PIROPLASMOSES.

A HISTORY OF THE DISCOVERY OF THE DONOVAN BODIES IN MADRAS.*

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Piroplasmosis.—Under this head I have classified a new disease prevalent in Madras, the symptoms are those of so-called chronic malaria. As this new addition to the Indian fevers merits a full account, I shall write in some detail on its discovery, history, etiology and symptoms; bringing the information up to date of writing this report (22nd February 1904). I had noticed many cases of chronic irregular pyrexia, with enlargement of the spleen and occasionally of the liver, bronchitis, oedema of the feet, subcutaneous haemorrhages chiefly of the petechial type, diarrhoea of a dysenteric nature and cancer oris. The treatment was most unsatisfactory, no drug having the least beneficial effect. Such cases were being registered in hospital as chronic malaria, but as I was not a believer in the pyrexia of malaria unaccompanied by parasites in the peripheral blood, I, for the nonce, classified the cases as enlargement of spleen cause unknown. Notwithstanding I had still a lurking suspicion that there might be, at present undiscovered stage of the malarial haematoozoan, which might be the cause of these irregular pyrexias, that there were resistant forms of the genera Plasmodium and Laverania.

With a view to remove this doubt, I attended the post-mortem and took smears of blood from the spleens of cases said to have died of chronic malaria. On the first day, 9th April 1903, I found in a slide containing such a smear numerous peculiar round and oval ring-like little bodies, with two masses of chromatin situated on opposite poles; convinced as I was of their parasitic nature I could not, however, refer them to any group of the Protozoa. I thought I had discovered the long-sought-for-resting-stage form of the malarial parasite in man. But on procuring the same bodies in two other cases on the 23rd and 24th April 1903, I changed my view and considered that they might be post-mortem degenerations of the nuclei of the splenic pulp cells. On the 15th June 1903, I received the British Medical Journal of the 30th May of the same year, and in it, on page 125, was an account by Major Leishman, R.A.M.C., of organisms identical with mine. I at once recog-
he considers the parasites found by you to be the same as his. I think that the bodies are certainly parasites, but I cannot see any evidence at all that they are related to trypanosomes. Hence I feel very strongly that the parasite is an entirely novel one, and that therefore consider that the discovery is one of great importance. It is possible that the parasites are the cause of the fever in the cases, and this fever appears to me to resemble that of Kala-azar.

On the 5th November 1903, a contribution was sent by me to the British Medical Journal: "On the Etiology of one of the heterogeneous fevers of India." This appeared in that periodical of 28th November 1903, page 1401; in this I stated that the bodies had been determined by Laveran and Mesnil to belong to the genus Piromplasma, species new.

The symptoms caused by these organisms appeared to me from the very commencement to be very like those of Kala-azar, but not having seen a case of this disease of Assam I was chary in deciding. My students of their own accord often discussed with me, Manson's small book in hand, the similarity of the two ailments. With the hope of procuring blood from the spleen of Kala-azar cases, I sent a letter on the 10th November 1903 to the Indian Medical Gazette, which was duly published in December 1903, on "A possible cause of Kala-azar." In this I mentioned that the symptoms of my cases, which had then amounted to 17, tallied very closely with those of Kala-azar, and that I was led to believe the cause might be identical at the same time requesting medical officers in endemic areas to send me slides of smears of spleen juice or blood obtained by puncture intra vitam.

In the Bulletin de l'Académie de Médecine, Paris, No. 35, Séance du 3 Novembre 1903, Laveran described my parasite and he and Mesnil gave it the name of Piromplasma Donovani. Later Laveran and Mesnil contributed a paper to the Académie des Sciences, Paris; a copy of this I give verbatim, as it is of importance that the original description should be on record in this hospital. [A translation of this appeared in Indian Medical Gazette, August, 1904.—Ed., Indian Medical Gazette.]

I have nothing to add to the descriptions made by these two French savants. There is nothing definite to note about the parasite seen in the fresh blood, they can barely be discerned, the two chromatin spots appear as brightly refractile areas, there are no movements in the free forms.

