NOTES ON GUINEA-WORM IN THE SUDAN.

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Filaria medinensis, or "Guinea-worm," is a parasite capable of causing great loss of efficiency as well as suffering amongst garrisons stationed in endemic areas, and a discussion on the subject is therefore of interest to army medical officers.

Although natives are much more subject to the disease than Europeans, still the latter only escape it by avoiding the localities where it exists, or by taking precautions more elaborate than would be likely to obtain under Service conditions amongst the rank and file.

Should it ever become necessary for British troops to operate in Tropical Africa, the difficulty of water supply would involve the breaking up of columns into detachments, and the water discipline of detachments is usually bad. But apart from the question of British troops, a large number of our officers serve from time to time with native corps, and to them the question of "Guinea-worm" has a decided importance.

I do not propose to discuss the natural history of the parasite, which is well known to you all, beyond reminding you that the mode of entry of the embryo Guinea-worm into the human body is no longer a matter of doubt, this question having been definitely settled by the researches of Leiper.

That observer has definitely proved that the embryos, after a stage of a few weeks' duration in the body of the cyclops, are ingested, with their intermediate host, in drinking water, and enter the tissues through the stomach walls.

The males and females come together in the tissues about the mesentery (Castellani), and after connection the males die off while the impregnated females make their way towards the surface of the body, usually towards the lower extremity, where they give rise to the symptoms characteristic of the disease.

I return to the military aspects of the disease. From the strategical point of view its importance is greatly lessened by the fact that, after infection by the ingested parasite, a period of about a year elapses before the symptoms become manifest.

The disease is therefore of no immediate importance to a column operating in an infected district provided the duration of the military operations is less than twelve months. Garrisons, how-
ever, especially when composed of native troops, are likely to suffer very severely under certain conditions.

To illustrate this I may quote from my Annual Report on Medical Services in the Bahr-el-Ghazal for 1902.

"At Waw, where the garrison consisted of 100 men of the 10th Sudanese, and about 30 irregulars (Jehedieh), Guinea-worm was a perfect scourge to those soldiers who had spent a previous year in the district, although the detachment of the 10th Sudanese, who were newly arrived, did not suffer at all. There were, in all, 19 admissions to Waw Hospital. Of these 11 were from the irregulars, 7 from Sudanese civilians and 1 from the 10th Sudanese. The solitary case in the 10th Sudanese was a soldier transferred from the 14th Sudanese, and who had spent the previous year in the Bahr-el-Ghazal.

"At Rumbek (a station garrisoned by twenty men of the irregulars) 14 cases occurred. It is not an exaggeration to say that at one time a fifth of the corps of Jehedieh was unable to march from this cause."

I will give you another example of the amount of inefficiency caused amongst troops exposed to infection by this disease.

In the winter of 1904-05, 30 non-commissioned officers and men of the 2nd Battery Egyptian Artillery and 39 non-commissioned officers and men of the 1st Company Egyptian Garrison Artillery proceeded to Khordofan district for duty. These men spent the summer of 1905 in El Obeid. Twice each week a fatigue party was sent out with mules to cut grass and bring it in to the station. After the breaking of the rains, pools formed in the areas where grass was cut, and from these pools the men were in the habit of drinking. The detachments returned to Khartoum in the spring of 1906.

Up to July, 1906, I had no less than 25 admissions from this party of 69 men to the Khartoum Hospital for Guinea-worm. There were probably more later, after I had proceeded on leave, but during April, May and June, 36 per cent. had been admitted. When you remember that the average time in hospital is thirty days, the amount of military wastage is at once apparent.

Another instance can be quoted from a paper by Dr. W. M. Graham, of the West African Medical Service. He reports that "in a force of native troops, averaging 350 monthly, which had been under observation during the year, 57 men, or 16.28 per cent., had suffered from the disease, and they had been incapacitated from
duty for an aggregate of 1,304 days, or for an average of 22.8

days each.

The two outbreaks which I have mentioned yield instructive

results on analysis.

Taking the Bahr-el-Ghazal outbreak first, I have notes of 12

cases. These produced 20 worms in all, and the whole number

affected the lower extremity, 1 being in the thigh, 9 at the knee,

and 12 in the leg, foot, and ankle. This brings out clearly the

preference of the worm for the parts most likely to be in contact

with water.

Multiple infection was common. The greatest number of worms

in one man was 7. The average for the 12 cases was 1.7 per man.

In 8 cases for which I have the dates of admission and discharge,

the average number of days in hospital was 26.

