A CASE OF DUM-DUM FEVER.

By MAJOR H. B. MATHIAS, D.S.O., R.A.M.C.,
AND MAJOR W. B. LEISHMAN, R.A.M.C.

(I.) HISTORY OF THE CASE BY MAJOR MATHIAS.

Gunner H. C., R.F.A., aged 24, service, three and a half years, went to India in November, 1901, where he was stationed at Barrackpore near Calcutta. He had good health until the following August (1902), when he was in Hospital for seven days with ague; he was again admitted early the following month (September) with "abscess of the liver," and was operated on for this disease. The entry in his medical history sheet is as follows: "Barrackpore Station Hospital, admitted September 6, 1902. Disease, abscess of the liver. Remarks, single abscess, free incision, excision of piece of ninth rib. Developed symptoms of mental aberration which passed off." There is no record of dysentery and the man himself stated that he had never suffered from it. He was invalided to England in February, 1903, arrived at Netley March 24, and, a week later went on six weeks' furlough. He joined at Newport, May 14, 1903, on the termination of his leave, and reported himself sick the following morning, complaining of sore throat; he stated he had been ill for a fortnight and had been treated at home for tonsilitis.

On admission he looked somewhat anaemic and sallow, but is naturally of a dark complexion. Has a relaxed sore throat, and tonsils slightly enlarged, but not to any great extent; has a scar in the mid-axillary line on the right side, where a portion of the ninth rib was removed when he was operated on, complains of pain in the site of the wound as if a needle was running into him and is unable to lie on that side on account of this pain. The liver is still somewhat enlarged, and the dulness is increased upwards, especially behind. He has a slight cough but no physical signs can be discovered on examining the chest. Temperature on admission 100°; pulse 76, regular. Bowels open, motions appear healthy. Urine, acid, specific gravity 1020, no albumen or sugar. He stated that he had never had syphilis, and there are no signs of this, or of tubercular disease.
From the time of his admission he had an irregular temperature, which persisted although the throat symptoms very quickly passed off. On May 30, or a fortnight after admission, his spleen was found to be enlarged, the edge could just be felt at the costal margin. Early in June a specimen of blood was taken which gave a negative result with Widal's reaction; his blood also showed no marked leucocytosis, nor could any malarial parasites be found in it. He remained much the same until June 20, when he got much worse; his liver became more enlarged, he was slightly jaundiced and complained of the pain in the old scar; he suffered from profuse sweats whenever he went to sleep, and his temperature which had been lower, suddenly rose to 103°. There appeared to be some enlargement of the left lobe of the liver, displacing the colon, and as his condition became very grave, Dr. Vines and Dr. Paton, the latter a surgeon of the Newport and Monmouth Hospital, kindly saw the case with me, and agreed that in all probability the man had some suppuration going on either in or in connection with his liver, and that an exploratory incision should be made in his abdomen, and the pus, if found, evacuated. The man was removed to the Newport Hospital, and on June 27 Dr. Paton performed the operation. An incision 3 inches long was made below and slightly to the left of the ensiform cartilage. The liver was found to be enlarged, and the left lobe to extend right across into the left side, but no abscess could be found either in or around the organ; the spleen was also found to be enlarged. The wound was then closed. At this time his condition was desperate and he was not expected to live from day to day. The wound did not heal well, the spleen enlarging now more rapidly, causing tension on the stitches in the wound; eventually, however, it healed well, and he made a good recovery as far as the operation was concerned. As soon as he was fit to move he was brought back to the Station Hospital, and from that time until his death his condition was one of progressive asthenia, characterised by pallor and great emaciation, and at times he was very despondent.

On December 14, 1903, his feet and legs became swollen and edematous, and he took to his bed, and from this time onwards did not leave it. Localised edema of a transient character was frequent, affecting the left leg, scrotum and left eyelid; there
was a tendency for bed-sores to form on his back and hips, and this was only avoided by very careful nursing and an air bed. On January 5 he had a fit at 1 p.m., whilst eating his dinner, epileptiform in character, which lasted about three minutes, and which left him in a more or less comatose condition, suggestive of cerebral thrombosis, and in this state he remained until the day before his death, when he appeared better and spoke, saying he felt all right; he, however, had another fit that evening at 9 p.m., and died at 4 a.m. the following morning. There had been symptoms of partial paralysis of the left side of face and left arm for the last few days of his life, also internal strabismus left eye, and he passed all his motions under him.

