

*Non-contacts.*—Table IV. summarises the findings with regard to the naso-pharyngeal swabs taken from non-contacts at various centres in the district. The 3 “agglutinable” meningococci found all belonged to Type II. strain; and while 1 agglutinated up to a dilution of 1:400, the remaining 2 only agglutinated up to a dilution of 1:100. Of the 19 meningococcus-like organisms met with in the naso-pharynx during the course of the investigation, the fermentation reactions of 10 of them which survived sub-culture were determined; as also those of the meningococcus G. isolated from the cerebro-spinal fluid. Table V. gives a summary of these fermentation tests:—

TABLE V.

Lab. No.	If agglutinable. Type.	Fermentation reactions.			Lab. No.	If agglutinable. Type.	Fermentation reactions.		
		Gluc.	Malt.	Sacc.			Gluc.	Malt.	Sacc.
62	—	+	+	—	238	—	+	+	—
89	—	+	+	—	316	—	+	+	—
107	—	+	+	—	326	—	+	+	—
116	—	+	+	—	328	—	+	+	—
140	II.	+	+	—	G.	III.	+	+	—
158	—	+	+	—					

Gluc., glucose. Malt., maltose. Sacc., saccharose.

As will be seen, both the epidemiological (“agglutinable”) and the other (“non-agglutinable”) meningococci found during the course of the investigation all give the same fermentation reactions. This corresponds with previous experience.

As a practical Army measure, however, only “agglutinable” meningococci are recognised as constituting true “carriers.” This is based on the teaching of the Central Cerebro-Spinal Fever Laboratory, London, which holds that only men harbouring meningococci agglutinating with standard type sera up to a dilution of at least 1:200, after 24 hours at 55° C., as against controls, are to be considered as constituting an immediate source of danger. Meningococci from cerebro-spinal fluids show agglutination up to this titre and, as a rule, beyond.

In the present investigation, in order to standardise results, complete macroscopic agglutination, after 24 hours at 55° C., in one or more of the dilutions usually put up 1:100, 1:200, and 1:400, as against the normal serum control, has been recognised as constituting a positive result; this standard having been adopted by me in previous work.

It will thus be seen from the summary of results given in Table IV. that “sample swabbing” in the Alexandria District (Egypt) has only yielded 3 “carriers” among 310 non-contacts swabbed—i.e., a “carrier rate” of only 1 per cent. The standard of the Central Cerebro-Spinal Fever Laboratory, London, being adopted, this “carrier rate” would be lower still.

General Conclusions.

The foregoing studies of cerebro-spinal meningitis in Egypt add little that is new to our knowledge of the disease and its prevention. But, they afford a striking confirmation of the hypothesis previously advanced by us associating outbreaks with a high degree of atmospheric humidity when the meningococcus is about.

A “carrier rate” of only 1 per cent. among “non-contacts” taken at random in the Alexandria District (Egypt), and constituting therefore a fairly good “sample”—as against a rate 10 or even 20 times as high in England under similar circumstances, i.e., working with the same medium and technique—suggests an explanation of the comparative immunity of Egypt from the disease. With the meningococcus so little about, atmospheric humidity in Egypt gets little chance to precipitate outbreaks.

We have indicated by ventilation studies, based on the hygrometric state of the atmosphere met with indoors in occupied quarters during sleeping hours, how the greatest attention requires to be paid to ventilation as a corrective to overcrowding, in view of keeping the indoor humidity as low as possible,—considering the part attributed by us to atmospheric humidity in the ætiology of cerebro-spinal fever.

APPENDIX.

Cases of Cerebro-spinal Fever at Mew Camp during February and March, 1918.

Name and Reg. No.	Regiment.	Date of admission to hospital.	Name and Reg. No.	Regiment.	Date of admission to hospital.
T., 68687	5th B.W.I.	5.2.18	G., 9054	5th B.W.I.	11.3.18
F., 6791	“ “	6.2.18	M., 6485	“ “	16.3.18
U., 6505	“ “	8.2.18	To., 6714	“ “	17.3.18
S., 6548	2nd W.I.R. (att. B.W.I.).	8.2.18	J., 6954	“ “	17.3.18
B., 6771	5th B.W.I.	25.2.18	E., 6788	“ “	25.3.18

