1. Head Injuries from a Physicist’s Point of View.  (H. Holbourn.)

H. HOLBOURN: It was pointed out that the force which produced the maximum distortion of the brain was the shearing type and that this is produced by sharp rotation of the head. When this occurs, the maximum movement takes place at the surface of the brain. If the skull is violently flexed or extended on the neck, the shearing action has its maximum action on the under-surface of the brain. The temporal pole is brought into violent contact with the lesser wing of the sphenoid and this is where the middle cerebral arteries are. A pure transverse movement does not produce distortion. Professional footballers use this fact when heading a ball. They take the blow on the top of the forehead, so that the direction of the force falls in line with the fulcrum and the centre of gravity of the head thus producing no rotation. A blow between the eyes causes the maximum distortion and is the easiest way of killing. If there is a slow acceleration, such as might be produced by a fall on to a sharp spike, there is not much shearing and the maximum damage is local. Conversely, sudden rotation with rapid acceleration will cause more widespread damage.

G. JEFFERSON recalled the early work on the pathogenesis of head injuries, especially referring to the theory of oscillation in the ellipse of Mariotte 200 years ago. No one spoke any longer of oscillations nor knew whether they were important. Gama had experimented with gels 100 years ago, but had not discovered the shearing factor that Mr. Holbourn had shown so clearly, though his results otherwise were the same. Kocher and Ferrari had buried cover-glasses in the brain and found that only the superficial ones could be broken. In each age surgeons had very rightly attempted to apply the physical knowledge of their times to these problems. We must turn to them again.

2. Pathology of Closed Head Injuries in the Acute State.  (H. Cairns.)

H. CAIRNS: There is a strong temptation to regard each new type of lesion discovered in the brain in head injuries as the cause of concussion, but the morbid histology of this condition is still unknown. This is not surprising when we consider how easily the state of consciousness is modified by drugs, acute blood-loss, sepsis, and so forth. Present methods are not adequate to display structural changes in the brain in such easily reversible disturbances.

About 80 per cent. of head injuries are uncomplicated cases of the concussion syndrome. It is in the 20 per cent. of unusual cases that the pathology is of particular interest. The fact that there are so many negative explorations for subdural haematoma is by no means to be condemned in the present state of knowledge, for it indicates that there is still much to learn of the pathology of the unusual head injuries in relation to the clinical states.

The following pathological changes in the circulation were described:—

1. Obstruction to the internal carotid artery in the neck producing hemiplegia after head injury.
2. Traumatic rupture of the internal carotid artery in the subdural space.
3. Haemorrhagic necrosis of part of the frontal lobe, due to fibrinoid necrosis and thrombosis of the perforating arterioles. This is a type of lesion associated with temporary or permanent hemiplegia coming on soon after head injury, sometimes without fracture of the skull. In the early stage there is slight narrowing of the corresponding lateral ventricle; later, whether or not there has been spontaneous recovery of the hemiplegia, the body and anterior horn of the ventricle show diffuse dilatation.

4. Focal cortical and subcortical haemorrhage. The lesion is a congeries of berry-like haemorrhages, one at the summit of each of several adjacent convolutions. There is no deformity of the ventricle, but there may be focal signs, and these show prompt improvement after operation to remove the clots. The cases so far operated on have been cases of aphasia.

5. Delayed cerebral or subarachnoid haemorrhage.

6. Traumatic venous thrombosis has been found in several fatal cases associated with swelling of a cerebral hemisphere. The clinical picture does not appear to be distinctive.

7. Rupture of the veins of Labbe and Trolard.

8. Fat emboli in the vessels of the choroid plexus and of the brain. This has been described by Dorothy Russell.

3. Observations of Operations on Closed Head Injuries with Special Reference to Subdural Hydroma. (A. A. McConnell.)

A. A. McCONNELL: In cases in which the headache commenced some time after the injury, there were six cases that had not been concussed and six cases following concussion. A subdural collection of fluid appeared to be responsible for delay in recovery, because symptoms subsided after removal of the fluid (see p. 237).

