proliferation of sarcolemma nuclei, and muscle cell budding and splitting. The survival of the young muscle cells thus formed depends upon the degree of encouragement they receive to function; otherwise they run the risk of destruction before they reach maturity, either simply by disuse-atrophy or by condensation of the recently formed scar tissue. Their failure to survive only increases the amount of fibrous tissue formation.

During the treatment of compound fracture of the femur, then, we have all the necessary conditions for the formation of fibrous tissue in muscle—namely, trauma, sepsis, and prolonged disuse. Our picture of the quadriceps, therefore, is that of a muscle which has practically lost its contractility and extensibility and is pervaded throughout with fibrous tissue gluing the fibres together, and to a large extent actually replacing the muscle cells. In addition, in the neighbourhood of the fracture and about each sinus the muscle is riveted, as it were, to the bone by dense scar. Even with a normal joint such a shortened muscle forms a very considerable obstacle to flexion of the knee. Similar changes are found about tendon sheaths and in tendons and ligaments around the knee-joint due to the same causes.

The conditions to be dealt with, therefore, before we get movement are perimuscular and periarticular adhesions, intramuscular adhesions, contracted and imperfectly functioning muscle cells. Experience in the treatment of stiff knee, following the type of compound fracture we are considering, shows that the real block to flexion is not due to changes in and about the knee but in the quadriceps.

Treatment should be first prophylactic, by chemical sterilization, removal of all sequestra, and early secondary closure of wounds when possible. Secondly, any scarring which binds the muscle to bone and all intramuscular and periarticular adhesions must be broken down. Thirdly, the normal functions of contractility and extensibility must be restored and growth of young muscle cells encouraged.

As soon as the condition of the wounds permit the quadriceps should be treated by graduated contraction by means of the Bristow faradic coil. This loosens intramuscular and periarticular adhesions, and restores tone to the muscle, which begins to increase in size.

If the fracture is united and the patient out of the Thomas splint, a small sand-bag is placed beneath the knee as he lies in bed, the heel being off the bed. The weight of the leg is then sufficient to commence flexion. As the knee begins to bend the size of the sand-bag is increased, the patient being encouraged in the meantime to extend the knee voluntarily. In this way flexion of 20 to 30 degrees is obtained, and graduated contraction and exercises are continued until he is able to fully extend the knee from the flexed position.

The knee should then be further flexed under gas, the remaining intramuscular and periarticular adhesions being broken down in this way. It is most important that during this operation the knee should not be bent beyond the point of extreme muscular extensibility at the time. When this point (generally just short of 90 degrees) is reached the surgeon feels a characteristic jerk, which can only be recognized by experience, but which closely resembles the sudden stop felt on dorsiflexing the ankle of a patient with contraction of the Achilles tendon. The knee and thigh are then vigorously slapped (tapotement)—a procedure which tends to limit any effusion into the joint and deep tissues. The patient is put back to bed either in a suspended knee flexion splint, in which the thigh only is fixed, and which is bent at an angle beyond that obtained during the operation, or simply with the joint flexed over sand-bags as before described. The following day the knee may be slightly swollen, and the patient may complain of some pain on each side of the patella ligament, and where the muscle scarring is most dense. Gentle massage (effleurage) is comforting at this stage, while weak faradic graduated contraction undoubtedly hastens absorption of effusion from the tissues.

This treatment—massage and graduated contraction—should be continued for three days; at the end of this time any effusion will have disappeared and passive movements should be commenced in addition.

Two points will now be noticed: First, that flexion cannot be obtained to the same degree as in the theatre—the loss may be as much as 10 degrees—and secondly, that voluntary extension is only to about 165 degrees. This

range, particularly the extension, will increase from day to day under treatment by the Bristow coil and voluntary exercises until the patient is able to perform active movement from about 100 degrees to full extension.

At the end of a week or ten days, if the fracture is firmly united, the patient should be instructed in knee-bending exercises while standing at the foot of his bed. At least every other day he should be made to lie face downward on the bed, and the surgeon, holding the thigh down by grasping just above the knee, should flex the leg passively with his other hand in one slow, firm, continuous movement. By these means flexion beyond a right angle is generally obtained. Daily graduated contraction should be continued for four or five weeks, at the end of which time, if improvement is not satisfactory, the knee should be wrenched again.

