As regards local treatment of the joint every patient had rest and application of Scott's dressing.

The above-mentioned cases gave encouragement to continue with the sensitized vaccine, but it was thought desirable to try the administration of bigger doses.

On that account the following routine was adopted in the cases reported below:

1st day	...	...	100 million of gonococci.
5th day	...	...	200 " "
9th day	...	...	400 " "
13th day	...	...	600 " "
17th day	...	...	800 " "
21st day	...	...	1,000 " "
25th day	...	...	1,200 " "

And increasing 200 million every fourth day up to a maximum of 2,000 million.

CASE XI.

Admitted May 16th, 1917, with gleet, some swelling and pain of left wrist, and slight swelling of left shoulder with marked stiffness and restricted movement. Vaccine was begun the same day, and on May 23rd the pain became easier and the swelling began to subside. On June 6th the pain and swelling had gone. The result was that movements at the wrist were quite normal, and only slight restriction of movement remained at the shoulder. The temperature was normal throughout. In this case the local treatment was by ionization.

CASE XII.

Admitted April 14th, 1917, with purulent urethral discharge. On July 3rd some swelling and pain appeared in the left knee. Vaccine was begun next day. The pain became easier on July 13th, and the swelling began to subside on the 14th. The pain and swelling had gone on August 6th. In the result the knee was practically normal, though movement was somewhat restricted. The temperature was normal throughout.

CASE XIII.

Admitted June 11th, 1917, with purulent urethral discharge, and some swelling of the left knee. Vaccine was begun on July 11th, and the pain was easier two days later. The right knee developed slight swelling and pain on July 16th. By July 18th the left knee was greatly improved. On July 28th the right knee was free from pain. Two days later the left knee was better and all other joints were normal. Finally on August 18th all movements were normal.

CASE XIV.

Admitted June 15th, 1917, with purulent urethral discharge, well-marked arthritis of the left elbow with fluid, early arthritis of the right elbow, and pains in the right leg. Temperature 102° F. Vaccine was begun the same day. The pain was less on June 21st, and the swelling less on June 27th. The pain disappeared on July 10th, and the swelling on July 14th. A week later movements in the arms were normal.

CASE XV.

Admitted June 30th, 1917, with purulent urethral discharge, swelling and tenderness of left ankle and knee. Temperature 99.4°. Vaccine was begun at once; on the following day the right ankle was swollen. On July 14th both pain and swelling had diminished, and the ankles and knee were greatly improved on July 16th. By August 1st the pain had left the affected joints, the left knee was practically normal, the right knee normal, but the left ankle still slightly swollen. This patient showed marked reaction to the vaccine when he received a dosage of 1,200 million, after which he had transient pains in all his joints.

CASE XVI.

Admitted July 8th, 1917, with purulent urethral discharge and both knees swollen and painful. Temperature 99.6°. Vaccine was begun the same day, and the pain and swelling abated on July 13th. On July 18th the right knee was greatly improved; the left knee slightly improved. The next day there was slight pain in the right ankle, and on July 23rd the fingers of the left hand swelled. The right ankle was free from pain on July 24th. On August 15th the knee movements were practically normal, and on August 23rd the hand was better and the left ankle almost well.

CASE XVII.

Admitted July 23rd, 1917, with gleet, and swelling and pain of left knee, but no fever. Vaccine was begun the same day. The pain and swelling were less on July 28th. The knee was greatly improved on July 31st, and the pain had gone on August 16th. By August 20th the knee was practically normal in its movements.

The last six cases were all treated locally with Scott's dressing, lead and opium fomentations, and ionization.

From a consideration of these seventeen cases I feel justified in recommending the administration of sensitized gonococcal vaccine as a line of treatment worthy of trial in cases of acute and subacute gonococcal infection of joints.

The first case, as already stated, was given an autogenous sensitized gonococcal vaccine, the micro-organism being grown from the fluid aspirated from the knee. All the other cases were treated with sensitized gonococcal

vaccine prepared from four strains of gonococci, all of which were obtained from urethral discharges. None of these strains was autogenous for any of the cases treated.

I have the impression that recently-obtained strains are best for this purpose, and endeavour has been made to avoid using gonococci which have been subcultivated for more than four months, the strains being discarded at the end of that period and younger ones employed. Four strains of gonococci have always been employed in the preparation of the stock vaccine.

In the matter of dosage the second routine has the advantage of being less troublesome for both patient and medical officer, and the results are quite as good as with the first routine; the second is to be recommended, though probably one might give even bigger doses with safety.

