A LECTURE ON BENIGN AND PERNICIOUS MALARIAL FEVERS.

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By PATRICK MANSON, M.D., F.R.C.P., LL.D.,

Physician to the Seamen's Hospital, Albert Docks; Lecturer on Tropical Diseases at St. George's and Charing Cross Hospitals.

THERE is an infinite variety in the clinical manifestations of malarial poisoning. Certain general statements may be made about them, however. In more temperate climates, and in the winter and spring seasons of warmer latitudes, malarial fevers are usually distinct intermittents; and fresh infections occurring in these places and seasons, so far as the subject has been studied, are found to be produced, by the benign tertian and quartan parasites, and are therefore of little danger. Relapses, however, of previous malignant crescent-forming parasite infections, originally contracted during the hot weather, may occur during the cold season; in fact, are far from uncommon. Such cases I often see here, the original infection having been acquired long before somewhere in the tropics.

First attacks of benign parasite malaria may assume the characters of a remittent; generally in temperate latitudes they are frank intermittents. First attacks of malignant parasite malaria, although they may in a few instances be intermittents, are in the majority of cases remittent in type; and so are attacks the result of extensive reinforcement by fresh parasites (through fresh exposure) of the old stock which the old fever subject generally carries about him in a latent condition. The first attack experienced by a newcomer to a highly malarious district with a hot climate is, therefore, generally remittent and severe.

I do not think it necessary or desirable to attempt to describe in detail the infinite variety malarial attacks assume; it would be impossible in the limited time at my disposal; and would only be an uninteresting and unprofitable ringing of the changes on rigor, pyrexia, diaphoresis, bilious vomiting, bilious diarrhoea, constipation, catarrhal gastritis, headache, bone-ache, prostration, and so forth. The picture would be further confused by the fact that the natural procession of events is generally nowadays broken in on by the action of quinine, the use of which is almost universal with Europeans in the tropics; so that it is difficult to say how any given malarial fever would develop, or how it would terminate if left alone. Sometimes in the case of natives of tropical countries who may not always command a few grains of quinine, such fevers pass into a typhoid state, with dry brown tongue, sordes in the mouth, muttering delirium, terminating in collapse and death. In others, untreated remittents and intermittents gradually subside spontaneously in the course of a week or fortnight; or the remittent may merge into an intermittent which in the course of weeks or months subsides for a time to recur every now and again at longer or shorter intervals. The Italians describe a form of malarial fever the natural evolution of which seems to be in periods of fever of several days' duration, followed by apyretic intervals also of several days' duration—"long interval fevers" they call them. In these the fever seems to subside spontaneously. Kelsch and Kiener allowed certain cases of remittent to run their course unchecked by quinine, and they found that in ten or twelve days the fever gradually expended itself. Unfortunately the observations of these talented and most careful observers did not include a study of the parasite, so that their work to this extent is defective.

One type of these fevers, known as bilious remittent, has long been recognised on account of the bilious vomiting, gastric distress, sometimes bilious diarrhoea, sometimes constipation, which accompany the recurring exacerbations of the fever. It is further distinguished by the pronounced icteric or rather reddish yellow or saffron tint of the skin and

sclerae, a tint derived probably not from absorption of bile, as in obstructive jaundice, but from modified hæmoglobin free in the blood or deposited in the tissues—*hæmapheine* Gübler called the substance. These bilious remittents are very common in the more highly malarious districts of Africa, America, the West Indies, India, and in fact in all tropical countries. They are not specially or directly dangerous in themselves, but they result usually in profound anæmia, and are often but the prelude to chronic malarial saturation and the fruitful cause of much bad health and invaliding.

A modification of the bilious remittent—what Kelsch and Kiener call typhoid remittent—is very much more grave as affecting life than the simple bilious remittent. In the typhoid remittent typhoid symptoms—such as low delirium, prostration, dry tongue, swelling of spleen and liver, sub-sultus tendinum, marked melanæmia—are superadded to the usual symptoms. Recovery is the rule, but a considerable proportion of such cases prove fatal.