There are several precautions to be taken, apart from those already mentioned, when wrenching a knee: First, if the site of fracture is tender to deep pressure, coaptation splints should first be applied. Secondly, there should not be too much anxiety to get too much flexion at one sitting. Overflexion may result in rupture of the quadriceps, injury to the patella ligament and capsule of the joint, or even fracture of the patella. Thirdly, whatever the degree of flexion, the patient is not ready for a second wrenching until he is able to extend his leg fully.

During the after-treatment the graduated contraction should not be too severe. If, following treatment by this method, the patient complains of stiffness in his muscle, it is probable, as pointed out by Major Bristow, that more harm than good is being done. An overworked muscle does not develop, it atrophies.

What has been said about the knee applies obviously, though to a lesser extent, to the other joints of the limb. During treatment, then, it is the duty of the surgeon to see also that the hip and ankle joints and the toes are not allowed to become stiff.

TREATMENT OF BILHARZIAL INFECTION BY TARTAR EMETIC.

BY

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TARTAR EMETIC, as advised by J. B. Christopherson,¹ must be accepted as a positive cure of bilharzial infection. I knew many of the cases on which his recommendation was based, and had commenced the treatment in the Egyptian Military Hospital, Khartoum, where the opportunities of proving or disproving its efficiency are many among the fellaheen recruits of the Egyptian army. Since then McDonough has reported that he had previously used the drug; and Major Strong of the Australian Medical Service tells me that he and one or two brother officers had worked with it in 1916, in fairly small doses and at intervals of not less than a week between the injections, but no one felt convinced of the possibility of curing the disease, nor had anyone the courage to adopt the truly heroic dosage which is necessary to affect the bilharzia worm and its ovum.

Our cases are divided into two series; the first is composed of twenty-six cases which were treated in the period from June 27th, 1918, to August 10th, 1918, and the second of thirty-six cases treated from August 12th, 1918, to January 15th, 1919.

The interval between these two series was longer than the actual dates seem to indicate, for there happened in August an outbreak of influenza in the ward where these cases were; the temperature in all the cases was considerable—never less than 104°—and one patient died whose organs showed most extensive fatty degeneration;² fearing the toxic effect of antimony in such cases, the treatment was discontinued in several patients whose urine still showed bilharzia, and the first three of the second series were started on injections of 10 c.cm. of mercury perchloride solution, 1 in 1,000, as has been tried by Madden of Cairo. But this solution failing to have the effect of clearing the urine of blood and ova, we again resorted to tartar emetic, and have used it invariably since.

Of the first series of 26 cases, 14 were discharged with the urine free of blood and ova, 11 were still infected but

were discharged on account of the influenza epidemic, after receiving doses of tartar emetic varying from 3 grains to 23 grains, and one died. All these patients were very heavily infected, having indeed been picked out at inspections for their unhealthy look, and found on examination to be infected with bilharzia. With the one exception all were returned to duty looking fit, and have been able to continue with their units since.

Early in January we asked for these men to be sent for examination, but unfortunately only nine could report.

Of the fourteen discharged cured, four reported.

The result of microscopic examination of the urine was in one completely negative. One had a few ova in a clear urine, and the ova did not hatch out in two hours. One had a little blood, but no ova. One had blood and pus in slight amount, but no ova.

Of the eleven discharged before the urine had quite cleared, five reported.

Two who had received 23 grains and 15 grains respectively had blood and pus, but no ova. One who had had 13 grains had many ova, but none hatched in two hours. One who had 5 grains had some blood and many ova, of which a few hatched. One who only had 3 grains had much blood, and many ova which hatched.

