abscess formation around such a missile first giving evidence of itself a year after the injury. The middle ground position is the safest one—namely, always to extract a foreign body if it can be accomplished without increasing the damage already done.

This discussion applies solely to deeply implanted missiles, for all agree that superficial and easily accessible ones should of course be removed. Extraction with a magnet is the only justifiable method applicable to deep-seated bodies and can often be accomplished after suction of the track in the usual method by gently sliding into it, to the proper depth, a French wire nail with rounded point. Contact with the proximal end of the nail is then made with a portable electro-magnet, which need not be a weight greater than can be easily handled, and if the foreign body is magnetizable and proper contact secured it will be withdrawn along its own track of entry.*

All of the foreign bodies from which cultures were made gave a growth of organisms—usually streptococcus, staphylococcus, or some gas-producing bacillus.

10. THE USE OF ANTI-SEPTICS.

The use of watery solutions of antiseptics in the brain is disappointing, for they lead to oedema with swelling of the tissue and an increased tendency to herniate. It was not until Dakin's dichloramine-T in eucalyptus oil came to be utilized as a routine during the latter weeks of our service that there was a notable diminution in the number of infections.

It is true that the technique of the procedures had greatly improved at this time, and true also that we can record no thoroughly conclusive bacteriological studies, though cultures of many of the wounds and foreign bodies were made. With the dichloramine-T, in not a few cases in which an infected foreign body was removed and in which bone fragments as well gave an abundant growth, no symptoms whatsoever followed closure of the wound without drainage. In two instances the cultures showed the presence of the pneumococcus in the ventricular fluid, and the only patients in the series who have recovered from active gas infection of the brain were treated with this drug.

As the terminal step of cleaning out the contused pathway of the missile a small amount of the oily solution is injected along the course of the track through a small catheter, and, just before final closure of the scalp, the dural surface of the wound is moistened with the same solution.

CONCLUSION.

This bare recital of an operative method for a certain type of the many wounds which occur in warfare makes dull reading. It is hoped that it will nevertheless carry some suggestions to others who, like the writer, without preliminary instruction, may, by force of circumstance, have to undertake similar tasks. Much admirable work directed toward the improvement of cranial operations has been done by surgeons in the allied armies—in the British Forces notably by Sargent, Gray, Anderson, Grahame, and Wagstaffe. Unfortunately, however, there have been few, if any, detailed reports of a series of cases, either from front or base, and the underlying principles of treatment

* The extraction was successful in eleven cases in the series in which the missiles would otherwise have been inaccessible. It would have been preferable to place the interposed nail in exact contact with the foreign body under the direction of a fluoroscope, but our situation did not permit of this. The procedure is capable of great development, and next to the eye the brain is the most favourable place for employing the magnet.

of these penetrating wounds has been the source of some disagreement. A surgeon naturally becomes wedded to the particular procedure which he happens to have developed and is more likely to succeed therewith than by adopting the methods of others.

There can be little doubt but that, as is the case with thoracic, abdominal, and joint injuries, the earlier a cranial operation is performed the less likelihood there is of sepsis. The mortality, however, in a hospital near the front is, in the natural course of events, almost certain to be greater than the mortality of operations for similar conditions at the base, for delay always serves to eliminate a certain percentage of the more desperately injured. For this all allowances must be made.

A distinguished surgeon once seriously advocated operating upon typhoid perforation in the second rather than in the first forty-eight hours, because the collected statistics had shown that a larger percentage of cases operated upon in the second forty-eight hours recovered. In the difficult task of dealing honestly with statistics fallacies of this kind at least can be avoided.

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who from time to time were assistant members of the surgical team on whose shoulders fell the larger part of the work.

NOTE ON THE EXTRACTION OF A FOREIGN BODY FROM THE BRAIN.

BY

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THE damage necessarily done to the brain structure in the removal of a foreign body, coupled with the fact that experience has shown that fragments lodged in the brain may give rise to very little disability, argues for leaving deep-seated ones in position until such time as it becomes evident that their presence is the cause of the symptoms and that removal, if it can be effected, will lead to an improvement in the patient's condition. The following is a report of a case in which the attempt to remove a foreign body from the brain was considered to be indicated and was justified by the result.