**Temperature.** — His temperature ran a very irregular course throughout (chart attached), but as a rule there was an evening rise and a morning fall; this was not by any means constant, the morning temperature being occasionally the higher. The charts show periods of apyrexia, and it was noticeable that at these times the spleen diminished in size.

**Pulse.** — The pulse varied with the temperature and was usually between 80 and 100 until the last fortnight of his illness, when his temperature became subnormal, and the pulse rate fell to 70. Haemorrhagic murmurs were occasionally heard over the cardiac area, and on one occasion he had an intermittent pulse (every fourth beat), but this only lasted twenty-four hours.

**Respiration.** — His respiration was slightly affected from the commencement. There was a tendency to bronchial catarrh; harshness of expiration and crepitation were present at apex of right lung with slight diminution of resonance on percussion during the months of October and November, but this cleared up.

**Hæmorrhages.** — Small haemorrhages took place from the lips and gums, but not to any extent; he had two or three attacks of epistaxis but not of any large amount; there was more frequent oozing of blood in small quantities from both nostrils. He had a well-marked attack of hæmaturia towards the end of his illness, and blood cells were found in his urine for some time before this.

**Blood.** — The blood was examined continually during the progress of the disease; no parasites, malarial or otherwise, could
be discovered; there was no leucocytosis or poikilocytosis at any time. Blood counts were made during the months of September and October, 1903. These showed: red corpuscles, 3,500,000; white cells, 8,000. The white count was made on four or five different occasions with the same result. A specimen of blood (film) was also sent to the Royal Army Medical College Pathological Laboratory (January 6, 1904). Major Leishman, R.A.M.C., examined it and reported "No abnormal cells, no nucleated red corpuscles or myelocytes, no leucocytosis or alteration in the shape of cells. Percentage of the various leucocytes:—

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<tr>
<th>POLYNUCLEARS</th>
<th>LARGE MONONUCLEARS</th>
<th>LYMPHOCYTES</th>
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_Spleen._—The condition of the spleen was very interesting; it gradually enlarged until the end of October, when it began to decrease. At the end of September it crossed the middle line above the umbilicus by 1½ inches, and extended down to nearly the crest of the ilium; it gradually decreased in size during the month of November, more rapidly during December, until shortly before death it could only just be felt below the costal margin, being from 1 to 1½ inches below it. He never complained of any pain in the organ nor was it at all painful on palpation until the last month, when it was evidently very tender. This was, however, I think due to the diminution in size of the spleen dragging on adhesions formed in connection with the scar in the abdomen.

_Liver._—The liver also underwent changes in size, but not to anything like the same extent as the spleen; it was probably larger at the time of the operation than at any later period. He had jaundice twice, the conjunctivæ being distinctly yellow, but this soon passed off.

_Digestive system._—He took nourishment extremely well, and on the whole his appetite was very good, becoming somewhat capricious towards the end of his illness; he, however, ate solid food up to within a week of his death.

_Skin._—His skin presented a peculiar saffron-coloured tint due to anaemia; a few purpuric spots made their appearance shortly before his death. No glandular enlargements (beyond those mentioned) could be discovered at any time.
Tongue.—Was generally moist and clean, except when the temperature ran very high, when it became dry and brown.

Bowels.—Were constipated at the commencement of his illness, requiring enemata and laxatives; latterly he suffered from diarrhoea, having four or five motions in twenty-four hours. He never had melena, and his motions appeared healthy and bile-stained, except on the two occasions when he had jaundice. There was considerable distension of the upper part of the abdomen before he was operated on, and also before his death, and the veins of the anterior abdominal wall and chest became distended; there was also evidence of fluid in the peritoneal cavity.

Eyes.—His eyes were examined and found to be normal. No change in the fundus.

Urine.—His urine was examined from time to time: at first it was normal, latterly, during the month of December, it always contained albumen, about one-third; blood cells and epithelial casts were found microscopically, and there was distinct haematuria at the time he had the fit.

Treatment.—Exploratory opening of abdomen.

Drugs.—Quinine given in grs. x. doses. He took as much as xxv. to xxx. grs. a day with no effect on the temperature. Arsenic, beginning with liq. arsenicalis η. v. increased to η. x. three times a day after food, continued for long periods, was discontinued in December as it did not appear to have any influence on the disease. Iron given alternately with the arsenic, calcium chloride and iodide of potassium. Bone marrow was also given raw and in the cooked state.

Neither drugs nor dietary seemed to make any difference to the course of the disease.

Post-mortem examination, ten hours after death, made January 13, 2 p.m.—Rigor mortis present. Body much emaciated; skin saffron coloured, purpuric spots on arms and legs; muscles anaemic; scar of operation wound in right side on level of ninth rib; scar of operation wound 3 inches long in abdomen below ensiform cartilage.

