upon the terrible experiences they have gone through. These men are often too tired or unable to read, for want of concentration of attention, and may be amused by simple games, knitting or wool work, bead work, basket work, and net making.

Mental Hygiene in Later Stages.

As soon as they are better, patients are encouraged to play billiards, cards, and other games, in the winter time especially; also there are frequent concerts and popular lectures, all of which serve to divert the mind and produce an atmosphere of cure, which is very essential. Soldiers will put up with a good deal provided they have good and abundant food, and it is essential for recovery that there should be no grumbling. Grumbling and grouching are contagious, and it is always well to get rid of a soldier from a ward if he is exciting discontent in the others. Discipline is very essential; laxity of discipline, over-sympathy and attention by kind well-meaning ladies giving social tea-parties, drives, joy-rides, with the frequent exclamation of "poor dear," has done much to perpetuate functional neuroses in our soldiers. The too liberal gifts of cigarettes have produced a cigarette habit in officers and men which is highly detrimental in these cases of war neurosis, especially in cases of irritable dilated heart.

Again, in many functional paralyses, the idea of a permanent disability requiring pension for the rest of a man's life, may become a fixed idea, owing to wrong diagnosis, over-sympathy, and misdirected treatment. In many of these cases, as I have found, what is required is merely strong suggestion to the patient that there is nothing the matter with him except the idea that he is paralysed, which has become installed and firmly fixed in his mind by prolonged bed, daily massage and electricity, which has kept suggesting to him that there is an organic disease causing his complaint.

Some patients, owing to an injury by a fall caused by an exploding shell, have developed a functional paralysis on the side of the injury, either arm or leg, or one of these limbs. Supposing it is the arm that is so affected, I perform a number of associated movements of the two arms together—the healthy one and the paralysed—myself assisting the immobile arm, telling the patient at the same time to help me by thinking of the same movement. After a little while he may be doing the main part of the movement himself. In all these functional paralytic conditions of an hysterical nature a great tonic is to tell the patient that it is not at all likely that he will ever be sent back to active service, for he would be no use, and that what we want to do is to discharge him from the service in such a state that he will be fit to resume his previous occupation, or we can put him to some work useful to the State, whereby he will not be a burden to himself or the community. I am quite sure that if this method were adopted early, in a large number of cases known by an expert to be temperamentally unfit for military service, a great economic saving would be effected. Of course precautions would have to be taken against malingerers. I am sure that machines employed by doctors as a means of making the functional paralitics move their limbs are wrong in principle and in practice, and I entirely approve of the methods adopted by Colonel Deane at the Croydon Hospital of restoring function by natural methods, in which the mind is exercised.

Colonel Deane lays especial stress upon the value of associated movements, such as we get with the parallel bars, the climbing rope, skipping, football, Indian clubs, and the nautical wheel, and the ordinary apparatus of the old-fashioned gymnasium. My contention is that this apparatus can be applied to any man who is capable of any movement. The inestimable advantage is that his mind is projected into his paralysed limb, and all his sound limbs are being exercised at the same time. Constant change and adaptation is another advantage, especially when associated with mental occupation in the work. Diversion of the mind by useful occupation, both in the workshop and in the garden, have been most successful in restoring health and strength to these disabled men. This treatment I have been enabled to carry out through the generosity and kindly interest of Lady Henry Bentinck, who at her own expense has built in the grounds at the Maudsley Hospital a large workshop fitted with every appliance for carpentering, cabinet making, and

metal work, and with a first-rate instructor. There are patients, however, who cannot stand the noise of the hammering and tapping.

Agricultural Employment During and After the War.

I am convinced that occupation in the open air is a very beneficial mode of treatment of nervous cases in the convalescent stage. It does not, however, always seem to be popular with a certain type of case. In commencing the treatment of convalescents by manual labour, it is essential to regulate carefully the character of the labour and the number of hours per day, and the work should be so arranged and graduated as not to induce more than that gentle sense of fatigue that promotes appetite, interest, sleep, and the general sense of well-being. Each case, therefore, has to be inquired into and the individual encouraged to take interest. When a shell-shock case is discharged from the service who by upbringing or inclination has a desire to work on the land, means should be provided whereby he can do so. The money he earns for his labour should be supplemental to the pension money or gratuity.

TREATMENT OF CRANIAL INJURIES IN WAR.*

BY

CAPTAIN J. ANDERSON, R.A.M.C.

