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President—F. W. WATKYN-THOMAS, F.R.C.S.

Discussion on Brain Abscess

MR. D. W. C. NORTHFIELD

The Management of cases of brain abscess.—This series of cases of abscess of the brain comprises only those in which the infection has apparently spread from the ears or from the paranasal sinuses. Consideration of difficulties of diagnosis and treatment is followed by an outline of the method of treatment now adopted, and which is giving more hopeful results than former methods.

In the first group of cases in which differential diagnosis has proved difficult, the presence of acute suppurative meningitis has been a stumbling block. Lumbar puncture easily confirms its presence, but whether or not an abscess is also present may be uncertain. During the early stages of abscess formation the cerebrospinal fluid commonly contains a high cell count (predominantly polymorphonuclear) and a moderately raised protein content, but the chlorides are not reduced. The fluid is sterile, and the pleiocytosis steadily diminishes with a change to lymphocytes. There is no general meningeal infection although this may develop in unfavourable cases, with a corresponding increase in cells and fall in chlorides. Complementary to these changes in the cerebrospinal fluid is the clinical picture. In all expanding or space-occupying lesions in the cranium a detailed and accurate history is of great importance, in order to detect the chronological sequence of symptoms indicating increased intracranial pressure and spreading focal disturbance of neurological function. Neurological examination yields the necessary objective evidence of a localized brain lesion. Headache, vomiting and diplopia are common to meningitis and abscess, but drowsiness and mental obfuscation suggest an abscess, and restlessness, delirium and severe toxæmia usually accompany meningitis. Persistent and early vomiting is often a symptom of an abscess in the posterior fossa. There may be little or no pyrexia or increase of pulse-rate, and indeed a bradycardia is a valuable sign of abscess, but in meningitis the temperature and pulse-rate are usually much raised. The importance of aphasia, hemianopia and other localizing paralytic signs need not be stressed. A leucocytosis in the blood is seldom present in an uncomplicated case of brain abscess, although usually considerable in meningitis.

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When " focal signs " are found in a case of meningitis, if they are not due to an *intracerebral* collection of pus, they may be caused by a loculus of leptomeningeal fluid.

In a girl of 20 radical mastoidectomy was performed for left chronic otitis media ; the lateral sinus was opened and had to be plugged. Drowsiness and dysphasia rapidly developed and three days later the wound was reopened and two drams of pus were aspirated from within the cranium in the left temporal region. When she came under my care, poor co-operation prevented a satisfactory examination, but slight right-sided pyramidal signs developed and the cerebrospinal fluid was purulent and contained streptococci. The temporal region was again explored ; no pus was found within the brain and the ventricle was easily tapped making a brain abscess highly unlikely. There was, however, a gush of purulent cerebrospinal fluid from between the brain and the cranium. She died ; autopsy revealed no abscess but diffuse suppurative leptomeningitis. The " focal signs " in this case were clearly due to trapping of the cerebrospinal fluid around the temporal lobe.

In another case, in which a cerebellar abscess was suspected owing to the presence of localizing signs, an exploratory operation revealed no abscess, but a considerable quantity of cerebrospinal fluid was evacuated from the region of the cerebellopontine angle, and the boy made a rapid recovery.

Adams McConnell (1937) has described similar cases of loculation of cerebrospinal fluid in the posterior fossa ; in his cases, symptoms of raised pressure and " focal signs " were associated with a cerebrospinal fluid of normal content.

Otitic hydrocephalus—now familiar to us by reason of the writings of C. P. Symonds—has been rare in my experience. It is usually to be distinguished from abscess by the comparative well-being of the patient, in spite of headache and perhaps vomiting, and by the absence of abnormal neurological signs apart from papillœdema. Changes in the cerebrospinal fluid are variable but generally of a mild order.