Thorax.—On opening the thorax the pericardium was found to contain several ounces of a straw-coloured fluid.

Heart.—9½ oz., small, muscles anaemic, valves healthy.

Right Lung, 25½ oz.; no adhesions; slight engorgement at
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base, otherwise appeared to be healthy; no signs of tubercular disease.

Left Lung, 19½ oz.; no adhesions, appeared healthy.

Abdomen.—On opening the abdomen 20 oz. of clear serum were found; the intestines had a peculiar translucent appearance, and the mesentery an oedematous look.

Mesenteric glands were enlarged and pigmented; towards the duodenum they were especially numerous.

Pancreas.—Weight 5½ oz.; enlarged and hard; more intimately adherent to the duodenum than usual.

Liver, 75 oz.; enlarged, especially the right lobe; the left lobe extended right across to the left side of the body. It was adherent to the old operation scar in the right side and also to the spleen; was of a maroon colour, tough on section, especially the right lobe, mottled in appearance; liver substance divided into large lobules by wavy, thick, pigmented lines. No sign of abscess or gumma, nor could any remains of an old abscess cavity be found.

Gall bladder contained about ½ oz. bile; appeared healthy.

Spleen, 43 oz.; much enlarged, extended from 1 to 1½ inches below the costal margin, congested, and very friable; no sign of abscess, infarct or gumma.

Right kidney, 7½ oz.; capsule not adherent, very pale in colour in patches; is somewhat tough on section; pigmented in places, with a mottled appearance.

Left kidney, 8 oz.; capsule slightly adherent, enlarged, pale-coloured areas showing through the surface; these were slightly tougher on section than the remainder of the organ, which had the same mottled appearance as the right.

Intestines.—Beyond the translucent appearance previously noted the intestines appeared healthy, and no signs of old ulceration existed in either the large or small intestine.

Bladder contained about one pint of urine, normal.

Brain, 47½ oz.; membranes congested; some patches of organised lymph on the brain surface on each side of the longitudinal sinus; choroid plexus congested, otherwise the brain appeared normal. No thrombosis could be found. There was no excess of cerebro-spinal fluid.

(II.) Remarks on the Case by Major Leishman.

On January 7, 1904, I received from Major Mathias some blood films from this case, together with a short abstract of
the history and present condition of the patient. The result of this blood examination is incorporated in his description, but it occurred to me, on reading the abstract, that, while there was little evidence for or against a diagnosis of that very vague disease "splenic anaemia," there were many points in which the case resembled those which I have elsewhere described as "Dum-Dum fever." In mentioning this to Major Mathias I suggested that, if possible, he should obtain samples of the patient's blood from the spleen by puncture of that organ with a view to determining the presence or absence of the parasitic bodies which I found in one of these cases at Netley in November, 1900. This he kindly undertook to do, but, unfortunately, owing to the retraction of the spleen below the ribs, which he describes above, the operation was postponed and death took place before the organ was again in an easily accessible situation.

At the necropsy Major Mathias made smears from the liver and spleen and forwarded them to me, together with portions of these organs, for examination. The parasitic bodies were easily detected in the smear preparations, both from the liver and the spleen.

In the spleen smear, stained by Romanowsky's method, the bodies were most numerous, averaging two or three in a field (Zeiss Apochrom. $\frac{1}{3}$" Obj. and No. 6 Comp. Ocular.), and they presented the same appearances as those I described in the original case already alluded to; small, more or less definitely circular, chromatin masses, 1.5 to 2 $\mu$ in diameter, while close to each lay a smaller body, most frequently in the form of a short rod, but occasionally in that of a dot, and so intensely stained as to appear almost black. This smaller body was seldom in actual contact with the larger, and was often situated at an angle to the larger mass, somewhat like an accent on a small letter $\circ$, thus (i). In a few instances a pale, blue-staining stroma, oval in shape and 3-4 $\mu$ in its longest diameter, was seen enclosing both chromatin bodies, the larger of which was always closely applied to the periphery of this blue-staining stroma. In most cases, however, this stroma was absent, or, at least, unstained, and the parasitic bodies appeared to be lying free among the spleen cells and the red blood corpuscles. In no instance was a parasite found in a red blood corpuscle.
In the smear from the liver the parasites were fewer in number and were mostly found lying in the protoplasm of large mononuclear cells, probably the hepatic cells. In this situation they presented the same appearance as those found in the spleen. The capsulated forms I have seen in Donovan's specimens and the so-called zoolea masses figured by Ross, Laveran, Manson and Marchand, were not found in this case.