The post-mortem find is generally, an enlarged, pigmented or unpigmented, spleen; liver enlarged, congested or circrushed; intestines, especially the large, deeply congested, inflamed or ulcerated. Details of the necropsies will be found with the summaries given of the several cases further on. On the 23rd December 1903, I received a wire, despatched 22nd idem, from Dr. C. A. Bentley of Assam, to the effect that—"Similar to those described by Leishman and you, found intra vitam in Kala-azar." This communication was evidently the result of my letter to the Indian Medical Gazette of December 1903. I have since received a slide from Dr. Bentley containing blood of a Kala-azar case; Piromplasma Donovani were present in large numbers. Thus my surprise, that these so-called chronic malaria cases are identical with Kala-azar was correct.

This Piromplasma (whose place in this genus is doubted by Ross, Manson and others, but I shall not enter into details on this subject), is found in the spleen in varying numbers, from 30 and more to one in a field, in some cases the slide has to be examined for half-an-hour before four or five are found; it is also found in the liver, kidneys and suprarenals. In the peripheral blood it is very rarely found, and only when the temperature is high, above 104° F. later; also found in ulcers most probably caused by an itch mite, Suroptes scabiei. Several of my patients suffering from Piromplasmosis are covered with itch, the itch mite has so far eluded detection. In case 45 I found on the 13th February 1904, the usual Piromplasmatas in scrapings from small ulcers in the skin of the lower extremities; I was led to look for the organisms in such skin lesions by Wright's of Boston, discovery of bodies very similar, if not identical, with mine in scrapings from Oriental Sore (Delhi Boil). Up to the end of the year under report, 31 cases were admitted into my wards; the admission since 17th June 1903, number among Europeans and Eurasians 211, and natives 507, a total of 718, this gives a percentage of 4-91 suffering from Piromplasmosis; as but one case occurred among Europeans and Eurasians, the natives only should be taken into account, i.e., 30 cases in an admission of 507 or 5-91 per cent. Of these 13 died, four were removed moribund, 13 were discharged at their own request always in a worse condition than on admission, and one still remains in hospital. At date of writing this report the number of cases of Piromplasmosis has gone up to 46, i.e., in my wards only. Lieut. Christophers, I.M.S., informs me that he has had during the last month (part of January and February 1904) 18 cases from the other Physicians' wards. The disease is very common in Madras, especially in Black Town, and generally speaking all cases of that convenient disease "chronic malaria" or "malarial cachexia" are nothing but Piromplasmosis. I give in tabular form the number, names, dates of admission and discharge with remarks of the 31 cases admitted into my wards during the year, i.e., since 17th June 1903, the date of the first case found by me in my wards. The diagnoses were always made from microscopical examination of the blood taken during life from puncture of the spleen.
### Table of cases of Piroplasmosis admitted into Second Physician's Wards during 1903.