Girl, aged 13 years : left chronic otitis media had been present for a year, and symptoms of increased intracranial pressure for about a week. There was papillœdema but no convincing focal signs. The cerebrospinal fluid contained 20 lymphocytes per c.mm. and 40 mg. of protein per 100 c.c. Compression of the right jugular vein gave a rise in cerebrospinal fluid pressure, but on the left side there was no rise. Lateral sinus thrombosis with otitic hydrocephalus was diagnosed, but the patient's continued deterioration led me to explore the temporal lobe, and no abscess was found. Mr. Keogh explored the mastoid and found an extradural abscess and thrombosed sinus and again explored the temporal lobe with negative findings. Recovery followed a stormy illness, complicated by a brain fungus and a cerebrospinal fistula through the mastoid wound, giving rise to a quadrantic hemianopia. The papillœdema subsided after about a month.

In another group of difficult cases, the pathology does not yet seem satisfactorily explained. The clinical picture mimics closely that of cerebral abscess, but no abscess is found on exploration, and the patients usually recover spontaneously. These may be cases of brain œdema due to thrombosis of cortical veins, although in a case under my care there was no abnormality of those veins exposed by craniotomy. Dott in 1940 described to the Section of Neurology similar cases which he considered were due to a non-suppurative

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encephalitis. Cortical venous thrombosis can be recognized with greater certainty when the affected veins drain the central areas of the cortex, the characteristic feature being epilepsy with sudden hemiparesis. The cerebrospinal fluid may contain an excess of cells and protein—and in severe cases it may be blood-stained.

At times it may be difficult to distinguish between an abscess and a tumour; the presence of otorrhœa may be misleading.

Female, aged 40 years: right otorrhœa since childhood; several years bouts of severe headaches and vomiting with right homonymous visual hallucinations. In one such attack there was stupor for several days, when a mastoid operation was undertaken in order to exclude an extradural abscess. When she came under my care, there was drowsiness, neck rigidity and a positive Kernig: no papilloedema and the visual fields could not be tested; other neurological signs had no localizing value: cerebrospinal fluid, 440 mm. pressure, 5 cells per c.mm. and 60 mg. protein per 100 c.c.—compatible with a chronic abscess. Ventriculography indicated a right frontal tumour, and a meningioma arising from the sphenoidal ridge was removed at subsequent operation.

More common has been the finding of an abscess when it has been little or not at all suspected. There have been six cases of temporal and two of cerebellar abscess in which there was no clinical evidence of ear disease. Three of these died: at autopsy, in two there was golden fluid in the middle ear of that side only on which the abscess was situated, suggesting an old infection, and in one unmistakable evidence of bone disease on the same side as the abscess. Of the cases that lived one showed radiologically opaque mastoid air cells. The possibility of abscess should always be entertained in cases of suspected tumour if the history is short and if the cerebrospinal fluid gives any support, whether or not there is any evidence of a causative septic focus.

The significance of certain physical signs deserves greater emphasis. An abscess may not give rise to papilloedema; in my experience papilloedema has been absent in two out of three cases, and in cases of acute abscesses and in the early stages its absence is the rule rather than the exception. Neck rigidity and Kernig's sign are constant accompaniments of meningitis, but these signs must not be considered to indicate of necessity the presence of that condition. They are common findings in cases of cerebral tumour and their causation is related to brain herniation—through the hiatus tentorii and through the foramen magnum. An abscess causes similar dangerous herniations of the brain, so that nuchal pain and rigidity and Kernig's sign do not necessarily indicate meningitis; but those signs should always be viewed with gravity, and especially if associated with severe headache or drowsiness do they indicate the urgency of the situation.

