MALARIA.

AN ANALYSIS OF ONE HUNDRED CASES WITH SPECIAL REFERENCE TO MALARIAL DYSENTERY.

BY:

WILLIAM JAMES CROW.

* * *

1917
In the course of my Military work, at a Base Hospital in the near East, considerable opportunities have presented themselves for the study of some of the commoner tropical diseases, more particularly Malaria, and, in a minor degree, Dysentery. It is my purpose in this paper to give an analysis - from personal observation - of a hundred of the more serious and interesting cases of Malaria which have come under my notice. The cases selected may be roughly divided into four classes:

1. Malaria - Benign Tertian.
2. Malaria - Subtertian.
3. Malaria - Quartan.
4. Malaria - Complicated with Dysentery.

The diagnosis in each case has been established by microscopic examinations, as I took blood films from all the cases, and had them examined for the presence of parasites.

In many of the cases, repeated blood examinations were made before the parasites were found, and in others the blood was examined at short intervals to show the effect of different methods of treatment. In those cases complicated by Dysentery, the stools also were examined for both Amoebae and Bacilli, by microscopic examinations.
examinations
and bacteriological tests.

Appended is a temperature chart of every case showing:

1. The temperature curve.
2. The finding of blood film examinations.
3. The results of treatment.

(I.M.Q. = Intramuscular Quinine Injection).
(B.F. = Blood Film Examination).

ETIOLOGY & HISTORY.

Malaria is a disease of a specific infective nature, characterised by well marked fever of an intermittent or remittent type. It is mostly found in tropical and sub-tropical countries, but it also occurs in a less severe form in temperate climates. The cases occurring in the latter are, I believe, usually relapses of primary attacks acquired elsewhere.

Warmth, abundant vegetation, stagnant surface water, and low lying and marshy districts favour its development, while the opposite conditions retard it. Most of these conditions - ideal for the development of the Malarial parasites - are met with in the bed of the Vardar river and the Struma Valley, from the latter of which most of this series of cases have come.
Though known, even to the ancients, the origin of the disease was never understood, until the year 1880, when Laveran, a French physician, made the discovery of a minute parasite in the blood of patients suffering from the disease. This parasite, to which he gave the name Plasmodium Malariae, was found to attack and destroy the red blood corpuscle. Prior to this discovery, Malaria had always been regarded as a typical miasmatic disease, produced by bad air, emanating from marshes and swamps. In 1890, Golgi did much valuable work in differentiating the various kinds of parasites and classifying them according to the different clinical forms of the disease they produced.

Laveran's discovery, however, threw no light upon the source of infection, and for some years, the manner in which the parasites gained an entrance into the blood remained obscure. Sir Patrick Manson was the first to direct attention to the real channel by which infection is brought about. From a study of the parasitic changes in the blood he came to the conclusion that the parasite had a further development in some other host and that probably the mosquito, which was known to abound wherever Malaria was prevalent. From a study of the stomach contents of mosquitoes which had been permitted to distend themselves with blood containing the parasites, he found that long slender filaments
slender filaments
were thrown out from the periphery of the parasites.
These filaments or "flagella" in course of time became
detached from the parasite and actively mobile, and he
conjectured that the parasites left the mosquito in this
form to infect swamp water, by means of which human infection
was thought to be brought about. In 1895 Major Ronald Ross
confirmed Manson's theory that the mosquito was the definite host of the parasite; but he also made the important
discovery that a complicated life cycle, requiring about
a fortnight for its full development, took place in the
mosquito and that the mosquito itself was the agent
of infection and the means of transmission of the disease,
and not merely the water infected by the mosquito, as
Manson had thought. In other words, Ross showed how
the parasites, sucked up by mosquitoes from an infected
person after the completion of the necessary life cycle,
were returned by the mosquito, through its salivary
secretion, to new human beings, who thus became infected.
Ross further discovered that only one genus of mosquito -
the Anopheles - was susceptible of infection, and able
to spread the disease, and Grassi, an Italian naturalist,
by means of experiments among the many different kinds
of mosquitoes in Italy, confirmed Ross's statement.

Continued:-
Acting on Ross's discovery, Sir Patrick Manson determined to test the effect of the bite of Anopheles mosquitoes, brought from a Malarious district, on a healthy person. He had some infected Anopheles brought from Italy to England, and two persons volunteered to subject themselves to the bite of the Anopheles. The experiment was carried out and proved successful. Both persons developed Malaria eighteen days after they were bitten, and the parasites were found in their blood. Thus, positive evidence was obtained that a healthy man could be infected with Malarial fever by infected Anopheline mosquitoes.

From a study of the life history of the parasite it has been established that there is:-

1. A stage of development in man.
2. A stage of development in the mosquito.

A brief epitome is as follows:-

The parasite is conveyed by the bite of the mosquito to the human blood in the form of a small filamentous cell, called a sporozoite. This penetrates a red corpuscle, grows rapidly, matures and finally ruptures the corpuscle - at the end of forty-eight or seventy-two hours according to the species - setting free a fresh brood of parasites (or merozoites as they... Continued:-
as they are called), and accounting for the febrile attacks. These fresh parasites attack other red cells, and the cycle of development in man is thus completed and may go on recurring again and again.

Some of the forms do not rupture but circulate in the blood stream unchanged. These are called sexual cells, or gametocytes. After the blood is swallowed by the mosquito, these sexual forms become fully developed, and, as was pointed out by McCallum, in 1898 sexual fertilization of the organism takes place. The fertilized cell, when fully matured, contains a large number of sporozoites. It finally bursts and the latter are set free in the body cavity of the mosquito, and in course of time find their way to the salivary gland of the insect, to be injected along with the salivary secretion into the human subject. From the time the mosquito sucks up these sexual forms from a case of Malaria to the time when its salivary gland s are charges with sporozoites ready for injections a period of twelve days usually elapses.

Thus we have an asexual cycle in the human subject and a sexual in the mosquito brought about and maintained.  

Continued:-
ETIOLOGY & HISTORY, CONTINUED:

Three forms of the parasite occur in man:

2. Plasmodium Falciparum -(or Praecox):- Producing Subtertian Fever.

While these parasites with the completion of the cycle of development, at the end of forty-eight or seventy-two hours, produce the characteristic temperature waves of tertian and quartan fever, it must not be forgotten that mixed infections occur, and also double and triple infections with the same species of parasites. In this way the temperature curve is greatly modified in appearance - e.g., several of the cases in this series show a typical quotidian type of fever, although in reality they are double tertian, two broods of merozoites having come to maturity on alternate days. (vide charts):-
Now that it has been established that Malaria is an infectious disease due to the infection of human subjects by the bites of infected mosquitoes, the measures taken against the spread of disease should be directed towards:—

1. The protection of Malarial patients from the bites of mosquitoes.

2. The protection of healthy persons from the bites of mosquitoes.

3. The total abolition of mosquitoes or a diminution in their numbers.

4. Quinine prophylaxis.

1. THE PROTECTION OF MALARIAL PATIENTS.

The patient suffering from Malaria, unless protected by means of mosquito netting, is a constant source of danger to others. A healthy anopheles may become infected by him, and so infect healthy people. He himself also may become reinfected, by other infected anopheles and so have his illness aggravated.