MALARIA FROM THE SURGEON'S STANDPOINT.<sup>1</sup>

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THE only type of malaria to be considered from the surgeon's standpoint is the subtertian or malignant tertian. In the quartan type the *Plasmodium malariae* goes through the entire process of reproduction in the circulating blood, and does not especially accumulate in any one organ or produce special effects. The tertian type, produced by the *Plasmodium vivax*, also goes through its life-cycle in the blood, and although the tertian sporulating forms are found in the internal organs, such as the spleen, they do not tend to accumulate in these organs or produce special effects. The third type, the subtertian or malignant tertian, caused by the æstivo-autumnal parasite, sporulates almost entirely in the internal organs, attacking any organ and producing symptoms peculiar to the disease of that organ: on the heart causing endocarditis or myocarditis, on the lung a pneumonia, on the spleen a splenitis and perisplenitis, on the pancreas an acute hæmorrhagic pancreatitis, on the liver a hepatitis, &c. Castellani and Chalmers, in writing of subtertian malaria, say:—

“These parasites seem to affect the red corpuscles so profoundly that they are liable to adhere to the walls of the capillaries, in which the parasite sporulates; hence it may produce severe local symptoms, due to the mechanical blocking of capillaries and the intense local action of the toxin; thus it is associated with what is called the malignant fevers—i.e., the fevers which produce local effects on one or more organs.”<sup>2</sup>

In two and a half years on the island with the British Expeditionary Forces the number of cases I have seen in which malaria has proved to be the direct cause of surgical ailments referable to one organ have been comparatively small and with a very small mortality. Malaria as a complication in surgical cases and malaria simulating certain diseases are far more common, especially the first, where all the symptoms may indicate some other illness, for instance, after a gunshot wound of the head (and this is frequent) the symptoms may all point to a cerebral abscess, but under quinine therapy the urgent symptoms disappear and recovery is uninterrupted.

The classification is only made for the purpose of descriptive surgical pathology. Clinically, it is all malaria, and the treatment spells quinine and quinine only. In some of the sequelæ of malaria surgery may have to be resorted to, as in cases of ruptured spleen or the splenomegaly of chronic malaria, drainage of the abdomen in malarial cirrhosis, &c. Decapsulation of the kidney has also been done for suppression of urine in cases of blackwater fever on the island.

Reports and Discussion of Cases.

A number of cases were recorded, but space does not permit of all being printed.

CASE 2. *Acute hæmorrhagic pancreatitis due to malaria.*—Patient, aged 26, invalided for malaria and admitted with this complaint. He was in hospital about six weeks; he had three slight attacks of malaria (subtertian), rings and crescents found in blood. The clinical findings were nil, except a palpable spleen, temperature in each attack not

<sup>1</sup> Paper read before the Conference of Medical Officers, Malta.  
<sup>2</sup> Text-book on Tropical Medicine, by Castellani and Chalmers.

higher than 102° F.; patient recovered rapidly from attacks. General health excellent; sent to convalescent camp and a few weeks later to active service camp. After about a week at the latter he was readmitted as a surgical case. While on duty, he was suddenly seized with a severe pain in upper abdomen; carried to his tent. He was sent to hospital immediately.

On admission he was very collapsed, sweating profusely; pulse 120, weak and intermittent; abdomen distended and rigid, with marked resistance in epigastrium; drawn anxious look; temperature 98°; a few hours later 101°; appeared very ill. At laparotomy a few hours later there was some free bloody fluid in the abdomen; pancreas was enlarged and congested; small petechial hæmorrhages and fat-necrosis in surrounding tissues and mesentery. Appendix normal; liver and spleen slightly enlarged and congested. The abdomen was closed without drainage; intramuscular quinine gr. 10. During the first 24 hours after operation he collapsed twice; stimulants, artificial respiration, and oxygen. Next day he was much better, but sweating profusely. After this, under quinine, recovery was rapid and uninterrupted. He was allowed up at end of second week. Temperature became normal on the third day and remained so as long as patient was in hospital.

I have seen one other case on the island in which the diagnosis was made of acute pancreatitis, which cleared up rapidly under quinine. Surgical interference is contra-indicated, as the pancreatitis is due to a capillary thrombosis formed by the massing of the parasites and pigment.

These malarial abdominal infections are always due to the subtertian parasites, and if the parasites attack one particular organ there will be symptoms referable to that disease. In this case the pancreas was the principal organ to be attacked, and the symptoms were those of an acute pancreatitis from other causes. This explains the rapid recovery of these patients under quinine therapy if promptly and efficiently given, otherwise they rapidly die, or the organ becomes so damaged that it is unable to perform its function.