During the last six years there have been under my care twenty-four cases of abscess secondary to ear or paranasal infection. Various methods of treatment have been tried and I have finally chosen the closed method which we owe to Clovis Vincent. In the following analysis are set out the results of the various procedures:

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ANALYSIS OF TREATMENT OF 24 CASES OF BRAIN ABSCESS

Cases	Treatment	Survived	Died
9	*Drained*	2	7
3	Drainage only	0	3
3	Aspiration + drainage	1	2
1	Decompression + drainage	0	1
2	Aspiration + decompression + drainage ..	1	1
15	*Not drained*	10	5
3	Aspiration only	2	1
4	Decompression + aspiration	1 (died later of epilepsy)	3
2	Aspiration + enucleation	2	0
5	Decompression + aspiration + enucleation	4	1
1	Enucleation only	1	0

Various methods of draining an abscess have been employed and the results can be fairly described as disastrous, but the figures of survival for treatment by closed methods are much more favourable.

An analysis of the post-mortem findings is instructive, for it throws light upon the problems of treatment. Extensive and massive œdema of the brain was the most frequent finding, and pronounced brain herniation was noted in some of these cases. Diffuse leptomeningitis was the next commonest finding, and less often ventriculitis. Multiple abscesses were found in one case causing a honeycombing of the temporal lobe. In another case the abscess could not be detected by the needle. Pulmonary embolism caused the death of one patient. Another died in status epilepticus whilst temporarily discharged from hospital to await final enucleation of the abscess, which had been aspirated several times; the autopsy revealed a shrunken thick-walled abscess with no recent spread of the infection. Thus it would appear that treatment usually failed on account of massive œdema with brain herniation or because of acute meningitis (including ventriculitis).

Of the ætiology of brain œdema there is little knowledge, and indeed there is no unanimity of opinion as to the pathological criteria of its lesser degrees, nor of the precise mechanism of its development and spread. Its presence may be assumed if there is marked drowsiness, lack of improvement as a result of treatment (in the absence of meningitis), and the neurological signs of brain herniation. The treatment of œdema in both abscess and tumour of the brain constitutes perhaps the most urgent and the most formidable problem in neurosurgery. Dehydration methods have had and are still having a great vogue, but in my experience have proved disappointing. Indeed, I have been frequently impressed how in some cases œdema persists and spreads in spite of treatment, in a manner best described as fulminating and malignant.

By reason of the observations at autopsy of the displacements of the brain—caused by œdema, and of the results of treatment, my opinion is hardening that the only hopeful line of attack is surgical decompression. This is by no means always successful, probably because it is not resorted to sufficiently early; and if advanced œdema is an irreversible change—this is almost certainly true. Such decompression for brain abscess is obtained by the Clovis Vincent procedure, and some measure of relief of tension results from the mere aspiration of the abscess.

The avoidance of meningitis and the treatment of the established condition

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vie with brain œdema in difficulty and importance. Chemotherapy helps, but other methods must be employed at the same time. Diffuse meningitis may occur at the same time as the spread of infection into the brain, or it may be due to the surgeon's activities. During drainage, it is very liable to occur as a direct spread over the surface of the brain, and the two-stage method was introduced to cope with this. Infection may also spread centrifugally in the brain, probably as a result of the dislocation of the infected area towards the drainage opening in the skull and the consequent disruption of the delicate newly-formed natural barriers to micro-organisms. Operative, autopsy and experimental studies show that at the deepest pole of an abscess its wall is thinnest, and it is in this area that secondary loculi commonly form. From this poorly walled-off pole of an abscess, there is a most important pathway of infection to the subjacent ventricle, for œdema softens the intervening white matter and the ependyma of the underlying ventricle may rupture into this softened area. Ventriculitis has been quite clearly caused in this manner in two cases. Finally, as is well recognized, the ventricle tends to wander as a diverticulum through the softened white matter towards the brain fungus which tends to develop as a result of drainage, and the diverticulum can easily rupture on its surface. The accepted treatment of acute suppurative meningitis uncomplicated by abscess is chemotherapy, maintenance of the patency of the cerebrospinal fluid channels by frequent lumbar puncture and the free administration of fluids—" forced drainage ". If an abscess is present, the subarachnoid spaces are inevitably obstructed by the swelling of the brain and by the herniation of brain into the various cisterns. Thus attempts to drain cerebrospinal fluid by lumbar puncture lose effectiveness, and, indeed, are dangerous by accentuating herniation and compression of the mid-brain or medulla. Some decompressive measure is, therefore, as logical a form of treatment for the meningitis as for the œdema.

