

## RELAPSING FEVER AS SEEN IN EGYPT.

One of the most serious diseases affecting Egyptians employed with the Egyptian Expeditionary Force during the recent war was undoubtedly Relapsing Fever. Its importance depended on the facts, that at certain seasons there was both a very heavy case rate and also a very high mortality. British and Indian troops as well contracted it, and a number of cases occurred amongst Turkish prisoners and amongst Arab and ~~American~~ <sup>ARMENIAN</sup> refugees. A few British cases were observed by the writer in the Citadelle Hospital at Cairo, in January and February 1918, while large numbers of cases mainly Egyptians, but including Turks, ~~Americans~~ <sup>ARMENIANS</sup> and Arabs, were observed at Kantara in No. 3 Egyptian Hospital over a period of six weeks in March and April 1918; occasional cases were seen <sup>the</sup> in Segregation Camp, Kantara, during 1918, 1919 and 1920. Detailed observation of the cases at the Kantara Hospital was very difficult owing to the large numbers of sick requiring attention - the average number of patients being 2,800 - the insufficiency of the British staff, and the difficulty of thoroughly supervising the work of the Egyptian nursing orderlies.

### Seasonal Incidence.

The greatest seasonal incidence of the disease, as seen among Egyptians, was during the early spring: during/

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during the summer months relapsing fever seemed a condition of very little moment, cases being rare, and being diagnosed and treated early, but by the end of the year an Egyptian Hospital was sure to contain a very considerable number of cases. As the new year came on, the numbers increased very rapidly, new cases arriving daily, and rather more on one day than on the preceding one: relapsing fever wards would become filled to their very utmost, and in No. 3 Egyptian Hospital an array of stretcher cases awaiting "606" could be seen any afternoon, arranged outside the tent set apart for this treatment.

Among British troops there was a similar seasonal incidence in the numbers of cases, commencing from about December, when perhaps two or three cases might be received at a base hospital in Cairo or Alexandria. During February and March a medical ward containing 60 beds might have four or five cases of relapsing fever: April and May would see these numbers diminishing and the disease would not be seen at all during summer and autumn.

Professor Sandwith writing in "The Practitioner" for 1904, states that Griesinger regarded February and March as the special months for the epidemics of relapsing fever in Egypt, while Sandwith himself extends the period until May. According to Perthuisot (Bull. Soc. Med. Chir. de l'Indo Chine, 1914/

1914) the majority of relapsing fever epidemics in Indo-China commence during the cold season and disappear in summer: this has been attributed to the heavier clothing worn in winter, to the crowding of people together in their quarters, and to the consequently greatly increased difficulty of getting the multiplication of lice checked once it has started. The same winter conditions held good in regard to Egyptian labourers, and they seem to offer sufficient explanation of the marked seasonal increase of relapsing fever in Egypt.

Weather.

It does not seem possible to lay much stress on the kind of weather experienced in one winter as compared with that experienced in another. Thus in Kantara the rainfall during the three winters from 1917-1918 onwards varied very little, and the same seems true in regard to Palestine and Egypt in general. The average temperature in Egypt and Palestine during the winter of 1919-1920 was, according to the inhabitants, the coldest experienced in these parts for 25 years. Theoretically cold weather should increase the difficulty of getting complete and regular disinfection carried out of men and clothes, while heavy rains might also interfere with disinfection of gangs of Egyptian labourers working perhaps in some out-of-the-way area. As a matter of fact, the proportion of relapsing fever/

fever cases to all other cases in No. 3 Egyptian Hospital was less in spring 1920, than it had been in spring 1918, only in what might be considered a very reasonable measure, bearing in mind the greater facilities for disinfection available in 1920.

Cases occurring in a cold month, for example in January, did not differ in any way in their general symptoms from cases occurring in a warmer month.

The state of the weather did not influence one's prognosis in regard to any case: the weather could only be held responsible if a patient had been exposed to very trying conditions before infection, thereby lowering his general resistance to the disease in its acute form, and protracting convalescence. Relapsing fever epidemics in Europe during the nineteenth century occurred, according to Murchison, as often in the warm months as in the cold ones, and the severity or mildness of the weather seemed in these epidemics also of little importance.

#### Destitution and Famine.

The factors of destitution and famine, found to be so important in the European epidemics of relapsing fever in Europe, can not be regarded as important in the relapsing fever seen in Kantara. Winter conditions in south Palestine were often trying enough, but there was no destitution and no famine. In regard to British troops there was very often a history of the occupation of Turkish quarters at some recent date, and/

and many cases occurred in men attached to Egyptian labour gangs or working in hospitals for Egyptians. It was curious how very little relapsing fever occurred amongst the Turkish prisoners who were passed down the line in such great numbers subsequent to the capture of Damascus and Aleppo. These men were often destitute and underfed, and there was no lack of lice on their persons, but both relapsing fever and typhus were very great rarities amongst them. As regards the question of body vermin, lice or lice eggs could always be very easily found on Egyptians admitted to hospital, but fleas were never numerous and bugs were almost never seen. Even during summer time a plentiful supply of lice eggs could be found on the clothing of Egyptian labourers, a supply only to be called moderate by comparison with the numbers to be seen in winter.