So important is this preventive measure considered by the Army Medical Authorities here, that an order applicable to all the Hospitals in this area, is in force making it compulsory for all, 

Continued:
PROPHYLAXIS, CONTINUED:

for all
Malarial patients to be in bed and covered with their mosquito curtains between the hours of sunset and sunrise, when the anopheles are most active.

2. THE PROTECTION OF HEALTHY PERSONS.

This is of the utmost importance and should be carried out by means of a mosquito curtain or net of a very fine mesh - eighteen to twenty strands to the square inch - because the anopheles are small and get through ordinary netting. The curtain may not always be effective, owing to the hand or other exposed part of the body coming in contact with it. A better, though more expensive and less practicable form of protection, is a mosquito proof house. Experiments carried out in Italy showed how people could live in most Malarial districts without contracting the disease by living in houses protected in this way.

3. THE TOTAL ABOLITION OR A DIMINUTION OF THEIR NUMBERS.

It has been proved that by draining the swamp and destroying the breeding places in and near human habitations, the number of mosquitoes can be greatly diminished. The breeding places of the insects are chiefly in stagnant pools and
PROPHYLAXIS, CONTINUED:

pools and
collections of standing water, and measures taken
for the removal of the water by drainage, the
covering in of wells etc., and the killing of the
larvae by petroleum or kerosene sprinkled on the
water, have done much to reduce the number of
mosquitoes and so check the spread of the disease.

4. QUININE PROPHYLAXIS.

Much has been written of quinine as a
prophylactic. By some, it has come to be considered
almost a specific in the protection of the individual
against the disease.

In the series now under consideration,
it was ascertained that, in sixty-six cases,
quinine had been taken regularly, either in
solution or tablet form, in doses of five to ten
grains daily, over a period extending from three
weeks to four months. In forty of these cases the
first infection took place, the remaining twenty-
six had been previously infected before they began
to take quinine, prophylactically, and got relapses
notwithstanding.

Though it is inexpedient that I should here
describe the prophylactic measures taken by the
authorities in the unit in which I worked, I

Continued.
PROPHYLAXIS, CONTINUED:

worked, I may say that the evidence is strikingly in favour of the use of the mosquito net.

The measure of immunity which the drug gives has, in my opinion, been much over-estimated, and the mosquito curtain is the most valuable protective measure we possess. The relative merits of quinine prophylaxis and protection from mosquitoes are well shown in the following table by Celli:

<table>
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<tr>
<th>Protective Measures</th>
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<td>1. Mosquito protection plus</td>
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<td>Quinine prophylaxis........1.75 per cent.</td>
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<td>2. Mosquito protection alone........2.5 &quot;  &quot;&quot;</td>
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<tr>
<td>3. Quinine prophylaxis alone........20. &quot;  &quot;&quot;</td>
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<tr>
<td>4. No protection at all..............33. &quot;  &quot;&quot;</td>
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Celli also pointed out, that, with quinine prophylaxis, there is the possibility of the parasites acquiring an immunity to quinine; and that, if a person, who had been taking quinine prophylactically for some time, should develop Malaria, he did not respond satisfactorily to quinine treatment, no matter in what form, the drug might be given.

The value of the drug as a means of controlling the disease after infection is undoubted, and persons who have once had Malaria should use quinine
PROPHYLAXIS, CONTINUED:-

use quinine systematically for some months.

Clinically, the following varieties are met with:

1. Fever of a regular intermittent type.
2. Continued fever with well marked remissions.
3. Certain pernicious, rapidly fatal forms.
4. A chronic cachexia, with Anaemia and enlarged spleen.

All these types are to be met with in this series of cases.
SYMPTOMATOLOGY.

Of the hundred cases in this series fifty were primary infections, thirty-five recurrent, and in the remainder no definite history could be obtained.

Since the specific parasite has been found in every case by blood examinations, the exact nature of the infection - whether Benign or Malignant - has been established. The cases have been classified accordingly, and the following is an analysis of the symptoms present in each group.

The cases complicated with Dysentery will be discussed separately.

Of the seventy pure cases of Malaria, thirty-eight were proved to be Benign Tertian, and thirty-two Subtertian.

The very large proportion of Subtertian cases is accounted for in two ways:

(1). The cases occurred in the late summer and autumn - during the months of September, October, and November - when the plasmodium falciparum is known to be most prevalent.

Continued:
SYMPTOMATOLOGY, CONTINUED:-

(2). The chronicity of the disease in many of the cases. This should not therefore be taken as a real index of the relative frequency of the two kinds of infection.

In the majority of the Benign cases, there was a definite history of illness lasting for several days prior to admission to Hospital. The symptoms complained of were chiefly pains in the head, back and limbs, together with a feeling of chilliness, lassitude, and general weakness. Sometimes there were no such premonitory symptoms, the illness commencing suddenly with vomiting, headache and shivering.

In the Subtertian cases the mode of onset was much less constant. In some, prodromal symptoms, resembling those of the Benign type, existed, but in not a few cases these symptoms were entirely absent. Vomiting and diarrhoea not infrequently preceded many of the Subtertian attacks.

In most of the Benign infections, the characteristic cold, hot, and sweating stages were present. In some there was merely a sensation of chilliness, but the majority developed actual rigors. In the Subtertian cases, the cold stage was not so
not so constantly present, and was often represented by slight chilliness instead of an actual rigor. Sometimes it was entirely absent, the attack commencing with severe headache, vomiting, diarrhoea, and rise of temperature. When a rigor did occur, it was more severe than in the Benign cases, and was accompanied by greater prostration. In both varities the cold attacks were frequently ushered in with vomiting. Sweating was more constant in the Subtertian infections. Indeed, it was seldom absent, whereas in those cases with Benign parasites it was often slight, and frequently not apparent at all.

Following on the cold stage, comes the period of fever - the so called "hot" stage.