History of the Case.

T. K., a man aged 20, was wounded on February 7th, 1917. The note from the casualty clearing station was: "Several small wounds in neck and back of head. Semi-conscious and suffering from shock. Vomited on the way down to the casualty clearing station. X-ray report stated that there is a small foreign body in the brain and that there is some damage to the occipital bone." He was kept in the casualty clearing station and base hospital in France for seven weeks and improved considerably; he was then transferred to England. On admission to the 2nd Western General Hospital his condition was poor; there was marked mental dullness, slowness and hesitancy of thought and speech, and he was somewhat childish mentally. He could not sit up for more than a few

FIG. 14.—Sketch illustrating the method of suction of the track of a penetrating wound.

minutes and suffered from intense headaches. He seemed to have some difficulty in opening his eyes and in bringing his mind to bear on anything. The tendon reflexes were all increased in the left arm, and there was definite weakness of the left arm and leg. There was slightly increased knee-jerk and very marked ankle clonus. The signs and symptoms all suggested a sub-cortical lesion in the right Rolandic area, and the x-ray examination confirmed this view, a foreign body being located in the suspected region. For three months he was kept under observation and symptoms became more marked. Any effort was followed by marked clonic spasms, and he was quite unable to sit up. He complained of a burning pain over the right side of the head.

The patient knew that he was getting worse both mentally and physically; he was therefore transferred to the Manchester Royal Infirmary for investigation and consideration as to the possibility of operative interference. He was again x-rayed and the foreign body was localized as 2 in. deep from the scalp beneath the Rolandic area of the right side; the damage in the occipital region was no

FIG. 1.—Radiogram showing position of foreign body, A.

longer noted in the x-ray plates. In view of the fact that the patient had steadily become worse since admission, it was decided to attempt the removal by means of a special instrument described by one of us (A. E. B.) before the Electro-therapeutic Section of the Royal Society of Medicine.¹

The Operation.

On June 26th, 1917, the foreign body was relocated as 2 in. deep and a skin mark was made on the right parietal region just before the operation in the theatre (by H. H. R.). The position of the skin mark corresponded to a point about half an inch behind the lower third of the fissure of Rolando. The fragment was small, but it could be seen on the screen fairly well. The patient was then anaesthetized. The bone was marked through the skin mark by a fine drill and then the flap was reflected. A one inch trephine was then used, taking the bone mark as the centre, and the opening enlarged slightly above and below. In order to assist in the repositioning of the patient on the x-ray couch, small screws were put into the skull on either side of the opening.

The patient was then taken to the x-ray department and the head placed in exactly the position in which the skin mark had been made, the shadow of the foreign body falling midway between those of the two small screws. A small horizontal incision, three-quarters of an inch long, was then made in the dura, and the point of the extractor placed in position (by A. E. B.). With the lights out, the extractor was then manipulated so that the shadows of the fragment and of the points of the extractor fell exactly in the middle of the small fluorescent screen attached to the instrument. With the lights up, the point of the extractor was allowed to descend almost to the depth of the fragment (2 inches), a small band of rubber tube having been placed on one of the blades to mark this distance. Then, with lights off, the blades were gently opened to see that the shadows of the fragment and the extractor points still corresponded

to the centre of the fluorescent screen. Seeing that the direction was correct, the blades were allowed to descend to the full length, and very gently moved about to "feel" the foreign body. Almost at once the bell attached to the instrument gave a slight ring, showing that the metal had made contact across the blade points, and that by raising the points very slightly, then opening sufficiently and descending, the fragment should come in between the jaws of the extractor. This manipulation was carried out, and the shadow was again seen between the blades. On closing the blades the bell at once rang continuously, showing that the fragment had been caught. With the lights on, the instrument was gently withdrawn, and in the middle of the clot of blood that came away was the small foreign body.

The patient was then taken back to the operating theatre, where the incision in the dura was brought together and the opening in the skull closed by replacing the piece of bone.