| No. | Name               | Residence | Date of admission | Discharge       | Remarks               |
|-----|--------------------|-----------|-------------------|-----------------|-----------------------|
| 1   | Doraisami Mudali   | Periyamett| 20 May 1903       | 15 Oct. 1903    | Died                  |
| 2   | Shunugam Nadar     | Black Town| 30 June 1903      | 10 July 1903    | Do                     |
| 3   | Munisami           | Do.       | 9 July 1903       | 9 Aug. 1903     | At own request        |
| 4   | Rajamannar         | Do.       | 29 July 1903      | 18 Sept. 1903   | Do                     |
| 5   | Thungavelu         | Do.       | 7 Aug. 1903       | 26 Aug. 1903    | Two admissions        |
| 6   | Murugesa Naicker   | Triplcane | 6 Aug. 1903       | 26 Aug. 1903    | At own request        |
| 7   | Venkatarajalu      | Mint Street| 28 Aug. 1903     | 1 Sept. 1903    | Do                     |
| 8   | Vedachellam        | Perambur  | 2 Sept. 1903      | 28 Nov. 1903    | Two admissions        |
| 9   | Ponnusami          | Ponneri   | 29 July 1903      | 25 Sept. 1903   | Removed moribund.     |
| 10  | Raghavan Chetti    | Do.       | 7 Sept. 1903      | 15 Oct. 1903    | Do                     |
| 11  | Doraisami          | Black Town| 21 Sept. 1903     | 9 Oct. 1903     | At own request        |
| 12  | Ponnusami          | Chintadripett| 26 Sept. 1903    | 14 Oct. 1903    | Do                     |
| 13  | Chinappen          | Pudupett  | 14 Sept. 1903     | 8 Nov. 1903     | Do                     |
| 14  | N. W. Johnson      | Rangoon   | 5 Oct. 1903       | 6 Dec. 1903     | Do                     |
| 15  | Mari               | Choolai   | 31 Oct. 1903      | 20 Nov. 1903    | Do                     |
| 16  | Guruvan            | Kilpauk  | 23 Oct. 1903      | 14 Dec. 1903    | Do                     |
| 17  | Vartharajulu       | Choolai   | 14 Oct. 1903      | 13 Nov. 1903    | At own request        |
| 18  | Subrayalu          | Mint Street| 6 Nov. 1903      | 12 Nov. 1903    | Do                     |
| 19  | Anthony            | Royapuram | 14 Nov. 1903      | 1 Dec. 1903     | Do                     |
| 20  | A. John            | Black Town| 17 Nov. 1903      | 4 Dec. 1903     | Removed moribund.     |
| 21  | Buchi Raja         | Elephant Gate| 23 Nov. 1903    | 4 Dec. 1903     | At own request        |
| 22  | Jaganathan         | Ennur     | 25 Nov. 1903      | 26 Nov. 1903    | Do                     |
| 23  | Sivanantham        | Black Town| 1 Dec. 1903       |                | Still in hospital      |
| 24  | Narainsami         | Do.       | 17 Sept. 1903     | 8 Nov. 1903     | Died                   |
| 25  | Manikavelue        | Mint Street| 5 Dec. 1903      | 8 Jan. 1904     | At own request        |
| 26  | Munisami           | Washermanpett| 1 Dec. 1903     | 30 Dec. 1903    | Died                   |
| 27  | Kuppusami Naidu    | Mint Street| 6 Dec. 1903      | 3 Jan. 1904     | Died                   |
| 28  | Nathamani          | Elephant Gate| 17 Dec. 1903     | 19 Dec. 1903    | Do                     |
| 29  | Munisami Naicker   | Mint Street| 22 Dec. 1903     | 5 Jan. 1904     | At own request        |
| 30  | Raghavan           | Periyamett| 26 Dec. 1903      | 29 Dec. 1903    | Died                   |
| 31  | Chellappan Naicker | Pursewakum| 28 Dec. 1903      | 31 Dec. 1903    | Do                     |

I may mention that 44 punctures of the spleen were made *intra vitam* (66 up to 22nd February 1904); as a rule, there was no untoward result but one case died from puncture. The patient, case 22, was punctured at 8 A.M., was quite well till 3 P.M., when he was allowed to get up and leave his bed. When walking in the verandah to fetch water, he slipped and fell, was picked up in a dazed condition; at 5 P.M., he was noticed to be very bad, gasping for breath, a few minutes afterwards he expired. *Post-mortem* examination showed extensive haemorrhage in the peritoneal cavity, obviously from the spleen puncture; the capsule of the spleen was greatly thickened and the pulp unusually diffusent.

Since this regrettable accident, patients were kept for 24 hours flat on their backs and not allowed to leave their beds, at the same time chloride of calcium in a 15-grain dose was administered immediately after puncture and repeated two or three times every three hours; the results so far have been satisfactory.
Several of these punctures were made for other purposes besides that for Piroplasmosis, for instance, for Löwit's parasite in leucæma and the resistant forms of malaria.

The symptoms are in typical cases—anirregular pyrexia of two or three months' duration accompanied with shivering with apyrexial gaps. About this time the spleen gets enlarged and painful, and edema of the feet begins; there is usually diarrhea of a dysenteric nature, which comes and goes for a week or so at a time, later the lungs are affected, there is cough and expectoration, enlargement of the liver, ascites (unusual), subcutaneous hemorrhages of a petechial nature, soreness of the mouth, gums or hard palate and canker oris. Marked emaciation and weakness supervene, the skin becomes dry and furfuraceous and if the patient is not washed, his skin takes on a dark colouration. In the majority of the cases there are signs of recent or chronic itch, the cause of this skin affection is at present doubtful, but it is probably brought about by one of the acarina. The blood examination in cases of piroplasma infection always shows a marked decrease of the red blood corpuscles, these vary from two to three millions to the cubic millimeter. There is no actual increase of the leucocytes but a relative one of the mononuclears, as in malaria. The urine usually contains albumin and invariably pigment urobilin. The feces in some cases contain balantidia, ankylostomata and rhabdonemata. Quinine has been given by mouth, hypodermically and intramuscularly ad nauseam, with no appreciable result. The same may be said of other less suitable drugs, i.e., arsenic, salicylate of sodium, carbolic acid, etc. I here give a very short summary of the 31 cases admitted during the year.

