were excluded from the series that I am now describing. In the cases in this series we decided at the outset of our study to perform a standard resection of the anterior part of the temporal lobe (usually 6 cm.) including such deeper structures within the temporal lobe as the uncus, amygdala, and the anterior part of hippocampus. The operations were usually performed under local analgesia with electrocorticographic controls, but in disturbed or apprehensive patients were performed under general anaesthesia. We found that as a rule, if the preoperative criteria were satisfactory, we always excised the affected temporal lobe utilising our observations at operation for correlation purposes.

Pathological changes

Subsequently our pathologist colleagues examined these resected specimens in great detail. They found that in nearly half the cases there was mesial temporal sclerosis. This pathological process has previously been described as "Ammon's horn (hippocampal) sclerosis" or by Professor

Penfield and his colleagues in Canada as "incisural sclerosis". Essentially it consists of a loss of neurones to varying degrees with consequent gliosis in the deeper temporal lobe structures such as the hippocampus (Ammon's horn) and the amygdala, and also in the more severe cases, often in the uncus, hippocampal gyri, and other temporal lobe structures. There have been many theories put forward to explain it, for there is no doubt that it dates from infancy or early childhood. The classical view of the German pathologists, Spielemeyer and Scholz, is that it is the result of hypoxia occurring during major epileptic attacks, and hence is a sequel of epilepsy rather than its cause. A newer view of Professor Penfield is that it is the result of herniation of the mesial temporal structures during child-birth consequent upon the moulding of the head and that the cerebral damage then set up may in due course itself become an epileptogenic lesion. The viewpoint of my colleagues and myself lies midway between these two extremes. We feel that the hypoxia of childbirth, and more important the hypoxia that is associated with infantile convulsions, produces scarring in these vulnerable temporal lobe areas that in due course initiates temporal lobe seizures.

Three other groups of pathological changes were also encountered. In nearly a quarter of our cases small unsuspected collections of glial cells (astrocytes, oligodendroglial cells, with or without nerve cells or calcium bodies) were found, usually in the neighbourhood of the amygdala. These bodies have hitherto received only scanty recognition, and Dr. J.B. Cavanagh and myself were the first to describe a sizable series of these cases. Whatever their nature, malformations or neoplasms, they are benign and of great chronicity. We are now learning that they can occur also in other parts of the brain. The remaining two pathological groups consist firstly of a small group of miscellaneous lesions including cortical scars that may result from head injury of cortical infarction from arterial disease, and secondly of a group of cases in which no specific lesion was found. In this latter group there was some degree of subpial and white matter gliosis, but such changes are so dependent upon an individual's interpretation, and are found so frequently at autopsy, that one cannot be certain whether they are really a true pathological entity.

Complications and sequelae of operation

Transient complications of the operation are fairly numerous, but permanent ones fortunately rare. It is common for a patient during the first

two or three weeks after operation, to exhibit focal motor seizures involving the contralateral face and perhaps arm. These "neighbourhood seizures" are due to odema of the brain spreading from the area of excision and invariably disappear.

Permanent sequelae of the operation include some degree of homonymous hemianopsia usually limited to the upper quadrants and not noticed by the patient. Intelligent patients after removal of the dominant temporal lobe may notice a small but specific defect in learning new material when it is presented to them by sound but not by vision. Almost all patients, however, learn to compensate for this, and executives may find that during conferences they may have to jot down the salient points of the conversation with pencil and paper. This seems to imprint the memory of the conversation on to their consciousness, and few subsequently have to refer to their pencilled notes.

Therapeutic results of operation

In our series of 100 consecutive patients operated upon and followed up for periods of from 2 to 10 years, it was learnt that four had subsequently died, three of status epilepticus and one by suicide. All four were rated as failures. In addition 6 others failed to keep in touch with us after the second year, usually because they live overseas—these 6 were rated on their last follow up report. Otherwise the majority of patients have been contacted yearly, either by personal interview or by postal enquiry.

It would seem that 53 of the 100 patients are now fit-free, or have not had more than 2 or 3 fits in any one year since operation. We term these our success group, and most of them are now off medication. 30 others have had their fits reduced by 50 per cent or more, and in them we consider operation was worthwhile, — these patients are usually still on medication. Only 17 patients were not appreciably improved as regards epilepsy.

We found that most of the patients who were improved had either mesial temporal sclerosis or a small focal glial malformation in the resected specimen. Thus when lesions of this type were present, over 90 per cent of cases are improved, whereas when only gliotic changes are present, only 60 per cent are improved. While, therefore, we cannot always explain the benefit after operation on the fact that the resected temporal lobe contained a lesion, the results of surgery were better when lesions were found.

Accompanying the improvement in epilepsy there is usually an

improvement in the patient's personality and in his employability. We may summarise these improvements by saying that if the personality was normal before operation, it remains normal afterwards. Aggressive outbursts and depressive features are commonly benefitted. Feeble-minded patients remain feeble-minded, although they may show a social improvement. Patients with episodic confusional psychotic states are almost invariably benefitted as are some patients with paranoid confusional states. But patients with schizophrenic-like states remain schizophrenic, even although the epilepsy disappears. Further, it should be noted that many of our patients had been epileptic most of their lives, and in their rehabilitation much psychotherapeutic support and vocational guidance had to be given over many months by my psychiatrist colleagues.

Conclusions

Surgery therefore has an important part to play in the treatment of certain selected epileptic patients whose attacks appear to originate in the temporal lobe, but cannot be controlled by drugs. In a sense we have only scratched upon the surface of a large social and medical problem because the chronic epileptic population of any country must be large, and we can only benefit a small proportion. But the benefit that can be conferred is gratifying, and we hope that through further study we shall be able to sharpen our criteria of selection of cases and to learn more of the mechanisms of epilepsy, which Hippocrates called the "sacred disease".

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Résumé...

Le résultat opératoire de 100 cas d'épilepsie temporale sont discutés. Après le choix de malade d'après les critères décrits, le malade subit une lobectomie temporale antérieure, y compris certaines formations profondes. Les résultats de l'examen anatomopathologique de la pièce opératoire sont variables et fort intéressants.

Après avoir discuté les complications post-opératoires immédiates et les séquelles permanentes; l'auteur discute les résultats obtenus avec un recul de 2 à 10 ans: il y a 53 malades avec un résultat très bon, 30 malades avec 50% d'amélioration et 17 échecs.

Les résultats cliniques sont mis en parallèle avec les constatations anatomopathologiques de la pièce opératoire et tire la conclusion que l'intervention peut jouer un rôle très important sinon pour guérison total au moins pour une amélioration très nette.

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