THE main object of this short paper is to urge the plea for early and complete operative interference in gunshot wounds of the skull.

By *early*, I mean the earliest possible moment after injury that the patient can be brought to an area where environment and staff are suitable for cranial surgery. Exigencies of military situation or type of campaign may affect this, but, as a rule, these areas are to be found in the casualty clearing station of to-day.

By *complete*, I mean operation on the lines suggested by Colonel Gray in his paper.¹ As I have no doubt you are all familiar with this, I will only touch later on certain points that have particularly appealed to me. I consider, however, that it is almost essential to actually see the method practised by one who is thoroughly familiar with the routine, in order to appreciate the finer points of technique.

Here I wish to emphasize that the operation must always be considered as one where a most careful and exact surgical toilet is to be observed if results are to be attended with success.

The findings of our French colleagues, as reported in the *Presse médicale*, February, 1915, was: "All wounds of the skull should be trephined at once, and that this is the operation of urgency *par excellence* in military surgery." Since then early interference appears to have increased in favour.

In earlier days I adopted the more conservative procedure of excision of scalp wound in minor cases, and evacuation to base for further interference if necessary. This is not good, because on arrival at base, if trephining had to be done, my excised wound had to be again excised to get rid of a possibly septic area. For the more severe cases I performed a complete operation, but left the wound open.

Those cases which I was able to trace compare unfavourably with our more recent results. I think, therefore, that the axiom "All or nothing" is a sound one to adopt in the majority of cases.

Since August, 1916, I have adopted the method as demonstrated to me by Colonel Gray. I had previously attempted this, but I found that I obtained more uniformly good results on observing one or two finer points wherein my technique failed. No other class of wound has given the same even and gratifying results.

I think *all* scalp wounds, perhaps with the exception of minute abrasions, ought to be excised. Suspicion of bone injury demands investigation. It is very frequently found, particularly in the frontal region, that what appears to be a simple symptomless scalp wound is one involving much brain tissue.

During an action many factors govern the question at issue. I feel certain, however, that no case of head injury

* Paper read at a meeting of medical officers of an army in the field.

should be allowed to pass on to the base without very careful examination. In certain cases it is perfectly obvious from the first that evacuation is out of the question. These include all cranial wounds with escape of brain tissue, and all cases with definite signs of cerebral compression, either from fractures or haemorrhage.

All doubtful cases also ought to be retained for immediate operation. These cases should be kept for at least five or six days after operation, if the situation permits.

Anaesthesia.

In only 3 per cent. of my cases (apart from those in which multiple wounds rendered general anaesthesia necessary) was the help of a general anaesthetic required, and then only to cope with restlessness or pain of injection if the preliminary opiate had not acted well. When general anaesthesia is required for other wounds infiltration of the scalp is still advisable. It affords the necessary haemostasis and freedom from immediate post-operative discomfort.

With simple local anaesthesia the operator can gauge much more accurately the general condition of his patient and the limits of legitimate surgery, while the post-operative shock becomes almost negligible. Of course, local anaesthesia requires some practice, and in nervous cases it may be unfair to persist with it alone, but one can usually desist from general anaesthesia after he is put well asleep.

The method I use is a primary injection of morphine or omnopon half an hour previous to operation; complete blocking of wound area with

Novocain	...	...	...	2 per cent.
Mag. sulph.	...	...	...	1 per cent.
Aqua, sterile or saline, add to	...	...	100	per cent.

Boil, and when cold add adrenalin, 15 minims, to each 30 c.cm. Usually about 30 c.cm. are required for each operation.

It does not appear necessary to pay great attention to the preparation of an isotonic solution. I have seen no bad results from the use of solutions of widely differing tonicity.

Operation.

Our chief enemy in wounds of the head, as in other parts, is sepsis, and in order to defeat it we must completely remove its main attacking force before it has gained a secure footing, and at the same time place the defences at their best for resisting any further attack. To obtain this complete excision of the wound must be performed. The head is shaved; this is greatly facilitated if a hot antiseptic soap compress is applied to the head on admission. I have found a good depilatory of value in civil practice, and I think this might be extended to military spheres with advantage.

After disinfection by picric acid or iodine, the injured scalp is removed by an elliptical incision down to bone well clear of damaged tissue. The ends of the incision must be well freed, when it is easy to remove damaged tissue and pericranium with the handle of the scalpel or periosteum elevator.