The same writers class by themselves a set of cases they call adynamic remittent; cases which are characterised by fatuousness, restlessness, nervous depression, intense muscular and cardiac debility, profound and rapid blood deterioration, icterus, leucocytosis, and melanæmia, liability to syncope, occasionally hæmoglobinuria, a liability to hæmorrhages, and a marked tendency to local gangrene. Such cases frequently prove fatal.

Many writers have drawn attention to what are called pernicious attacks or pernicious symptoms—the French neatly designate these *accès pernicleux*—a series of phenomena, the possibility of the appearance of which, not only in the course of remittents but in the course of what is seemingly only an ordinary paroxysm of intermittent fever, should never be lost sight of by the practitioner in tropical climates. English writers have not sufficiently accentuated this matter. Over and over again in Hong Kong I have seen these *accès pernicleux* supervene in malarial cases, and carry off the patient with horrifying suddenness—as suddenly as an attack of malignant cholera. The wary practitioner is always on the look-out for them, and is always prepared with measures to meet them promptly when they threaten.

Pernicious attacks are roughly classified into cerebral and algide. The cerebral are divisible into hyperpyrexial, comatose, convulsive, paralytic, and so forth; the algid into syncopal, cholericiform, dysenteric, hæmoglobinuric, etc.

The first case of pernicious fever I met with I shall not readily forget. I had got through my day's work, as I thought, and was sitting down to dinner, when an urgent summons was brought me to go at once to a hotel not very far from my house in Hong Kong. I was there in a few minutes and was met by the landlord who told me that one of his guests—a powerful mining engineer—on coming home from a walk had complained of feeling ill, and had been shivering, although the weather was very warm at the time. A hot alcoholic drink was prescribed by the landlord, and swallowed by the sick man. The liquor was hardly down when he became violently delirious, frightening everyone in the house, and requiring half a dozen men to restrain him. They sent for me immediately. By the time I arrived the patient had become quiet—in fact, was unconscious and was lying on his back breathing stertorously, his face flushed, his skin dry and burning, and his pulse running. As soon as possible I had him stripped, soused with cold water, rubbed with lumps of ice, fanned; every effort possible in the circumstances being made to reduce his temperature. I sent for a hypodermic injection of quinine to a neighbouring chemist, but before the medicine arrived the pulse flickered, went out, and the man was dead. I did not know much, nor could I learn much, about this man's antecedents, and was inclined to regard the case as one of what is called heat apoplexy; but from what occurred not long afterwards I was led to change my opinion about the nature of the case.

I was asked to see in consultation another very powerful muscular European, a sugar boiler, who had been suffering from what was regarded as an ordinary intermittent fever, but about which, as it had not yielded to quinine, his medical attendant had become anxious. A short time previously the man had fractured his arm, and as there might be some mischief about the injured bone to account for the persistency of

the fever, I was asked to see him particularly in this connection. I examined the arm, but as the bone appeared to be soundly united, and as there was no particular swelling or tenderness at the seat of fracture I saw nothing in this to account for the symptoms. The man sat up in bed without much apparent distress while I examined his arm. He looked a big strong fellow; but I was struck by his peculiar manner, the muscular tremor, the twitching of the features, and his somewhat unaccountable drunken-like taciturnity. I took his temperature; it was 105° . I could do nothing but advise a purge and quinine and to watch the case. Next day I saw the man's medical attendant, who told me that soon after my visit the patient's temperature began to rise, rapidly passing 106° , 107° , 108° , 109° , and 110° , and that he died of hyperpyrexia the same evening.

Case after case of this description I saw during two or three unhealthy summers in Hong Kong, mostly in intemperate men. European policemen were constantly being brought into hospital from outlying malarious suburbs suffering from hyperpyrexia supervening on what seemed to be ordinary malarial attacks, and not a few of the soldiers who were engaged on certain fortifications under construction at that time died in the military hospitals in the same way. So frequent were these cases of hyperpyrexia and coma that I got one of the hotels to have a portable bath constructed so as to be in readiness to meet an emergency which occurred more than once among the guests.

