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C.M.G., Consulting Ophthalmic Surgeon to the British Expeditionary Force, for his interest in the case, and for his confirmation of the ophthalmoscopic appearances.

PRELIMINARY NOTE ON SPIROCHÆTES OCCURRING IN THE URINE OF CASES OF "P.U.O."

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During the past few months I have examined the urine of cases of P.U.O. for spirochætes, using a modification of Renaux and Wilmaers' technique. The results are so suggestive that I venture in this preliminary note to call attention to the necessity for a systematic examination of the urine in certain clinical types of P.U.O., which may ultimately turn out to have a common etiological origin.

Since in March last Garnier and Reilly suggested that in certain cases of icterohaemorrhagic spirochaætosis the chief incidence of the disease may be upon the kidney, I have examined a number of cases of trench nephritis and found a spirochaæte in a fairly large proportion. Further, in what I regard as a definite clinical type of P.U.O. (appendicular or abdominal —described below) which is probably a mild form of icterohaemorrhagic spirochaætosis, I have found a spirochaæte almost constantly present in the urine. Again, in the relapsing type of P.U.O. (trench fever) a spirochaæte can frequently be found in the urine, during and immediately after the exacerbations of temperature.

METHODS.

The technique which I have been using is as follows:

At first the specimens of urine were obtained in the ordinary way, and brought to the laboratory in clean bottles; but later, precautions were taken to try and avoid contamination of the samples. After drawing back the foreskin, the prepuce and meatus were swabbed with a 1 in 1,000 hydrarg. perchlor. solution; the patient then passed urine, and a sample towards the end of the act of micturition was caught in a large sterile test-tube. The urine was centrifuged and at first, after pouring off the supernatant fluid, the deposit was washed with sterile water and re-centrifuged. Control experiments showed, however, that the spirochaætes seem to be of comparatively low specific gravity, requiring therefore...
prolonged centrifuging (ten minutes at least, and the longer the spinning is kept up the greater the number found) and care not to remove the lowest layer of supernatant urine before re-centrifuging. So it was found easier, once one learnt the morphology of the organism, to pick it out in greater quantity even amongst a certain amount of debris, rather than to hunt for isolated spirochetes on a comparatively clean slide; and the deposit was not washed. Dark-ground illuminations not being available, the following methods of dealing with the deposit were adopted: —

(1) Indian Ink.—Some of the deposit was mixed intimately with a drop of "chin-chin" liquid pearl ink (Watson) on a clean slide, and a film made by drawing along the slide a small piece of cigarette paper wetted in the drop. The film so made soon dries, and then can be examined directly with the oil-immersion lens. Spirochetes if numerous show up readily by this method, but the debris of the urinary deposit sometimes causes confusion and difficulty. This method, however, probably shows the spirochetes in a more natural condition than when mordants and dyes are used.

(2) Tannic Acid and Carbol-fuchsin (Renaux et A. Wilmaers).—Films are made of the deposit and fixed for ten minutes in absolute alcohol; then covered with 5 per cent tannic acid solution, and warmed till steaming; then well washed with distilled water, and without drying stained with carbol-fuchsin, steaming for half a minute, washed, dried, and examined. This is a very simple and rapid method, but does not give such a clear-cut picture as silver nitrate.

(3) Tannic Acid and Silver Nitrate (Fontana).—The films are fixed with repeated washes of fixing fluid (acetic acid one cubic centimetre, formalin twenty cubic centimetres, aq. dest. 100 cubic centimetres), then washed well with distilled water, flooded with mordant (tannic acid five grammes in 100 cubic centimetres, aq. carbolic solution one per cent), and warmed for thirty seconds, then well washed with changes of warm distilled water, flooded with one per cent silver nitrate and warmed gently for half a minute, washed and mounted in balsam.

**Spirochetes.**

The spirochetes have the following characters:—

They are about one to one and a half times the diameter of a red blood corpuscle and are very thin, the ends tapering.

They show five to eight more or less regular turns, and may be straight, bowed, or lying in a semi-circle.

The spirals are not so fine as in *Spirocheta pallida*, nor so coarse as in the spirochete of Obermeier.

The organisms are very resistant to staining, being uncoloured by Leishman, Romanowsky or Giemsa's stains, and requiring a mordanting method, but may be demonstrated by Indian ink methods.
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They occur in the urine, often abundantly, during and immediately after the rise of temperature, but in the intervals may be so scarce as to be practically absent. Like McNee and others, I have been unable to find any organism by direct examination of the blood of these patients, and I have not had an opportunity of determining post mortem at what part of the urinary tract the spirochetes originate.

RESULTS.

The following are the cases in which I have found spirochetes in the urine:

- Trench nephritis .... 3 cases
- Pyelonephritis, with abscesses of lungs .... 1 case
- Relapsing P.U.O. .... 15 cases
- Myalgia following P.U.O. .... 1 case
- N.Y.D. appendicitis .... 5 cases

Whether, in these different cases, we are dealing with the same spirochete I am unable to state at present.

CLINICAL ASPECT.

These observations suggest that we may be able to bring into line at least two clinical types of P.U.O.

(1) A disease with acute onset with chills, and vomiting, pain in the abdomen, usually more marked in the right upper quadrant, running a continued fever for several days, often with enlargement of the spleen and herpes of the lips. The pulse-rate is not increased, and is usually slowed to fifty to sixty beats per minute in the convalescence. There is a leucocytosis of 12,000 to 25,000 with relative increase in the large mononuclears. The cases, if an attempt is made at diagnosis, come to the base as "? Appendicitis" or "N.Y.D. abdominal." I recognize that these are the cases which presented nothing but a normal temperature, malaise and slow pulse, and were evacuated to U.K. In three such cases last year I remember a note coming from Captain Stokes to the effect that the guinea-pig into which the blood of the patient had been injected had died on the ninth or tenth day with signs of spirochætosis. In his published cases he notes that the urines of the patients were examined with negative results. In these cases now I find spirochetes almost constantly in the urine. French authors have suggested that cases of interhemorrhagic spirochætosis may have almost their whole incidence on the kidney, and so one finds spirochetes in cases which cannot be distinguished from acute (trench) nephritis, except, perhaps by the long continuance of much albumin and kidney debris in the urine.

(2) The relapsing type of P.U.O. (trench fever) with the characteristic
periodic rises of temperature, myalgic and periosteal pains and a leucocytosis with or without enlargement of the spleen, in which an improving technique has enabled me more and more frequently to find a spirochete in the urine during and immediately after the exacerbations of temperature.

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REFERENCES.