#### Occupation.

In an epidemic of relapsing fever at Tourah prison, Egypt, reported by Professor Sandwith, some stress is laid on the importance of hard physical work as apparently predisposing to relapsing fever. Those convicts on hard labour produced a much higher percentage of cases than convicts engaged on lighter occupations. The nature of the work done in an Egyptian labour gang does not seem to have been of importance in causing or in predisposing to relapsing fever/

fever: men engaged in sanitary duties were just as liable to contract the disease as men engaged in railway construction or in loading and unloading ships. There was a fairly heavy case rate amongst Egyptian nursing orderlies, but early diagnosis and treatment usually made the illness, in such cases, a short one.

#### Relation to Typhus.

When the relapsing fever epidemic of spring 1918 was at its height in Kantara, an outbreak of typhus on a large scale might well have been expected, and would have been in accordance with the nineteenth century epidemics described by Murchison, but such an outbreak did not occur. At a time when from 15 to 25 cases of relapsing fever were being diagnosed daily by blood-film examination, the number of cases diagnosed as typhus did not exceed 25 in a period of three months. Complete isolation of the few cases of typhus which did occur was very carefully carried out, in what was practically a complete little self-contained hospital, standing some 600 yards from the main hospital: isolation in a corresponding fashion of the large numbers of relapsing fever cases occurring, was not possible, with the space and equipment available. It was certainly, however, very rare for a diagnosis of typhus to be made and isolation carried out, before the 3rd or 4th day of illness, and, until this was done, contacts with these early cases/

cases were quite numerous. Indeed it is hard to see why merely stray cases of typhus occurred in the labour gangs, whereas stray cases of relapsing fever very rarely occurred, one case from a labour unit being almost always followed by many others. The occurrence of typhus among Egyptian orderlies in attendance on typhus cases was very common, much more common than was relapsing fever in orderlies nursing relapsing fever cases; indeed at one time it required a little firm persuasion to get orderlies to take over typhus cases, so marked was the sickness rate amongst them.

Isolation.

The control of Egyptian patients in hospital was a real difficulty, as these men were almost completely ignorant of the nature of infection, and no amount of routine orders could prevent contacts with relapsing fever cases occurring. Barbed wire fencing, unless done very completely as round a prison compound, was quite insufficient to limit the wanderings of a patient if disposed to go a little afield. In labour gang camps any attempt to thoroughly isolate contacts would have meant a very serious reduction in the effective strength of a unit, especially allowing for a 14-day incubation period, and all one could do was to rely on the morning sick parade for picking out early cases. Indeed, allowing for 24 hours elapsing, between a man's/

man's taking ill and a positive diagnosis being given at the hospital and reported to the unit in question, very large numbers of infective lice might have been spread throughout the gang. In regard to British cases isolation of contacts could be very thoroughly carried out without seriously affecting the strength of a unit, cases being so comparatively rare. A number of cases occurred in the ~~American~~ <sup>ARMENIAN</sup> refugee camp at Port Said, although the refugees had (been all) twice disinfected at Kantara, where they were detained for observation for a few days, before being sent on to their final destination: if any case had occurred at Kantara, it was the routine to isolate all contacts in special compounds at the Segregation Camp until the incubation period had expired.

Clinical Symptoms.

The illness sometimes set in somewhat slowly, taking perhaps 24 hours to confine a man to bed, but the typical onset was sudden, and a man might waken in the night, within an hour or two of falling sleep, to find himself feeling very miserable and ill: thus one British patient, who had been sight-seeing in Alexandria one morning at 11 o'clock, was only too glad to have himself carried into an ambulance by 3 p.m. en route for hospital. At the onset a sense of chilliness was common, rarely accompanied by rigors; convulsions were never observed as an early symptom/

symptom. Frontal headache and pains in the back and limbs were the rule, to a mild degree in cases of slow onset, but very intense when the onset was abrupt: the muscle pains and a certain degree of limpness were the warning in mild cases but there was no warning in the cases of acute onset. Vomiting was fairly often the first symptom of trouble, and, when it did occur, it was usually very intense and overwhelming, masking the other symptoms and suggesting a severe gastro-intestinal upset. Vomiting sometimes caused a considerable degree of disturbance all through the illness, but its greatest intensity was at the beginning. A symptom which usually appeared early was giddiness, and, although the patient perhaps did not always realise it, it was giddiness which made the recumbent posture a necessity and not weakness. This giddiness was peculiar in that it tended to come on in waves, lasting for two or three hours at a time and then quietening down into a condition of comparative comfort. When the giddiness was at its worst, a patient had no sense of security unless when lying down, and could not even venture to go twenty yards for a glass of water: during the intervals he might feel fairly easy, and might even attempt a joke, if occasion presented itself. As the illness progressed the giddiness became more constant, melting by degrees into the dazed condition which often preceded the crisis. The temperature rose early to perhaps 103°F/

103°F, but a temperature of from 100°F to 101°F for the first 48 hours did not. at all negative a relapsing fever infection: cases were not uncommon where the patient did a day's work after beginning to feel ill, and ran a temperature of only from 100°F to 101°F for the first 48 hours of illness. I know of no cases which did work of any value for more than 24 hours from the time of onset of symptoms.