I have little doubt that many of the cases of sudden death from hyperpyrexia and coma, usually credited to what used to be called "ardent fever" or "heat apoplexy," are really of the nature I describe—malarial. If careful inquiry be made into the antecedents of many of these cases a history of mild intermittent will often be elicited, or it will be found that the patient had been living in some highly malarious locality. Some years ago, in Hong Kong, I had a colleague who, in consequence of having to make frequent professional visits to a highly malarious suburb, himself contracted malaria. His attacks were of a very irregular, indefinite character, and, as sometimes happens when the patient is living in the midst of malarial influences, were but imperfectly controlled by quinine. They kept coming and going all summer and pulled him down very much. For the sake of the coolness and the change, one afternoon he was moved to a house on the top of the hill, which serves as a sanatorium to Hong Kong. He had little or no fever at the time and appeared to bear the short journey, which was made in a sedan chair, well. During the night I was sent for in a great hurry to see him. I dressed and ran as quickly as possible to the house he was staying in. When I got there—in perhaps half an hour from the time he sent to call me—he was dead. A thermometer was on the chair beside his bed. I picked it up and looked at the mercury. It registered 107° , I think. Feeling ill during the night he had taken his temperature, and, doubtless, it was when he saw it had risen so high that he became alarmed and sent for me. His servant told me that his master seemed fairly well when he retired for the night, and that the first intimation he had that there was anything amiss was his being woke up to run for me. I took the temperature of the dead body. It was 110° .

There were two or three practical lessons which experiences such as these rubbed into me in the East and one of them was never to make light of a malarial fever—particularly of a malarial fever of the mild, irregular type, which does not yield promptly to quinine. I did not have practical knowledge then of the use of the microscope in the diagnosis of malarial conditions, but from what I have since seen I have no doubt that in those cases the crescent form of the parasite was present; and if I were ever called on again to advise in cases of malarial infection in such places as Hong Kong, I would advise every crescent-bearing malarial to quit the place for a non-malarial country, and not to return till crescents and febrile recurrences had completely disappeared. Such patients are standing on a volcano which is liable to blow up at any moment.

In addition to these hyperpyretic, comatose conditions, other forms of cerebral attack are met with in the course of fevers, such as sudden delirium ending in coma and perhaps death; convulsive seizures of an epileptic or of a tetanic cha-

acter with or without delirium or coma and which, if not fatal, may eventuate in permanent psychical disturbance; various forms of paralysis which may be complicated with aphasia.

These aphasic attacks are very interesting and curious. I was once asked to see a gentleman who had come to Hong Kong on business from somewhere in the Malay Archipelago, where he had resided for many years, and where he had suffered a good deal from fever. The night of his arrival in Hong Kong, he had promised to dine with a friend, but not turning up to dinner the friend called on him the following morning at his hotel. The friend found him "off his head," and came for me. I found the sick man lying in bed, huddled up in the blankets, apparently shivering with cold. I proceeded to examine him and to ask the usual questions. He put his tongue out and gave me his pulse to feel readily enough, but the only answer I could get to my questions was "sonna, sonna, sonna." I learnt afterwards that "sonna" is the word for a flower in one of the Javanese dialects. If I showed him an orange or a watch or a pencil—anything, in fact—and asked what its name was, the reply was invariably "sonna, sonna, sonna." He had some psychico-visual aberrations too, for when I gave him my watch to tell me the time, being thirsty, I suppose, he took the glitter of the watch glass for water, and carried the watch to his mouth and made as if to drink it. He could read a written word correctly, but he could not write it correctly. His temperature was up, and I concluded he was suffering from a malarial attack. Under quinine he improved rapidly, and in less than a week was up and about and attending to his business. Curiously enough, for some time subsequently he had great trouble with his vision owing, apparently, to spasm of the left ciliary muscle. Ultimately this gradually left him, and he made a perfect recovery.