Successful treatment depends upon accurate diagnosis ; this must include precise localization, an estimate as to the " age " of the abscess, and the presence or otherwise of meningitis. So essential is such information that no ancillary method should be ignored. A diagnostic burr hole and tapping through a clean area of skin may be all that is necessary for confirmation in some cases ; on the other hand, one should never hesitate to employ ventriculography. If ventriculography confirms the diagnosis—an osteoplastic flap is reflected forthwith and the abscess contents evacuated through a wide-bore blunt needle, the operation field being swamped with a bactericide such as proflavine, to avoid its infection. If tension is not sufficiently relieved, the dura mater may be opened so as to provide an orthodox osteoplastic subtemporal decompression and, provided no pus has been spilt, there is apparently little or no risk of infection. Even if the dura mater is not opened, bone should be removed from the base of the flap so as to provide a gradual decompression which results from the stretching of the dura mater. A burr hole is made in the bone flap over the most superficial part of the abscess through which it may be subsequently aspirated. When a diagnostic tap reveals an abscess conveniently accessible, and if there is but little swelling of the brain, decompression may not be needed, or may be postponed. In cases of cerebellar abscess, provided the patient's condition allows of it, the dura mater of the posterior fossa is

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fully exposed in every case; the abscess can be aspirated more easily than through a burr hole behind the mastoid process. But the dura mater should probably never be widely opened owing to the proximity of the cisterna magna, and the consequent ease with which diffuse meningitis can occur. The aspiration of a cerebellar abscess affords much greater relief of tension than aspiration of a hemisphere abscess, owing to its strategical position in causing an obstructive hydrocephalus.

At the time of aspiration, the cavity of the abscess is irrigated with electrolytic sodium hypochlorite (Milton). Using small quantities (less than the amount of pus obtained), 50 per cent. Milton is allowed very gently to flow into the cavity and is then aspirated; large quantities of ropy pus can usually be obtained, which would otherwise be too viscid to pass through the needle. When the fluid returns fairly clear, it is valuable to leave in the abscess a small quantity of 5 per cent. Milton or of 1 : 1000 buffered solution of proflavine. A bactericide in such a closed cavity appears to aid in the destruction of organisms (two abscesses have become sterile under treatment) and to accelerate the localization of infection and the maturation and contraction of the abscess wall. It is also a prophylactic against infection of the needle track. At first it may be necessary to repeat aspiration every few days, but these intervals gradually lengthen. The patient's condition, the amounts of pus obtained and the resistance of the abscess wall are all factors which are weighed in making a decision to re-aspirate.

Thorotrast (1-2 c.c.) injected into the abscess at one of the early apirations is of great help. It gradually becomes "fixed" in the wall of the abscess and the size and the position of the abscess can be demonstrated radiologically. Thorotrast may fail to depict the whole of an abscess if there are several loculi. This happened in one case; over-confidence in the X-ray appearance led me to forget the possible presence of a deeper loculus, which was thus inadvertently ruptured during enucleation, and the patient died of a diffuse meningitis.

What criteria guide one as to when to enucleate the abscess? They are the subsidence of acute inflammation and the formation of a tough wall. This is indicated by the disappearance of toxæmia and of meningitis, reduction of intracranial pressure—and consequent softening of the decompression—and diminution in the neurological signs of a focal cerebral lesion. The toughness of the abscess wall can be estimated by the blunt aspirating needle, and by the radiological appearance of the thorotrast shadow which diminishes in size and acquires a crisp crenated outline. There is a well-defined optimum period for successful enucleation. The above pathological criteria must be satisfied for obvious reasons, but if operation is unduly postponed, it becomes technically more difficult owing to the formation of an excessive degree of scarring around the abscess, leading to an unnecessarily wide excision of tissue. Secondary loculi or separate deeply placed abscess may develop if a case is left too long. During the optimum period, the abscess wall is well defined, is sufficiently tough to "handle", and separates cleanly from the surrounding white matter. In this series, the age of the "youngest" abscess has been six weeks, and of the "oldest", six months, estimating age from the first symptom of intracranial disorder. The third month (i.e. between eight and twelve weeks) appears to be the "time of election" for enucleation.