4. Increased Permeability of the Arachnoid following Head Injury. (H. Heyl and J. Small.)

H. HEYL AND J. SMALL: The paper described the occurrence of non-cystic fluid in the subdural space following head injury. Eleven cases were cited from a series of 74 head injuries treated in the previous six months, the following observations being made:

The phenomenon reported was found to occur both in closed and open head injuries. The fluid was in some cases present bilaterally while in others free fluid was present on one side, and encysted hydroma or haematoma on the other. Most of the cases developed evidences of increased intracranial pressure two or three weeks after the head injury, the physical findings being diffuse pyramidal signs, mild papilloedema (often unilateral), speech defects, abnormalities of tongue movement, 6th and 7th nerve paresis, and increased spinal fluid pressure. On opening the dura, xanthochromic fluid escaped, followed by a persistent welling up of fluid, most of which was seen to be sweating from the subarachnoid space through an intact arachnoid mater. Following the escape of this fluid, the previously tense brain gradually receded from the surface, and normal pulsation commenced.

Study of this subdural fluid has demonstrated that the protein content has always been raised above that of the subarachnoid fluid obtained either by ventricular tap or lumbar puncture. In one case, for example, the protein content of the ventricular fluid was 25 mgr. per cent., of the fluid in the lumbar subarachnoid space 30 mgr. per cent., and of the subdural fluid 150 mgr. per cent.

To account for the presence of this subdural fluid and the sweating of fluid through the arachnoid is to theorize: it may be due either to an increased permeability of the arachnoid or an osmotic attraction of cerebro-spinal fluid through the arachnoid mater caused by the high protein content in the subdural space resulting from bleeding.
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at the time of the injury. It was suggested that the rate of recovery of these patients was accelerated by the utilization of burr-hole drainage of this fluid.

5. Traumatic Porencephaly. (M. A. Falconer and Dorothy Russell.)

M. A. FALCONER AND DOROTHY RUSSELL:

6. Fat Embolism. (Dorothy Russell.)

DOROTHY RUSSELL: Out of 125 fatal accidents 41 showed evidence of fat embolism and in 29 this was the major cause of death. In six cases there was no bony injury. (Robb. Smith, 1941). Cerebral fat embolism may complicate the picture in head injury. Two cases were described. One case had a depressed fracture of the frontal bone—he was conscious but confused and irrational with loss of appreciation of time and place. He was shocked and so was given three pints of plasma and a fracture-dislocation of the ankle manipulated. Following this the respiration rate increased. The scalp wound was then redressed and he was given two pints of blood. On the following day the head injury was dealt with and the bony fragments removed. The patient became restless and the pulse again increased in rate and he died on the third day. Histological investigation in both cases revealed irregular hyperaemia of the brain with ring hemorrhages associated with capillary fat emboli. Fat emboli were also demonstrated in the degeneration of the choroid epithelium.

Dr. POLLAK described the clinical history and necropsy findings in a patient injured by an underwater explosion. No fractures were present in this case.


W. McKISSOCK had tried the use of 100 c.cs. of plasma which had been concentrated four times, but was unable to demonstrate any lowering of the C.S.F. pressure estimated by lumbar manometer readings nor any evidence that it possesses a therapeutic effect.

Some surprise was expressed by members at these results. Harvey Jackson had observed lowering of pressure in the brains of tumour bearers when concentrated plasma was given.

8. Subdural Hematoma following Ventriculography. (D. W. C. Northfield and J. Schorstein.)

Cases were reported by D. W. C. NORTHFIELD and J. SCHORSTEIN on subdural hematoma following ventricular puncture: an example in the posterior fossa after head injury was described by F. K. KESSELM. Full description will appear later.

9. Radiography of Foreign Bodies. (H. Jackson.)

H. JACKSON: He had seen a few examples in which foreign bodies retained in the hair have given rise to difficulty when interpreting radiographs—for this reason he advocated shaving the head before taking radiographs in the "blitzed" cases, since metal, masonry, wood, and glass, if it contains lead, obscures the picture. He thought it was important to obtain very good films, otherwise some foreign bodies which had penetrated the dura would be missed. He himself had removed a large piece of glass and others had found wood: large foreign bodies were sometimes left embedded in brain because they were translucent to X-rays. Stones and pebbles might be very difficult to see except in extremely good X-rays. He described experiences which illustrated the fallacy of negative X-ray reports made from poor films.
10. Traumatic Anosmia. (A. D. Leigh.)

A. D. LEIGH: Out of a study of 679 patients suffering from head injury, there were 44 cases of defects of smell; 28 showed a complete anosmia, and 16 were incomplete. In all these cases the post-traumatic amnesia and period of unconsciousness were long, and hospitalization a matter of months instead of weeks. Anosmia is a bad prognostic sign as regards fitness for Army service; 2 died, 16 were discharged from the Army, and 7 were placed in Category C. In only 3 cases had there been any evidence of recovery of smell.