These cerebral attacks are now explained and, it appears to me, correctly explained by the supposition that they depend on embolism by the malarial parasite of the capillaries of the various nerve centres involved—in hyperpyrexia the thermic centres, in aphasia Broca's convolution, and so on. By microscopical examination of properly prepared sections of the brain in fatal cases, such a plugging of the vessels can generally be readily observed. The preparations I showed you some time ago were of this nature. The earlier students of malarial melanæmia had remarked the presence of pigment in the cerebral capillaries in such cases, and attributed the associated symptoms to thrombosis by the pigment. But Frerichs, having failed to find pigment in certain cases attended with cerebral symptoms whilst he found it in abundance in others in which there had been no special cerebral symptoms, rejected this hypothesis. At that time the malaria parasite had not been discovered, and Frerichs was not aware, of course, that there is a variety of the malaria parasite which does not form pigment, nor were the facts of localisation of the cerebral functions so well understood then as they are at the present day.

The algid forms of pernicious attack, as indicated by the name, are characterised by collapse and extreme coldness of the surface of the body, a sort of cyanotic pallor, and a tendency to fatal syncope. These symptoms coexist with high axillary and rectal temperature. This condition may be associated with, and in a measure dependent on, acute dyspeptic trouble accompanied with severe epigastric distress, tender, retracted abdomen, incessant vomiting. Perhaps choleraic symptoms appear the stools suddenly becoming loose, profuse, and colourless, a rice-water discharge pouring from the patient as in cholera, and, as in cholera, leading to cramps in the limbs, loss of voice, pinched features, washer-woman's fingers, and almost complete suppression of urine, and, perhaps, fatal collapse. Such attacks are very deceptive and may be mistaken for true cholera; but the high axillary temperature, the history of recent ague fits, and the subsequent rapid disappearance of the choleraic symptoms on the appearance of the hot and sweating stages suffice for diagnosis, particularly if they are supplemented by a microscopical examination of the blood. Although not usual, recurrence of the choleraic symptoms may take place at the next fever period. I have seen such cases in Hong Kong. We are told that at Peshawur, and in the Punjab, the severe

malarial fever prevailing there is often ushered in by such symptoms and may be hard to diagnose from true cholera.

Another form of pernicious attack is characterised by the sudden appearance of dysenteric symptoms, perhaps by hæmorrhage from the bowel or elsewhere. Some time ago I saw such a case at Greenwich. The patient had been admitted apparently suffering from ordinary dysentery; but the house-physician, finding that the axillary temperature was higher than is usually met with in dysentery, had the wisdom to examine the blood. Plasmodia were found in great profusion. Thirty grains of quinine, instead of 30 grains of ipecacuanha, were at once given; the dysentery was speedily checked, and I believe the patient's life saved. The possibility of a suddenly developed dysentery being of malarial origin must therefore be thought of if axillary temperature is found to be high; and in every case of this description an examination of the blood should be made before the usual treatment for dysentery is instituted—a treatment which, in the adynamic state the patient is probably in, might very well prove fatal.

In the preceding types of algid pernicious malarial attack the dangerous symptoms show themselves in the rigor stage of the fever. There is yet another form in which the danger appears to depend on an exaggeration of the symptom which is usually hailed as bringing relief, and, for the time, freedom from danger. The sweating may be excessive and cause collapse which, if the patient rise up suddenly or make an undue effort, may lead to fatal syncope. Weak and cachectic patients should be warned of this possibility, and not be permitted to rise suddenly or exert themselves in any way during the defervescence of an ague attack.

The pathology of these various forms of alidity is probably of a very mixed character. In the gastric, choleraic, and dysenteric types probably there is an accumulation of plasmodia in the vessels of the intestinal mucosa; they have been seen there. In those attacks in which profuse sweating is the dangerous element the diaphoresis may be regarded, at all events in part, as symptomatic of excessive blood destruction—of what is in reality equivalent to a sudden and extensive hæmorrhage; or, it may be, that it is only an excessive reaction to the malarial toxins. The dangerous syncope attending all these types of alidity is secondary, and merely an expression of collapse.