After a day or two, even the condition of a case whose symptoms had set in mildly became very uncomfortable. A varying degree of muscle pain was more or less constant; and was associated with considerable headache, hot ~~dry~~<sup>dry</sup> skin, bad taste in the mouth and difficulty in sleeping, while a degree of nausea was often present, which on the slightest provocation turned into actual vomiting. Appetite was usually gone, and cool drinks were all for which the patient had any desire.

These symptoms persisted very continuously for from five to seven days, until the crisis drew near, when they became very much worse, and it was the twelve hours which preceded the crisis which left the most marked impression on the mind of the patient. The temperature was then at its height, and was probably rarely below 103.5°F, the skin was intensely hot and very dry, with no suggestion of perspiration, the headache became throbbing in character, and the mouth, tongue, gums and teeth so coated and sticky that/

that swallowing was a difficulty. The misery of the patient was very complete; he could not lie for more than a few minutes in one position; every bit of him felt uneasy and sore, and the closing of the eyes, to rest them for a little, was the signal for all manner of ideas and goblin shapes to take possession of the mind. The opening of the eyes was enough to scatter these shapes for the time-being, and the mind in an ordinary case was clear enough to be fully conscious of all the unpleasant sensations of the condition. According to some British patients the succession of grotesque shapes persisted in appearing in spite of the most determined efforts to drive them away, and these shapes were often described as possessing an apparently endless variety of head. Just when the patient felt that he could not carry on much longer, and that something must give, if he was to retain any command over himself at all, the temperature would begin to fall, the skin would become moist and cool, and the perspiration would pour forth freely enough to make a change of pyjamas a very early necessity. The mouth, too, would become moist and fresh, and the goblins of the mind would begin to beat a hasty and final retreat, so that, in a matter of three or four hours, the patient would be feeling very comfortable and wondering if his past distress had been a reality; an easy comfortable sleep usually soon followed.

A number of symptoms occasionally occurred in addition to these stated above, and among these may be mentioned the presence of a skin rash. The question of a skin rash in Egyptian patients was always a difficult one to decide about, partly because of the impossibility of making regular and, if necessary, repeated examinations for it, owing to the very large number of cases requiring attention, and partly because of the difficulty of detecting rashes in dark brown skins, a difficulty which Professor Sandwith also mentions in his article in "The Practitioner." Rashes on the abdomen and chest certainly occurred, but no weight could be placed on their occurrence from the point of view of diagnosis or prognosis. Jaundice also was seen, but no weight could be placed on it either, unless it occurred in a moribund patient, the gravity of whose condition could be determined from other points. A low delirium was often seen as a terminal event in fatal cases, and this usually merged into a semi-comatose and comatose condition before death occurred. I never saw or heard of symptoms suggesting meningitis occurring in a case of relapsing fever in Egypt, although such cases occurred in Macedonia in the last Balkan war. Enlargement of the spleen was common, but this was certainly often due, at least in part, to other conditions, such as, for example, chronic malaria/

malaria.

The primary febrile period, was followed by an apyrexial interval of about seven days. The Egyptian patients, unless very debilitated to start with, felt remarkably well during this period; headache and backache were gone, appetite was good, and a sense of general well-being was a very present fact. Indeed so well did many of the Egyptian patients feel, that it was with difficulty they were kept on in hospital until really fit for hard work again, and until there was no reasonable chance of a relapse occurring. A British case was usually very content to spend the week following the initial fever very quietly, mainly in bed, unless he had his illness cut very short on its first day by an injection of "606":

#### Relapses.

The second pyrexial attack closely resembled in every way the first one, the symptoms being of about the same severity, but the attack often ran a slightly shorter course than the first one had done. Many of the British cases seen had had two pyrexial attacks before coming under observation during the second apyrexial period, and such men were usually in a somewhat debilitated state; headache and muscle pains were absent, but the men were obviously feeling the effects of the two previous pyrexial attacks, and they were only too pleased to lie in bed/

bed and rest. This condition was even more marked in a few British cases seen first after a third pyrexial attack. A third pyrexial attack, when it occurred, tended to be again a shade shorter than its predecessor, but the distress of the patient seemed just as great as it had been during the first attack. I was never sure of any Egyptian case having more than three pyrexial attacks, but one British case at least had had four attacks before getting "606".

I have no evidence to show how many relapses might have occurred if cases had been treated on symptomatic lines alone, the giving of "606" affecting the course of the disease so much. Each relapse certainly told very heavily on the patient, as judged by his condition during the apyrexial period, and I saw no case, British or Egyptian, diagnosed by blood examination as relapsing fever, which became well without the use of "606". Cases of an ambulatory type are described from Indo-China, but I never saw such cases in Kantara: all cases with pyrexia in hospital had blood-films examined, and, if spirochaetes were found, very definite symptoms of illness were always present also. The scarcity of spirochaetes in a blood film was no indication that the patient was going to be only mildly unwell, or that the disease would come to an end spontaneously without a relapse occurring. One British soldier was observed through three relapses of what was clinically/

clinically typical relapsing fever, although spirochaetes were not found in the blood: his condition towards the last few hours of each relapse seemed just as uneasy as that of a patient whose blood had shown numerous spirochaetes in every field. I was moved from the Citadelle Hospital when this soldier was still under treatment, and I do not know how his case progressed after I left.