C. P. SYMONDS stated that he had seen a case of slight head injury which had developed anosmia.

G. JEFFERSON expressed the view that it was important to separate the cases in which there was a shearing off of the olfactory nerve filaments from those of bruising of the olfactory tract. The former never recovered. It was best seen clearly in olfactory groove meningiomas. The problem was important from a medicolegal point of view.

11. The Intradural Approach for the Cure of Cerebro-Spinal Rhinorrhœa. (K. Eden.)

K. EDEN: With the accumulation of large numbers of cases, the question of cerebro-spinal rhinorrhœa becomes important. Lawson stated that this condition was always fatal in the course of time. Cairns recently pointed out that these cases may heal spontaneously. The danger of meningitis is not the only one, aerocele may arise and it may be necessary to operate. The mortality rate of those operated on had formerly been 30 per cent. It was thought that sulphonamide might diminish the danger and gave courage to operate on persistent cerebro-spinal rhinorrhœa. The disadvantage of the usual extradural approach was that there was a considerable risk of lighting up infection from the bone edges when the dura was separated from the edges of the opening into the nasal sinuses. He described two cases in which the leakage of C.S.F. had been stopped by an intradural operation through a small frontal bone flap. One had an aerocele. Both recovered. Sometimes it is difficult to localize the leak preoperatively, the intradural method gives good exposure.

D. W. C. NORTHFIELD stated that he had seen three cases of cerebro-spinal rhinorrhœa. Two ceased spontaneously after two weeks. The third case was a young woman who was concussed and remained unconscious for three weeks and then recovered. She had cerebrospinal rhinorrhœa and she was observed for four weeks. She then had two attacks which might have been meningitis. After the second attack she was operated on and made a satisfactory recovery.

C. P. SYMONDS pointed out that the case for operative repair appeared to be satisfactory, but several questions arose. If there was a fracture in the posterior wall of the frontal sinus, should it be repaired as a routine? How common was this type of injury? He wished to know the proportion of cases which had a fracture of the skull over the sinuses; he thought that their number might be considerable, but had only had one complicated case of his own of late meningitis resulting from frontal fracture.

Drs. GREENFIELD had only five cases in 20 years.

Drs. SYMONDS stated that he would like to know what was the long-term prognosis of the cases operated on. Could we be sure that operation would certainly prevent meningitis appearing at a later date? If it was thought advisable to operate on all cases, then there was going to be a great deal of work to do. What was the risk of stirring up trouble by doing a severe operation immediately after injury?

H. CAIRNS said that in any figures one must take into account the deaths caused by the onset of meningitis immediately after injury. He had operated on one case in the early stages; this went well, but it was always a big undertaking. Theoretically, operations should be safe, but fully 50 per cent. of the cases had already infected frontal scalp wounds by the time they came to hospital. At the moment, with present X-ray methods, it is impossible to be certain what is the state of the posterior plate of the frontal air sinus. If one had reason to think that there was a wide defect in the posterior wall, then a fascia-lata graft should be applied. There was a sequel to one case which had been operated on some years ago. The patient had received an injury one year previously, associated with meningitis and aerocele. In this case the frontal sinus was explored. The patient returned one year later with a fatal attack of meningitis.
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W. McKISSOCK asked whether it would not be possible for the society to collect the cases of cerebro-spinal rhinorrhoea and find out what was their subsequent history.

N. DOTT expressed the view that it must be very rare for cerebro-spinal rhinorrhoea to be associated with aerocele, because the brain becomes adherent to the margins of the fistula.

C. P. SYMONDS thought that the air in the frontal sinus would be aseptic so that the incidence of infection should be low. The question was raised of how long can one wait for the fistula to heal up? If there is severe bleeding from the nose, perhaps one should operate immediately. It might be preferable to use the extradural approach if the opening is far forward, but the intradural if the fracture extends further back.

HARVEY JACKSON pointed out that the patients who had severe nasal hemorrhage often got cerebro-spinal rhinorrhoea. Fractures through the cribiform plate should be operated on early because the opening had a tendency to increase in size; 50 per cent. of the injuries to the frontal sinus closed by themselves, but the remaining cases did not do so. When the posterior wall was involved he thought that the mucosa lining the sinus should be removed.