1. Doraisami Mudali, a sickly thin boy, aged 12 years, was born and lived at Periyamett, admitted 20th May 1903, for enlarged spleen, liver and irregular pyrexia. Fever of a month's duration with shivering, spleen noticed to enlarge about three weeks ago, had occasional edema of the feet. His spleen extends down to the umbilicus, liver half an inch below costal arch; he became gradually thinner and thinner with occasional attacks of dysenteric diarrhoea and died on the 15th November with very severe canker oris and extensive petechia over his chest and abdomen. Temperature chart is attached. No post-mortem was allowed.

2. Shumugam, an unhealthily and emaciated boy, aged 13 years, lived in Black Town, admitted 20th June 1903 with irregular pyrexia of two years' duration, enlargement of spleen and edema of feet. The spleen was down to the umbilicus, liver 2 inches below costal arch, edema of the feet well marked; temperature never above 103° F, died on the 10th July, 11th day of admission.

3. Munisami, a thin boy, aged 12 years, lives in Black Town, history of fever for a month before admission, 9th July 1903. Slight enlargement of the spleen, none of the liver, very slight edema of the feet. Discharged at his own request, 8th August 1903.

4. Rajamannar, a rather健康y looking boy, aged 15 years, lives in Black Town, had fever for 15 days before admission on 29th July 1903. Spleen enlarged half way down to umbilicus, liver about an inch below costal arch; his feet swell occasionally, has had one go of diarrhoea, latterly had bronchitis; he became thinner and weaker and was discharged on 18th September 1903.

5. Thungavelu, a wretched, thin, half-starved boy, aged 14 years, lives in Black Town; fever for a month outside. Was admitted twice in hospital, in August for twenty days and again in December for 7 days; on the latter occasion for a severe attack of canker oris; was discharged moribund 11th December. During his stay in hospital he had very little pyrexia, not above 102° F. Spleen slightly enlarged, liver normal and edema of feet.

6. Murugesa Naicker, a thin man, aged 30, lives in Triplicane, admitted beginning of August and discharged 26th of the same month. Spleen slightly enlarged to umbilicus, liver normal and diarhœa present; removed moribund, 1st September 1903; temperature ranged from 100° to 101° F.

7. Venkataramulu, a bullock-cart driver, aged 40 years, lives in Mint Street, ill for 20 days. Admitted 28th August 1903 very ill, spleen enlarged to umbilicus, liver normal and diarrhoea present; removed moribund, 1st September 1903; temperature ranged from 100° to 101° F.

8. Vedachallam, a healthy looking and well-built boy, aged 12 years, lives at Perambur, fever 13 month's duration. Spleen enlarged to umbilicus, liver normal no diarrhoea and no edema of the feet; during his stay in hospital for over two months had irregular pyrexia and had become a little thinner when discharged.

9. Ponnusami, a thin boy, aged 13 years, lives in Black Town. During the 2nd week of October he had an extensive crop of petechiae over chest and front of ankles; temperature very irregular, discharged moribund.

10. Raghavan Chetti, aged 12 years, comes from Pondicherry, fever for three months. Spleen enlarged half way to umbilicus, liver normal, feet oedematous, had an extensive crop of petechiae over chest and front of ankles; temperature very irregular, discharged moribund.

11. Doraisami, a thin boy, aged 13 years, from Black Town. History of fever of long duration; liver and spleen considerably enlarged, oedema of feet and bronchitis. Died on 8th October; a very partial post-mortem allowed by relatives; liver and spleen removed, both much enlarged and congested but non-pigmented.

12. Ponnusami, a cook, aged 20 years, lives in Chinadripet, fever for four months. Spleen slightly enlarged, liver normal, very mild pyrexia, stopped 10 days in hospital.

13. Chinappan, a milkman, aged 34 years, lived in Padupett, fever of short duration prior to admission for dysenteric motions. Temperature varying from normal to 101° F., spleen enlarged, about four fingers' breadth below ribs, liver normal, occasional oedema of feet, had dysenteric motions during the whole of his two months' stay in hospital.