#### Convalescence.

The length of the convalescence varied very considerably and depended mainly on the duration of the illness preceding the administration of "606", and also, although to a less degree, on the condition of the patient before turning ill. An Egyptian of good constitution was usually fit for discharge to full duty when he had been free from fever for fourteen days, provided he had received "606" during the first attack of fever or during the first apyrexial interval. A British soldier under the same conditions was usually fit after about a fortnight's stay in hospital to be sent to a convalescent camp for ten days, after which period he would probably be fit to return to full duty. On the other hand, convalescence in the case of a man, who had had two or three relapses, was very slow, and such a patient required, as a rule, at least six weeks after his final pyrexia before being completely fit again. In at least one case the condition of the patient had become so poor, by delay in/

in having treatment, that leave to England was granted: this man had been very healthy and even outstandingly robust before he contracted relapsing fever.

Complications.

Complications during the acute stage among British cases were very rare: troublesome diarrhoea occurred once, but this may have been due in part to "606". A considerable degree of anaemia, loss of appetite and physical weakness were very marked in cases with a long convalescence. Among Egyptian patients diarrhoea was more common, possibly due to a recurrence of some form of real dysentery, perhaps amoebic or bilharzial. Parotitis was fairly often seen, occasionally double, and, if so, suggesting a bad prognosis. Bronchial catarrh and bronchitis also occurred, and rarely pneumonia. Some form of eye trouble was a very common sequel, sometimes a very late one amongst Egyptians: trachoma, with its sequelae had most certainly a great deal to do with this, and there did not appear to be any specific ophthalmia, such as <sup>c</sup>Murhison describes occurring very frequently as a complication of relapsing fever in Britain. Possibly the high temperature of the fever itself or the anaemia and debility of the convalescent stage were enough to rouse any latent eye trouble. Many an Egyptian was discharged from service for eye defect, whose eyes had only commenced to show <sup>r</sup>serious failure of vision after an attack of relapsing fever, although/

although trachoma had been present before.

Another complication, although a rare one, was rupture of an enlarged spleen, probably originated by a blow received by the patient. Sudden collapse from no apparent cause, with or without death following, was never seen, but very few of the cases were beyond middle life, so that serious cardiovascular changes and tendency to sudden death would not be so common. Tachycardia on slight exertion was common during convalescence, but this usually disappeared very soon and left no apparent permanent effects. Haemorrhages did not occur among any of the British cases seen; among the Egyptians haematuria was common, but it was very hard to exclude bilharziasis as the real cause of this haemorrhage. Facial paralysis was not observed as a complication.

#### Mortality.

The mortality in British cases was very low, possibly it was nil: no deaths occurred among the British cases of which I have any personal knowledge. Two British cases were known to me as having been seriously ill, one being the case of the man already mentioned who had to be sent to the United Kingdom to recuperate, while the other was complicated by a mild pre-existing nephritis. This latter case made a complete recovery, and the kidneys did not seem permanently affected either by the relapsing fever itself or by the "606" given: the amount of albumen present/

present in the urine and the microscopic nature of the deposit were the same after the illness as before it. Relapsing fever was not a serious cause of death among Turkish prisoners: fifty of these were examined in succession post mortem by the late Professor Ferguson of Cairo, in autumn 1918, and death was usually due to some bowel condition such as dysentery, or to some lung condition.

The mortality among Egyptians treated at No. 3 Egyptian Hospital was high, and during the spring of 1918, there was a death rate of 28% over a series of at least 700 cases. The most common period for death to occur seemed to be during the original fever or during the first apyrexial period, but I can not be absolutely certain on this point, as reliable histories were not always available. A moribund patient was usually highly fevered and stuporous or perhaps delirious, and he became comatose before death. I remember well five cases of relapsing fever lying side by side, two of whom were in a state of deep coma and were within an hour or two of death. Two of the others were stuporous, only able to follow one with their eyes, and to indicate thirst by gestures, while the fifth man, although somewhat heady, was considered fit to stand an injection of "606"; he died also before twelve hours were gone.

Death also occurred during the late convalescent period/

period, usually in a case which had had two known relapses before the fever finally settled. In such cases marked secondary anaemia and extreme debility were very marked features; a degree of diarrhoea or actual chronic dysentery was often present also, while painful eye trouble might make an additional drain on the patient's vitality. Such a patient was not much more than a living skeleton before death, with the subcutaneous fat used up, and the bones apparently covered with dry skin and nothing more. Post Mortem the spleen was the organ which showed the most obvious changes; it was usually of large size and often diffluent: infarcts were common. Cloudy swelling of liver and kidneys was commonly present.