A small quantity of clear cerebro-spinal fluid came away when the extractor was inserted to its full depth, suggesting that the fragment lay in the lateral ventricle, and this was again suggested on examination of the fragment; it was partially covered by a deposit of what appeared to be lime salts.

From measurements of the skull, the foreign body lay slightly over half an inch from the mid-sagittal plane.

In the x-ray department it took perhaps five or ten minutes to reposition the head accurately; the extraction of the fragment occupied about three minutes. The slight extent of the disturbance to the brain may be judged by the fact that there was no paralysis, even on the following day.

FIG. 2.—Radiogram showing actual size of foreign body.

After-History.

The shock of the operation was not as severe as expected, and even on the following day he could move both the hand and foot fairly well. There was no paralysis of any part and within a week the power of the grip was as good as before the operation. Recovery of power continued, and the mental condition became very much clearer; it was evidently less effort to think, and the patient himself stated that he felt that he was getting better. He was able to sit up in bed without any ill effect, and the clonic tremors were less frequent and not so easily brought on. The wound healed rapidly, and the trephine disc united to surrounding bone firmly. A few weeks after operation he was able to stand and walk a few yards with assistance. On August 30th, 1917, he was transferred to Dr. Macmillan at Moorlands Red Cross Hospital, but the journey in the ambulance seemed to cause a setback for a time. Attempts to stand brought on the clonic spasms, which were also induced even in bed by slight causes. The grip was less strong, and there was very slight paresis of the facial muscles. Improvement has gradually taken place, and he is now very much in the condition he was in before he was transferred except that the mental condition is now much sharper, and there is less hesitancy in speech and thought. There is no trace of facial paresis, the grip is fairly strong, and he can walk about the room with assistance. He is evidently recovering quite satisfactorily though slowly.

The Extractor.

The extractor is made like a pair of dental forceps, the jaws being about 1½ in. apart when closed. Above the jaws is fitted a small fluorescent screen. Beaks or blades are fixed at right angles to the jaws and meet at the points, but are insulated from one another by a small fibre block let into one of the blades, which is made slightly longer than the other (see Fig. 4). For brain work the blades are thin and close together, the point of the longer blade being rounded. For the removal of foreign bodies from ordinary tissues stronger blades are used, the point being fashioned like a blunt dissector so that the instrument can dissect, and, by opening the blades, separate its own way down after the skin incision has been made. The blades are connected with an electric bell through a relay that is specially fitted in order to avoid stimulation of structures

when contact is made. When the blades are brought into the correct relationship with the foreign body—that is, with the longer blade alongside and the shorter blade

FIG. 3.—Diagrammatic view of the instrument. A. Screen holder and contact of the insulated blade; C, insulated blade; D, block of fibre on insulated blade; E, connexion bell circuit.

touching the top of the fragment—contact is made and the bell rings. This indicates that by raising very slightly and opening the blades the foreign body can be picked up without any intervening structures being also caught.

Protection, additional to that of the diaphragm, tube, box, etc., is afforded by a sheet of heavy x-ray proof rubber with a 3-in. hole in it that is placed either above or below the patient.

FIG. 4.—Large view of the points of the blades of the extractor, showing how contact is made by foreign body across the points.

The use of this instrument is not easy; like other surgical instruments, it requires practice. It also requires experience in the interpretation of x-ray shadows. When the foreign body can be seen, it looks so simple to pick it up with the points of the extractor, which can also be seen in the fluorescent screen. And it is simple, provided that the operator recognizes that it is absolutely essential to make an *exact start* directly over the foreign body and move the points of the extractor *exactly* in the line of the rays—that is, straight

to the foreign body, correcting his direction as he proceeds towards it.

Only certain cases are suitable—that is, those in which access can be had to the foreign body directly in the line of the rays, and through soft structures, or with the assistance of a trephine, as in this case. Old-standing aseptic cases, surrounded by a fibrous capsule, are not suitable for extraction.

It is not an instrument for anyone to use—it involves exposure to x rays, and must be used by or in co-operation with a competent radiologist, who is experienced in radio-therapeutics, and who knows where the danger zone from x-ray dermatitis begins, and how to protect not only the patient but also the operator.

REFERENCE.