*Pseudo-appendicitis.*—I have seen many of these cases on the island due to malaria, which cleared up rapidly under intramuscular quinine. If the diagnosis is made surgical interference is not necessary. The cause of the pain on the right side is, I believe, a referred pain due to an acute splenitis, which, in my own observations, has always been present, although in some cases it may be due to the localisation of the parasite in the intestinal mucosa.

I have had many cases of appendicitis, both catarrhal and suppurative, in malarial patients and the only point in the differential diagnosis, as far as I have been able to observe, is the white cell count. In both classes of cases all Murphy's symptom-complex are present except leucocytosis—i.e., pain, vomiting, a little temperature, and rigidity of the right rectus. In pseudo-appendicitis or pseudo-cholecystitis due to malaria one finds a marked leucopenia, with a decrease in the polymorphs and a high mononuclear count. In true cases of appendicitis complicated with malaria one finds a relative leucocytosis, with an increase in the polymorphs. The non-discovery of the malarial parasites in the peripheral blood is of no account in the diagnosis.

*Malarial attack following operation.*—The following explains why an operation brings on an attack, and often of a very severe nature, and nearly always atypical in persons who have never previously suffered from one.

"It is a well-known fact that the plasmodium can exist in the spleen of persons who show no signs of fever or malaria cachexia, and go through their life-cycle there, but it would appear that they are restrained from invading the circulation by the action of some antitoxin and, therefore, do not increase to such numbers as to cause toxic symptoms. Thus it is obvious if the restraining influences which conduce to the condition of latent malaria are removed, an attack of malaria will follow."<sup>3</sup>

It is practically always the condition of latent malaria in patients which is the most annoying, though rarely fatal, complication in surgical cases. These patients give no history of having had malaria, and usually a history of perfect health up to the time they were wounded. The surgeon operates quite confidently that everything will be all right, then 24 to 48 hours after operation an impending attack of malaria is often foreshadowed by these symptoms, and I have noticed this especially in bone and joint cases. The patient complains of severe pain in the wound; the

latter looks unhealthy; joints often become very swollen and exquisitely painful, the least movement causing much pain. The temperature at this time is subnormal, but in a few hours rises to 105° or 106°, without a rigor. If I happen to see the patient at this stage, I give immediately quinine gr. 15, intramuscularly.

I have had a number of these cases under my care, and have found that the impending attack cannot be prevented by giving quinine at this stage, although it may be considerably shortened, and by giving another dose, also intramuscularly, the next day a second attack is rare.

Delayed wound healing is also a feature in this type of case. Wounds look unhealthy, granulate over, only to break down again in a few days. Some of them resemble syphilitic sores, and often it is only with a negative Wassermann and response to quinine therapy one becomes convinced that malaria is the ætiological factor.

I have never seen these conditions in known treated cases of malaria. As a prophylaxis against post-operative attacks of malaria I have found 15 gr. of quinine intramuscularly the night before operation extremely valuable.

*CASE 7. Camouflaged malaria.*—Patient aged 21. Service 3½ years. Had been in Salonika one year. Admitted to St. Elmo Hospital on diagnosis of gunshot wound of right elbow-joint. No history of malaria or dysentery; had felt well up to time he was wounded. On admission temperature 102°, pulse 118. Patient very weak and anæmic; great pain in arm; headache, dizziness, and ringing in ears. Examination revealed very little apart from the wounded arm, which was swollen, cyanotic, and tender from shoulder to fingertips. Elbow especially swollen; pus streaming out of a pin-point opening on anterior side just over brachial artery. Glands in the axilla were enlarged and tender. Day after admission severe headache; face very flushed. He had several fainting attacks; proposed operation for drainage of elbow-joint postponed. Temperature 102°; pulse 130, very weak and intermittent. Strychnine and digitalis were given during the day.

Next day his general condition had improved somewhat, and under ether anaesthesia the elbow-joint was drained; no attempt at resection on account of serious condition. During the next two days he improved greatly. Temperature not above 99° and pulse 100; ate well and slept well; complained of nothing but a feeling of giddiness, which he said he had had for some weeks before he was wounded.