The mortality among Egyptians in Kantara compares unfavourably with the mortality in relapsing fever epidemics quoted from other countries, but it is in keeping with the mortality of the bilious typhoid cases described by Griessinger as occurring in Egypt in 1851. In Tonkin according to Primet (Trans. XVII International Congress of Medicine London 1913) the mortality fell from about 75% or 50% to 5%, once treatment by "606" was introduced. In Indo-China the mortality fell from 69% in 1911 to 4.2% in 1913 for a similar reason (Bull. Soc. Med. Chir. de l'Indo-China 1914.) Murchison gives a shade above 4% as the mortality among 18,000 cases treated/

treated in the Lendon Fever Hospitals during the nineteenth century, and that was, of course, without the "606" treatment which was the routine at the Kantara hospital. 30% is given as the mortality during an epidemic in the United Provinces in India (Indian Medical Gazette 1913); "606" was not used in the treatment of this epidemic. Among the civilian population of Egypt the following are the figures for the years 1916 to 1919:-

	<u>Cases.</u>	<u>Mortality.</u>
1916	10,494	8.3
1917	11,158	9.3
1918	13,926	12.1
1919	3,221	18.3

A just comparison of these various figures is difficult, as in the first place it is not made clear on what lines a diagnosis of relapsing fever has been made in the different epidemics, whether a clinical diagnosis has been taken as sufficient, or whether the finding of the spirochaet<sup>e</sup> in the blood has been invariably required. One has no means of determining accurately what quality of attention and treatment were available in each area, how soon specific treatment was given to each case diagnosed, and what measures of isolation were taken. Then, in the figures quoted for Egypt, for example, it is very probable that a higher mortality would be given, if it were possible to make a very thorough post mortem/

mortem examination in all cases of death ascribed to pyrexia of unknown origin. Also the figures for Egypt include cases occurring at all ages and in both sexes, whereas the Kantara cases were all males, with ages ranging from about 18 to 45.

Various points fall to be considered as possibly having to do with the high mortality at Kantara, and among these is lack of sufficient or proper food. This can not be regarded as having anything to do with the heavy mortality, as the ration scale for Egyptians was very ample, it was specially arranged to suit his natural tastes, and in a place like Kantara there was never a shortage. A very comfortable scale of winter clothing also was allowed, especially during the later years of the war. The general conditions of life, however, of an Egyptian on service, were very different to what he had been accustomed to in Egypt. The winters in southern Palestine and along the Suez Canal could be very trying, and the temperature between sunset and sunrise often kept very low: there was often considerable rainfall in Palestine also, making life under camp conditions not a pleasant one. A member of a labour gang had usually a fairly steady day of work to do, and he could not take a day or two off duty when not feeling just quite fit, as he could so easily do at home. Although medically examined before enlistment, no very high standard of health was demanded: indeed it/

it would have been difficult to find an Egyptian peasant free from some form of latent serious disease. Bilharziasis urinary or rectal, affected well over 50% of the men, while *Anchylostome* ova, cysts of *Entamoeba Histolytica* or other intestinal parasite could be found in almost any stool examined. Enlargement of the spleen, venereal disease and trachoma were often seen. The fairly strenuous conditions of service must have told more heavily on men affected with one or other of the above conditions, than would have been the case had they been free from disease, and must have made them in poorer condition to resist fresh disease when it came. A patient with a marked degree of anaemia or with a dysenteric bowel is not in good condition for resisting a heavy infection of spirochaetes in his blood.

The force of the mental attitude of the Egyptian patient to disease is difficult to value; he certainly tended to consider his condition as a visitation from Allah, and to regard the ultimate issue of the fever as outside his own control, but I never found a patient so completely a fatalist as to refuse his injection of "606". An Egyptian might certainly not do his best in the matter of taking nourishing fluids, but he would not fail to drink an abundance of cold water.

Absolute confinement to bed was at times difficult/

difficult to enforce, as a patient would not hesitate if at all fit to leave his bed to get a drink or go to the latrine, and the Egyptian orderlies were not loath to encourage such doings and thereby save themselves some work. The good nursing and detailed observation of a British case must certainly have been of great value, specially in reducing complications during convalescence, whereas an Egyptian at times received very little outside help during his whole illness except from his "606" injection. An Egyptian contracting relapsing fever in Egypt would be able to receive very efficient treatment and in particular good nursing in a Government hospital, whereas the nursing of a patient in an army hospital was often very poorly carried out, the Egyptian orderlies being generally very imperfectly trained.

#### Immunity.

In African ~~T~~ick Fever a certain degree of immunity to serious attacks in later life is said to be acquired by an attack in childhood, but this does not seem to be true of relapsing fever as seen in Egypt. Immunity after relapsing fever in Egypt was of very short duration, and one attack did not seem to modify in any way a succeeding one: several cases had a second attack within six months of the first one.

#### Diagnosis.

The diagnosis of relapsing fever was not made in Kantara and "606" was not given, unless as a result of <sup>finding</sup> the/

the specific spirochaete in the blood. In a case where symptoms were at all severe it was very rare not to find spirochaetes in the first film examined and usually in considerable numbers.

Occasionally, however, a second film was required, taken perhaps twelve or twenty four hours after the former one. In one case with mild onset, spirochaetes were only found in the third film examined: this film was taken forty eight hours after the patient became ill, it was made from blood drawn from the median basilic vein, and even then it only revealed one or two spirochaetes as the result of fifteen minutes careful search.

The symptoms of this case were much more suggestive of commencing typhus than of relapsing fever, and, but for the examination of the venous blood, his diagnosis would have been missed for a few days.