14. N. W. Johnson, a very emaciated and feeble boy, aged 24 years, has had a very long spell of fever, first contracted in Rangoon. Has a huge spleen extending down to his pelvis and liver descending below the umbilicus; the abdomen is completely filled up by these two viscera; there is marked motting or pigmentation of the skin, has occasional eruptions of petechiae, epistaxis, slight bronchitis and the usual irregular temperature with night sweat. I append patient's own account of his case, dated 9th October 1903. "About very nearly four years ago I was appointed as clerk in charge of Segregation Camp, Rangoon. The camp was built on a disused paddy field just along the river's bank. During my first four months' stay at the camp I kept very good health, but as we were getting deeper into the monsoon the condition of the camp became a proper marsh, there were standing pools of water and the soil became so soft that it was with very
great difficulty one could walk. It was at this time
I got my first attack of fever and was treated by the
hospital assistant. I became worse and was compelled
to get admitted in the Rangoon General Hospital, this
was in July 1900. I was discharged having no fever. I re-
sumed work and continued to work, for about a week,
when I got a relapse. The second attack was more
severe than the first and I neglected myself more as I
was chary of asking for more leave. I became so bad
however that the Port Health Officer came to hear of it,
and ordered me to hospital, which I obeyed; this was
about the middle of August 1900. I was not more than
two days in hospital when the fever left me, this hap-
pened also on the first occasion. I therefore decided
to resign my appointment and leave Burma for good;
this I did and landed here about the middle of Septem-
ber. I kept fairly good health here and was able to put
on 1.5 lbs, however, did not last long. I started
getting fever till at last I got admitted into this hospital
somewhere in October or November. It was the same
here as in Rangoon, on the second day of my admission
the fever left me and about ten days later I left the
hospital. My next admission in this hospital was in
June 1901, fever again; after a stay of about a fort-
night, I left; my spleen then was slightly enlarged but
not tender. I was therefore not as to demand treatment.
By this time I got tired of Madras and was determined to go
back to Rangoon. I sailed from here on the 12th September,
arived in Rangoon on the 16th September and by
the 1st October I was working in the Agent's office, Burma
Railways, my health greatly improved. I was forced to
enter hospital, this time not with, but with a bubo.
I went into hospital on the 10th January 1902 (I was admitted on the 19th
November 1901.) From this date my proper troubles
about the spleen began. When I left hospital I had
no job and had to rough it till I found a living; in
this month 1902 I began getting fever again. To make matters
worse I took a job, a job where you work about a ship either by
day or night for about four hours at a time, subject to
the heavy dews of night and the excessive heat by day.
I managed to pull on with this up to the end of March 1902, but had to
throw up the sponge at last and seek admission in hospital in
April 1902. I was examined on admission and was told I
had a spleen abnormally large; this surprised me, and
I feared that my three months Adenoraemia had
appeared to be in no way affected. I was four months
in hospital and left strong enough to take up a clerk's
berth on board the B. I, S. N. steamer "Chitika." I
worked for about four months, put on some flesh and
looked and felt a great deal better. Since leaving
hospital I took bad again and went to Calcutta on
the 7th September, kept fairly good health for about
ten days, gained 7 lb. in flesh since leaving Calcutta, got
a relapse of fever about the 20th, became very bad about
two days before admission here, fever every night at
8 p.m., 104.6° F., Monday morning the 6th I was
admitted. This is a true account of my case. I may add
that although I was not affected by the heat on board, my
health was sound in size. As regards my mode of living
when in Rangoon it, I am ashamed to confess, was rather
fast. I was inclined to be intemperate before joining
the camp. On joining fever and plague were made an
excuse to drink heavily, on board a ship it was worse,
I drank more whilst working ashore than I did ashore.
I put this down as it may help to tell the
cause of my spleen, and besides I wish to tell the
whole truth.

It is difficult to state where this patient contracted
his present ailment, he probably had malarial fever in
Rangoon and subsequently got Piroplasmia in Black
Town; but this is mere guess. He was in hospital
for about three months and left at his own request, weaker and
thinner than on admission. (He sought admission again
this month, February 1904; he has become much worse.
He has since died).