In the Benign cases three different types of fever could be demonstrated:

1. Typical Tertian or regular intermittent Fever.
2. Quatidian Fever.
3. Irregular Fever.

The regular, intermittent variety was largely predominant in this group.
**15(a)**

### Graph - Brit. Donnelly

- **Name:** Brit. Donnelly
- **Age:**
- **Disease:** Malaria
- **D.T.:**

#### Table:

| Date | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Result | | | | | | | | | | | | | | | | | | | | | | | | | | | |

#### Graph Details:
- **Temperature (Fahrenheit):** 97° to 106°
- **Pulse:**
- **Resp:**
- **Urine:**
- **Bowels:**

### Graph - Bomb. W. Collins

- **Name:** Bomb. W. Collins
- **Age:** 30
- **Disease:** Malaria
- **D.T.:**

#### Table:

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#### Graph Details:
- **Temperature (Fahrenheit):** 97° to 106°
- **Pulse:**
- **Resp:**
- **Urine:**
- **Bowels:**
Name: Pte N. Taylor  Age 30  Disease: Malaria  B.T.

Date
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Temperature (Fahrenheit)
106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Pulse
24 24 22 22 24 23 19

Resp.
24 24 22 22 24 23 19

Bowel

Graph indicating temperature and pulse rate over time with notes on disease progression.

Name: Pte P. Morris  Age 43  Disease: Malaria  B.T.

Date
9th 10 11 12 13 14 15 16 17 18 19 20 21

Temperature (Fahrenheit)
106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Pulse
18 19 18 19 18 19 18

Resp.
16 16 18 19 18 19 18

Bowel

Graph indicating temperature and pulse rate over time with notes on disease progression.

Bronchitis Marked.

Bronchitis.
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Pulse, Resp, Urine, Bowels

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Pulse, Resp, Urine, Bowels

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Name: Dr. Carter

Date
Day of the
Time
Temp.

106°
105°
104°
103°
102°
101°
99°
98°

Pulse
Resp.


Name: Dr. G. Holland

Date
Day of the
Time
Temp.

106°
105°
104°
103°
102°
99°
98°

Pulse
Resp.


Continued...
SYMPTOMATOLOGY, CONTINUED:

In the Subtertian cases the same varieties were met with, but the paroxysms were generally more severe and prolonged, and the intervals between the attacks more uncertain. In some cases the rise of temperature was gradual and slow, instead of sudden, as in the Benign, whilst the fall was by lysis instead of by crisis. In others, the temperature, after reaching its maximum, oscillated for a day or two, and then suddenly fell to below normal, and remained sub-normal until the next attack.

Several of the Subtertian charts show more or less continuous fever, - some with sharp remissions, others with slight remissions. These latter closely resembled the Enterica Group of cases, especially as in both there is moderate splenic enlargement. A definite diagnosis can only be made in these cases by blood examination, and examination of the stools.

The following charts show how closely the disease may simulate Enteric Fever.

Continued:-
SYMPTOMATOLOGY, CONTINUED:

Speaking generally, the Subtertian infection produced an irregular type of Fever, and the Benign a regular Tertian type.

Two charts in this series are of special interest as they show typical quartan fever. In neither case, was the quartan parasite present. Benign Tertian parasites were found in the one and crescents in the other. The quartan parasite was found in none of the cases.
--- 17a. ---

**Name:** Dr. Lewis

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**Temperature (Fahrenheit):**

- 106°
- 105°
- 104°
- 103°
- 102°
- 101°
- 100°
- 99°
- 98°

**Pulse:**

- 2

**Resp:**

- 2

**Diuretics:**

- 1

**Bowel Movements:**

- 1

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**Name:** Turner Longlake

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<th>Day of Illness</th>
<th>Age</th>
<th>Distance</th>
<th>Malaria</th>
<th>BT (Quartan Fever)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
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<td>11</td>
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<td>13</td>
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<td>33</td>
<td></td>
<td>14</td>
<td>15</td>
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<td></td>
</tr>
</tbody>
</table>

**Temperature (Fahrenheit):**

- 106°
- 105°
- 104°
- 103°
- 102°
- 101°
- 100°
- 99°
- 98°

**Pulse:**

- 2

**Resp:**

- 2

**Diuretics:**

- 1

**Bowel Movements:**

- 1

---

Note: The chart is not palatable at all.
SYMPTOMATOLOGY, CONTINUED:

Spleen.

Enlargement of the spleen could be demonstrated in practically every case, and in many of the cases there was also tenderness. In some of the more chronic cases, with Subtertian parasites, it was most marked, the dullness in some instances extending well below the costal margin to the extent of three or four finger breadths. Pain, tenderness on pressure, or feeling of weight in this region was frequently present. The organ could most easily be palpated during the febrile attack and frequently during the apyrexial period, it was not palpable at all.

In only two cases was the liver also enlarged.

Herpes about the nose and lips was a very common symptom, especially in the Benign cases.

Bronchitis was not uncommon at the initial stage of the illness and was equally prevalent in both varieties.

Gastro-intestinal disturbance was a prominent feature in many of the subtertian attacks. It took the form of pain in the epigastrium, vomiting, and diarrhoea, with coated tongue. Vomiting was present twice as frequently in the subtertian cases. It was often distressing and in one or two cases

Continued:
SYMPTOMATOLOGY, CONTINUED:

SPLEEN, (Contd):

two cases
so urgent and persistent that all food by the mouth had to be stopped and rectal feeding resorted to. Apart from the attack of fever, no contributory cause could be found. None of the patients had a history of previous stomach trouble. Diarrhoea was often a troublesome symptom and was present chiefly in the Subtertian group, but it occurred much less frequently than vomiting.

JAUNDICE.

Jaundice of varying degrees was observed in some of the cases, and was most marked in the subtertian infections. The stools were typically pale and clay coloured, while examination of the urine showed the presence of bile pigment. Those cases were probably simply catarrhal forms, but several were certainly toxic in origin, as, in addition to the Jaundice there were well marked cerebral symptoms - delirium, coma, and incontinence of urine.