There is one form of what is believed to be malarial infection which, though fatally common in certain countries, and though possessing very alarming and distinctive symptoms, has only very recently been differentiated and studied. I refer to bilious hæmoglobinuric fever, sometimes erroneously called hæmaturic fever, sometimes blackwater fever. This most dangerous disease prevails especially in the more malarial districts of Africa so far as we are acquainted with them. It was first described by French naval surgeons stationed at Nossibe, a French settlement off the north-west Madagascar coast. This was early in the fifties. Subsequently it was found to have a more extensive distribution, and to be common, as I have mentioned, all over tropical Africa. It is also found in America in the hotter regions, in the West India islands, in the French colonies in the Eastern peninsula. I never met with it in China, and so far as numerous inquiries I made at one time on the subject can be taken as applying to the whole of that vast country, it is found nowhere in China except at Fatshan, a large town inland from Canton, and not very far from the Tonquin frontier. Dr. Whitney informed me that he had seen it there. It is known in Assam, but, strange to say, no Indian writer mentions it as a feature in the pyretology of Hindustan proper. It is not known in our colonies in the Malay country, and I am not aware that it has been described as existent in Java and the Dutch East Indies. It is rare in south Europe, but cases are met with in Greece and Italy. Possibly it has been overlooked in India and elsewhere, being confounded with bilious remittent. It is difficult to conceive, however, that the many acute observers who have carefully studied Indian diseases for so many years could have overlooked systematically this striking disease. Possibly it does not exist in India. Indeed, certain medical men, good observers, practising in Africa declare that it is of comparatively recent introduction into that country, and, moreover, that it is yearly becoming more common there.

There is another remarkable fact about hæmoglobinuric fever which would lead us to believe that it is dependent on a form of the malarial parasite peculiar to itself. Those who have suffered from it in Africa are liable, not only to malarial attacks of the ordinary kind on their return to Europe, but they are also liable to a recurrence of hæmoglobinuric symptoms for some little time after they come home. I have seen two such cases and heard of a good many others. French writers also record some five or six cases of the same kind.

The European resident in tropical Africa regards three, or four, or more attacks of fever as a regular feature in his *annus medicus*. Some of these attacks are of little gravity; others may be severe and inconvenient but, on the whole, they are not very much dreaded. When hæmoglobinuric symptoms declare themselves such fevers are invariably regarded, and very properly so, with the utmost apprehension; for not only are the attacks dangerous in themselves—at least one in every three or four is fatal—but even if recovered from they leave the patient intensely anæmic, with damaged kidneys perhaps, and strongly predisposed to a recurrence of similar attacks in one of which he will probably succumb.

Hæmoglobinuric fever is not common during the first year of residence in Africa, though in rare instances it does occur even as early as the second or third month. It is usually after a year or two of malarial saturation, and after many attacks of an ordinary character, that it shows itself. From some statistics which I prepared from the returns regarding the white employees of the Congo Free State it would seem that the third year of residence is the one most liable to this disease. Longer residence with immunity seems to imply special resisting powers and special suitability for the African climate. Native Africans, though subject enough to intermittents, seem to enjoy immunity from hæmoglobinuric fever.

A white man or woman who has been subject to occasional attacks of fever, which hitherto he had more or less successfully combated with quinine, has a recurrence of what at first appears to be the familiar symptoms. He has a slight or a more considerable rigor followed by fever—intermitting or remitting or irregular, with or without marked bilious symptoms. Earlier or later in the attack he becomes conscious of aching, perhaps severe pain in the loins and in the region of the liver. In consequence of a somewhat urgent desire he passes water, and he is astonished to see that his urine has become very dark in colour, malaga-coloured, or perhaps almost black. The fever continues—not necessarily very high. Very likely he suffers from epigastric pain and distress, bilious vomiting to an unusual extent, and, it may be, bilious diarrhœa, or he may be constipated. The pain in the loins and liver ache continue, and the urine becomes darker and darker. By and by the patient breaks into a profuse sweat, the fever gradually subsides; the urine, which hitherto had been somewhat scanty, flows more freely, and, after passing through various paling shades from dark brown to sherry red, becomes natural in appearance again. Coincidentally with the appearance of the dark colour in the urine, the skin and scleræ rapidly acquire a deep saffron-yellow tint, which persists and even deepens during the progress of the fever, and continues for several days a striking feature in the symptoms. When the fever subsides the patient is conscious of a feeling of intense weakness from which he recovers but very slowly. Fever may recur next day, or for several days, or it may not; or it may be remittent or almost continued in type. The hæmoglobinuria may recur with each rise of temperature, or there may be only one or two outbursts of this.