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Enucleation is facilitated by uncapping the wall of the abscess, excising with that portion of brain the adherent area of dura mater which constitutes the scarred track of the aspirating needle. When dissecting around the abscess, one must be ever alert for any prolongation of the abscess in a totally unexpected direction. The deeper the dissection the greater the care to be exercised to avoid rupturing its wall, and if the abscess is large and tense it is helpful to aspirate partially its contents, taking precautions against contaminating the field and the instruments, and the small hole must be closed by sutures. When the abscess is adherent to the wall of the ventricle, an opening into the latter may be unavoidable. In cerebellar abscess, the dissection is more difficult owing to the proximity of cranial nerves, and the abscess may be adherent to the dura mater covering the posterior surface of the petrous bone.

It is well recognized that epilepsy often follows the healing of an abscess, and enucleation may very likely avoid or diminish the frequency of this unfortunate sequel. But until the abscess has been finally eradicated an anticonvulsant should be given. In two cases fatal status epilepticus occurred after the patient left hospital; in one case the abscess had been drained, and had healed completely; the other has already been referred to. In neither case did an autopsy reveal any recent exacerbation of infection.

If the results of closed methods are examined again, it will be seen that they reflect the morbidity of the disease at its different stages. Some cases die in the early stages; extensive œdema was present at autopsy in the case which died following aspiration: the fatal issue might have been prevented by decompression, but there is no good reason to suppose that drainage would have been more successful. Of the three that died after aspiration and decompression, in one only was there extensive œdema. Only one case died out of eight in which enucleation was carried out, and this roughly indicates the relatively low risk of a fatal issue provided the early dangers can be safely overcome.

(That portion of the paper dealing with treatment is a summary of one delivered before the Society of British Neurological Surgeons, and is published fully in the *Journal of Neurology and Psychiatry*, 1942, v, 1.)

REFERENCE

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MR. TERENCE CAWTHORNE

An abscess of the brain is always secondary to a focus of infection elsewhere in the body, and the seat of this primary infection is to be found more frequently in the ear than anywhere else.

That there may be a direct connection even a track, between the ear and the brain abscess which has arisen from it is often the case. But to look upon this track as a channel along which pus can flow either from the abscess to the ear or from the ear to the abscess is an oversimplification of the problem that may have led to the belief that in the presence of intracranial symptoms it is less unfavourable to find copious than scanty discharge from a diseased ear.

Nearly all otogenic brain abscesses are adjacent; that is to say the infection spreads upwards into the temporal lobe or less frequently backwards into the cerebellum, but from time to time cases are reported of abscesses in parts of the

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brain not directly in contact with the affected petrous bone. These distant abscesses have been found mainly in the frontal lobe and are the subject of a monograph by Nielsen and Courville who suggest that the infection spreads *viâ* the venous sinuses. Such abscesses may be difficult to localize as I found in the case of a woman with a history of a discharging left ear for many years who, following a chill, developed a severe headache and gradually became irritable and drowsy. Mastoidectomy revealed extensive disease with granulations on the lateral sinus. Exploration of the posterior fossa revealed no abscess either then or three days later, when in addition, the temporal lobe was also explored with negative results. Eventually, in the terminal stages, the opposite temporal lobe was explored and a large abscess found, but unfortunately too late to save the patient.