At Rumbek, the Dinka tribe attacked the Fort at the end of

June. Of the 20 men in the Fort, only 8 were free from Guinea-

worms. The others, though able to fight on the defensive, could not

march in pursuit.

Turning to the Artillery outbreak, I have notes of 21 cases.

These produced 56 worms, or 2.7 per man. The tendency to the

lower extremity was again very marked, 3.6 per cent. of worms

presenting in the head and arm, 16 per cent. in the trunk, and

80.4 per cent. in the lower extremity. Of the last, over 70 per cent.

were found below the level of the knee. As I went on leave before

the discharge of these men from hospital, I have no records as to
duration of the disease, but believe it to have been about a month
in most cases.

I need not detain you with a lengthy description of the clinical

features of the disease. It is enough to say that the female worm

seeks the surface, causing much pain and inflammation as she

approaches her destination, and that a vesicle forms at the point

of emergence which ruptures and reveals the anterior end of the

worm presenting as a small white rod from the centre of an

inflamed area.

The embryos are discharged through the anteriorly situated

vulva under the stimulus of contact with water. If the worm snaps

and frees the embryos into the tissues a severe abscess usually

results.

This accident often follows treatment by traction on the worm,

and is very frequently brought about by injections of perchloride

of mercury solution.

Turning to the question of treatment, there is no doubt that,
if very carefully executed, the plan of winding the worm on a match, a small portion only being drawn out daily and tension avoided, often gives good results. So also does the perchloride of mercury method in some cases. But both these lines of treatment are liable to "regrettable incidents," and both are open to criticism.

In the Bahr-el-Ghazal, I formed an opinion on the whole favourable to treatment by injection of 1-1,000 solution of perchloride of mercury, an opinion which later experience has taught me to modify. I may again quote my Medical Report for that year, as it embodies my impressions after treating a series of cases:—

"I found that the best treatment was the injection of (1-1,000) perchloride of mercury solution; but this method, though sometimes followed by marvellous results, at times seems to fail altogether."

On looking over my notes, I find that even in the most favourable cases, abscesses formed after the injection of the perchloride, and these were opened and drained. The incision often made it possible to remove the worm, which was often found dead. The sequence of events was probably as follows:—

The injection either ruptured the worm directly by the impact of the needle, or by the stimulation of the fluid, led to extrusion of larvae into the tissues, and consequent abscess formation. The pus, not the perchloride, brought about the death of the larvae (that this happens has been mentioned by Leiper), and, on opening the abscess, the case rapidly recovered.

To this inimical effect of pus on the larvae, and also to the fact that incisions, necessitated by the abscess formation, led not only to the evacuation of pus but also of the remains of the worm, sometimes still alive, I now attribute the diminished time in hospital that often follows the use of perchloride of mercury injections. Whether the use of a method which nearly always leads to abscess formation is justifiable is another question. It is certainly to be avoided when the worm is in the neighbourhood of joints. On one occasion, for instance, where abscess followed traction on and rupture of a worm, the suppuration extended to the knee-joint, which had to be opened and drained.

To illustrate the point that injections of perchloride do not always kill the worm, I will read a short extract from one of my cases, a corporal in the Egyptian Artillery, of whom a photograph, showing the worm under the skin, is handed round:—

"On April 4th, 1906, a worm-like cord was to be seen making an
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'L-shaped' figure under the skin of the right chest below and external to the nipple.

"On April 11th I injected 20 minims of perchloride solution (1 in 1,000), distributed at several points along the track of the worm.

"Next day, all the horizontal and most of the vertical parts of the cord had disappeared, except that the track was represented by a faint line of ecchymosis.

"At the upper end of the vertical arm a puffy swelling had formed. . . . A few days later an abscess formed at this point and was opened. From it two live Guinea-worms were removed. Another small abscess formed at the foot of the 'L-shaped' area, from which a third living worm was taken."

What happened I take to be as follows:—

The two injections that happened to approximate to the anterior extremities of worms stimulated the parasites to extrude their larvae into the tissues. Abscesses resulted at both these points. The injections along the course of the worms led to no such abscess formation, as at these points no extrusion or larvae took place. Had the needle happened to penetrate the worms at these points, abscesses would probably have followed the mechanical liberation of the larvae. It is to be noted that the worms themselves were intact and alive. The injections certainly accelerated the cure, as these, given on April 11th, were followed by evacuation of the worms on the 17th and 18th, and the healing of the wounds a few days later.