It will probably be contended that these results are anything but satisfactory, but I think they are sufficient to justify a claim for the treatment, if for no other reason, that all the cases were so anaemic and looked so delicate before being treated that they were certain of discharge, but after the injections were able to carry on and do all their duties. Further, of the nine examined five months after treatment had ceased, only four contained ova, and two of this four had barely received treatment, having only had 5 grains and 3 grains respectively before being discharged; yet it was only in these two that any ova in the freshly voided urine would hatch on the addition of water. In the others the ova were dark or granular and did not hatch; they were presumably ova which had been lying dead or so altered as to be harmless, and were only present in the urine because their numbers having been so great in the bladder tissues, and the papillomatous masses one sees in such cases, that their extrusion was taking a long time. Symmers' records these same changes in ova found dead by him in the tissues.

The presence of blood and pus without ova in four cases is not to be wondered at when the unhealthy state of a heavily infected bladder wall is remembered; indeed, it is rather a matter for surprise that these two things disappear relatively so quickly as they do when a case begins to clear up.

In this first series the patients had for the first week or two been kept on milk diet, and then bread was added, but the diet never approached an equivalent of the full diet of hospital; this we recognized was a failing in our method, for it is well known that rest in bed on a milk diet will clear up bilharzial urine and give the semblance of a cure which may even persist for some time. It is impossible to state any average dose for the first series, as treatment was so interfered with, but in those cases which were continued until the urine was clear never less than a total of 25 grains was given, and in two cases over 30 grains were administered. This high dosage is in accordance with Christopherson's original work on the subject, but our more accurate and carefully controlled second series show that this dose is unnecessarily large.

The results in the 36 cases of the second series are reported thus early so that others may give the treatment a trial.

The diet throughout was either the ordinary diet or its equivalent—namely, milk 4 rotls, eggs 4, vegetable 1 rotl, rice 1 rotl, and bread 1 rotl; rest was not insisted on except for two hours after the injection—in fact, three of the cases were treated as out-patients, and carried on all their duties between times, as we shall show.

As has been said, the first 3 cases were started on intravenous injections of 10 c.cm. of a 1 in 1,000 solution of mercury perchloride. There were no untoward results from the injection of this apparently large dose every second day, but there was no alteration in the presence of ova in the urine. The influenzal epidemic made its first appearance in the Sudan in the bilharzial ward, and we not unnaturally associated the high temperatures which laid low patient after patient with our vigorous pushing of the tartar emetic; having seen patients not infested with bilharzia become ill and some die, we again attempted the antimony tartrate.

CASE I.

Mohamed S. H. was a typical illustration of how things went. The urine contained great quantities of blood and ova. From October 10th to October 18th he was given an injection every other day of 10 c.cm. of mercury perchloride, 1 in 1,000. No improvement in the condition of the urine occurred. On October 22nd, when the urine contained much blood and many ova, treatment with tartar emetic was begun. He received on that day $\frac{1}{2}$ grain; on October 24th 1 grain, on October 26th $1\frac{1}{2}$ grains, and on October 28th, and every second day until November 6th, 2 grains. After the first three injections of 2 grains he had some cough. On October 28th the urine still contained a little blood and ova were present. On November 2nd blood had disappeared and ova were few. Thereafter neither blood nor ova were detected, and the patient was discharged on November 7th. He was examined on November 19th, when the urine contained neither blood nor ova. The total amount of tartar emetic given in this case was 12 grains.

In order to control the effect still more, the "hatching out" time of the ova on the addition of water to the fresh urine in special glass containers was determined, and the following case is illustrative.

CASE II.

Mohamed F. A. was very heavily infected, the urine containing much blood and many ova, hatching in ten minutes. On November 5th he was given $\frac{1}{2}$ grain of tartar emetic, and on November 7th 1 grain; on that day he had cough, and the condition of the urine in respect of blood and ova was unchanged. On November 9th he was given $1\frac{1}{2}$ grains, and again had cough; on November 11th he received 2 grains, and on these two days the ova hatched in fifteen minutes. Thereafter he was given 2 grains every second day until November 27th. On November 13th the ova hatched in half an hour; on November 15th in one hour; on November 17th in an hour and a quarter; on November 19th ova hatched, but movements were very sluggish; on November 21st the ova did not hatch in three hours, and this was true also on November 23rd, on which day the patient felt weak. On November 25th there were few ova, and on November 27th none, but the patient had cough followed by slight fever. He was discharged on November 28th. When examined again on January 12th, 1919, the urine was quite clear, but contained a few black ova, which did not hatch. He was detained in hospital and the urine examined on two succeeding days, when ova were still found, but always black and apparently dead. The total dose of tartar emetic in this case was 20 grains.

