PRELIMINARY COMMUNICATION—PARASITES (? DEVELOPMENTAL STAGES OF SPIROCHÆTA RECURRENTIS) IN THE LIVER OF A FATAL CASE OF MESOPOTAMIAN RELAPSING FEVER.¹

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These observations are the result of the histological examination of two fatal cases of relapsing fever. One outstanding feature of the fatal cases in this country (Mesopotamia) has been the cerebral symptoms, and the examination of the brain was the primary object of the investigation. In the first case only the brain was examined, and the appearances were so interesting and suggestive that on the next opportunity a careful examination of the liver, spleen, kidney and bone marrow was made, as well as of the brain. I hope to place on record the full results as soon as I can obtain more material, but that must wait until the relapsing fever season comes round again. Meanwhile, I wish to record the findings in the liver up to date.

The case was that of an Arab coolie, who died twelve hours after admission to hospital, and was not in a condition for the administration of salvarsan. He is reported to have been ill for four days before admission. Spirilla were found in the peripheral blood on the morning of admission, but not at the time of the post-mortem. The liver and spleen were both enlarged and tender, and there was marked jaundice. It is rather important to try to fix the duration of the illness, but it can be only roughly estimated that death occurred about the end of the fifth day. That the crisis was near at hand is probable, as the only organ in which spirilla were found post mortem was the brain—e.g., in smears from the extravasated blood in the meninges and in certain portions of the cortex.

The histological changes in the liver were very striking, and may be briefly enumerated as follows:—

(1) Great destruction of the liver cells, the periphery of the lobule being, perhaps, the least affected. I should estimate that quite one-third of the total number of liver cells was affected.

(2) Infiltration of round cells into Glisson’s capsule.

(3) Engorgement of the portal and the hepatic veins and of the intra-lobular capillaries.

(4) Deposition of a very considerable amount of pigment.

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The presence of numerous parasites of a protozoal nature. I confine myself, for the purposes of this communication, to a description of these latter.

The Parasites (see Diagrams).

Situation.—They were scattered throughout the lobule, either inside liver cells or lying free in spaces surrounded by the vacuolated remains of degenerated liver cells, endothelial cells and leucocytes.

Staining Reactions.—Their reaction to ordinary stains is feeble, but with Heidenhaim's iron hæmatoxylin or prolonged staining with Leishman or with Weigert's iron hæmatoxylin a pretty fair idea can be obtained of their structure.

Description.—They are round or oval bodies, varying in size from four to eight microns. It is difficult to estimate the amount of shrinkage in sections, but the larger ones seemed to be just smaller than a polymorph leucocyte. The smallest were found in the liver cells, surrounded by a clear halo († shrinkage), in some the nucleus was not visible, and the protoplasm stained rather deeply and uniformly, but the majority showed a small feebly staining central nucleus (fig. 1). With the growth of the organism the nucleus becomes more evident and proceeds to divide into two by mitosis. This stage, with two nuclei (figs. 5, 10, 12), was the predominant one, and though a few were found still inside a comparatively uninjured cell, the majority were lying in spaces, as I have already mentioned, surrounded by the remains of degenerated liver cells and phagocytes. The nuclei at this stage were elongated, and rather ragged in appearance and stained feebly. After the division of the nucleus the protoplasm segments. A certain number of organisms showing more advanced stages of segmentation were found. In these the nuclei were smaller, more compact, and stained more deeply, some showing a ring appearance, and the corresponding segmentation of the protoplasm was likewise more evident. The largest number of segments or 'spores counted in any one was six, and all intermediate stages were seen. At no stage could I discover any trace of a cyst wall.

After knowing what to look for I returned to the examination of an impression preparation made from the liver, stained with Leishman, and was able to recognize only a very few perfect specimens of the parasite. It was evident that these bodies are of extreme fragility, and special methods of fixation will have to be adopted in making such preparations. As it was, there were large numbers of fragments, but a few good specimens were recognized lying free and in liver cells.

Comment.

It is to be regretted that so far I have been unable from lack of material to confirm the presence of these parasites in other cases of relapsing fever, but I anticipate having opportunity during the coming season, as relapsing fever is endemic in these parts.
There is little doubt in my mind that the organisms I have described will prove to be the early stages of schizogony of the *Spirochaeta recurrentis* in the vertebrate host. The reappearance of the spirochaetes in the blood of the vertebrate host can be explained only by some such phase of development which so far has eluded observation.

Breinl has described in the case of West African tick fever the formation, in the internal organs, of cysts, in which small red granules appear, which granules are supposed to be the cause of the re-infection of the blood; but, judging from the very abridged description of Breinl's work, which is the only one available to me at present, his observations differ considerably from the above. As stated, I could find no evidence of a cyst wall, and two points seem to confirm this, first, the extreme fragility of the parasites as noted in smear preparations, and, secondly, the effective action of salvarsan in preventing a relapse, even if administered during the apyrexial period.

That the liver is the seat of election for the development of the parasite is borne out by the clinical symptoms, and though there were histological changes present in the spleen and the kidneys, I have not so far found any developmental forms of the parasite in these organs. No changes were noted in the epithelium of the interlobular bile ducts. A striking histological feature is the great increase of macrophages, particularly in these cases, in the meninges.

A phase of schizogony has been described in the case of one other spirochaete—e.g., *S. gallinarum*. In this instance the "infective granule" (Balfour) enters the red cells of the fowl and initiates the phase of development which culminates in the formation of merozoites and the spirochaetes of the relapse. Likewise, I believe that the formation of a granule is a necessary preliminary of the phase of schizogony of the *S. recurrentis*, and I have noticed that the great majority of intracellular spirochaetes show a well developed granule.

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EXPLANATION OF PLATE.

Camera lucida drawings showing the parasites (P) situated inside liver cells. Figs. 1-7.

Fig. 5 shows commencing segmentation of the parasite.

Fig. 7 shows an advanced stage of degeneration of the liver cells with invasion of leucocytes.


Camera lucida drawings illustrating different stages of the parasite as seen in sections of the liver. Figs. 8-15.
To illustrate "Parasites (Developmental Stages of Spirochaeta Recurrentis) in the Liver of a Fatal Case of Mesopotamian Relapsing Fever," by Lieutenant Colonel J. C. Kennedy, R.A.M.C.