In the more severe forms of hæmoglobinuric fever there is a very great deal of bilious vomiting, intense epigastric distress, and severe liver and loin ache. The urine may continue copious and very dark in colour; or it may gradually get more and more scanty, acquiring a gummy consistence, a few drops only being passed at a time. Finally it may be completely suppressed.

In those severe cases death is the rule. It appears to come about in three or four ways. The fever may assume the typho-adynamic type; or suddenly developed pernicious cerebral or algid symptoms may supervene. In other cases the symptoms may be like those consequent on sudden and profuse hæmorrhage—jactitation, sweating, sighing, syncope. Or it

may be that suppression of urine, persisting for several days, terminates; as cases of suppression usually do, by sudden syncope, or convulsions and coma. Or nephritis may ensue and the patient die from uræmic trouble three or four weeks after all signs of hæmoglobinuria and fever have disappeared.

If the characteristic dark brown urine of a hæmoglobinuric case be stood for some time in a urine glass it separates into two well-marked layers: an upper of a clear, though very dark port-wine tint, and a lower—perhaps amounting to one-half or one-third of the entire bulk—of a somewhat brownish-grey colour, consisting of a sediment in which an enormous number of hyaline and hæmoglobin tube casts are to be found together with a large quantity of brownish granular matter. Here and there epithelium is met with, but blood corpuscles may be entirely absent or very few in number. The urine turns almost solid on boiling, and for some days after it has regained its normal appearance it is still found to contain albumen, though in gradually diminishing amount.

If the kidneys of a fatal case are examined at an early stage of the disease they are seen to be enlarged and congested, the tubules blocked with hæmoglobin casts, the cells laden with yellow pigment grains and the capillaries with black malarial pigment. If the case survives three or four weeks and dies of uræmia the appearances are those of a large white kidney.

Such is a brief and imperfect sketch of this most important of the African forms of malarial poisoning—a disease which, as Africa becomes more opened up and more frequented by Europeans, is bound to occupy a greater amount of attention from medical writers than it has hitherto done.

The parasitology of hæmoglobinuric fever has hardly been worked at. Plasmodia have been found in the blood and organs, but their specific characters have not been accurately determined. Considering the peculiar clinical manifestations it gives rise to and the facts of geographical distribution, I think it very likely that the parasite of malarial hæmoglobinuric fever is specifically different from the malaria parasites usually met with in Europe and, perhaps, in India.

OBSERVATIONS ON MALARIA PARASITES

MADE IN SECUNDERABAD, DECCAN.

By RONALD ROSS, M.R.C.S., D.P.H.,

Surgeon-Major, Indian Medical Service.

THE following observations may be of interest in connection with certain statements which have been made of late respecting the malaria parasite, such, for instance, as its scarcity in India and the difficulty of finding it.

From April 28th to September 8th, 1895 (that is from the middle of the hot weather till the middle of the rains) the writer examined microscopically the blood of all the fever cases which he found in the station, namely, such cases only as are returned under the heads of malarial and simple continued fever. The large majority of the cases occurred in men of the writer's regiment stationed in a malarious quarter of the large station of Secunderabad; all were natives or half-castes, and nearly all were fresh infections. It is proper to state here that the writer, owing to pre-occupation with other microscopical work at the time, did by no means profess to make any exhaustive examination of the blood in all cases; he used the simple method given by Laveran and Mannaberg, and detailed by Patrick Manson; he examined all cases once, but many cases only once, and it should be added many cases (especially when they were coming in at the rate of 4 or 5 daily) very hastily. Out of 112 casualties the parasites of malaria were found in 69 or 61.6 per cent.; namely, 20 spring tertians, 2 quartans, 32 fresh summer-autumns, 6 cases of crescents only, 3 mixed tertians and summer-autumns, and 6 of doubtful species. It must be remembered that this 61.6 per cent. of positive cases is extracted from a total which includes those simple continued fevers which the writer for one had formerly thought to be the more common fevers of the country.