On the whole, the method by gradual traction on the worm commends itself to me as better than the perchloride method, provided it is done with reasonable skill and with very thorough antiseptic precautions. There are, however, two dangers. On the one hand, the worm forms a line of admission for bacteria from the surface to the deeper tissues. On the other, rupture of the worm may easily take place, and will nearly always be followed by abscess formation. Even when carried out with perfect success, the process is a slow one, and, where multiple infection exists, involves many weeks in hospital and a great expenditure of time and trouble to the medical officer concerned.

The method that is most strictly scientific is the daily douching of the protruding end with sterile water, the affected area being protected in the intervals by a loose, moist, aseptic dressing, and the limb being immobilized. The douching leads to the natural extrusion of the larvae at the surface under the stimulus of cold
water. When all the embryos have been extruded, the dead worm can be pulled out without difficulty, or, if not accessible, will soon be absorbed by the tissues. This method again involves a protracted stay in hospital, but is quite without risk if properly carried out.

Were I again in charge of cases, I should apply traction where the worm was in a safe situation, and should adopt the water method for all worms in the vicinity of joints.

Prophylaxis can be attempted along two lines: by filtration of the water, and by preventing the infection of pools. The cyclops, being a large organism, is stopped by the coarsest kind of filtration, and all you have to do is to get your troops to strain their drinking water through khaki or any fairly dense material. This can be done in cantonments, but that is just where the disease is not contracted. It is in the pools, refilled by the early rains, that the cyclops abounds, and these pools, infected by natives, who enter them for ablution purposes and to fill water-vessels, are often the only water supply on the line of march in infected districts.

You will note that June and July, the months of the early rains, are the months of greatest prevalence of the local lesion. The native liberates embryos from his parasite into the pool whence his water supply is drawn. These, after a sojourn in the cyclops host, return to the human stomach, and thus pave the way for a fresh infection of the pools in the succeeding year.

The real prophylaxis consists in preventing infection of the pools. This can be approached by building troughs for the natives to draw water from, and policing the banks of the pools to prevent people entering the water. This is a counsel of perfection. It cannot be effectually carried out except near stations, or, in other words, places where a good water supply is already at the disposal of troops. It is on the line of march or on detached duty that infection of troops will occur.

Still, although the disease is difficult to prevent, much may be done to lessen its incidence. Nobody wants to get Guinea-worm, and if once the native can be convinced that a given measure will prevent it, there is a chance of his mending his ways. In the meantime it is well worth while for a military administration, with its eye on possible operations in infected areas, to improve the sources of water supply along strategical roads, to have combatant officers instructed in the causation and prevention of the disease and to attempt the isolation of infected civilians during the two or three dangerous months of the year.

Much research work remains to be done on the lines already indicated by Graham in his papers on this subject.
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The varieties of cyclops that serve as intermediate hosts, their life-history, and the possibility of preventing their existence in pools and wells, all offer profitable lines of research.

DISCUSSION ON MAJOR POLLOCK'S PAPER.

Brigade-Surgeon Beattie said that when he was serving he saw no malingering; he believed that when malingering did occur to any extent it was evident that the men were not being properly managed.

Surgeon-General Gubbins endorsed Major Pollock's opinion that one should be specially careful in coming to the conclusion that a man was malingering; he cited instances in support of this. In the case of mental disease one had to remember that soldiers were armed, and it was better to make a mistake and allow a malingerer to pass than to have a tragedy. The proposal to establish one place for observation of mental cases in India was not practical on account of the distances to be travelled; there should be four or five. He thought that at home all mental cases should be transferred to "D" block at Netley for observation.

Major W. S. Harrison said that with regard to spurious palpitation it was common for this to be produced by chewing cordite, which caused similar symptoms to those caused by the injection of nitrites. He referred to the case of a Royal Army Medical Corps recruit, who came under his care complaining of pain in the loin, radiating down into the testicle, and stated that his urine was bloody after the attack. When he was admitted there was no blood in the urine, but on the following day there was a copious deposit of what appeared to be pus, microscopic examination, however, showed that the supposed pus consisted of starch granules, and it had evidently been simulated by the addition of dusting powder to the urine.

DISCUSSION ON MAJOR CUMMINS'S PAPER.

Lieutenant-Colonel Sir W. B. Leishman inquired as to the habits of Egyptian soldiers in the matter of wading in water. He was very sceptical about the intelligence of filaria leading them to go to parts where transmission to other hosts was facilitated. He asked if Major Cummins had had any experience of the treatment by injecting perchloride of mercury directly into the prolapsed uterine opening of the worm?

Major Cummins replied that at home in Egypt the men lived a great deal in the water, but in the Sudan they wore boots and were not so constantly in the water; but the Sudanese, who were the main source of infection, were constantly paddling in water up to their knees.