It is interesting to note here the relationship between vomiting and Jaundice. In those cases where vomiting did not occur or
### Vic. Halson

**Age:** 21  
**Disease:** Malaria Sublerian

<table>
<thead>
<tr>
<th>Day of Ill.</th>
<th>Date</th>
<th>Pulse</th>
<th>Resp</th>
<th>Bowels</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/25</td>
<td>101°</td>
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<td>106°</td>
</tr>
<tr>
<td>2</td>
<td>1/26</td>
<td>101°</td>
<td></td>
<td></td>
<td>105°</td>
</tr>
<tr>
<td>3</td>
<td>1/27</td>
<td>101°</td>
<td></td>
<td></td>
<td>104°</td>
</tr>
<tr>
<td>4</td>
<td>1/28</td>
<td>101°</td>
<td></td>
<td></td>
<td>103°</td>
</tr>
<tr>
<td>5</td>
<td>1/29</td>
<td>101°</td>
<td></td>
<td></td>
<td>102°</td>
</tr>
<tr>
<td>6</td>
<td>1/30</td>
<td>101°</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>1/31</td>
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<td></td>
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</tr>
<tr>
<td>8</td>
<td>2/1</td>
<td>101°</td>
<td></td>
<td></td>
<td>99°</td>
</tr>
<tr>
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<tr>
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<td>2/3</td>
<td>101°</td>
<td></td>
<td></td>
<td>97°</td>
</tr>
</tbody>
</table>

**Result:** Well Marked Jaundice

### Vic. Adams

**Age:** 20  
**Disease:** Malaria Sublerian

<table>
<thead>
<tr>
<th>Day of Ill.</th>
<th>Date</th>
<th>Pulse</th>
<th>Resp</th>
<th>Bowels</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/25</td>
<td>106°</td>
<td></td>
<td></td>
<td>106°</td>
</tr>
<tr>
<td>2</td>
<td>1/26</td>
<td>106°</td>
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<td>1/27</td>
<td>106°</td>
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<td>6</td>
<td>1/30</td>
<td>106°</td>
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<td>7</td>
<td>1/31</td>
<td>106°</td>
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<td>2/3</td>
<td>106°</td>
<td></td>
<td></td>
<td>97°</td>
</tr>
</tbody>
</table>

**Result:** Delirium & Jaundice
SYMPTOMATOLOGY, CONTINUED:-

JAUNDICE, (Contd):-

occur or
was not a marked symptom, Jaundice developed. Where vomiting was a prominent and persistent symptom - often lasting for two or three days - Jaundice never appeared. In other words, the vomiting appeared to have prevented a probable source of infection of the bile ducts.

CEREBRAL SYMPTOMS.

In several cases with malignant infection there was marked Cerebral disturbance. In the milder forms, headache, drowsiness, mental confusion, and difficulty in articulation were the prominent symptoms; in the grave cases coma vigil, low muttering delirium, subsultus tentianum, and more or less profound coma. Three cases are worthy of special note:-

1. Sapper Hughes.

Walked into Hospital; nothing unusual noticed - temperature 99° F; a few hours later became semi-unconscious, staring vacantly in front of him, pupils equal, contracted, and reacting to
SYMPTOMATOLOGY, CONTINUED:

reacting to light; tendon jerks all exaggerated; crossed adductor jerk; ankle clonus on both sides; no patellar clonus; no Babinski. Next day had rigor and became quite comatose, with incontinence; quinine given intravenously and intramuscularly and coma became less apparent. Lapsed into deep unconsciousness next day, and intravenous quinine repeated with marked benefit; intramuscular injections of quinine continued and within a week from date of admission was able to feed himself. All nervous phenomena disappeared.
SYMPTOMATOLOGY, CONTINUED:--

CEREBRAL SYMPTOMS, (Contd):--

(2). Private Waring.

Admitted at night; walked in without assistance and did not appear to be seriously ill; next morning very dull; apathetic and difficult to rouse; could with difficulty answer questions; speech very blurred; pupils contracted and reacting to light; late in the day incontinence of urine and coma vigil present; knee jerks difficult to elicit; no kernig; no Babinski; temporary improvement with intramuscular injections of quinine, but in the evening had a rigor and a temperature of 105° F. accompanied by delirium; intravenous quinine given and in two days out of danger.
SYMPTOMATOLOGY, CONTINUED:-

CEREBRAL SYMPTOMS, (Contd):-

(3). Driver Cairns.

Admitted with marked drowsiness, moderate amount of Jaundice and incontinence of urine; with great difficulty could answer questions; quinine given intramuscularly with temporary relief; next day deep unconsciousness supervened and quinine given intravenously; within twelve hours mental condition had cleared and he became continent. Quinine continued by intramuscular injections and three days later was able to sit up in bed and take food; pupils were contracted in this case also.
CEREBRAL SYMPTOMS, (Contd):-

Blood examinations showed in all three cases a heavy infection with subtertian parasites.

These cases, I think, demonstrate how great the cerebral disturbance may be, how rapidly coma may develop, how lapses into unconsciousness are apt to occur, and how beneficent quinine is given intravenously and intramuscularly.

Most observers are now agreed that these cerebral attacks are due to blocking of the cerebral capillaries by Malarial parasites. Castellani states, that in pernicious cerebral fever, the brain has its capillaries filled with sporulating parasites; and Manson by microscopical examinations of prepared sections of the brain has frequently observed such a plugging of the vessels. This plugging of the cerebral capillaries produces lesions in the brain, such as we are accustomed to associate with thrombosis. The resulting symptoms are entirely dependent on the part of the brain involved.

Continued:--
Malarial cachexia - characterised by Anaemia, sallow earthy colour of the skin, irregular attacks of fever, and great enlargement of spleen - so called "ague cake" because of its firm consistence, was mostly found in the cases with subtertian infection. The pathology of the blood in these cases is worthy of special note.

**PATHOLOGY OF THE BLOOD:**

After severe, repeated, and prolonged attacks of fever, an Anaemia - often pronounced - is apt to develop. An examination of the blood shows several well marked changes. In the great majority of the subtertian cases - Anaemic changes were marked, and the changes chiefly observed were:

1. Pallor, marked diminution in the number and alteration in the shape of the red corpuscles.

2. Degeneration of red blood corpuscles shown by alteration in staining reaction.

3. In spite of the very severe Anaemia observed in some cases, nucleated red cells were rare.

4. Leucocyte changes:-(a). Relative increase in the number of mono-nuclear cells was the most constant change. (b). In a few cases there was an increase of the polymorphonuclea cells and small lymphocytes.

Continued:-
SYMPTOMATOLOGY, CONTINUED:

CASES OF MALARIA COMPLICATED WITH DYSENTERY.

The term Malarial Dysentery is used to signify an acute Enteritis occurring in the course of an attack of Malaria and associated with the passage of frequent motions containing blood and mucus. There is considerable diversity of opinion as to the causation of this condition.

Manson suggests that those Dysenteric cases are "probably due to the accumulation of parasites in the vessel of the intestinal mucosa". Castellani, on the other hand, describes Dysentery as a complication due to the Löschia tetragena or to the Dysenteric bacilli, or directly due to the Malarial parasite alone. Results of examination of these cases tend to support Castellani's view, in that the presence of the Dysenteric bacilli has been demonstrated bacteriologically in the stools in the majority of cases.