15. Maro, an emaciated young man, aged 20 years,
worked in the Buckingham Cotton Mills and lived in
Choolai; history of fever off and on for six months. There
was enlargement of liver and spleen, dysenteric motions, temperature between 99° and 103°
F., ulceration of gums over the last two upper molars
of the left side, two ulcers on the outer side of the left
foot and one in the gluteal region of the same side.
Died on the 21st day of his admission. Post-mortem
was held by Captain Kirkpatrick, i.e., and the
following notes were taken:—Height 5 feet, weight
76 lb. Rigor mortis is passing off. Edema of legs. Ab-
domen opened. Intestines semi-distended and pale;
abdomen contains about 6 oz. of darkish yellow fluid;
the omentum is pigmented; the parietal peritoneum has
also pigmented patches; the lower part of the ileum is
coiled and twisted in the right iliac region and the
caecum is found to be empty and at the ascending
colon by adhesions, the adhesions are firm; the vermiform
appendix is healthy. Thorax opened. The pleural cavity contains a small
quantity of fluid; some adhesions on both sides; left
lung is adherent to the diaphragm. Pericardium con-
tains 2 oz. of clear fluid. Heart.—Lungs.
the only chamber not contains any blood, of a dark fluid
nature; endocardium is healthy; valves are competent;
coronary arteries healthy; the heart muscle appears
normal. Trachea, vessels dilated and full of blood;
pretracheal and bronchial glands are enlarged. Lungs
—Right lung, middle lobe is absent; the pulmonary
veins are full of blood; sputum moist, yellow and putrid.
Intestines.—Contents of intestines of dirty grey semi-fluid
materials. Transverse and descending colon are covered
by a number of small dark red purple ulcers, which
are mostly discrete, but in places they run together;
these extend as far as the muscular coat, there is little
thickening around them; in the washings a number of
scleros were found; the jejunum is contained in the
rectum contains a blood-stained fluid and the
sigmoid shows the same appearances as the colon. Spleen large, shapeless, soft, not very moist,
dark and pigmented. Liver is large, dark and flabby;
on section the substance is rather friable, shows pigment-
tion with small specks of yellowish colour intermeng-
ing, uniformly spread all over the surface. Kidneys,
colour is yellow and pale, the capsules strip easily. Brain
Cerebral vessels contain a small quantity of blood;
large pigmentation at the base of the brain; the brain
substance is very soft, otherwise nothing abnormal is
noted.

Weights—spleen 49 oz. and liver 72 oz.

16. Gurraru, aged 25, lives in Kilpauk; fever for
three months and diarrhea for one month before adm-
ission. Spleen enlarged one inch below costal arch,
liver barely larger than normal, oedema of feet;
discharged after a month and a half in hospital.

17. Varharajun, a fairly healthy young man, aged
18 years, lives at Choolai, had fever for two months
before admission. Spleen enlarged one inch below
umbilicus, liver slightly enlarged with oedema of feet.
Discharged after a month's stay in hospital.

18. Subramany, a puny, wretched looking man, aged
25 years, lived in Mint Street. Admitted for dysentery,
after eight days in hospital died of peritonitis. He had
fever off and on for six months before admission. Post-
mortem made by Captain Kirkpatrick, i.m.s., and the
following notes were taken:—Height 4 feet 7 inches; weight, 52 lbs. Abdomen
opened—Intestines distended, vessels on surface of small
intestines are injected cavity contains about 5 oz. of clear
yellow fluid; liver surface is covered with thin flakes of lymph; the omentum and transverse colon are adherent to the anterior wall, signs of old peritonitis. On separating the abdominal wall gently, a perforation, the size of a pin's head, is found on the anterior surface of the transverse colon, the sigmoid flexure is adherent to the anterior abdominal wall. Illium shows areas of inflammation having dark-red ecchymosed patches; its wall is pigmented; in the large intestine are a number of chronic ulcers whose edges are much raised and thickened and their floors covered by thick yellowish adherent slough, some of these extend through the whole wall of the gut. Spleen is large, capsule thickened in patches, there is a small white infarct on its anterior border, the section is dark and substance firm. Liver, surface irregular covered with small adhesions, patches of thickened capsule; section is tough, very dark, and there is an excess of fibrous tissue and pigment. Weights—spleen, 21 oz.; liver 28 oz.

19. Anthony, a very sickly looking Police constable, lived at Royaparam, had irregular fever for six months accompanied by shivering and occasional swelling of the legs; spleen very slightly enlarged, liver normal, had troublesome cough and soreness of his mouth, died on the 8th day of his admission.