Two interesting but quite common phenomena were displayed in this case—namely, the gradual killing of the vitality of the ovum, as seen by the lengthening out of the hatching period until at last when it broke it released a slow moving miracidium in place of the rapidly darting one; and, secondly, the discoloration of the ovum.

This case also shows what we had come to recognize as a general fact—namely, that after the patient had received 5 grains of the drug the improvement is rapid; the amount of blood for the first time begins to diminish and the "hatching out" time appreciably lengthens.

But all these results might quite easily be ascribed by doubting critics to the restful life of hospital, so we have pleasure in recording three cases whose mode of life was in no wise altered while under treatment, except to give them a two hours' rest after the injection, and even that one of them—the son of a civilian syce—did not have, as he constantly ran out of the ward so soon as he found it possible to evade the orderly, and that was usually in a quarter of an hour.

The following case is typical of the three:

CASE III.

Ahmed S. reported voluntarily for treatment, and we took trouble to explain to him that the idea of the treatment was not to discharge soldiers but to retain them, for every one knows how the Egyptian fellah loathes the army and will even mutilate himself to escape his military service. He said he understood the matter fully, but that he was anxious to be cured.

On December 9th, 1918, when treatment with tartar emetic (half a grain) was begun, the urine contained much blood and ova, which hatched in fifteen minutes, were present in great numbers. He received one grain of tartar emetic on December 11th, and one grain and a half on December 13th. The urine examined on these days was in the same condition as on December 9th. From December 15th to December 25th he received two grains of tartar emetic every second day. On December 15th the ova hatched in forty minutes. On December 17th there was much less blood; ova were present but did not hatch. On December 19th the urine was clear and the ova did not hatch. After that date the urine was clear and no ova were seen. Examination of the urine on many occasions down to January 1st, 1919, revealed nothing but a few oxalates. The total amount of tartar emetic given in this case was 14 grains.

Method of Administration.

The tartar emetic is made up with normal saline in the strength of $\frac{1}{2}$ grain in 2 c.cm., and is sterilized in an autoclave each time immediately before injection. A 10 c.cm. syringe is used, and as we sometimes had over twelve cases to inject at one time, and only one syringe was at that time available, we did not sterilize it afresh between each injection, but washed it out carefully by filling several times with sterile saline, and in that way removed all blood, so that any danger of haemolysis was removed. There was always a sufficient supply of needles kept freshly sterilized; if any of these needles became blunt we discarded them, as the danger of not getting properly into a vein only exists with such an unreliable needle. An injection was never commenced until the blood of the vein had been seen in the barrel of the syringe, and the plunger was always pulled back a little twice or thrice while the injection was being made to ensure that the needle had not shifted out of the vein. The skin over the vein was painted with tincture of iodine and one turn of bandage constricted the arm above the part. Working in this way in the last thirty-eight cases we did not have a septic arm nor anything more than a very slight and passing phlebitis; but in the first seven we had three rather severe infections; two had to be opened and dressed. The reason we found afterwards to be that one of our assistants had septic fingers, and though he never handled the needles or articles actually giving the injections, the infection must have passed from his fingers to the lips or edges of some of the dishes. Anyhow, when he was excluded from taking part in the procedure, all went well.

Injections were always given fairly slowly, especially in those cases where vertigo developed; by this means the number of such cases is diminished.

Complications.

Cough is extremely common, but is usually very slight. In two cases, however, we had seen it so bad as to lead to slight haemoptysis; even in these the symptoms disappeared in a quarter to half an hour. The cough is usually associated with a considerable amount of frothy expectoration which ceases when the coughing is over.

Vertigo is much less common but more troublesome; in three cases we first of all reduced the dose from two grains to one, and had finally to discontinue the treatment before the urine had been quite cleared, as the effect on the men was so great.

Vomiting was fairly common, but never severe. We have never seen any of the bowel complications—for example, diarrhoea—mentioned by Christopherson as seen in the treatment of bilharzia, and of which we have seen cases when treating kala-azar by this drug.