Captain W.R. Logan, R.A.M.C. - bacteriologist to the Hospital to which I am attached - who has done much valuable research work on this subject, has by the examination of the stools in the cases now referred to, been able to demonstrate both the Amoebae and Bacilli of Dysentery.

Continued:
SYMPTOMATOLOGY, CONTINUED:

CASES OF MALARIA COMPLICATED WITH DYSENTERY, (Contd):

As Malarial parasites were also found in those cases, his work has done much to elucidate the underlying causes and, in the cases under consideration, to demonstrate the simultaneous existence of Malaria and Dysentery in the same patient. The recognition of the occurrence of this double infection is of the utmost importance in the treatment of the condition.

In some cases the illness began with Malaria, in others with Dysentery, the symptoms of the other infection developing in the course of the illness. In a third group the diseases ran concurrently from the beginning. In all the cases no real and lasting improvement took place until the double nature of the condition was revealed, and both conditions treated.

Fifteen were first cases of Malaria, ten had had previous attacks and in five the history was indefinite. One case had previously had Dysentery. Fifteen had taken prophylactic quinine regularly. The attacks usually began suddenly with high fever and coated tongue. The symptoms present were solely dependent on the respective virulence of the two
SYMPTOMATOLOGY, CONTINUED:--

CASES OF MALARIA COMPLICATED WITH DYSENTERY, (Contd):--

the two infections. In some, Malarial symptoms predominated; in others, those of Dysentery were predominant. In all the cases there was great prostration, more or less acute abdominal pain and the passage of many motions containing blood and mucus. Diarrhoea - lasting from three to ten days - was a prominent prodromal symptom in thirteen cases. Where Malaria was the heavier infection rigors, headache, sweating and fever, were the more prominent features. The temperature in most of the cases was high and irregular, with well marked remissions and intermissions. In one case the temperature chart simulated Enteric. The spleen was enlarged in the majority of cases.

The following table gives the kind of parasites found:--

<table>
<thead>
<tr>
<th>Benign Tertian</th>
<th>Subtertian</th>
<th>Unclassified</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>12</td>
<td>12</td>
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</table>

Bacillary Dysentery was the most prevalent proved type of the disease as will be seen from this table:--

Continued:--
SYMPTOMATOLOGY, CONTINUED:

CASES OF MALARIA COMPPLICATED WITH DYSENTERY, (Contd):-

<table>
<thead>
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<th>Bacillary</th>
<th>Amoebic</th>
<th>Unproved</th>
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</thead>
<tbody>
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<td>3</td>
<td>4</td>
</tr>
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</table>

The Shiga variety of the bacillus dysentericus was isolated in sixteen cases and the Flexner Y. bacillus in seven.

Mixed Amoebic and Bacillary infections were also found in two cases, in addition to the Shiga bacillus many Entamoebae coli were present, but no Entamoebae histolyticae, or other pathogenic Amoebae were found. Trichomonas hominas was present in one case.

It would appear therefore that the clinical term Malarial Dysentery is here explained by the coincidence of the Malarial and Dysenteric infection.

Another important point brought out in the course of the examination made in these cases is that the percentage of "bacteriologically proved" cases of Dysentery in this doubly infected group is higher than in the cases of simple uncomplicated Dysentery.

A general survey of all the cases in this series goes to show that the symptoms in the Benign Tertian cases were as a rule less severe than the Subtertian. It should be mentioned, however, that in
 SYMPTOMATOLOGY, CONTINUED:

C A S E S  O F  M A L A R I A  C O M P L I C A T E D  W I T H  D Y S E N T E R Y, (C o n t d): -

that in some of the Benign cases, severe and prolonged illness occurred, whilst a few developed pernicious symptoms, like delirium and jaundice. It does not follow therefore, that an infection with Benign Tertian parasites necessarily means a Benign form of fever. Ewing describes a fatal case in which Haemoglobinuria and coma were the outstanding symptoms and where on post mortem examination the blood and spleen showed large numbers of plasmodia Vivax. It is rare for death to ensue as the result of this infection but it does occur at times, when there is a heavy infection. The graver manifestation of the disease arose almost exclusively in the course of the Subtertian infection.

D I A R R H O E A.

It has been proved that most of the cases with dysenteric symptoms were due to a double infection. The occurrence of diarrhoea - apart from a double infection - has yet to be accounted for. Now this symptom was present - at any rate in
### Murus VauoKaa

- **Diseases**: Malaria & dysentery
- **Shiga**

#### Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Disease</th>
<th>Shiga</th>
</tr>
</thead>
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<tr>
<td>P. Vaughan</td>
<td>20</td>
<td>Malaria &amp; dysentery</td>
<td>Shiga</td>
</tr>
</tbody>
</table>

#### Graph

- **Temperature**
- **Pulse**
- **Resp**
- **Stiff**
- **Bowels**

---

### Pte. H. Shardlow

- **Age**: 25
- **Diseases**: Malaria, Subtention, & dysentery
- **Shiga**

#### Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Disease</th>
<th>Shiga</th>
</tr>
</thead>
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<td>25</td>
<td>Malaria, Subtention, &amp; dysentery</td>
<td>Shiga</td>
</tr>
</tbody>
</table>

#### Graph

- **Temperature**
- **Pulse**
- **Resp**
- **Stiff**
- **Bowels**

---

*Stretley & Silverlock Ltd.*

98, Blackfriars Road, London.
### Case 1: Dr. Todd L

<table>
<thead>
<tr>
<th>Day of Illness</th>
<th>Symptoms</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Urine</th>
<th>Bowels</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Dehydration</td>
<td>106°</td>
<td>80</td>
<td>24</td>
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<td>2</td>
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<tr>
<td></td>
<td>Dehydration</td>
<td>105°</td>
<td>80</td>
<td>24</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Dehydration</td>
<td>104°</td>
<td>80</td>
<td>24</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Dehydration</td>
<td>103°</td>
<td>80</td>
<td>24</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Dehydration</td>
<td>106°</td>
<td>80</td>
<td>24</td>
<td>3</td>
<td>2</td>
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</table>