20. A John, a sickly man, aged 43 years, lives in Black Town; has had fever for two years irregularly, during the last seven months accompanied by dysenteric motions. Spleen enlarged to umbilicus, liver normal, has spongy gums and dysenteric motions, temperature normal throughout the 18 days of his stay in hospital, discharged moribund.

21. Buchi Raja, a very thin though otherwise healthy-looking boy, aged 14 years, lives near Elephant Gate; history of fever of a year's duration with enlargement of the spleen. Very slight pyrexia during his stay in hospital; spleen extends down to the umbilicus, liver two fingers' breadth below costal arch, no diarrhoea and no oedema of the feet.

22. Jaganathan, a spare, large-boned man, aged 35 years, lived at Ennur, complained of enlarged spleen and pyrexia of long duration. This man died from spleen puncture, an account of which has already been given.

Post-mortem notes by Captain Kirkpatrick, i.m.s.—Spleen is large, the capsule is tough; at its anterior border and outer surfaces are three small punctures the centre one of which is somewhat linear; the substance of the spleen is very soft and slightly pigmented, weight, 60 oz. Liver is rather pale, there are racemose pigmented markings; substance is firm; weight, 62 ounces.

23. Sivanantham, a sickly-looking boy, aged 25 years, lives at Black Town, fever and oedema of feet of two months' duration. This patient's temperature was of a most marked intermittent type, the chart is attached. He has had occasional petechiae and swellings of the feet with bronchitis. Latterly he greatly improved, his temperature decreased in size almost to normal, the oedema of the feet left him and the temperature was very little above normal. But this false improvement has not lasted, when writing this report, his previous unhealthy condition is returning.

24. Narainsami, an emaciated, very dark-complexioned man, aged 35 years, lived at Black Town; history of fever of two months' duration with dysenteric motions.

Was three months in hospital suffering from typical pyrexia, dysenteric motions, cough, oedema of feet and soreness of mouth. The strange feature about this case was that the spleen and liver were not enlarged, and it was with some difficulty that the spleen could be punctured. He died and a necropsy was held by me, the following special features were noted:—Fourteen ounces of blood-stained fluid in the abdominal cavity; parietal peritonitis, especially in the pelvis and sides, mesentery and omentum, covered with numerous petechial spots of recent origin, some, however, appear old, like mili-miliary tubercles. Intestines, lower part of the large, inflamed and ulcerated. Spleen normal, of a brownish pink colour, non-pigmented. Liver very slightly enlarged, normal in colour, non-pigmented. Suprarenals enlarged. The other viscera call for no mention.

25. Manika Velu, a spare young man, aged 20 years, lives in Mint Street; fever irregularly for four months, spleen enlarged two months ago, latterly he has had soreness of the mouth and oedema of the feet. Spleen enlarged to umbilicus, liver three fingers' breadth below costal arch; after a month in hospital discharged in the same condition as on admission; pyrexia varied from normal, to 103° F.

26. Munisami, a very sickly and emaciated boy, aged 14 years, lived in Washermanpet. Has had fever irregularly for two months, with sore mouth, diarrhoea and oedema of feet. Spleen and liver slightly enlarged. Was admitted on 1st December 1903, kept fairly well until 21st idem when symptoms of the disease became worse and he died on the 30th idem from oedema of the larynx. The following are parts of the notes taken:

21st December 1903. Oedema of the feet increasing, has a troublesome cough with expectoration.

25th December 1903. Has three sores, about half an inch in diameter, on and round left knee, resembling those caused by scratching pustules of itch (Sarcoptes scabiei); oedema of left foot much less; complains of pain in the left ear with a buzzing noise.

28th December 1903. Discharge of pus from the left ear, marked swelling below the ear and extending down the neck.

29th December 1.03. Pus discharging from both ears; left tonsil very much congested with a dirty looking slough, oedema of the fauces; swelling has increased over left lower jaw and neck, very painful to the touch.

30th December 1903. At 3-30 A.M. had great difficulty in breathing. Neck much swollen, purulent discharge from both ears profuse; marked oedema of fauces with almost complete closure of the isthmus faunum; cough on left tonsil has spread. Tracheotomy was performed at 8 A.M. and the patient died at 10-10 P.M. The temperature was of an intermittent type throughout, varying from 98° to 104° F.

Post-mortem.—The spleen enlarged, slate grey in colour, pigmented, weighed 16 ounces. Liver adherent to stomach and duodenum, nutmeg, weight 48 ounces. Intestines healthy and large intestines healthy, abdomen congested, several round worms, no ankylostomata.