Of complications resulting from the injections themselves, the only one to be expected, if reasonable attention to asepsis is given, is a little phlebitis at the seat of puncture of the vein. This was not very common, and depends on the idiosyncrasy of the patient, for in a case where it had once occurred it tended to occur again. It was never severe, being little more than a tenderness with a rise of 1° or 1.5° F. in the worst cases; all symptoms disappeared on the exhibition of a hot fomentation to the painful spot. On the other hand, if any of the fluid were allowed to escape from the vein into the tissues, the resulting inflammation and necrosis was much greater than is seen with a similar accident from "606," although the ultimate result is always good once the necrotic tissue has been evacuated. In our second series we did not have one case where phlebitis or any similar conditions gave us the least trouble.

Results.

The results of the second series of thirty-eight cases were as follows: Twenty-eight were discharged cured, no ova being found on careful examination of the urine. In one or two very little blood still existed, but it was surprising how in the vast majority, from being almost pure blood, the urine became absolutely negative.

Two were invalided from the service after receiving only 4 grains each; the first of these was invalided because of his very poor state of health, and the second because of the multiplicity of the intestinal infestations (ankylostoma, taenia, oxyuris) and a continued low fever. One, after receiving 16 grains, was much affected with vertigo and treatment was stopped, although the urine contained more

blood and mucus than we liked. We might possibly claim this case as actually a cure, for no ova were found on the last examination. Four were discharged with ova still in the urine after doses of 15, 13, 11, and 10 grains respectively because of vomiting and vertigo. Our intention in such cases is to suspend treatment for a month or two and then resume it, but so far we have no data to give. We are firmly convinced that severe vertigo and vomiting are indications for the discontinuance temporarily of tartar emetic.

Of the twenty-eight cases discharged cured we had the good fortune to examine fifteen during the first to second month after they left the hospital, and in none were blood or ova found. The other thirteen were not in Khartoum, so that we have so far no details to give of them.

CONCLUSION.

We apologize for the recent character of the cases in this paper, for we know only too well the criticisms to which it is exposed. At the same time we feel that the faith that is in us relative to the value of tartar emetic in bilharzial infections is justified by the results we have given, for these results are not based on naked-eye observations or beliefs, but on the non-partisan findings of the microscope. Nor can it be said that we have done no more than has so often been done by rest in bed or low diet, for our most instructive results were on ambulant cases with full diet, and no case was treated on anything else than a generous diet.

"But the blood and ova will recur," says the persistent sceptic. Perhaps he is correct; if so, we will repeat the treatment, and so kill the few remaining schistosomes that escaped our last injections.

Let any one try the effect of even four initial injections—that is, 5 grains—and watch the effect on the hatching period of the ova when water is added to the freshly voided urine, and we are sure he will feel justified in going on to the 15 grains, which we feel is a sufficient and perfectly safe dose to kill the bilharzia without affecting the patient, although in saying this we see no danger in going on to the 25 grains which Christopherson now considers the optimum.

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A CASE OF HYDROCEPHALUS.

BY

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ON February 14th, 1916, Dr. Squire of Pudsey asked me to see with him an ex-soldier invalided owing to suspected cerebral tumour. For the previous eighteen months headaches and diplopia had been the principal symptoms. Latterly his sight had deteriorated, and during the last few days he had suffered from intense left-sided supra-orbital neuralgia.

He was found to have right homonymous hemianopsia; papillitis on both sides; on the right with swelling of 1 D., and on the left of 4 D. The pupillary reflexes were present and the hemianopic pupillary reflex absent. Irritation of the recurrent meningeal branch was considered to be the explanation of the intense neuralgia. He had diplopia from paresis of left external rectus.

There was ataxy of the arms, more pronounced on the right side. The plantar reflex was extensor on the right side. Eleven days afterwards the pulse rate was 48, and the respirations 12; slow cerebration and cerebral vomiting were very pronounced.

First Operation.

The same day the left subtemporal area was decompressed. On reflexion of the dural flap the pent-up cerebrospinal fluid burst through the wall of the lateral ventricle. The dural flap was turned down and invaginated between