Sections of the liver showed a profound disorganisation of the hepatic tissue, the hepatic cells being to a large extent absorbed and their place taken by a loose, fibrous stroma, poor in cellular elements. In the dissociated columns of hepatic cells lying in this tissue many of the individual cells were seen to have undergone a marked fatty degeneration of their protoplasm, while in others the protoplasm had shrunk to a narrow band surrounding the nucleus. The portal and hepatic vessels showed some thickening of their walls, and surrounding some of them was a zone of round-celled infiltration. The presence of the parasites could not be clearly demonstrated in the sections as satisfactory chromatin staining is not possible in hardened tissues.

The sections of the spleen showed a general condition of hyperplasia with some thickening of the capsule; here, too, the parasites could not be made out with certainty. No pigment was found either in the spleen or the liver.

With regard to the symptoms of the case recorded by Major Mathias, these present many features in common with the other cases in which these parasitic bodies have been found, whether by spleno-puncture during life or post mortem, and a brief summary of these symptoms and signs may be of service in the detection of further cases and in the extension of our knowledge of the actual nature of the parasite and its possible pathogenic relationship to tropical splenomegaly. On both of these points we are, at present, much in the dark, and the subject offers a promising field for investigation.

(1) **Spleenic enlargement.**—This occurs early and seems a constant feature. The enlargement is usually very great, and appears to be frequently accompanied by pain. The fluctuation in size recorded in this case has not been mentioned before.

(2) **Hepatic enlargement.**—A certain degree seems always to accompany the splenic enlargement. In this case the previous
history of liver abscess obscured the diagnosis. The enlargement of the liver is important in view of the fact that, in most instances, the parasites have been found in this organ as well as in the spleen.

(3) Cachexia.—The peculiar earthy pallor of the skin and the intense degree of emaciation which accompany the later stages of the disease are very striking.

(4) Temperature.—The long-continued, irregularly remittent or intermittent charts furnished by these cases are in themselves characteristic in the absence of any other definitely ascertained cause for the almost constant pyrexia.

(5) Haemorrhages.—Epistaxis, bleeding from the gums, &c., have been mentioned in many of the recorded cases and formed a marked feature in this instance.

(6) Purpuric eruptions and subcutaneous haemorrhages have also been mentioned and are once more in evidence in this case.

(7) Transitory oedemas of various regions or of the limbs appear to be frequent and are especially mentioned by Donovan in connection with his cases.

(8) Headache.—Severe and persistent headache is not uncommon.

(9) Effects of Medication.—In none of the cases so far recorded have drugs proved of any service in modifying the course of the disease.

(10) Complications.—The frequency with which congestion of the lungs, diarrhoea and dysentery appear in the course of the disease is noteworthy.

(11) Blood count.—In several cases a large increase in the relative proportion of the large mononuclear cells, unaccompanied by a general leucocytosis, has been observed, the figure reaching 14 per cent. or even higher. This, if confirmed by further experience, is interesting in view of the importance which has of late been attached to an increase of these cells as affording evidence of recent malaria.

These, then, form the chief points presented in common by the cases in which the presence of the parasites has been demonstrated, either intra vitam or post mortem, by Donovan, Manson and Low, Marchand and Leddington, and by myself. We must, of course, await the results of much more extended observation before accepting these parasites as the actual cause.
of the disease in question, but the uniformity of their occurrence in a series of cases presenting so many symptoms in common is, to say the least, suggestive.

In my original communication I suggested that search should be made for these parasitic bodies in Kala Azar, which appeared to me to present a clinical picture closely resembling that of Dum-Dum fever, and it is interesting to learn that Dr. C. A. Bentley has recently telegraphed from Assam that he has found them in the spleen in this disease. A comparison of the list of symptoms detailed above with those of Kala Azar—of which a good account was given by Dr. Bentley himself at the meeting of the British Medical Association in 1902—will, I think, show that, as far as symptomatology goes, the two conditions are practically identical, and the conclusion can hardly be avoided that Dum-Dum fever may eventually prove to be no more and no less than Kala Azar. Should this be so we must then acknowledge that endemic foci of this disease exist in and near Dum-Dum, in Madras, and probably in many other parts of India, where its existence has been unsuspected hitherto, and, further, that it has in the past taken its toll of many a British soldier whose death has been attributed to Malaria.

Postscript.—A list of the articles published upon this subject will be found in the British Medical Journal of February 6, 1904, page 303.—W. B. L.