perform a more radical trephining operation. Both patients died with spreading septic encephalitis, which burst into the lateral ventricle, and purulent meningitis.

HAEMORRHAGE FROM MENINGEAL VESSELS AND SINUSES.

Any of the above types of head injury may be associated with haemorrhage from the meningeal vessels or from the larger venous sinuses. So far as possible, the haemorrhage is arrested by means of a muscle graft taken from an uninfected area. In the case of larger sinuses the piece of clean muscle excised from an uninfected area is plugged into the lumen of the sinus. The sinus may be compressed by introducing a gauze plug between the dura and the inner surface of the skull. Since employing the muscle-graft method I have not found it necessary to insert gauze into a vessel to arrest haemorrhage, and for some considerable time I have not passed a ligature through the dura to tie a bleeding vessel, thanks to the efficiency of the muscle graft when applied to the surface of the dura over the torn vessel.

COMPLICATIONS OF TREPHINING.

Only one or two of the subsequent complications of trephining will be dealt with. Herniation and meningitis naturally suggest themselves as the most common sequelae in the patients while they remain at the base hospital. Septic infection is the common cause. The treatment in each case is partly similar. The fundamental cause of serious herniation being undoubtedly septic infection of the brain substance, every possible precaution must be taken to avoid the introduction of infection, and when the brain is once infected to provide for efficient drainage. The careful toilet of the scalp wound and the complete removal of all infected and damaged tissue is therefore essential before trephining. The liability to the development of a fungus cerebri if the dura is opened and encephalitis ensues, is to my mind one of the strongest arguments against incising an intact dura, or enlarging the hole of an already opened dura. This lesson has been impressed upon me by my failures.

The extent of the hernia will depend upon the amount of infection, and be proportional to the size of the hole in the dura.

In order to diminish the tendency to herniation, and to bring the effect of gravity to our assistance in the treatment of hernia cerebri when it has developed, the patient should as far as possible be made to sit up in bed with a back rest. The patient should be kept quiet by the administration of bromides, chloral, or morphine. Lumbar puncture should be repeatedly resorted to. This may be performed under novocain local anaesthesia in most cases. It is highly undesirable to administer a general anaesthetic daily to a man who is already very seriously ill when a harmless local anaesthetic can be employed and is found efficient.

The amount of cerebro-spinal fluid drawn off averages about half an ounce. It should be withdrawn slowly, lest too rapid a reduction of the intraventricular pressure should cause an involution of the hernia with breaking down of subarachnoid adhesions. This may lead to a fulminating purulent meningitis.

It is dangerous to attempt to remove any of the hernia, owing to the very real risk of opening into a diverticulum of the lateral ventricle, which frequently protrudes into the herniated brain. The hernia should be protected with a ring pad, and kept as clean as possible. If the hernia is of moderately firm consistence, light bandage pressure may be applied to the surface.

Many of the measures adopted to prevent herniation apply equally in the obviation of meningitis—namely, removal of infected scalp and dirt, abstention from incising the dura unnecessarily, and careful treatment of the margins of the rent in the dura where it exists, to avoid breaking down recently formed adhesions in the subarachnoid space.

Urotropin in large doses may be given as a routine with a view to rendering the cerebro-spinal fluid sterile. Even when definite meningitis has become established it may be combated by repeated lumbar puncture. I have had several cases in which Captain H. Henry has demonstrated the presence of streptococci, staphylococci, and *B. perfringens* in the cerebro-spinal fluid, which have made a good

recovery, although definite clinical signs of meningitis had developed.

I have not had sufficient experience of the treatment of intracerebral abscess as the result of gunshot wounds to pronounce any definite opinion thereon.

The subject of epilepsy will also be better dealt with by those who have seen the cases after they arrive in England.

CONCLUSIONS.

There are a few fundamental principles which, I think, should be followed in the treatment of cranial injuries:

1. Two stereoscopic x-ray plates are essential for accurate localization.

2. Careful neurological examination will often elicit signs and symptoms which will guide in operative treatment.

3. All cases should be operated upon early, before marked sepsis has intervened. The special "head centres" at a casualty clearing station provide for early operative treatment.

4. The dura should be treated with respect, and the risk of hernia cerebri and meningitis when the dura is opened always borne in mind. The dura should be incised only when urgent symptoms demand it, and not merely to avoid phantom symptoms which may never arise. Headache and a mild degree of optic neuritis, unless increasing in intensity, are not necessarily indications by themselves.