27. Kuppusami Naidu, aged 30 years; admitted for ascites, diarrhoea, cough and enlargement of spleen; lives in Mint Street. Fever for about eight months, of an irregular type, spleen enlargement noticed six months ago, swelling of abdomen of five months' duration; associated with these were occasional bleedings from gums, sore mouth and oedema of the feet. Spleen and liver slightly enlarged, abdominal cavity full of fluid, well marked pleuritic rub on right side and friction sounds over liver and spleen. Feet much swollen, skin dry, covered with dirty black epithelial scales; petechiae over chest, coming out in crops; has diarrhoea, motions passed in bed. Hands covered with dark itch scabs on front of chest and small ulcers on ankles, was admitted twice, on the second occasion he was very ill and died on the eighth day.

The post-mortem notes were—Body thin and ill-developed, abdomen distended. Fifty-two ounces of thick yellowish fluid in abdominal cavity.

Liver, large congested, slightly nutmeg, no pigment, was adherent to stomach, duodenum, colon and diaphragm, and weighed 85 ounces. Spleen much enlarged, soft, no pigment, weight, 28 ounces. Intestines both small and large, matted together with adhesions; Peyer's patches congested. Superficial ulcers in transverse and
A METHOD OF PREVENTING DEATH FROM SNAKE BITE.

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Although this paper is a joint one, the authors wish to mention that each has had a different part in its production. The whole research may be fairly regarded as the natural outcome of the work begun in India nearly forty years ago by one of us (Fayrer), and this is the only ground on which his name can be associated with this paper. The instrument employed was designed by another of us (Brunton), and the actual experimental work was entirely carried out by a third (Rogers).

The first experiments on the use of permanganate of potash as an antidote to snake poison was made by one of us (Fayrer), in 1869, both by the local application of a solution and by injection into the veins, on the ground of its being a chemical antidote. The animals experimented upon were dogs, but the permanganate of potash did not seem to have any power to avert the lethal action of the poison. It was shown also by Wynter Blyth that Cobra venom when mixed in vitro with permanganate of potash becomes innocuous. His results were confirmed by two of us, who showed that some other substances had a similar power. They tried by the injection of strong solution of permanganate of potash and also by its local application to an incision made over the bite to destroy the lethal action of Cobra poison previously injected, but their experiments were unsuccessful, the permanganate appearing to be unable to overtake the poison which had got the start of it.

In 1881 Messrs. Couty and Lacerda made a number of experiments upon the effect of permanganate of potash on serpents' venom and Lacerda found that permanganate of potash not only destroyed the lethal action of the venom when mixed with it in vitro, but also preserved life when a 1 per cent. solution of permanganate was injected into the tissues close to the place where the venom had been previously injected and also when both venom and antidote were injected directly into the vein. At the time of presenting his note to the Academy of Science in Paris, M. Lacerda was apparently unaware of the previous experiments by Blyth, Brunton and Fayrer. In a later publication he discusses their experiments, but claims for himself to have scientifically demonstrated permanganate of potash to be a precious antidote to serpent venom, and to have brought it into common use and thinks, therefore, that the priority belongs to him, but he was apparently unaware that instructions for its use with the ligature had, many years before, been promulgated by Fayrer in India.

In the winter of 1881 a number of experiments were made by Dr. Vincent Richards, who found, like the previous experimenters, that Cobra poison was completely destroyed by permanganate of potash when mixed with it in vitro, so that death did not follow the injection of the mixture either hypodermically or into a vein. He found also that when Cobra poison was injected into a dog and the injection followed either immediately or after an interval of four minutes by a hypodermic injection into the same part of a solution of permanganate of potash no symptoms of Cobra poisoning resulted.

2 "The Thanatophidia of India," 1872, p. 95, by J. Fayrer, M.D., London: J. and A. Churchill.
3 "The Poison of the Cobra," by A. Wynter Blyth, M.R.C.S., "The Analyst," 9th February, 1877, p. 204.
4 "Note on the effect of various substances in destroying the Activity of Cobra Poison," Brunton and Fayrer, "Roy. Soc. Proc.," 29th June 1878, vol. 27, p. 465.
5 Couty and Lacerda, "Comptes Rendus," vol. 92, p. 465.
6 Lacerda, "Comptes Rendus," vol. 93, p. 466.