G. JEFFERSON described some studies made with H. Varley on the sulphonamide content of aspiration fluid, blood, and urine after dusting 5-0 gm. into fresh wounds as a prophylactic measure. There had been only one postoperative wound infection in 9 months since the method had been applied. The figures will be published later.


DOROTHY RUSSELL, M. A. FALCONER, AND A. M. MCFARLAN: It has long been known that if an abscess is to be dealt with satisfactorily then it must have a capsule. When assessing the factors governing capsule formation, clinical studies alone do not give the required information. The technique in the rabbit is to open the skull and reflect the dura over a part of the left cerebrum. Ten days are allowed to elapse for the wound to heal and granulation tissue to form over the decompressed area. The brain inoculation is made through this area, using 0-2 c.c. of a mixture of agar and a broth culture of living organisms. The agar allows the organisms to proliferate. The reaction excited by agar alone is confined to the microglia which becomes activated to form foam-cells and occasional multinucleated giant cells. The advantages of the method are first, that if the brain swells the decompression serves to relieve the pressure; secondly, the granulation tissue over the site of inoculation minimizes the risk of diffuse meningitis.

In the investigations so far conducted it has been found possible to obtain circumscribed abscesses up to three months. If the inoculation has taken the decompression bulges, the bulge may subside and thereafter the animal remains healthy. Out of 36 experiments with a strain of haemolytic streptococcus there was no infection in 6, localized abscess in 13, and abscess with spreading infection in 14. Growth in size of abscess depends upon centrifugal spread; spread is arrested in the region of increased vascularity by microgial infiltration. It would be a mistake to conclude that the time interval is constant for capsule formation and different types or organisms.


DR. ALLAN M. MCFARLAN said that he had examined pus from twenty-two cases of brain abscess and had isolated Staphylococcus pyogenes from six cases, Streptococcus pyogenes from two, a non-haemolytic streptococcus from one, Streptococcus pneumoniae from three, Proteus vulgaris from three, and mixtures of aerobes, or anaerobes, or aerobes and anaerobes from six. Previous workers had encountered a similar variety of organisms. It would be necessary to examine a large number of specimens before concluding which organisms were most commonly found, and
whether it was possible, as some authors asserted, to correlate the organism with the source of the infection, or with the formation of an abscess capsule, or with the clinical course of the abscess. He hoped that surgeons would continue to send him specimens from their cases so that he could study these points, and perhaps indicate how far it was legitimate to apply to human cases the results which Dr. Russell and Mr. Falconer were obtaining from their experiments on rabbits.

15. Brain Abscess. (J. B. Pennybacker.)

J. B. PENNYBACKER: 31 cases were seen in the Nuffield Department of Surgery, Oxford, in the last 3 years. There were 12 deaths, a mortality of 38 per cent. However, an analysis of the source of infection gave some grounds for optimism:

Classification as to source of infection:

1. Metastatic: 11 cases. (A) Bronchogenic: 5 cases, 5 deaths. (B) From distant foci other than lungs: 6 cases, 1 death.
2. Mastoid Infections: 11 cases, 6 deaths. (A) Cerebral: 7 cases, 4 deaths. (B) Cerebellar: 4 cases, 2 deaths.
3. Frontal Sinus Infections: 4 cases, no deaths.
4. From Penetrating Wounds: 1 case, no deaths.
5. From Infections of Scalp and Skull: 4 cases, no deaths.

Thus the majority of deaths occurred in the cases due to primary lung sepsis and mastoid infections, and it was hoped that advances in chemotherapy would lessen the incidence of these diseases and their serious intracranial complications. Furthermore, if this series were adjusted to exclude the five bronchogenic abscesses, two undiagnosed (and untreated) ones, and three in which an aspiration was done when the patient was in extremis on admission, there were left 22 cases, in which deliberate treatment was undertaken and of these three died, a mortality of 13 per cent.

Most of the classical methods of treatment had been tried as follows: (1) Simple Drainage: 2 cases, 1 death. (2) Decortication and Open Drainage: 5 cases, 5 deaths. (3) Decompression and Aspiration: 3 cases, no deaths. (4) Decompression without Aspiration: 1 case, 1 death. (5) Untreated: 3 cases, 3 deaths (2 undiagnosed). (6) Extirpations: 17 cases, 2 deaths. (Primary Extirpation: 7 cases, 2 deaths. Extirpation after Aspirations: 10 cases, no deaths.)