5. An attempt to remove foreign bodies should be made only in the case of those easily accessible. By "accessible" I mean those which can be removed without producing greater damage to the brain than that already created by the entry of the missile.

TRAUMATIC ANEURYSM OF THE LEFT SUBCLAVIAN ARTERY:

SUCCESSFUL LIGATION AT THE JUNCTION OF THE FIRST AND SECOND PORTIONS.

BY

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The treatment of aneurysm of the left subclavian artery by ligation of the vessel always presents considerable difficulties, which are the greater the nearer the ligature is applied to the origin of the artery. From the experience of the following case I have been led to draw certain conclusions, which are set out at the end of the report.

Pte. M., aged 35 years, sustained a gunshot wound of the chest on August 16th, 1917, at Ypres. The bullet entered behind to the left of the third dorsal vertebra and escaped just above the clavicle at a point corresponding to the junction of the middle and inner thirds of the bone. He spat blood for a day or two afterwards, but the wound progressed favourably, and on August 30th he was transferred to England. By September 3rd his wound was soundly healed. There was partial paralysis of the left deltoid muscle, for which daily massage and galvanism were prescribed. He continued to pick up until November 16th, when a pulsating swelling appeared at the root of the neck. It had all the characters of an aneurysm, and as it steadily increased in size, Colonel A. M. Connell, assisted by Major E. F. Finch, operated on December 8th. The swelling proved to be a saccular aneurysm arising from the second part of the subclavian artery. Owing to the dense matting of the tissues around the aneurysm the placing of a proximal ligature was not attempted. Instead a stout catgut strand was tied around the base of the aneurysm where it sprang from the upper convex margin of the artery.

This procedure was for a time followed by marked improvement, and both swelling and pulsation almost entirely disappeared. Then the aneurysm began to enlarge again, and by the end of December it had become obvious that, unless something further could be done, it was merely a question of how long he would live. In view of its position and the knowledge that one would have to conduct a deep dissection through tissues distorted by inflammatory exudate and containing vessels and nerves of the first importance, further operative measures could not be lightly entertained, but, as the alternative seemed wholly black, the facts of his case were placed clearly before him, and he elected to be operated on a second time. The operation took place on January 2nd, 1918, under chloroform anaesthesia given by Captain N. Milner. I had the valuable assistance of Major G. Wilkinson and Major E. F. Finch.

Operation.

The steps of the operation were: (1) Removal of the scar of the first operation, together with some unhealthy granulation tissue. (2) Subperiosteal resection of the inner half of the clavicle. The sternal attachments of the bone were not divided, and the decorticated bone was made to pivot over to the right after being surrounded by gauze. (3) A long and tedious dissection involving the ligation and division of several veins, injury to the thoracic duct or one of its branches, from which much milky fluid escaped, and identification of the subclavian and internal jugular veins and the lower part of the scalenus anticus muscle. (4) Careful division of the scalene muscle with a small scalpel from without inwards. The fibres were divided close to the rib and very cautiously, taking especial care not to encroach on the anterior or internal portions of the muscle sheath. (5) The subclavian artery at the junction of its first and second portions was ligatured with a double strand of No. 1 Van Horn's catgut after it had been ascertained that occlusion of the artery at this point controlled the circulation in the aneurysm. (6) The displaced portion of the clavicle was fixed in position by strands of catgut passed through holes drilled in the bone, and the extensive wound closed by a series of superimposed catgut sutures, a small rubber tube being left in for seventy-two hours.

Aseptic healing followed, and beyond a small mass of cicatricial tissue no local evidence of the aneurysm can be discerned.

I am indebted to Captain J. E. Stacey for the notes of the case.

The lessons which I have learnt from a study of this case are:

1. To be prepared to meet with extraordinary difficulty in exposing the artery on account of inflammatory exudate caused by the bullet or shell fragment.

2. The value—indeed I might say the necessity—of resecting the clavicle in order to secure adequate room.

3. The advantage to be derived from dividing the scalenus anticus muscle in the way I have described. By the judicious use of small retractors after its division it is possible to draw inwards the phrenic nerve and to displace the pneumogastric and sympathetic nerves, together with the other important structures lying to the inner side of the muscle, and so reach the distal part of the first portion of the artery.

BLOOD PRESSURE IN WAR TRAUMATISMS : A POSSIBLE SOURCE OF ERROR.

BY

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(Preliminary Note.)