The monthly casualties were as follows: End of April (hot weather), 4 crescents only (old cases), 2 spring tertians, 4 negative. May (hot weather), 1 crescents, 4 spring tertians,

2 doubtful species, 4 negative. June (rains burst on 12th), 1 crescents, 2 quartans, 2 doubtful species, 12 negative (many possibly summer-autumns). July (rains), 2 spring tertians, 13 summer-autumns, 1 mixed, 1 doubtful species, 13 negative. August (rains), 11 spring tertians, 18 summer-autumns, 2 mixed, 1 doubtful, 10 negative. September (to 8th rains), 1 spring tertian, 1 summer-autumn.

Out of the 43 negative cases it is almost certain that a large number were cases in which the parasites had been overlooked; 5 of them, however (though malarial to judge by the symptoms), still gave negative results after repeated examinations of the blood. Of the whole number of cases not more than 2 could be diagnosed with any certainty, on a study of chart, symptoms, and blood, as being non-malarial fevers; of these one was a three weeks' fever, and the other probably of a typhoid nature.

The great majority of cases, including such fevers as the writer had formerly thought to be febriculæ, were either at once shown by the microscope to be malarial or judged to be so by a comparison of them with the admittedly positive cases. The various species of the parasites agreed closely with the descriptions of Marchiafava and others; so that there is every reason for thinking that, as Crombie has already pointed out, the Italian classification holds also for India. The quartan, tertian, and summer-autumn parasites differed markedly from each other; but, contrary to a statement of Mannaberg, the young parasites of the two former varieties exhibited often an undoubted ring form, though the rings were much larger than those of the summer-autumn parasites. In these varieties the small rings and amœboid forms were, in the majority of cases, the only parasites seen at first, but were plentiful and easily found; occasionally, however, larger pigmented forms and "brassy" corpuscles were plentiful, and of course crescents, with the flagellate evolution form, set in as usual after the febrile period. The spring-tertians were generally double, and afforded, like the two quartans, a beautiful series of specimens. In the three mixed cases there were the small summer-autumn rings and amœbæ, in addition to the larger spring forms. It is an interesting point that the summer-autumn fevers set in after mid-summer; but it is impossible to state on one year's experience whether the seasonal variations found in Italy are also found in India; the crescent cases discovered in April and May were all old infections. With regard to the type of fever, it may be remarked that with the natives of India the summer-autumn parasites do not appear to occasion much more severe illness than do the other forms, rather the contrary perhaps. It is important to note that in several persons both quartans and spring-tertians recurred, retaining the original type, so that Mannaberg's theory respecting the function of crescents can scarcely be upheld. In the large majority of attacks the fever was benign, but in four or five it was accompanied by great prostration, and in one with delirium and bulbar paresis. Two children whose blood swarmed with small rings had bronchitis, and would certainly have been diagnosed under that head but for the microscope; one of them died, the only death of the 112 cases. It was noted that in two or three of the worst cases the parasites were exceedingly rare or not found at all in the peripheral blood; thus in the case of bulbar paresis only three rings were found in a dozen and more examinations made at different times. Splenic blood was not made use of.

In almost all the specimens in which the parasite, whether spring-tertian, quartan, or summer-autumn, was found at all it was found within one or two minutes of bringing the microscope to a focus. Experience showed that quickness of microscope diagnosis depends solely on knowing how to make a specimen and what part of it to examine first: speaking generally, the smaller the parasitic form looked for the shallower must be the film of blood examined. For quick working by one familiar with the subject the only rules of technique which appear to be essential are to obtain a free (not squeezed-out) drop of blood from the finger, and to blow upon the slide in order to remove incessantly falling dust immediately before imposing the charged cover-glass. In large numbers of specimens diagnosis was effected almost immediately. The smallest summer-autumn forms were in reality *ceteris paribus* just as easy to discover as the larger parasites. In short, in the writer's experience microscopic diagnosis is