OBSERVATIONS ON HUMAN SPIROCHÆTOSIS IN THE SUDAN.

By CAPTAIN L. BOUSFIELD,
Royal Army Medical Corps.

According to Sandwith this disease has been found in Sudanese, but apparently only in Sudanese resident in Egypt.

Lately, however, two cases were reported at El Obeid by Captain A. B. Cummins in the Journal of the Royal Army Medical Corps, February 1910, both occurring in Egyptian soldiers who had just returned off leave; unfortunately, their previous medical histories while on leave are not related, so that one does not know if they had previous attacks.

Another case has been found at the Civil Hospital, Khartoum, apparently imported from Egypt, and six cases have now occurred amongst the soldiers at Khartoum, the infection undoubtedly coming from Egypt, probably from a village, Ashmun Gurice, in the Mudiria of Manufia. Captain R. C. Anderson, R.A.M.C., made inquiries in Cairo, and found there was an epidemic of relapsing fever in a village close at hand, Kafr El Gazzar.

It seems scarcely possible that relapsing fever could have been missed in the more civilised parts of the Northern Sudan, and it is possible the disease does not exist there, and that all the cases have been imported. Five of the military cases occurred amongst recruits who came up from Egypt, arriving in Khartoum on January 1st, 1910, and all belonged to the 7th Battalion; the only other person to contract the disease was a soldier who worked in the pack store, and his history appears to help in elucidating the probable carrier, a point still in doubt with regard to some forms of human spirochaetosis. It strongly supports the view that the Pediculus vestimenti is the culprit.

The first patient was taken ill with fever in Cairo twelve days after joining from his village, apparently twenty-one days before arrival in Khartoum. This is of interest as apparently the recruit must have contracted the disease in his village, and therefore the incubation period was more than twelve days. Daniels and Wilkinson in their work state twelve hours to eight days for European relapsing fever, and also reproduce a table giving five to seven days as the incubation period.
This man occupied a common barrack room with the other recruits, and was ill two days with fever before reporting sick at the General Military Hospital, Abbassia, when he was admitted for six days and diagnosed as simple continued fever.

On discharge, he almost immediately started for Khartoum, and states he was ill with fever the whole way up; he was admitted to hospital the day after arrival, January 2nd, 1910.

On admission he had a rigor, and his temperature was 102° F.; blood films showed a few spirochetes after a prolonged search.

The second patient was taken ill on January 3rd, the third on January 7th, the fourth and fifth on January 9th, and the last on January 14th; they, however, did not report sick at once, and were admitted on the following dates: January 5th, 10th (two), 12th, and 15th.

The first five occupied the same barrack room at Abbassia, where, they all stated, they were bitten by bed-bugs, but only No. 1 was taken ill.

On the journey up all occupied the same railway carriage, but on arrival at Khartoum no two occupied the same barrack room.

No *Pediculi capitis, corporis, or pubis* were found on any of the patients; but, unfortunately, before the diagnoses were made, their clothes were sterilised, following the general rule on admission, and so *Pediculi vestimentorum* were not found. However, on the clothes of five other recruits who had travelled up with them a considerable number was discovered.

Dr. Andrew Balfour, the Director of the Gordon College Research Laboratories, kindly examined bed-bugs (*Cimex lectularius*) taken from crevices in the walls, near where the infected men slept, but could find no spirochetes on dissection; a dozen were placed in a jar with a young gerbil on the 14th, but on the 17th he reported the animal was still quite healthy.

During the periods of fever a monkey, two gerbils, one jerboa, and one chicken were inoculated with blood for Dr. Balfour, and on two occasions *Pediculi vestimentorum* were successfully fed on patients suffering from a relapse, and the results obtained will be recorded by him.