The neglected chronic suppurating ear is a much more frequent cause of brain abscess than the acute ear, and most authorities find that in 80 per cent. or more of abscesses there is a history of long-standing ear discharge. One reason for this lies in the fact that in the acute ear the prodromal symptoms caused by the infection eroding through the tegmen tympani are sufficient to demand exploration so that the process is arrested before a brain abscess can develop. On the other hand, in the chronic ear there may have been a very gradual erosion of the tegmen tympani, leaving the dura exposed to the disease with no symptoms other than a discharging ear and occasional bouts of headache. Such a state of affairs may be present for years, and may go unsuspected until an acute upper respiratory infection causes a flare up of the chronic process in the ear which spreads through the exposed dura to the brain.

I have noted erosion of the tegmen tympani by disease in nine cases of temporal lobe abscess secondary to chronic ear discharge, and in eight of these the increased thickness of the dura suggested that the erosion was of long standing; in all of them part at least of the exposed dura was sloughing. On opening the dura there was, in four cases, a subdural collection of pus with an underlying superficial ulceration of the brain tissue, but no deep abscess. In the remaining five, the abscess was separated from the surface by a narrow area of inflamed brain.

The invasion of the brain may be unsuspected because the otitis media is so fleeting, or again it may follow accidental damage during the course of a mastoid operation or as the result of exploring the brain for a supposed abscess.

Four methods of spread of infection from ear to brain may be recognized by the naked eye and are as follows:

(1) Spread to an adjacent or distant lobe with no obvious change in the overlying dura.

(2) Direct extension with obvious alterations in the appearance of the overlying dura.

(3) Direct extension with dural changes, subdural abscess and superficial cortical ulceration.

(4) Implantation abscess due to accidental or deliberate trauma.

In the first type it seems probable that the method of spread is by the perivascular spaces or by the blood-stream, either as an embolic or a thrombotic

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process, especially the latter, and in the distant abscesses it is more than likely that the extension has taken place *viâ* the venous sinuses. This is the most likely method of spread in the abscess that follows an acute ear infection, especially if the latter is fleeting.

The second type is, in my experience, the commonest and is most usually seen in abscesses secondary to chronic suppuration. In the cerebellar abscesses I have seen, the spread has been by this way, either *viâ* the bone between the sinus and the labyrinth (3 cases), *viâ* the labyrinth (1 case), or *viâ* the lateral sinus (1 case).

The third type, where the abscess is on the surface of the brain in association with a subdural collection of pus, is possibly more common than is generally realized and is not distinguishable clinically from the other types of abscess. It deserves attention because it responds to local drainage without exploration of the brain. In fact exploration of the brain is likely to do more harm than good and I content myself with free incision of the dura and nothing more.

The fourth type is probably the least frequent and requires no explanation except that it serves as a warning against the casual exploration of the brain through an infected area.

In otogenic cases the classical features of brain abscess, namely headache, vomiting, stupor, slow pulse and subnormal temperature, are often modified by the acute infective process in the ear and adjoining intracranial space, and the only general symptoms that I have found to be constant are headache and slow cerebration. I have not yet met a case in which headache was not a prominent feature.

Nominal aphasia is constantly present in abscesses of the temporal lobe on the left side. It has been said that in left-handed persons it might be expected to be present if the abscess were on the right side. The only right-sided temporal lobe abscesses that I have seen have been in right-handed persons and they did not have nominal aphasia.

I have, however, seen a left temporal lobe abscess in a patient who was left-handed and he had nominal aphasia. The case in question was a real problem because both ears had been discharging for years and both were acutely inflamed and there was nothing to choose between either of them as the cause of the meningitis and brain abscess from which the patient appeared to be suffering. Although semi-delirious and drowsy, he was sufficiently co-operative to exhibit well-marked nominal aphasia and as he was left-handed it was decided to explore the right ear first of all. Mastoidectomy revealed extensive disease in the tympanum and mastoid antrum but no erosion of the tegmen tympani and a healthy dura. Nothing more was done on the right side and the left mastoid was opened, when an eroded tegmen tympani was found with a sloughing dura, and a subdural and superficial cortical abscess were drained. It has been suggested that this patient, a young man of 24, was really right-handed and that his apparent left-handedness was due to imitating his elder brother.