Only a few of the cases treated have shown any reaction after administration. Case xv showed the most marked reaction, and one or two of the others had a slight increase of pain in the affected joint or joints, which generally disappeared after a few hours.

I have to acknowledge my indebtedness to Captain C. Lundie, R.A.M.C., and Captain W. J. Ronan, R.A.M.C., for giving the vaccine an extended trial in their cases and for so kindly supplying me with the clinical notes. I must also thank Captain Billington, R.A.M.C., for his helpful suggestions when I began this work.

A NOTE ON MUSCLE NERVE TESTING DURING OPERATION.

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The following is a brief account of the method adopted for the electrical testing of a peripheral nerve at the time of operation at the Military Orthopaedic Hospital, Shepherd's Bush.

It is necessary, in the first place, to emphasize the extreme importance of testing the excitability of the nerve in many cases, and that it is therefore essential that the surgeon should be prepared to do so in every case. If, on cutting down on the nerve, a complete anatomical division is found, with an end bulb on the proximal end and perhaps an inch or more of separation, there is no need to test the electrical conductivity of the nerve.

But very often this is not the case. The exposed nerve may show a thickened area with no anatomical division, and the question arises whether or no there is physiological conduction through this. It may be thought that a complete investigation of the case beforehand should suffice for diagnosis, but it happens sometimes that the notes of cases are not complete, and that the surgeon may not be fully familiar with the case. In any case, a diagnostic method as easily applied and as valuable as is that under discussion should always be made use of.

It is quite simple to test the conductivity of the nerve, and the result, coupled with a consideration of the history, will give a clear indication whether the lesion is recovering or not.

The relative rapidity of return of voluntary power and of faradic excitability (as ordinarily tested) after injury is not constant; sometimes the one and sometimes the other returns first. If the exposed nerve is stimulated faradic response in the muscles always precedes, in my experience, the return of voluntary power. It occurs so often that it may be regarded as a constant factor.

Illustrative Case.

Pte. H. Gunshot wound through neck, August, 1916.

There was a lesion of the fifth and sixth cervical nerves, with paralysis of the deltoid, biceps, and supinator longus muscles. The scars of entrance and exit were in the root of the neck.

The case was treated with the arm in abduction for five months, in order to relax the deltoid and biceps. As there was no evidence of recovery, exploration was decided upon. The fifth and sixth cervical nerves were explored in the posterior triangle, together with the upper trunk and its anterior and posterior divisions. Some scar tissue was dissected off during this exposure, and the nerves were stimulated. Faradic excitability was evidenced by contraction of the biceps, deltoid,

and supinator longus muscles, and the wound was closed. Two months later faradic response and voluntary power were regained in the paralysed muscles. The recovery was neither hastened nor retarded by the operation, in all probability, but the response to the test rendered further exposure unnecessary, and made the prognosis as to recovery favourable.

Testing is sometimes of use in another way when operating on cases in which there is much scar tissue and the anatomical relations of parts are disarranged. Any nerve or branch can be stimulated and defined with certainty by noticing the muscle or muscle groups which contract on such stimulation.

The Apparatus.

The apparatus required consists of (1) a faradic coil and metronome, and (2) electrodes and connecting cords which can be sterilized by boiling.

The only essential of the coil is that it shall yield a sufficiently weak current. The coil we use yields a current so weak that it can only just be appreciated when both electrodes are placed on the tongue. If the current is strong, the overflow to the muscles other than those which are being tested causes general contractions, and renders accurate observation impossible. This difficulty is commonly met with.

The metronome interrupter is the simplest method to adopt in testing. The metal probe is held in contact with the nerve, and at each beat of the metronome the electrical circuit is made or broken. The testing electrode has not to be moved, and an accurate observation is easily made.

The testing electrode, a long metal probe with a terminal at the end for the attachment of the connecting wires, is far simpler than the type sometimes employed, consisting of two platinum wires insulated in a glass handle. These bipolar electrodes are easily broken—for example, in boiling—and, moreover, great care has to be exercised that both points, which are close together, are making contact with the nerve at the same time. The metal probe electrode is absolutely simple, cannot get out of order, and there is no difficulty in being sure that it is making contact with the nerve.

The cords and connexions are all sterilizable by boiling. There is no need, therefore, to wrap them in towels and so waste time during the operation, and there is no risk of infecting the wound. The connecting cords can lie on the sterilized towels by which the field of operation is shut off without risk.

The secondary electrode necessary to complete the circuit is attached to any convenient part well clear of the site of operation. In testing the nerves of the arm, for example, it is attached to the foot.

Method of Application.