The importance of these cases lies in the fact that the only man, besides the recruits, to contract the disease was the pack-store keeper who issued new clothes to the troops, took the dirty ones and wrapped them in bags ready for washing, and lived and slept in the same room with these bags of dirty clothes prior to their being sent to the wash.
There is ample evidence that the recruits were bitten by bed-bugs in Abbassia, possibly on the way up as the Egyptian third-class railway carriages are said to harbour these pests, and again in the barrack rooms at Khartoum where the recruits were mingled with other soldiers. Thus, if Cimex lectularius carried the disease one would have expected others to contract it, but only those who came into intimate contact with infected persons, a circumstance bound to occur on a railway journey of several days' duration, or with clothes of such cases, contracted the disease.

Everyone of the patients denied previous attacks of fever when in this village.

Further, bed-bugs are rarely found on clothes, for they retire to their lairs before the dawn appears, while Pediculi vestimentorum have their homes in the linings, &c., of the garments. Thus the last case seems strikingly to uphold the view advanced by Mackie in India, Dreyer, Kirton, and Graham U. Smith in Egypt—that the pediculi are probably the usual carriers.

With reference to the transmission of the disease, Nuttall has shown that Cimex lectularius can convey the S. recurrentis from mouse to mouse and Schaudinn has found spirochaetes persisting in bugs up to thirty days.

There is a record of a macacus monkey, having been successfully inoculated with S. recurrentis contained in an emulsion made from the contents of eight bugs, and dying of fever.

The above evidence shows that the bug can carry the European disease, but it has also been proved that an emulsion of the tissues of Pediculi vestimentorum can produce Algerian spirochaetosis in a Macacus, though the emulsion was found on microscopic examination to be free from spirochaetes (Sergent and Foley).

Mackie states that in London he found spirochaetes persisting up to three days in 10 per cent. of the Pediculi vestimentorum from infected cases.

The flea is common in Egypt, but is not believed to carry the disease, and is practically unknown in the Sudan.

A few points dealing with the clinical side may be noted.

Relapses.—One case had no relapse, the temperature reached a higher point (107·4° F.) than in any of the others, and the fever lasted only two days.

Four cases had one relapse, and one had in all probability three relapses, though he was only seen at the end of his final attack of fever.

The following table gives the number of days of pyrexia and apyrexia:
Thus the duration of the first attack of fever varied from eight to two days, but that of the relapse was practically constant—five days.

The fever usually rapidly reached its maximum or thereabouts on the first day with morning remissions varying from 1°F to 5°F during the periods of fever; the termination in each case, except No. 2 was by crisis with marked diaphoresis; the temperature between and subsequent to the attacks was almost invariably subnormal.

The spleen was enlarged in all cases, and in five was palpable, extending from ½ inch to 2 inches below the costal margin; in one the enlargement could only be detected by percussion. A considerable increase in size of the spleen was noted on several occasions during a relapse. All complained of pain in the splenic region, and two evinced very marked tenderness on palpation.

The Liver was not appreciably enlarged in any case, but was extremely tender and painful in two.

Anemia was noted in five cases, to a very marked degree in two. Vomiting occurred in two cases, a definite rigor in one, herpes labialis in one, epistaxis in two. Prostration and weakness was very evident in all, but none showed any symptoms giving rise to anxiety, and all, except No. 2, rapidly regained health.

All had the usual concomitants of fever—headache, backache, and white-furred tongue, while three complained of pain and tenderness over the tibia. Jaundice, diarrhoea, eye effections, and albuminuria were absent in all cases.

The lungs and heart were not affected, and the pulse-rate was never noted above 112. However, on one occasion, it was observed to rise from 64 to 92 on a morning when the temperature was 96.5°F; but during the day a relapse occurred, the temperature
448 Observations on Human Spirochætosis in the Sudan

rising to 104.4° F.; in this case the rise in pulse rate foretold the onset of a relapse.

With reference to the spirochæte, Dr. Balfour will deal with it, and only a few points will be noted.

In the first case, probably the third relapse, very few were found, but in the others the spirochætes were numerous, and always found during a relapse, but not in the apyrexial periods.