¹ *Proc. Roy. Soc. Med.*, 1916, vol. ix (Electro-therapeutic Section), pp. 75-89; and 1917, vol. x, p. 103.

ON THE INFLUENCE OF MUSCULAR EXERCISE ON LONGEVITY.

BY

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To promote longevity all the systems and organs of the body ought to be kept in a healthy condition, and prevented from decaying as long as possible. We must not attend to one of them alone, but to each and all of them, must endeavour to keep them all sound and vigorous, make them assist one another, and work together in harmony.

In the present paper I intend to show the principal features of the influence of the muscular system on the functions of the other systems and on the life of the whole organism.

The contraction of the muscle, as shown by Professor Ludwig, Sir Lauder Brunton, and Dr. Oliver of Harrogate,

causes dilatation of the arterioles, capillaries, and lymph spaces, allowing more oxygenized blood to flow to the muscular fibres, which abstract from it what they require for their nutrition and let the remainder, together with the used-up material, pass partly into the veins, partly into the lymph spaces and the lymphatic vessels. By this process the muscle is nourished, the products of decomposition are removed, metabolism is promoted, and heat is produced. In addition, the small blood vessels, through their increased action, are kept in a healthy condition. We may go further and say that the spheres of the brain which initiate the contractions of the different sets of muscles, are likewise favourably influenced, for an increased flow of blood is attracted to them by their work and the blood vessels are forced into greater activity, by which their own coats as well as the brain substance are nourished.

Walking Exercise.

The most natural of all muscular exercises, as pointed out by Hippocrates, is walking exercise. A great part of all the muscles of the body is activated by it; the action of the heart and respiratory organs is increased; the blood is passed with greater force from the heart into the blood vessels of the body, which are obliged to contract more vigorously, carry more blood to the different organs of the body, nourish the latter, and are themselves nourished through their work. By the contraction of the muscles of the legs more blood is attracted to them, and is squeezed out from them into the veins and lymphatics and carried to the heart, which is forced to contract more vigorously. The pumping action of the heart thus induced strongly assists the circulation of the blood and lymph in the abdominal organs, and is helped in this by the more powerful contraction of the diaphragm and abdominal walls which accompany the increased respiratory movements forced on by the more rapid and more energetic contractions of the heart. The more powerful breathing leads to improved oxygenation of the blood and increased metabolism. All the organs in the abdominal cavity are favourably influenced by active walking; the appetite, the digestion, and assimilation are remarkably improved.

Thus walking exercises a favourable influence on the whole organism. We must therefore take daily walks and, if possible, in the open country, and do so in all weathers. The amount of walking required by different persons varies according to personal conditions and the manner of living; we may say between half an hour and two or three hours. It depends not only on the constitution of a person, but also to a great degree on the varying state of health and strength, on habit, on occupation, on the meteorological conditions—heat or cold, dryness or humidity, strong or light wind, or stagnation of air.

The walk ought not to be extended to actual fatigue, but ought to lead to exhilaration and agreeable warming of the whole body. The pace of walking, too, must vary in different persons, from less than a mile to three and four miles an hour, according to the condition of the walker and to habit, and ought not to be changed all at once from an accustomed slow to an unaccustomed very rapid pace.

With increasing age the power and the inclination to walk diminish, and this coincides with the diminution of the creation of warmth. Friar Roger Bacon, in the thirteenth century, stated that the body heat decreases after the age of 40. His statement agrees with the experience of many others as well as myself, though the exact age varies in different persons according to their general condition, their manner of living, and especially their activity. To prevent this decrease of heat production persons advancing in years must continue to walk or take other muscular exercises as much and as long as they can, and must not allow their friends to dissuade them from doing so, or yield to their own inclination to give it up. Even if it rains or snows, or the weather is otherwise disagreeable, they must continue to take their accustomed exercise; since, if they neglect it, and stay at home engaged in reading or some other occupation, they have great difficulty in resuming the necessary exercise. Great is in this respect the difference between the young and the old; the former can easily return to active muscular work after long rest, not so the latter. They must not regard their number of years but their physical capacity. If those advanced in years neglect muscular exercise their muscles waste, their metabolism fails, their body heat