One source of contamination has appealed to me frequently at this point of the operation—namely, weeping from soiled wound on to a clean area. I think this can be combated by the application of the actual cautery to the wound itself, sterilization and desiccation being thus procured.

Sufficient access to the wound of the bone can in almost every case be got through the elliptical incision. The turning down of flaps is practically never required for this purpose. They may, however, be employed with advantage: (a) in removing a foreign body from the brain through an unopened area; (b) in dealing with an extensive meningeal haemorrhage; (c) in decompression operations.

One now proceeds to excise the septic bone area. This can be done either by making a very small trephine opening outside the soiled area and completing the excision with a skull-cutting forceps just wide of the soiled bone, or by the "nibbling" method, in which case it is advisable to frequently change the nibbling forceps for clean ones. The former is better technique, but I have found the latter simpler, and the results have been equally good, and it does not entail removal of so much

bone. It is better not to trim the edges of the opening accurately.

If portions of the dura are destroyed and soiled, these are cut away.

One can now proceed as with a clean case.

I do not consider a head operation complete which does not deal with non-pulsating dura or brain tissue. Unless free pulsation is present one cannot hope for the best results. Remember that the dura is opened at operation only after the field is rendered aseptic by excision—usually easy in cases of non-opened dura.

It is desirable that a skiagram should be taken in all cases. One cannot tell whether foreign material has penetrated or not beyond easy reach of the *index* finger, which is practically the range of legitimate interference in the majority of cases. It is found that the brain does not suffer from careful exploration by the finger, if the hole in the dura and the deeper track permit of its introduction fairly easily. The exploration must be done without force and with extreme caution. It will be found that usually the intracerebral pressure is sufficient to evacuate the foreign elements and pulped brain by *vis a tergo*. The finger really coaxes them out. When the skiagram shows that the foreign body is lying just beyond reach of the finger, or if it is too firmly fixed for the brain to "vomit" it out, a forceps or scoop may be used to extract or loosen it. These instruments should be used only in extreme cases, as they are apt to cause more damage than the finger. If the track is too small to admit the finger, any attempt at exploration is contraindicated without previously locating the foreign body by the *x* rays.

In glancing bullet wounds and in fractures, where it is evident that a foreign body has not penetrated, the fragments of bone are practically never beyond easy reach of the finger. Such cases need not be *x*-rayed in a "push," as the skiagram will only be of academic interest.

It is well to drain all cases except the very simplest. In the majority of cases the drain should not extend beyond the dural opening. The smallest possible drain ought to be used. I prefer a perforated rubber glove finger with salt therein. If the wound in the brain shows a tendency to ooze blood, use a tube. If the brain is infected, drain direct to surface—if not, drain to one end of wound. If the track is grossly infected, a piece of folded rubber with salt therein, and possibly also a small rubber tube, should drain the brain to a "direct" opening. Immediately before introducing the drain, the length of the track should be ascertained by the finger. It is always shorter than the depth to which fragments have been driven.

I have found aeroplane dope varnish, with 1 per cent. picric acid, to be an excellent transparent dressing, used with gauze in the same way as mastisol.

Where many small wounds bespatter the head in the neighbourhood of a large one, and all are obviously septic, I think it wiser to salt-pack for twenty-four to thirty-six hours previous to operation.

In wounds of the large venous sinuses, the value of the "postage stamp" graft is marked. It is easy to apply and efficient. I favour a graft from some distant part, rather than from the neighbourhood of the wound.

Operative Findings.

Wounds of the head show a remarkable tendency to heal by first intention if gross sepsis is removed and pressure relieved.

Wounds of the head left open show a similar tendency to become secondarily infected. Healthy brain tissue with good blood supply can apparently deal with all minor sepsis. Such, no doubt, is present in many cases at the end of the operation; therefore, when in doubt, drain. An open wound often develops fungus cerebri, which is usually an omen of disaster and an associate of infection. I have yet to see marked hernia cerebri in a first intention wound.

In the great majority of cases the elliptical wounds resulting from excision can be closed, owing to the mobility of the scalp, if all layer sutures are used with superficial sutures between. It is well to work from each end in tying the sutures.

In cases where complete closure cannot be obtained by this method, one must not hesitate to use plastic means, to which the scalp is particularly adaptable.

The method I favour most is the extension of the original incision to form a large U or S flap.

FIG. 1.

FIG. 2.