The management of brain abscesses secondary to ear disease presents many problems, and a study of the literature reveals a wide variety of opinions as to who should treat them, how and when and by what route they should be drained and in what manner the drainage should be maintained; but on one

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aspect of the treatment opinion seems to be unanimous, namely that the abscess should be drained or evacuated in such a way as to avoid spread of the infection to healthy tissues in the cranium.

With this object in view, it is urged by many authorities that an abscess should be allowed to localize and become encapsulated before it is drained. This is probably true of many brain abscesses, but in those secondary to chronic otitis media, especially when, as is so frequently the case, there is an acute flare up of a chronic ear, I think that unless the condition of the patient forbids it, the mastoid should be drained without delay. This enables the infecting focus to be eradicated, and prevents further spread of infection from the ear to the intracranial space. It also allows for the inspection of the dura adjacent to the petromastoid and the evacuation of any extra- or sub-dural collection of pus. In the case of the subdural abscess that may be accompanied by superficial cortical ulceration or at any rate some degree of encephalitis, this drainage of the infecting focus is usually sufficient to arrest the process. A policy of waiting in this type of case is a mistake. The only way of knowing that such a state of affairs is present is by exposing the dura at the site of infection.

When an abscess within the brain appears ready for evacuation, the question arises as to the route by which it should be drained. As the principal object is to drain an abscess without encouraging the spread of infection, advantage should be taken of any pre-existing track along which the abscess may be drained. Besides being shut off from the remainder of the intracranial space it has the additional advantage, in the case of adjacent abscesses, of being the shortest distance between the abscess and the surface.

When an abscess is thought to be adjacent to an infecting ear, the first step should be a thorough exposure of the dura adjoining the ear by means of a radical mastoid operation. An extradural or subdural abscess can be drained and if there is evidence of a track leading either to the middle or to the posterior fossa, the abscess can be drained along this track. If not, and the only way of being certain of this is to expose the dura *viâ* the mastoid, it may be wiser to explore the brain through a separate, surgically clean, approach.

The PRESIDENT said that the mastoid should always be opened and thoroughly explored and the dura uncovered. After that he would wait for the abscess to localize.

Had any member used the method of drainage through the track (Lemaitre's method)—the introduction of a fine catheter with gradual dilatation along the track ?

Was there such a thing as a non-suppurative encephalitis, or, alternatively, did every brain abscess start with a non-suppurative encephalitis ?

Lastly, there was the importance of headache. No patient with an *uncomplicated* mastoid, however much pain he might have, should have a headache.

Mr. Cawthorne had asked about distant abscesses. He had seen one in the opposite temporal lobe and this he had discovered too late.

Mr. W. O. LODGE said that if they were to wait until their patients came before them with meningitis they were bound to have a very high mortality, and of the few patients who recovered a certain number would suffer later from epilepsy. Therefore a more aggressive attitude should be cultivated. The commonest cause of brain abscess was chronic otitis media. In 1941

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2 per cent. of candidates for the Services were rejected on account of chronic otitis media, which should therefore be made a notifiable disease.

Mr. THACKER NEVILLE was surprised at Mr. Northfield's insistence on excision of the abscess cavity. He would puncture the abscess with a needle and put in two minute drainage tubes and aspirate through them. Mr. Northfield had not converted him to excision by his figures.

Mr. R. G. MACBETH said that the best results were obtained in cases of brain abscess by a neuro-surgical team. It was important to differentiate between the chronic and the acute type of brain abscess. Though otologists had obtained their successes in the chronic type most of them had been disappointed with their results in the acute type. If neuro-surgeons handled the acute cases, there was at least a hope that some of these would recover. Where there was acute middle-ear suppuration, this should be dealt with first.