### Case 2: Pvt. Marsh H.J.

<table>
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<th>Symptoms</th>
<th>Temperature</th>
<th>Pulse</th>
<th>Resp.</th>
<th>Urine</th>
<th>Bowels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dehydration</td>
<td>106°</td>
<td>80</td>
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<tr>
<td></td>
<td>Dehydration</td>
<td>105°</td>
<td>80</td>
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<td></td>
<td>Dehydration</td>
<td>104°</td>
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<td>24</td>
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<td></td>
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<td>80</td>
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<td>Dehydration</td>
<td>106°</td>
<td>80</td>
<td>24</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note:** The graph shows a fluctuation in temperature and symptoms over a period of 20 days for each case.
Name | Pat. Jones S.H. | Age | 24 | Disease | Malaria & Dysentery, Shiga | Result
--- | --- | --- | --- | --- | --- | ---

| Date | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Temperature (°F) | 106° | 105° | 104° | 103° | 102° | 101° | 100° | 99° | 98° | 97° | 96° | 95° | 94° | 93° | 92° | 91° | 90° | 89° | 88° | 87° |
| Pulse | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Resp. | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Diarrhoea | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No | No |

---

Name | Mr. Morris A. | Age | 29 | Disease | Malaria & Dysentery, Shiga | Result
--- | --- | --- | --- | --- | --- | ---

| Date | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Temperature (°F) | 106° | 105° | 104° | 103° | 102° | 101° | 100° | 99° | 98° | 97° | 96° | 95° | 94° | 93° | 92° | 91° | 90° | 89° | 88° | 87° |
| Pulse | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Resp. | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Diarrhoea | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

---

It sounds like these are charts representing the temperature, pulse, respiration, and diarrhea for patients with malaria and dysentery. The graphs show fluctuations in temperature, pulse, and respiration over time.
SYMPTOMATOLOGY, CONTINUED:

DIARRHOEA, (Contd):

at any rate in
a severe form - chiefly in the Subtertian cases and
may be explained as follows:

The Subtertian parasites are known to
sporulate in the internal organs and produce signs
of disease in the organs attached. The organs in
which they sporulate in greatest numbers suffers
most. Just as the parasite may attack the brain
and produce cerebral symptoms (coma etc.,) it is
reasonable to argue that they may also attack the
intestines and produce intestinal symptoms.

From a study of the morbid changes that
take place in Malaria, it has been shown that such
an accumulation of parasites does sometimes take
place in the intestines. Microscopically the
capillaries of the intestinal mucosa have been found
filled with parasites in all stages of development.

VOMITING.

Vomiting in these cases may reasonably be
accounted for by a similar condition occurring in
the gastric mucous membrane.
SYMPTOMATOLOGY, CONTINUED:

VOMITING, (Contd):

Thus severe vomiting and diarrhoea in malignant cases may be due directly to the parasites and their toxins. Some of the milder forms in this series possibly arose from improper feeding, exposure and hardship.

COMPLICATIONS.

(1). CARDIAC.

Apart from Dysentery, symptoms referable to the circulatory system were those most commonly present. In some cases there was evidence of Cardiac derangement. Clinically there were found signs of dilatation - pain or discomfort over the praecordia, irregular action of the heart, sometimes tachycardia, and an occasional soft systolic murmur at one or other of the cardiac openings - most frequently the mitral. Palpitation was a common symptom and a tendency to faintness was not infrequently present. In one case there was sudden collapse, the patient becoming cold and pulseless, and requiring energetic measures to bring him round.

Continued:-
COMPLICATIONS, CONTINUED:-

CARDIAC, (Contd):-

The cardiac dilatation may be accounted for in one of the following ways:-

(1). Changes in the myocardium due to Malarial Toxocmia.

(2). The pyrexia.

(3). Anaemia resulting from Malaria.

(4). Causes independent of Malaria, e.g., physical overstrain, tobacco.

(5). Any combination of these conditions.

At all events with rest in bed and the administration of cardiac tonics - strychnine and arsenic - the symptoms quickly disappeared and the dilatation subsided.

(2). PULMONARY.

(a). BRONCHITIS.

The occurrence of Bronchitis at the onset of the disease has already been mentioned. Signs of slight Bronchitis were present in many cases and disappeared in a day or two without special treatment. These were probably cases who had contracted Bronchial disease simply as a result of cold, exposure and hardship.
COMPLICATIONS, CONTINUED:-

PULMONARY, (BRONCHITIS) (Contd):-

In the malignant cases the respiratory symptoms were sometimes well marked, and the physical signs were those of a bronchitis, with a few patches of dullness here and there over which was heard distant tubular breathing - in other words, a broncho pneumonia. Dyspnoea, short dry cough, with little or no expectoration and a moderate amount of fever were the leading symptoms.

True lobar pneumonia was present in only one case and, as it presents some interesting features, I shall give a short history of the case.

Driver Hamilton.

Aet. 32; admitted with pain in right iliac region and radiating upwards towards the right chest, round the back, and downwards to the thigh; four days duration; sudden in onset; vomited twice on second day of illness; bowels regular.

Headache, "cold shivers" on day of admission, temperature 102°F., pulse 96; blood examination showed the presence of Benign Tertian parasites; no previous attack of Malaria; prophylactic quinine in liquid and tabloid form for a month. Continued:-
On admission abdomen retracted and tender; marked pain on pressure over McBurney's point but no increase of resistance; case at this stage was suggestive of appendicitis but, as blood examination showed the presence of Benign Tertian parasites, it was decided to watch the case and try the effect of quinine treatment. Lungs, negative but diaphragmatic pleurisy was thought to be a possible diagnosis. Signs of pleuro pneumonia at right base subsequently developed with cough and typical pneumonic sputum. Whole lung became involved and the physical signs were those of a typical pneumonic consolidation - dullness, bronchial breathing, vocal fremitus and resonance increased.

The abdominal pain subsided under the use of quinine and the patient made a good recovery, although resolution in the lungs was slow.
COMPLICATIONS, CONTINUED:

An interesting feature of this case is that the symptoms at one stage of the illness closely resembled those of appendicitis. Apart from the cases in this series, I have seen several other cases of Malaria with marked abdominal pain and tenderness simulating "acute abdomen" and where the diagnosis was only cleared up by the finding of parasites in the blood.

The other point is the presence of pneumonia in a person suffering from Malaria. The physical signs were definitely those of pneumonic consolidation. The symptoms however, lacked some of the striking features of an uncomplicated or primary pneumonia. For example, the respirations and the pulse rate were not so rapid as one would have expected from the amount of lung consolidation present. Neither was the temperature as high as one usually finds in a pneumonia and it came down, not by crisis, but by lysis. In fact, the temperature closely resembled an Enteric chart but agglutination tests gave a negative result.

These cases raise the question of the association of pneumonia with malaria.

Many observers describe a definite malarial pneumonia, i.e., a form of pneumonia.
COMPLICATIONS, CONTINUED:—

of pneumonia
due to the Malarial parasite which clears up with
the administration of quinine alone. Osler
describes such a case. The patient had Tertian
Malaria with parasites in the blood. Both lungs
were involved, the temperature fell by crisis,
and the condition cleared up with quinine, although
"there were no features in the disease whatever
suggestive of Malaria".