On the evening of the second day following his operation, without any warning, and while talking, he had three severe epileptiform convulsions, became very violent, and relapsed into unconsciousness. Next morning, as he was still unconscious, a lumbar puncture was done; spinal fluid under greatly increased pressure, but clear. A white blood count was made and film taken for malaria; catheterised specimen of urine showed a faint trace of albumen, but no casts. The bacteriological report of spinal fluid negative; sugar reaction present. Films negative to malaria. White blood count was 8600; polymorphs, 60 per cent.; lymphocytes, 29 per cent.; large mononuclears, 5 per cent. Patellar reflexes were absent; Babinsky and Kernig signs absent; some slight retraction of head. Major W. H. Kiep examined the eyes; report negative.

During the next 24 hours patient still remained unconscious; temperature, 102°; pulse, 130; involuntary urination and defæcation. Lumbar puncture; fluid still under greatly increased pressure, but clear; bacteriological report as before; films again negative to malaria. The arm looked unhealthy and the edges of the wound gangrenous, with a very offensive odour; amputation was discussed, but decided to try intravenous quinine first. Quinine hydrochlor., gr. 15, in 10 oz. normal saline given; another lumbar puncture at same time. Two hours after the injection he commenced to perspire profusely; 16 hours later perfectly conscious; temperature, 98°; pulse, 90; patient very weak.

From this time recovery was uninterrupted, quinine hydrochlor., gr. 15, was given daily intramuscularly for a week, then twice a week for four weeks. The arm cleared up rapidly. During the next ten weeks in hospital he had no further rise of temperature and was sent to England as a walking case. Malaria parasites were never found in the blood, and the spleen was only just palpable.

This was a case of camouflaged malaria, where all symptoms indicated some other illness. The septic condition of the arm followed by the sudden coma pointed to an extension of the infected foci to the brain, with a resulting cerebral abscess, especially with the negative history of malaria and the absence of parasites in the blood. The white cell count and the absence of any localisation symptoms were the only two factors in the probable diagnosis of a cerebral malaria. Later the prompt response to quinine therapy and the rapid recovery left no doubt as to the diagnosis.

<sup>3</sup> From Text-book of Castellani and Chalmers.

The complications of camouflaged malaria are the most fatal in surgical cases, as they are usually rapidly fatal, and while one is trying to make a diagnosis the patient dies. Castellani, in writing of cerebral malaria, says:—

“No diagnosis of hemiplegia or of any brain or spinal disease without such obvious cause as traumatism should be made in malarious districts without first examining the blood to see whether the subtertian parasite is present.”

I do not think he goes far enough in this statement, as in the most serious and fatal of my cases parasites have never been found in the peripheral blood. Splenic punctures have not been made, or the parasite would undoubtedly have been found there, but I have relied on the white cell count, especially in the presence of suppuration and the large spleen, and corroborated it by the final test of the response to quinine therapy.

A case (No. 8) was recorded of *purpura hæmorrhagica* due to malaria, or, as Castellani calls it, hæmorrhagic pernicious fever. Fortunately this very fatal complication is rare. The hæmorrhages appear during the attacks but never during the intermission. Untreated it rapidly produces severe anæmia, with thread pulse, delirium, and death; often all treatment is of no avail. Operations on these patients are absolutely contraindicated unless it is the question of the life of the patient, and then every precaution should be taken to guard against and prevent hæmorrhage. Even the extraction of a tooth has led to fatal results in these cases.

The relation of quinine to hæmorrhages is still a debated question. My own experience tends towards the view that the quinine has very little, if anything, to do with it. Where I have observed a tendency to hæmorrhage in malarial patients post-operative or otherwise I always give quinine hydrochlor. in small doses, with large doses of calcium lactate and, if necessary, horse serum.

The last case recorded (No. 9) was one of amputation of the leg. The most interesting thing about this case is that for nearly two years under certainly not the most ideal conditions in Salonika the patient had no relapse of malaria in a known subtertian infection. I mention the case especially as it proves that the parasite may remain dormant for years in the system and the patient in perfect health. Suddenly it may light up when the vitality of the body is lowered and produce an attack of a very serious nature. Also the sudden acute dilatation of the heart in these cases is very common, often proving fatal.

#### Conclusions.

These surgical manifestations, complications, and sequelæ usually result from a neglected and undiagnosed malaria or from a malaria inefficiently treated with quinine. The fact that there have been so few on the island speaks well for the promptness and efficiency of the treatment and the correctness of diagnosis.