It was the routine in Kantara to examine the films stained with Leishman's stain, and not to use the dark field illumination. ~~The~~ former method yielded very satisfactory results, and it was indeed the only method which could be put into operation when fifty or more films had to be examined daily, in addition to other laboratory work. The examination of fresh blood is very satisfactory when cases are few, but it would be very awkward to arrange it for large numbers, unless an ample laboratory staff were available. I never heard of any/

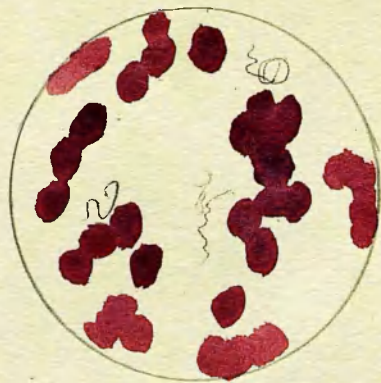
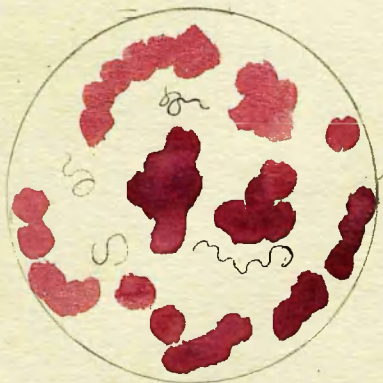
any laboratory worker with the E.E.F. isolating the spirochaete from the urine, tears, or cerebro-spinal fluid, nor yet of anyone using <sup>Löwenthal's</sup> ~~Leucuthal's~~ reaction as a method of diagnosis in the febrile stage: nothing was ever said as to the <sup>SNCC</sup> ~~presence~~ of chlamydozoal bodies in laboratory reports on films. A moderate leucocytosis was the rule with about 75% neutrophil polymorphs present: not much weight can be given to any increase found in the eosinophils or large mononuclears in Egyptians, owing to the very large chance of this depending on some other exciting cause, such as bilharziasis or chronic malaria.

Most films from an ordinary clinical case showed at least one spirochaete to the field, and in a heavy infection 10 to 20 spirochaetes might be present. The spirochaetes were very slender, and, as they rarely met the eye in exactly the same focus as the blood corpuscles, they could very easily be overlooked in a film, unless one were on the look-out for them. In the sketches accompanying, drawn from films made from cases treated in Kantara, an endeavour has been made to reproduce the "far-awayness" and almost vagueness of the spirochaetes as compared with the corpuscles: the latter seem to dominate the picture, with the spirochaetes as of simply third rate ~~im-~~portance. In length the spirochaetes average about three/

three times the width of a red blood corpuscle: shorter forms occasionally occur, and rarely what appears to be one of double length can be seen, with a portion towards the centre distinctly thinner than the rest. The spirochaetes take up a very great variety of positions, and an examination of large numbers of them shows almost no two with exactly the same curves. The eye in examining field after field finds as constant a variability, as does the finger in examining the pulse in auricular fibrillation: there seems to be almost a refusal on the part of the spirochaetes to take up similar positions. Spirochaetes lying in an extended position are rare, and, if so, three open waves are about the maximum; anything of the nature of a series of somewhat tight and more or less regular curves, such as are shown by the *Spirochaeta Recurrentis* is very rarely seen. The formation of a complete loop is common, and often two spirochaetes form a sort of tangle of loops, so that it is very hard to tell which part of the tangle belongs to one spirochaete and which to another, or whether there may not be a third spirochaete involved in the group: one tangle of spirochaetes will be found in almost every field of a heavily infected film.

While the morphology of these spirochaetes of Egyptian relapsing fever appears to differ considerably from that of the spirochaetes described from other/





other epidemics, this difference may simply depend on the regular use of stained preparations. MacFie and Yorke (Annals of Tropical Medicine, Liverpool 1917) state very definitely that they were unable to discover any morphological distinctions between the spirochaetes causing European, Indian and African relapsing fever, while Farrham (British Medical Journal 1916) says that the number of the coils in a spirochaete is not a specific character but is primarily dependant on its rate of motion. The tendency in the Egyptian spirochaete, however, to the formation of loose irregular waves with very commonly a complete loop and often a tangle of loops showing, makes a very different picture to that usually given of a relapsing fever film.

#### Differential Diagnosis.

During the first<sup>forty</sup> eight hours a case of relapsing fever might easily suggest some other condition. Owing to the presence of lice in large numbers on patients on admission, typhus fever had to be kept very thoroughly in mind, but it was only a case of relapsing fever with very mild onset that suggested clinically an ordinary case of typhus. As cases of small-pox occasionally occurred among the Egyptians, it was always possible for an early small-pox case to be treated as relapsing fever until negative blood film examinations and the appearance of/

of the characteristic smallpox rash settled the diagnosis. In dealing with patients, of whom only an occasional one knew any English, it was often very difficult to get an exact history in regard to the duration of the illness, the early symptoms and the present feelings of the patient, and all the stress had to be laid on the laboratory findings, unless when a case had been ill for a few days, and already showed some characteristic sign or symptom. It was certainly a wise thing for the person taking blood films to be wary of receiving lice, fleas or sputum from the patient, as typhus, plague and meningitis occasionally occurred among a series of relapsing fever cases. Cases clinically suggestive of Weil's Disease did not occur at Kantara among Egyptians, and no blood films were reported as containing the *Leptospira Icterohaemorrhagiae* or any organism resembling it.