FIGS. 1 AND 2.—To illustrate plastic operation for closure of an elliptical loss of tissue in the scalp. Fig. 1: First stage, showing line of incision for detachment of flap. Fig. 2: Operation concluded.

To close an elliptical loss of tissue in scalp by plastic method, the ends of the wounds may be sutured to reduce the amount of plastic necessary (Fig. 1).

An S incision is made as indicated by the dotted line (Fig. 1). The end A should extend well beyond a line drawn at right angles to the main axis of, and through the end of, the raw area. The scalp is undermined completely to any desired extent, as indicated by the shaded area. This is easily done by thrusting a curved blunt-pointed scissors, concavity towards the skull, between the aponeurosis and pericranium, opening the blades and withdrawing. Here and there it may be necessary to cut away resistant strands of tissue. Suture at *a-a'* to see

FIG. 3.—Diagram of plastic operation for triangular defect in the scalp.

the dura. Thus this method has an advantage over that of turning down a flap, and is no more elaborate. For a triangular defect, proceed as shown in Fig. 3.

After-Treatment.

The semi-recumbent position in bed seems to be that most appreciated by the patient, and at the same time I

think it helps to prevent hernia. Constipation is a feature of these cases. Early action of the bowels is always important. All head cases are given as a routine after operation, calomel gr. vj, followed by salines next morning. Urotropin gr. xx every four hours for thirty-six hours, then intermitted for twenty-four and later repeated, undoubtedly helps to render the cerebro-spinal fluid more capable of dealing with bacteria.

The drain is usually removed in twenty-four to forty-eight hours after operation.

Lumbar puncture ought to be resorted to *before* any marked signs of excessive cerebro-spinal pressure occur—for example, for persistent headache, focal spasms, or a tendency to hernia cerebri. These symptoms are frequently due to local interference with circulation. Removal of cerebro-spinal fluid seems to allow in most cases a rapid readjustment. This may be of importance in preventing "spreading oedema."

The amount removed varies from 10 to 30 c.cm. at a time, according to the amount of pressure. The wound, especially if open hernia cerebri is present, ought always to be observed during removal of fluid, which must be done slowly, in order to prevent breaking down of protective adhesions in the neighbourhood of the lesion.

REFERENCE.

¹ BRITISH MEDICAL JOURNAL, February 19th, 1916, p. 261.

EARLY TREATMENT OF GUNSHOT INJURIES OF THE SPINAL CORD.*

BY

TEMPORARY COLONEL H. M. W. GRAY, C.B., A.M.S.

To judge from the greater vulnerability of the spinal cord, its lesser capacity for recovery, and from the anatomical arrangement of the spinal canal, it might have been thought that the general desire to interfere in spinal injuries, and to prevent secondary complications, would have been as great as that shown with regard to cranial injuries, but this has not been the case. The technical difficulties of the classical operation of laminectomy, the loss of blood entailed by it occasionally under general anaesthesia, and the doubtful results of deferred operations, seem to be the chief factors in preventing patients, suitable for early operations, being treated on principles similar to those which govern our treatment of wounds in other parts of the body.

In these late cases the patients are usually in poor condition, suffering from pulmonary or urinary complications, and the parts are obscured by masses of fibrous tissue. But in early cases the presence of fractured laminae usually makes the operation a comparatively simple one; it is easy to perform under local anaesthesia, and the use of good adrenalin makes it practically bloodless. Pulmonary complications are not predisposed to, or influenced by, the anaesthetic. Operation in the early stages can, in fact, be done with extraordinarily little upset to the patient. Out of a large number I have never seen a death which could be said to have been hastened by it.

The fact that so many cases improve without operation, in spite of the abnormal conditions by which the cord is surrounded, would lead one to hope that they would improve more rapidly as well as to a greater extent, and that some cases otherwise permanently paraplegic might experience relief if they were submitted to early operation. The cord, to a greater extent than most parts of the brain, is deleteriously affected and retarded in recovery by pressure of fragments of bone, foreign bodies, and other debris. There seems reason to believe that it responds well to prompt removal of these unnatural conditions.

In a casualty clearing station, however, during an action, a hurried selection of cases for evacuation must be made. Under present conditions only those which are most favourable must be retained. In all cases which are sent off by ambulance train the urine should first be drawn off if retention be present.

Some general considerations in making the decision are here mentioned.

There are three types which arrive at a casualty clearing

* Paper read at a meeting of medical officers of an army in the field.