The majority of cases were treated by eventual extirpation of the abscess. This means that they had to be kept alive until the abscess wall had attained a sufficient thickness to make it possible to dissect it out in toto. From observations in a few cases in which it was possible to assess the age of the abscess accurately, it seemed that a period of eight to twelve weeks from the onset of the cerebral infection was usually necessary. During this period, the risks are death (or visual failure) from increased intracranial pressure, and a widespread infection of the nervous system (usually from rupture of the abscess into the ventricular system or into the subarachnoid space). To prevent these complications, preliminary aspirations of the abscess were usually necessary, and a decompression might be required as well.

Aspiration was best done at the place where the abscess most nearly reached the convexity of the brain. In some cases (of metastatic abscesses, for instance) a ventriculogram might be necessary to show the position of the abscess, but many cases of abscesses following frontal sinus and mastoid infections were eloquent enough to make ventriculography unnecessary.

Whether or not a formal decompression were done depends on the relief obtained by aspiration. The decompression in the first instance was usually an osteoplastic flap designed so that it could be used eventually for extirpation of the abscess. The dura was left unopened, but if this did not afford a sufficient decompression (as judged from the general condition of the patient), it might be necessary to open the dura over the abscess and protect the cortex with a sheet of gutta-percha tissue. This prevented adhesions to the bone flap and simplifies subsequent re-elevation of the flap.
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Thorotrust was instilled into a number of abscesses, on the recommendation of Kahn, of Ann Arbor. Two cubic centimetres were instilled at the time of the initial aspiration; skigrams then showed the site and size of the abscess, and afforded useful information for subsequent tapping and excision. In addition, there was some evidence to suggest that thorotrust evokes a microglial reaction in the wall of the abscess and might encourage the formation of a thicker capsule.

The technique of excision presented no peculiar problems. He had found it helpful to aspirate the abscess at an early stage of the dissection, even though it was usually impossible to do so without contaminating the field. On general grounds, a gross escape of pus is best avoided, but in many cases no harm came from the spilling of small amounts. The wounds were closed without drainage.

D. W. C. NORTHFIELD: During the past 5½ years he had treated brain abscess by drainage with tube or packing; out of 29 cases 15 died. He thought that with more mature judgment these figures were improving.

Analysis of Method of Treatment:

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<thead>
<tr>
<th>Procedure</th>
<th>CASES</th>
<th>DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drained</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Aspiration and drain</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Decompression without opening dura</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Decompression with aspiration</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Aspiration</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Decompression with aspiration and enucleation</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Enucleation</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

The danger of enucleation was the spilling of pus. Success could be obtained even with abscesses containing virulent organisms. He was convinced that nothing could be done about the cases in which infection was not localized. Chemo-therapy had been used in 14 cases, 7 of which died. The causes of death were as follows:

<table>
<thead>
<tr>
<th>Condition</th>
<th>CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple abscesses</td>
<td>4</td>
</tr>
<tr>
<td>Meningitis</td>
<td>4</td>
</tr>
<tr>
<td>Gross oedema</td>
<td>3</td>
</tr>
<tr>
<td>Pressure cones</td>
<td>2</td>
</tr>
<tr>
<td>Pulmonary embolus</td>
<td>1</td>
</tr>
</tbody>
</table>

Edema may occur. In the massive type the oedema may involve the whole of one hemisphere and nothing that one could do appeared to have any effect. Pressure coning with involvement of vital centres caused death. The best method of dealing with the situation was by raising a flap, but without opening the dura.

The method of operating in favourable cases is as follows: A bone flap is elevated, the field is isolated by lintein wrung out in proflavine sulphate. The abscess is then needled; he washes the abscess cavity out with Proflavine or Milton at half strength. This dissolves stringy pus and he continues to do this until the fluid becomes clear. He leaves a little fluid in the cavity. Some cases have become sterile. Finally he inserts a little thorotrust which aids in the subsequent localization. He has been able to detect diminution in the size of the abscess. It is a mistake to leave the abscess too long, the waiting time had varied from six weeks to six months. If operation is performed at six weeks, then the capsule may rupture. If it is left too long, then fibrous trabeculae form making excision difficult. He thought that two to three months was the best time for excision. In certain cases it might be necessary to aspirate the abscess through a burr-hole without elevating a flap, e.g. if the patient is too ill to be moved and is in another hospital.