Mr. HOLT DIGGLE said that neuro-surgery had revolutionized the treatment of brain abscess in general. But he still thought that so far as their own specialty was concerned—and they were dealing more largely with otitic brain abscess than with abscesses of the frontal lobe—they would as a group prefer to continue the old teaching of Macewen to drain the brain abscess through its stalk of infection.

Mr. Cawthorne had said that in all cases of chronic infection a radical mastoid should be performed, but when one had to deal with an acute hæmorrhagic condition it was difficult to do a good radical mastoid and the patient might be in a moribund condition when seen. Of late it had been his practice to do a Schwartz operation in such cases and deal with the intracranial condition as revealed. Since then he had had better results. Subsequently he had dealt with the chronic condition by performing the radical operation after the acute symptoms had subsided.

Mr. I. G. ROBIN said, with reference to aphasia, he was reminded of a patient who went into an L.C.C. hospital two years ago in coma. She had had an otitis media for five years. She had hemiplegia and true aphasia, which cleared up, and he saw her one and a half years later with hemiplegia again and no aphasia. The patient was right-handed, and this was a left-sided abscess, 3 in. inwards and forwards with multiple loculi. It had a very dense capsule with the track leading forward. Injection showed several cerebral loculi far forward. He could feel no abscess wall to these loculi, and he thought there must have been an acute spread within the last month.

The PRESIDENT, in closing the discussion, said that in the absence of a neuro-surgeon he was perfectly willing to do decompressions to any size and if need be drain the abscess, but if it came to a question of enucleating the abscess, that was entirely a neuro-surgeon's job, and fortunately even in wartime a neuro-surgeon was usually available.

Mr. D. W. C. NORTHFIELD (in reply) said that with regard to the treatment given to the ear, he had always been able to work with an ear surgeon. Some cases that had come to him from other hospitals had already had the ear disease attacked in one way or another, and there had been no necessity to do anything further. In cases in which abscess had arisen as the result of chronic ear disease, when he had successfully dealt with the abscess, he referred the case to an aural surgeon, or, if the ear condition had appeared to be rather

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more urgent, he dealt first with what appeared to be the predominant condition. It was wrong to operate on the ear in a patient who might be moribund not because of the ear disease, but because of the abscess. Then the treatment of the abscess should take precedence over anything else. After one or two aspirations, which was now almost his routine method, if the patient was improved, and if then a stage was reached in which the ear condition was predominant he would say: "Get on with the ear operation and do whatever is necessary." Each case must be taken on its own merits.

Left-handed or right-handedness would appear to depend on which of the two hemispheres was the dominant one—usually it was the left. A left-handed person usually had a dominant right hemisphere. On the other hand, he might be fundamentally still dominant in his left hemisphere but have developed left-handedness. In such a case he would expect the left-handed person to have aphasia only from the left temporal region. Usually a left-handed person had aphasia only from the right-sided lesion, although he had seen such an unusual case as a right-handed person having aphasia from a right-sided lesion. Such a person was dominant in his right hemisphere, but he grew up using the right hand.

Headache was a conspicuous feature of brain abscess.

As to the necessity of enucleating an abscess he had had three cases in which aspiration only was undertaken and appeared successful, but he felt nervous lest these cases should flare up again; in one of these a ventriculogram was done and another was watched carefully, but no sign of returning abscess was discovered; but he always felt happier when the abscess was removed as if it were left there was always a risk that loculi would form.

As to aspiration and drainage by a fine tube, this might be all right in given cases. Each surgeon should proceed with those methods which in his hands had proved most successful. In his own hands drainage had not been successful.

Hammering in a case of brain abscess must accentuate the condition. It was a point which Mr. Hugh Cairns had raised at a meeting of the Section some years ago, and he quoted Macewen who said that he never used a hammer but always a curette or burr.

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