#### Prognosis.

The prognosis in the case of British troops was always good: a long convalescence was, however, inevitable, when a case had gone on to two or three relapses without having specific treatment. The outlook in regard to Egyptians had to be very much more guarded: death was certainly frequently the issue even in cases treated early, cases in which, too, the physique of the patient had appeared ~~very~~ good. The outlook for patients who were worn out and/

and anaemic on admission was a poor one, and a long convalescence at best was certain for them, with the very likely possibility of eye trouble or dysentery setting in also. Cases likely to require a long convalescence were usually discharged to their homes: the process of getting them restored to a condition of active physical health was a very long one, and, as they were all on short contracts for army service of about six months' duration, it was more economical to let them complete their convalescence at home, although a week or two of work might be lost from them, than to retain them in hospital or convalescent camp for a possible short time of service prior to expiry of contract. The outlook for Egyptians was made worse by the presence of other diseases, which often became active as an after-effect of the relapsing fever: as a rule, also, Egyptians films showed a heavy infection of spirochaetes, which was an indication for early treatment and careful after-attention for relapses. I can see no real reason, however, why the prognosis for Egyptians could not have been very much improved, if disinfection, isolation, nursing and treatment had been available for them in the same complete way as it was available for British troops: in particular, inefficient attention on the part of the Egyptian orderlies very greatly increased the chance of death occurring. The prognosis for stray cases among Egyptians was thoroughly/

thoroughly good, provided there was adequate leisure for the British staff to thoroughly supervise treatment from start to finish. It was essentially the epidemic nature of the disease in 1918 and the inadequate provision to meet it under the conditions existing at the time that made the prognosis for Egyptians such a poor one.

### Prophylaxis.

Prophylactically the destruction of lice was the important measure, but the carrying of this out in thorough detail was often a difficult matter. It was easy to get a company of labourers to strip and bundle up their clothes for the disinfection, but it required a very careful and unwearied overseer to make sure that no leather belt escaped disinfection, and that no little purse or bag was hidden in the hand of its owner; even a piece of string tied round the angle had to be removed, lice eggs being usually easily detectable in the knot.

The principle type of disinfection in Kantara was a chamber heated with steam and equipped with a trolley set on rails running up the centre and shelves on either side. Temperatures recorded by a thermometer placed inside some clothes just within the door were usually about 212°F, but the chambers had the disadvantage of being unprovided with any permanent means of indicating the inside temperature when/

when the steam was on. The morning sun in Egypt in midsummer was not a strong incentive to hard work, and the Egyptian engineer in charge of the disinfection could save himself much shovelling of coal by not turning the full volume of steam from the boiler into the disinfecting chamber, thereby effecting an economy of his strength and of his coal and sparing the lives of many lice and lice eggs. Application was made for a British engineer but this could not be granted. The action of a disinfecting chamber of this sort was at best a little doubtful; certainly many eggs could be found on disinfected clothes, which were not browned nor yet had left their characteristic upright position. A very important point was the tightness of the bundles of clothes and blankets; ten blankets tightly rolled together almost entirely prevented any action taking place on a hen's egg or on a potato placed in the middle of the roll, after forty-five minutes in the chamber. Exceptionally a moving louse was found on clothing after the full period of steaming; in such a case one felt sure that the clothes had been too tightly packed, or that the engineer had not been heating up properly. Smaller disinfectors acting under pressure produced more reliable results than did the large chamber described, but their small capacity was very much against them: with them also the poorest results on lice and eggs were got by packing/

packing bundles of clothing too tightly.

While the clothes were in the disinfector the men were bathed in a solution of cresol, (2%), with sometimes N.C.I. powder (1%) soft soap (1%), and paraffin (1%) added. Each man had rather less than one minute in the water and he was instructed to give his axillary and pubic hair a very good rubbing. This bathing had very little effect on the eggs but it certainly reduced the number of lice when well carried out.

The treatment of lousey scalps was a big problem in dealing with Egyptians in the mass. In one small hospital in Mantara it was the rule to shave the heads, and, if necessary, the axillary and pubic hair of all cases on admission: this was found the only thorough method of securing that patients were received free or practically free from body vermin. In large hospitals a close cropping of the scalp was all that could be managed with the number of barbers and hair clippers that were ordinarily available: the barbers were always working under strength, as regularly one or more went down with relapsing fever. A sudden increase in cases has been noted by Wiese (Deut. Med. Woch. 1918) following upon a large amount of hair cutting, and has been ascribed to the crushing of lice with blunt scissors. No such relationship could be traced in the Kantara cases, hair cutting being carried on very steadily all the year round in the labour gangs while/

while cases occurred on a large scale only in the spring months. A fortnightly disinfection was the routine for all Egyptian labour companies during the last year of the war, and every 500 men would include one or two barbers.