C. P. SYMONDS mentioned that he had recently been surprised by the results of chemo-therapy and aspiration in two cases of brain abscess. He was doubtful if anything was to be gained by the enucleation of the abscess capsule.

G. JEFFERSON stated that he was somewhat puzzled because he felt that these results did not fit in with his experience, but the results were most creditable and had been presented and analysed in a very convincing way. They have demonstrated that cerebral abscess can sometimes be controlled by certain procedures. It would seem that in the end it does not matter whether the abscess is removed or drained. We do not know whether the scar of a healed abscess is worse than the scar of excision as a cause of epilepsy. The discussion gave one the impression that simple drainage was bad, but this does not fit with experience. Of 9 cases in 12 months all the single abscesses, 7 in number, had recovered. He demonstrated slides showing abscesses outlined with thorotrust: one temporal lobe abscess was of a
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size so great that it seemed that whatever the result of drainage, to turn down a flap and excise would be a formidable procedure. This abscess was drained and disappeared. It is not necessary to drain an abscess from below, but from the most dependent point when the patient is lying in bed. Another case was a child who fell in the playground, a pebble was found in a wound, she came into hospital three weeks later desperately ill. Thorotrast was injected into the abscess and later drained and the child did very well. A third case was a boy with seven abscesses in the left temporal lobe—similar to a carbuncle; drainage would have been useless, so a temporal lobectomy was performed. This child had a stormy convalescence, developed a residual abscess which was drained, and the case recovered satisfactorily. A fourth case, an occipital cerebral abscess, developed 24 years after the original head injury, a shell wound. It was treated by tapping and was later excised. When doing this a small abscess at the tail was found which had not been demonstrated by thorotrast. It would seem that the important thing is to get the problem of infection over, when one reaches the stage when the abscess acts as a tumour then one can treat it satisfactorily. There were times when tapping succeeded, other times drainage, again excision might be best. Eventually we should be able to lay down rules for the employment of each of the methods.

N. DOTT stated that a displacement of the ventricles did not necessarily mean the presence of a cerebral abscess, because the resulting oedema from thrombophlebitis might give the same picture. He thought that intravenous sucrose might be helpful in nursing a cerebral abscess from the acute into the chronic phase, giving 70 c.c.s. of sucrose daily; every day gained is useful. He had used this in a case in which bone has been removed over a considerable area. He thought that sucrose was able to break some vicious circle and improvement was maintained. He had found drainage to be valuable when pressure is a problem. He had left a catheter in an abscess, having pushed it along the course of the needle and had then slowly withdrawn the catheter 2 mm. a day; it may be necessary to do nothing further. Thorotrast had demonstrated the abscess shrinking to a small knob. Multiple abscesses might not be so bad as former speakers had indicated because he had successfully treated a case with four; three of these were drained and the fourth excised after seven months. His routine was to deal with the cause, get room for expansion either by raising a bone flap or bone removal, giving sucrose, and if the patient was losing ground he tapped the abscess, put a catheter in, and if it did not heal went on to excision.

H. CAIRNS thought that it was important to investigate the pus obtained from acute abscesses, we might find that it affected the prognosis, not in an individual, but as a general rule in a large series.

Mr. J. E. A. O'CONNELL agreed with the undoubted benefit of tapping an abscess. He recalled a case of puerperal sepsis developing a cerebral abscess. An osteoplastic flap was turned down, but the dura was not opened. The abscess was tapped and 30 c.c.s. of pus were removed. After a further two weeks the abscess was tapped again, the fluid was clearer. With successive tapings, the contents became clearer and eventually sterile. This was an advantage because excision could then be undertaken without risk of infection. He thought that abscesses following penetrating wounds should be drained because in these cases there is already some cerebral dysfunction.

D. W. C. NORTHFIELD agreed that the two cases described by Dr. Symonds were very impressive and showed the benefit of aspiration. He agreed with J. O'Connell that it was an important point that aspiration allowed the contents of an abscess to become sterile. He did not agree that a large abscess need deter enucleation; if it was of large size, it was difficult to drain. It should be tapped repeatedly until it had shrunk, then it could be removed. He thought that the period of hospitalization was less following excision than with drainage.