There is no difficulty in recognising the quartan and the simple tertian variety, as the attacks are usually typical and parasites can always be found in the peripheral blood if films are taken at the proper time. The difficulty in diagnosis is the subtertian, with its many masks and innumerable sequelæ, and it is this type which is most often untreated because undiagnosed.

It is to be doubted whether any of us realise sufficiently what a protean disease malaria is, and the points to be emphasised are:—

1. That an operation often brings on an attack of malaria of a very severe nature, and an acute dilatation of the heart during or following an operation is very frequent, often proving fatal, and the utmost precautions should be used in regard to anæsthetics for these malarial patients. Ether given by the Vernon Harcourt method is the safest; chloroform, in my opinion, is absolutely contraindicated.

2. That the malarial parasites of subtertian malaria may attack any organ, giving all clinical symptoms of disease of that organ, as the surgeon who has no experience of malaria will find to his cost.

3. That the negative history of malaria and the absence of parasites in the blood is of no account in the diagnosis of a positive malaria.

4. That in a malarial patient convulsions and coma occur in an apparently healthy man without any warning, and that it is not uncommon for a man with acute cerebral malaria to be arrested for drunkenness; and that in every case of brain or spinal disease, or other obscure complaints occurring in men who have been East, malaria is one of the first things that should be considered by the surgeon.

5. That the subtertian malaria may simulate almost any disease, surgical, mental, or medical. It may produce such insidious symptoms that when the patient feels ill enough to see a doctor treatment is of little avail.

6. In the acute attacks there may or there may not be a chill, and parasites may or may not be found in the blood in this type.

The patient may have no idea himself that he has malaria, and herein lies the danger. A man with a subtertian infection is always in danger of his life, and too much importance cannot be attached to the question as to the care of these malarial victims in England after they return to their homes. As Professor Osler wrote some years ago: “There is no other disease which compares with it, except perhaps tuberculosis, in the extent of its distribution and its importance as a killing and disabling disease.”

## Clinical Notes.

### MEDICAL, SURGICAL, OBSTETRICAL, AND THERAPEUTICAL.

#### A CASE OF MULTIPLE EPULIDES.

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IN the following case the growth of a fibrous epulis (to be more definite, hypertrophy of the fibrous tissue of the gingival muco-periosteum) has been associated with each tooth of the temporary and permanent series which has erupted.

#### Account of Case.

The patient, a girl now aged 11, was admitted into hospital in May, 1912, when a portion of the tissue was examined microscopically. Some uncertainty existed as to its nature. A further section showed it to be purely fibromatous. The gingival margins were considerably enlarged and nodular. The tissue particularly involved was apparently the gum margin and the neighbouring portion, but not the greater part of that covering the roots. As the result of treatment it would seem that the periodontal membrane is also involved, the bone is not involved; X ray photographs showed no changes. The growth had extended round the crowns, in parts even reaching to the top of the teeth, and also in thickness. In the early stages it appears markedly vascular and somewhat denuded, but later it seems less vascular and is mottled with faintly yellowish-brown patches. There was no tendency in the tissue to break down except where injured by opposing teeth. Growth is slow, the increase being marked by months rather than weeks. Patient suffered no pain; general health seemed affected, probably owing to difficulty in eating. The growth superficially resembles a simple fibrous epulis, but is sessile, while the simple epulis is nearly always pedunculated.

Of particular interest is the effect of treatment, and this coincides with the records of other cases, and of that of a simple fibrous epulis. Seven separate operations have been performed and an attempt was made to save the teeth, but recurrence followed. All the temporary and eight of the permanent ones have been extracted, the growth completely excised, and the margins of the alveolus removed. The stages of the operations were as follows: All the temporary incisors and the first temporary molars were extracted and the growth removed, whilst the abnormal tissue was cut away freely down to the bone margin round the remaining eight teeth. Where the teeth remained the growth recurred and in July, 1912, the four molars were removed as being less accessible than the canines, and the tissue again pared away round the latter. In October, 1912, the canine teeth were similarly treated. The child was now nearly 5 years old.

No change took place for about two years, nor was there any sign of a similar growth until after the first permanent molars appeared, when the condition recurred in about a year and the previous operation was repeated. In October, 1917, the maxillary incisors had erupted, with recurrence of the condition, and although it was suggested upon the lower incisors it was not marked. An operation removing the tissue around the upper incisors without the teeth was unsuccessful and the teeth were removed in November.

The present condition shows the lower canines involved, also the left lower second premolar, which is erupting into the socket of the first permanent molar. The same change