Figures of 8, coils, and long spiral forms were observed, but by far the most numerous were the last-named, and my opinion, based on these few cases, is that the various appearances were due to the positions taken up by the spirochætes at the moment of fixation, and that figures of 8 and coils were more frequently seen in the thicker portions of the films.

In the apyrexial periods blood was examined on several occasions for intracorpuscular forms, but with no success.

The spirochætes, the morphology of which will be dealt with by Dr. Balfour, stained readily by Leishman's method and by the Giemsa stain, carbol fuchsin, carbol thionin blue, and Bismarck brown; Gram's stain was not applied.

My thanks are due to Mul. Awal Basili Eff. Susa for his help in carrying out observations on these cases, and for his energetic and capable assistance in the microscopical work.

Since finishing these notes two other cases have been admitted to the Egyptian Army General Hospital, Abbassia, and as they presented symptoms not encountered in the Khartoum cases a short account is attached:

CASE 7.—A Nafar from the Khedival escort was taken ill with fever three days before admission. He had returned four days previously from leave from his village Saheet, Mudirieh Sohog, so that he probably contracted the disease there. On March 21st he was admitted with a temperature 103° F. in a lethargic condition, and he had lost the power of speech, though quite conscious, understanding all that was asked him. There were bronchitic rales and some diminution of breath sounds at the right base, his pulse was 116 and his respirations 28; a tentative diagnosis was made of incipient lobar pneumonia. His spleen and liver were not enlarged or tender. He had suffered from two attacks of fever, lasting six to seven days, during February, but had been well during the last month.

Next day his knee-jerks were absent, together with the cremasteric and abdominal reflexes, and there appeared also to be some slight rigidity of the neck and tenderness over the spine, but
Kernig's sign was absent. However, as there had been recent cases of epidemic cerebro-spinal fever he was placed in the isolation hospital. His temperature was 102° F., and just before removal blood films were taken, which on examination showed a fair number of spirochætes.

On the third day after admission his temperature rose to 104° F. and then fell by crisis, accompanied by profuse sweating. His power of speech and reflexes were completely restored within three days of the fall of temperature and he had no further relapse.

Case 8.—A Nafar from the Bulakatomina School was admitted on March 28th with a temperature of 102° F. His tongue was furred and white, pulse 90, respirations 18. His spleen was just palpable and tender, otherwise he presented no physical signs. He stated that he had been ill with fever four days before admission and had had considerable pains in his knee-joints. He had been on leave in Cairo, and was taken ill two days after his return.

He stated that all his family were well, and that he had enjoyed excellent health except for a bout of fever lasting seven days some two months ago.

He was taken ill in camp. Blood examination showed nothing abnormal.

Two days later his temperature was normal and remained so for eight days. The disease was considered to be some form of simple fever. However, on the tenth day after admission his temperature rose to 101° F., and next day a few spirochætes were found. Two days later many spirochætes were found; on the fifth day of the fever the temperature fell by crisis from 103° F. to normal, accompanied by profuse sweating. This attack was only accompanied by the ordinary signs and symptoms of fever.

Three days later his left knee joint became hot, very tender, and distended with fluid. There was no accompanying rise of temperature and pulse-rate; the condition cleared up rapidly and had completely disappeared in four days; he had no further relapse. This condition, I think, was due to spirochætal fever, and was not rheumatic.

These two men came from different units, and had been on leave shortly before the onset of their illness, so that the origin could not be traced, and their clothes had been sterilised and washed on admission.

Microscopically, the spirochætes appeared identical with those seen in the Khartoum cases.
Observations on Human Spirochaetosis in the Sudan

Burri's method with Chinese ink was found to show up the spirochaetes wonderfully, and is a very rapid and simple process. I have but recently used this method for diagnosis in early syphilis, and certainly the results are as wonderful as the process is simple, requiring no expert knowledge and skill.

---

Case 2.—Anemia and debility very marked, but no physical signs of any other disease.

---

Case 3.
Case 4.

Case 5.
Observations on Human Spirochaetosis in the Sudan

CASE 6.

CASE 7.
Case 8.