Craig considers, in a case such as has been described, the Malarial element is concealed or masked by the pneumonic symptoms and he sums up such cases under the term "masked Malaria". Castellani on the other hand, gives it as his opinion that true lobar pneumonia when present in a Malarial subject is due to the pneumococcus, and is therefore a complication; but he qualifies this opinion with the statement "that a severe Subtertian fever may produce symptoms resembling a pneumonia". Bronchial pneumonia, occurring in a Malarial patient, he regards as a complication due to the pneumococcus, and not directly to the Malarial parasites. Manson expresses no opinion as to the causation of the condition but states that "the subject of Malarial cachexia is very

Continued:
COMPLICATIONS, CONTINUED:—

is very liable to a low and highly fatal form of pneumonia". Thus it seems that those pulmonary cases may arise:—

(1). Directly from a pneumococcal infection.

(2). Directly from the presence of Malarial parasites.

In this series of cases many of the men suffered from an initial Bronchitis, were debilitated from previous disease and hardship, and so were liable to have a pneumococcal infection super-added. In the cases where the sputum was examined, pneumococci, staphylococci, and streptococci were found, and altogether the evidence seemed to support Castellain's view of a super-imposed infection.

In favour of the second theory is the fact that many of those cases respond well to quinine, and that, under its use the fever drops and the respiratory symptoms clear up; also that post-mortem examinations of fatal cases has shown the lungs to contain Subtertian parasites in all stages of existence. Whatever the cause may be

Continued:—
COMPLICATIONS, CONTINUED:

may be

the important practical point, to my mind, seems to be that, in Malaria, and particularly in the Subtertian type, respiratory symptoms may predominate, and that until the double nature of the infection is recognised and treated, no satisfactory results will accrue.

DIFFERENTIAL DIAGNOSIS.

In a typical attack of fever, the diagnosis presents few difficulties. The rigors, the regularly recurrent paroxysms of fever, the elevation of temperature, and the splenic enlargement all go to make up a picture easily recognisable and unlike any other condition. The difficulty in diagnosis arises in the atypical forms of the disease. In the absence of blood examinations, a definite diagnosis cannot be made in many instances. Confusion arises chiefly in the double infections and the "masked forms" of the disease. The diseases in this area which most closely resembled Malaria were Influenza, Heat Stroke, Dengue, and Typhoid and Paratyphoid Fever.
Differential Diagnosis, continued:

**Influenza:**

In Influenza, the presence of catarrhal symptoms, sore throat, and continuous fever serve as distinguishing features.

**Heat Stroke:**

Heat Stroke, if pronounced and accompanied by high fever, delirium or coma may be difficult to distinguish from an attack of Cerebral Malaria. The mode of onset, the absence of splenic enlargement, and the examination of the blood for parasites should help to clear up the diagnosis.

**Dengue:**

The different onset, the course of the temperature, the location of the pain chiefly in the joints or teninous insertions near the joints, and the presence of a more or less pronounced rash are distinguishing features of Dengue as compared with Malaria.

**Enterica Group:**

Most difficulty was experienced in distinguishing between Malaria and the Enterica Group. Some of the cases which came under
DIFFERENTIAL DIAGNOSIS:

ENTERICA GROUP, (Contd):-

came under
my observation had previously had Malaria and at
the onset of the Enteric attack, had relapses of
their Malaria. Many of the temperature curves -
at any rate for the first few days of the illness -
were materially altered on this account, and the
diagnosis rendered difficult. Reference has
already been made to the resemblance of a
Malarial fever of a slightly remittent type
and an Enterica case. The sudden onset of
high fever in Malaria (instead of the gradual
rise), the more marked enlargement of spleen,
the presence of a certain amount of Anaemia and,
most important of all - the presence of the
parasites in the peripheral blood - are the
distinguishing features. Widal's reaction,
the isolation of the baceilli from the stools
and other bacteriological tests greatly aid in
the diagnosis.

RELAPSING FEVER:-

Only three cases of Relapsing Fever have
come under my notice, and in all the symptoms very
closely resemble those of Malaria. In all cases
DIFFERENTIAL DIAGNOSIS, CONTINUED:

RELAPSING FEVER, (Contd):-

In all cases
the onset was sudden with a rigor, severe headache, pains in the back, high fever, injected conjunctivae, etc. In one case the fever continued high for three days before falling; in the second it remained at 104°F. for one night and dropped to normal next morning, while in the third there was only a moderate amount of fever present. The diagnosis in all cases was made by the finding of the spirochaetes in the blood.

It will be seen then that routine examination of the blood for parasites is of prime importance in the recognition of Malaria. In obscure cases, the diagnosis cannot be established in the absence of such an examination.

MALARIAL CACHEXIA:-

The Anaemia, peculiar colour of the skin, the occurrence of vomiting, and the recurring attacks of fever associated with this condition are features which bear some resemblance to pernicious Anaemia. In some respects, too, the blood changes are similar. They differ however in one important detail - the rarity of nucleated red corpuscles in Malarial cachexia.

Continued:-
DIFFERENTIAL DIAGNOSIS: CONTINUED:-

MALARIAL CACHEXIA, (Contd):-

In spite of the very severe Anaemia observed in some cases, nucleated red cells were rare.

TREATMENT.

The introduction of quinine in the treatment of Malaria is of interest from the historical standpoint. In 1639 Cinchona bark was first introduced into Europe by the Countess of Cinchon, wife of a viceroy of Peru, who is reputed to have been cured of an attack of Malaria by the use of this bark. In 1820 quinine was shown to be the active principle of the bark and since that time it has been regarded as the drug, with a specific anti-malarial action. When judiciously administered it destroys the parasites in the blood. In the cases now under observation, it has frequently been observed that, after the use of quinine, repeated blood examinations gave negative results - even in cases where the first blood examination showed the presence of a heavy infection of parasites.

Continued:-
METHODS OF ADMINISTRATION:

Three methods were employed in these cases:

1. By the mouth.
2. By intramuscular injections.
3. By intravenous Injections.

1. BY THE MOUTH.

In most cases the bowels were freely opened with a preliminary dose of calomel followed by a saline. During the early part of the paroxysm - if the symptoms were not urgent - aspirin was given to relieve the headache and induce sweating, and only after the patient had begun to perspire was the quinine treatment begun. This method was adopted as it was found that the quinine, if given early in the hot stage, only aggravated the headache and other symptoms. Sometimes the patient was too ill to justify this delay, and in these cases quinine treatment was immediately begun.