L. GUTTMANN, E. GUTMANN, AND G. WEDDELL: Sensory tests at a variety of different intervals were carried out following experimental section of the saphenous minor (sural nerve) or its adjacent nerves, the peroneal and tibial. It was possible to recognize with this method the autonomous, intermediate and maximal zones of the individual nerves. The area of sensory loss, tattooed into the skin after each test, progressively diminished before regeneration from the proximal stump had taken place. This shrinkage therefore must be due to an overlapping action of the surrounding nerves. Histological preparations were made of the skin, of the whole area supplied by the saphenous minor nerve and of a little beyond this at various
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intervals after the nerve had been resected. When several tests (at approximately two-weekly intervals) had been done, the plexus of the nerves supplying the skin was found to be well within the earlier markings. The neurohistological boundary line was invariably found to follow closely the markings of the test just previous to the removal of the skin. The origin of the nerve fibres which grow towards the area of the sensory loss was discussed.

17. Observations on the Spinal Injuries of this War. (A. S. Kerr.)

A. S. KERR: Immediate observation of the level of complete sensory loss is important because if it remains the same then there is permanent damage of the cord. He thought that then open reduction for interlocked facet was harmful and that the fracture should be left alone and care taken of the bladder and the skin. In injuries of the cervical spine he thought that skull traction should be used in all cases showing cord signs or not. The first three cases were treated using steel wires through burr-holes with a 29-lb. traction. The burr-holes should be placed only a little in front of the spine—not too far in front or behind. Traction should be continued for three to four weeks before the plaster is applied. If the patient was paraplegic then traction should continue for six weeks because after this the skin appears to tolerate plaster better.

Care of the bladder is very important, he was against suprapubic cystotomy and thought tidal drainage should be used in every case. Suprapubic cystotomy has been performed because it was very easy to carry out, but it was impossible to keep it water-tight over a long time. Infection always occurred if the bladder is empty, it contracts down and leads later to frequency. He thought that laminectomy was justifiable under the following circumstances:

1. Presence of metallic bodies.
2. Increasing cord damage.
3. Radiographic evidence of bony encroachment.
4. When spinal block was present.

R. BARNES: Among air-raid casualties there was a greater proportion of severe spinal injuries with displacement and cord drainage than is ordinary civil practice. Forcible flexion was the cause. He reduced all cervical dislocations by extension under Pentothal. Reduction was confirmed by X-ray before applying plaster, which extended up to the head and down to the pelvis and should be kept on for three months. He described in considerable detail all the spinal injuries in one of the special centres. He has had two fractures of the axis without cord involvement: it might be associated with a second lesion at 4C. The pedicles of the axis were fractured with displacement of the body, taking the atlas with it. The dislocation in the second patient was not serious. The mechanism of the fracture was, perhaps, a severe blow on the base of the occiput causing flexion with loss of the protective influences of the neck muscles.

18. Fractures of the Axis Vertebra. (G. Jefferson.)

G. JEFFERSON: He spoke of the particularity of this injury, a fact which nobody appeared to have observed. It was a definite recurrent entity in large series of cases. The fracture occurred through the pedicles or sometimes through the articular facet and lamina. He described briefly its mechanism as a torque phenomenon, produced by the dispersal of lines of forces that took place owing to the absence of a superior articular facet on the superior surface of the pedicular component of this peculiar bone. This paper will appear in full later.


A. S. KERR: Three cases were described in which brachial plexus injury was accompanied by loss of sensation from the angle of the jaw to the axilla with paralysis of the diaphragm. Sweating was absent in some of the cases. He could find no
references in the literature to injuries of the plexus of this sort, but imagined that they must have been overlooked. He was trying to work out the causation.

In discussion no members had seen examples, but Kerr thought it must be common and have escaped observation.

20. Blood Fibrin as a Styptic. (A. Dickson Wright.)

A. DICKSON WRIGHT: The history of brain surgery is really the history of haemostasis—the various procedures for effecting this, he reviewed. The disadvantage of muscle graft was that it was not always available owing to the position of the flap. Cushing used to operate at the same time that a breast operation was being performed in another theatre. A. D. Wright suggested that it would be better to use fibrin. Plasma was not so good as serum because it would not filter, so it had been his practice to whip plasma in order to get fibrin. A skin-graft knife could be used to take a wafer or it could be rolled out into a sheet or pressed between glass. He gave an impressive demonstration of its utility.