DURING the last two years a number of observers have estimated the blood pressure in cases of war traumatism and have published their results. Personal observations in the same line, chiefly made from observations on officers at the Swedish War Hospital in London, have convinced me that there is a possible source of error—namely, that in a certain proportion of unilateral traumatisms the pressures in the two arms may show wide differences. Not only is this so, but the readings on one day may be higher in one arm than in the other, but the reverse a day or two later. When differences occur they generally diminish as improvement proceeds and disappear some time before complete recovery.

In the cases mentioned below all the readings were taken with Riva-Rocci apparatus, and were measured alternately first from the one arm and then from the other on successive days. The interval between the two readings on the same day varied from five seconds (two apparatuses being employed) to ten minutes. Neither the length of this interval nor the arm in which the pressure was first estimated seemed to have any influence on the actual readings; this was shown by a number of controls taken from ten to thirty minutes later. These were obtained first from the arm which was dealt with last and with a different interval.

Thirty-six cases were examined in all; in twenty-six no difference, or only a slight difference (2 to 4 mm.), was found; such differences were considered negligible. In six cases differences of 6 to 8 mm. were found, which sank to about half this amount about three days later, and disappeared at the end of the week. The details of the other four cases are given below. Naturally a much larger number of observations will have to be made before definite conclusions can be drawn, but I think I should point out this possible source of error in order that those who are working on blood pressure in war traumatism may avoid it.

CASE I.

Lieut. —, suffering from a small septic shrapnel wound of the right shoulder inflicted on February 8th, 1918, with resultant muscular weakness of the whole right arm.

Date.	Right Arm (Injured Side).		Left Arm.		Difference.	
	Max.	Min.	Max.	Min.	Max.	Min.
February 28 ...	98	68	104	68	-6	+0
March 1 ...	108	68	104	66	+4	+2
" 5 ...	108	64	110	70	-2	-6
" 9 ...	112	71	110	72	+2	-2
" 20 ...	112	74	106	72	+6	+2
" 30 ...	108	72	108	78	+0	-6

The wound was practically healed on March 30th.

CASE II.

Lieut. —. The right leg was so badly injured on October 24th, 1917, that it had to be amputated through its middle on October 25th; reamputation in its upper third was performed on December 21st.

Date.	Right Arm (Injured Side).		Left Arm.		Difference.	
	Max.	Min.	Max.	Min.	Max.	Min.
February 21 ...	114	58	108	58	+6	+0
" 22 ...	122	68	126	62	-4	+6
" 23 ...	126	76	108	62	+14	+10
" 28 ...	114	52	104	60	+10	-8
March 9 ...	130	54	122	56	+8	-2
" 13 ...	106	48	124	60	-18	-12
" 18 ...	130	62	152	74	-22	-10

All the observations except the last, when he had been walking, were taken while the patient was in bed.

CASE III.

Capt. —. The right humerus badly splintered by a missile on September 20th, 1917. Bony union was quite good by January 8th, 1918, but he was left with almost complete paralysis of the musculo-spiral nerve. By the end of March, when he left the hospital, some amount of movement had returned in the extensors of the wrist.

Date.	Right Arm (Injured).		Left Arm.		Increase on the Uninjured Side.	
	Max.	Min.	Max.	Min.	Max.	Min.
February 23 ...	118	78	126	68	+8	-10
" 28 ...	120	68	132	72	+12	+4
March 5 ...	118	80	126	84	+8	+4
" 6 ...	92	74	114	76	+12	+2
" 12 ...	112	84	112	82	0	-2
" 18 ...	104	72	118	72	+14	0
" 22 ...	92	66	102	72	+10	+6

The pulse was much feebler and the auscultatory blood pressure sounds were less distinct in the right arm during the whole time that the patient was under observation.

CASE IV.

Lieut. —, on April 12th, 1918, was hit by a bullet which penetrated the right lung, leaving him with a good deal of consolidation in the right lower lobe, and diminished respiratory movements on that side.

Date.	Right Arm (Injured Side).		Left Side.		Increase on the Injured Side.	
	Max.	Min.	Max.	Min.	Max.	Min.
May 16 ...	128	72	110	78	+18	-6
" 17 ...	118	66	108	72	+10	-6
" 21 ...	128	80	112	72	+16	+8
" 23 ...	118	72	112	66	+6	+6
" 24 ...	118	72	114	70	+4	+2
" 28 ...	118	72	112	72	+6	0
" 30 ...	124	82	122	82	+2	0

The movements of the right lung were much improved on May 28th.

I am much indebted to the Medical Committee of the Swedish War Hospital for permission to publish the above results.