The routine method was to give 10 grains of the sulphate in acid solution thrice daily half an hour after meals, and this dose was continued for four or five days after the temperature had reached normal. It was then reduced in amount to five grains thrice daily and this was continued

Continued:-
TREATMENT, CONTINUED:

METHODS OF ADMINISTRATION.
BY THE MOUTH. (Contd):

was continued
for another week. During the convalescent stage, 
tonics, like iron and arsenic, were given during 
the day and a dose of quinine in the evening.
The diet during the febrile stage, consisted chiefly of fluids and light, easily assimilated food.

This was the usual method of treatment, 
and the one always adopted to begin with.
In many cases, however, quinine by the mouth could not be tolerated, and other methods had to be resorted to.

(2). INTRAMUSCULAR INJECTIONS:-

If vomiting or diarrhoea were prominent features, or if the symptoms were such that prompt measures were required, recourse was had to intramuscular injections. The salt used was the bi-hydrochloride because of its extreme solubility and the usual dose given was 10 to 15 grains. The quinine solution, hypodermic syringe, and needles were sterilized and the site of the injection painted over with tincture of iodine. As a rule one intramuscular injection daily sufficed, but in

Continued:-
but in
the severe cases, two or three such injections
were required.

The maximum daily dose given in these cases
was 30 grains and the greatest number of injections
given to one patient was seventeen. The injections
were made deep into the gluteal or deltoid muscles
taking care to avoid the course of important
nerves. The method is attended by some pain
at the place of injection, but, as a rule, this
is only transient. If the injections are merely
made into the sub-cutaneous tissues, necrosis or
fibrous induration may follow. I have only seen
two cases in which local necrosis took place, and
in both it was due to the injection being made too
superficially. If reasonable precautions are taken
the attendant risks are practically nil.

The majority of the cases in this series
had, at some period of the illness, quinine
administered in this way. The indications for
the employment of this method were:-

Continued:-
TREATMENT, CONTINUED:

METHOD OF ADMINISTRATION,
INTRAMUSCULAR INJECTIONS. (Contd):—

(1). The presence of much gastro-intestinal disturbance, e.g., vomiting and diarrhoea.

(2). In obstinate cases, when quinine by the mouth appeared to be failing to act.

(3). In pernicious infections, e.g., Cerebral Malarias.

(4). In double infection of Malaria and Dysentery.

In all the severe types of fever, this method was employed with most gratifying results. In many cases the patient was stuporose or semi-conscious, and unable to swallow, and I am convinced that many of these cases would have become comatose but for the prompt action of quinine given intramuscularly. The great value of this mode of administration is shown in this series by the fact that in so few cases was it found necessary to give the drug intravenously. Where the earliest possible action was of importance, or where the patient's life was in danger this method was always adopted first of all and was found most reliable and altogether gave the best results.

Continued:
(3). INTRAVENOUS INJECTIONS:

In four cases the symptoms were so pernicious that quinine was introduced by the intravenous method. All were deeply comatose cases with a very heavy infection of Subtertian rings and crescents, and it was imperative that the drug should be given by the quickest possible method if a fatal termination was to be avoided. Major J.W. Struthers, R.A.M.C. carried out the treatment in every case. 10 grains of the bi-hydrochloride in 200 cc. normal saline was the strength of the solution employed. No disturbance was noted as the solution ran in, except in one case where the pulse rate rose to 152 per minute, but came down within an hour. This case required a second injection the following day and no circulatory disturbance was noted. The intravenous quinine was supplemented by intramuscular injections, and the maximum dose given never exceeded 35 grains in the 24 hours. The quinine did not appear to cause the immediate disappearance of the parasites as blood examination, after the intravenous quinine, showed the presence of "many rings and crescents". Within eight to twelve hours after the injection however, considerable improvement in the general
TREATMENT, CONTINUED:-

INTRAVENTOUS INJECTIONS, (Contd):-

the general
condition of the patient could be observed.
The coma became less profound and the ability to
understand and answer questions gradually returned.

Three of the cases made a good recovery
and the fourth ended fatally. The prognosis in the
latter case was always bad, as, in addition to the
Malarial infection he suffered from a most virulent
Shiga Dysentery. So critical was his condition
that it was deemed necessary to give two injections
of anti-dysenteric serum intravenously. He
collapsed from two serious haemorrhages from the
bowel, and death ensued as the result of the
Dysenteric rather than the Malarial infection.

TREATMENT BY DRUGS OTHER THAN QUININE:-

Of the other drugs which have been
recommended in the treatment of Malaria, Salvarsan
is the only one which has been tried in these cases.

Salvarsan - given intravenously or
intramuscularly - has been found to act upon the
plasmodium Vivax, and its value when given with
quinine has been recognised in Benign Tertian cases.

Continued:-
Some of the cases in this series resisted quinine treatment. They had relapses of fever from time to time and repeated examinations showed the presence of parasites in their blood. On the suggestion of Captain J.S. Fowler, R.A.M.C., Kharsivan - a preparation similar to Salvarsan - was tried in some of these more resistant cases. Major J.W. Struthers, R.A.M.C., administered this drug intravenously in nine cases with subtertian infection. The dose used was .3 gramme in normal saline solution. The blood was examined for the presence of parasites immediately before giving the drug and also afterwards and the examinations compared. The results were most disappointing. Six of the cases showed no improvement. The remaining three showed slight improvement. One of these improved for a fortnight, the parasites disappeared from the blood, but, at the end of that time, the patient had a relapse with rise of temperature and the parasites reappeared in the blood.

Nicolle and Conseil and others have tried Salvarsan in Malaria with only moderate results,
TREATMENT, CONTINUED:-

TREATMENT BY DRUGS OTHER THAN QUININE, (Contd):-

moderate results,
and it seems apparent that the drug has little or no value in Subtertian cases. Appended are the charts of the cases in which it was tried, with the results of the blood examinations noted.
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**Pulse, Respiration, Bowels:**
- Pulse: 60-70
- Respiration: 20-25
- Bowels: Normal

**Temperature:**
- 99°F to 102°F

**Apparent Temporary Improvement with Quinine.**

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**(contd.)**

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**Pulse, Respiration, Bowels:**
- Pulse: 60-70
- Respiration: 20-25
- Bowels: Normal

**Temperature:**
- 99°F to 102°F

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**(contd.)**

**CorAd.j**
**G. Harper GA**

**Date of Dis.**

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No improvement after Quinin.

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**C. Maynard W.L.**

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No improvement with Quinin.
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Diarrhea