For those working amongst relapsing fever cases several smaller points were found to be important. It was courting disaster to sit on a bed or on a chair in a ward, to lay aside one's cap or to lean against the tent wall: even a bundle of temperature charts brought in from the wards to the office might conceal one or two lice. It was wise to work with one's sleeves rolled up, and not to use a gown, unless the said gown were kept in a thoroughly safe place when not in use. It was also wise to use gloves when giving "606"; at least one medical officer working in a British hospital and with a British patient, being directly infected by the patient's blood. A nightly examination of one's clothes for lice or lice eggs was time well spent, and regular disinfection of Egyptian batmen and mess servants was thoroughly advisable, special attention to complete disinfection being very necessary immediately after a man had returned from home leave. A considerable amount of lice-borne disease must have been introduced into Egyptian units by men returning from their homes, as relapsing fever and typhus were very prevalent amongst the civilian population in Egypt during/

during part of the war period: new recruits for Egyptian units were disinfected at Kantara before going to their various depots, but this procedure was not carried out in the case of men returning from leave.

Treatment.

As regards active treatment, "606" was the routine drug used, and it was given intravenously in the form of Salvarsan or Kharsivan. In twenty British cases treated personally or observed in Cairo a dose of .6 gram was given. All these cases had had at least one relapse before being treated; none of them had a relapse after receiving one injection. The injections were usually given during an apyrexial period: if given during the fever, it was given early before the patient had got near his crisis. All these patients had an uninterrupted convalescence, its duration varying directly with the duration of the illness preceding treatment. One British case, treated at Kantara, received an injection of .3 gram Salvarsan within twelve hours of taking ill: twelve hours later his temperature and his general symptoms had entirely settled, and there was no subsequent relapse. Another British patient at Kantara was given .3 gram Salvarsan towards the close of the original pyrexia, when his temperature had already fallen two degrees: he had an uninterrupted convalescence and no recurrence of fever. The uniformly/

uniformly good results of .6 gram "606" in British cases was very striking, and even the .3 gram dose was never required to be repeated in any of the few British cases who had received this dose.

As regards Egyptians it was the routine at Kantara to take blood films from all patients with definite pyrexia, and to administer .3 gram "606" as soon as the laboratory gave a positive diagnosis. The difficulty in getting blood films from all the pyrexial cases depended on the carelessness of the Egyptian orderlies, either in not reporting all their cases with pyrexia, or in reading the thermometer inaccurately. The "606" was given whether the patient was in a pyrexial or apyrexial period; in many cases, perhaps 50%, it was sufficient to prevent a relapse, and put an end to the active disease. If a relapse occurred, the .3 gram dose was given again, and in the event of an infrequent second relapse this was repeated: it must have been a very exceptional case which failed to receive at least one dose of "606": the only reason for not giving it would be that the patient was moribund before being diagnosed, and this only rarely occurred.

The heavy mortality amongst Egyptian cases, in spite of treatment with "606", made some medical officers deny its value. In partial explanation they suggested that the patients were not dying from/

from relapsing fever, but from concomitant diseases, such as dysentery for example; this, however, could be true of only a very small fraction of the Kantara cases. The difficult conditions under which so many cases were treated by such a small efficient staff really afford a sufficient explanation without laying any blame on "606"; its value is certainly undoubted in the British cases. An initial dose of .4 gram "606" was the usual one given at an Egyptian Hospital up the line, but it is questionable if this dose prevented the occurrence of relapses to any greater degree than did the .3 gram dose. A dose of .5 gram Salvarsan, given on the first day of the disease, is stated by Klemm (Arch. für Schiff<sup>s</sup> und Tropen Hygiene 1914) to be necessary to cause the symptoms to disappear <sup>in</sup> relapsing fever treated in German East Africa; the same or a larger dose would probably have produced better results in Kantara. On the other hand Perthuisot, in the article already quoted, states that .15 grams was the usual dose in Indo-China, and that a second dose was never required, while in Tonkin (Bull. Soc. med. Chir. de l'Indo-Chine 1912), only six relapses occurred out of 332 patients treated with .2 grams arsenobenzol.

Comparison with relapsing fever in other Countries.

Some points of comparison suggest themselves between the relapsing fever seen in Egypt and relapsing fever/

fever as reported from other countries. The Egyptian type of fever resembled African ~~Tick~~ Fever in its tendency to have numerous relapses, also in its requiring a fairly high dose of "606" <sup>MAKE CERTAIN OF</sup> to ~~kill~~ <sup>kill</sup> all the spirochaetes. On the other hand, films fairly rich in spirochaetes, were the rule in Kantara, whereas films showing scanty spirochaetes seem more characteristic of ~~Tick~~ Fever. Again, Indian relapsing fever shows as many as 23% of cases recovering without having a relapse, and without receiving "606", whereas no known recoveries from relapsing fever occurred at Kantara apart from "606" treatment. So, too, in Indo-China recovery without relapse and "606" treatment is common, and a much smaller dose of "606" is sufficient. The Spirochaeta ~~Berbus~~ <sup>can</sup> is considered to be responsible for the relapsing fever of North Africa and Egypt, but it is associated with a much higher mortality in Egypt, among both civilian and army patients, than is the case in North Africa. The spirochaetes seen in Egypt have already been compared with those seen in other epidemics.