The nerve is isolated and the field of operation rendered dry by swabbing. A glass rod is passed under the nerve and the metal probe is placed in contact with the nerve. The core is fully withdrawn, one cell actuates the battery, and one layer of secondary is used (the studs for these adjustments are clearly marked on the coil), and the metronome is started. A normal nerve will be stimulated by this weak current, and the muscles supplied by it will contract at each beat of the metronome. If there is no contraction the current is strengthened by pushing in the core, and if further strength of stimulus is necessary by using two layers. Any current stronger than this is unnecessary, and will simply cause contractions in the surrounding normal muscles by leakage along the nerve sheath.

With the equipment advised and a nurse or assistant told off to work the metronome and turn on and off as directed, the testing takes only a minute or two.

As a point of interest and as showing how weak a stimulus is used the following fact may be noted: In stimulating the median nerve exposed in the arm, the muscles put into action vary according to the exact part of the circumference of the nerve which is stimulated. Thus the pronator radii teres or the flexors of the wrist, or the long flexors of the thumb and index finger can be made to react as practically pure and uncomplicated actions.

Incomplete Lesion.

In healing with incomplete or partial division of a peripheral nerve it is sometimes necessary to suture part

of the nerve and to leave other fibres intact. An exact estimate of the extent of the paralysis is of value. Incomplete lesions are not uncommon in the cords of the brachial plexus, and are frequent in the sciatic.

Pte. J.; simple fracture of femur at the junction of the middle and lower thirds, complicated by complete paralysis of the muscles supplied by the external popliteal nerve and weakness of those supplied by the internal popliteal.

On exploration it was found that the lesion was situated at the entrance to the popliteal space and that the sciatic was not divided but existed as one trunk.

Faradic stimulation both at and above this point yielded no contraction in the external popliteal supply. By dissection the external popliteal element was freed and found to be totally divided, whilst a marked thickening of the sheath, in which were embedded fragments of bone, caused a thickened lump in the internal. This was all dissected off, and the nerve was again stimulated. As it responded it was proved that no damage had been done to the conducting power of the nerve during this extensive cleaning of the sheath.

Complete Lesions without Anatomical Division.

In such a case as the following the absence of faradic response, together with the length of history, indicated the necessity for exsection and suture.

Pte. G.; gunshot wound of forearm, lower third, with paralysis of ulnar, intrinsic of the hand, and loss of sensation in the ulnar area. Exploration four months after the injury.

The ulnar nerve was exposed and found in anatomical continuity, but with a small hard nodule, the size of a pea, in the substance of the nerve. No faradic response was obtained by stimulation of the nerve trunk above the lesion. The nodule, which occupied the entire thickness of the ulna, was excised and end-to-end suture performed. Macroscopically there was no evidence of nerve fibres in the excised nodule.

EYE CHANGES IN TRENCH NEPHRITIS.

BY

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DURING the spring of 1917 I had the opportunity, while on duty at Malta, of examining a series of cases of trench nephritis, or what is probably the more correct term, war nephritis. They were seventy or eighty in number, and all came in the same convoy from the Macedonian front. They were chiefly young active soldiers between 20 and 30, though they were a few older men among them. The history was generally the usual one of fairly severe exposure and strain, though not necessarily in the front line. Nearly all the cases presented the disease in a severely acute form, and on their admission were mostly seriously ill. At that time the fundi of a large number were examined, either by myself or by my colleague, Dr. Moffett. We found almost invariably marked retinal congestion, with large pulsating veins. There were no signs then, however, of any patches of exudation or nerve involvement. Some weeks later, however, on the examination of one or two patients who had complained of eye symptoms, we found present the more definite changes of nerve swelling, accompanied by patches of retinal exudation. We then decided to examine the whole series again, and by degrees this was done, with the following result. To make the points clear the cases may roughly be classified at the time of this examination (somewhere about three months from the onset of their illness) into three groups, A, B, and C.

Group A numbered about 21. They were all convalescent, presenting practically no symptoms except slight anaemia and debility. The urine was free from albumin, except for a very slight trace in a few. In only four of this class were retinal changes found, and they were slight in amount—a few small spots of exudation, a small punctate haemorrhage, a slight haziness of the disc edges, or a little oedema along the course of the veins.

Group B—a series of 20 cases who had not done so well as the others. Albumin was generally present, though in small quantity. There was breathlessness and slight oedema often. Of these cases, 8 showed minor retinal changes, with small exudation spots. One, however, showed much more marked changes, pointing to a fairly severe neuro-retinitis.

Group C, 13 in number, were severe cases in which the disease was still marked. They were suffering from