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SYMPTOMS AND DIAGNOSIS
OF
MALARIA IN CHILDREN.

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L. EMMETT HOLT, A.M. M.D.,
NEW YORK,

Attending Physician to the North Western Dispensary in the Department
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THE SYMPTOMS AND DIAGNOSIS OF MALARIA IN CHILDREN.

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L. EMMETT HOLT, A.M., M.D., New York,

Attending Physician to the North-Western Dispensary in the Department of Diseases of Children.

THE peculiar manifestations of malaria in children is a field of observation which has been much neglected. This is especially true of this country, where the opportunities for its study are so much more extensive than have been enjoyed by either English, French, or German writers. Many of our foreign text-books on diseases of children do not even allude to malaria. Of our American authors, most have contented themselves with a brief description of a remittent and an intermittent variety, divided into stages like the classical cases in adults. The organism of the child is peculiarly susceptible to all acute infectious diseases, and malaria forms no exception to the rule. Thus, it has been often observed in epidemics that young children are the first who are affected. The poison acts not only more rapidly, but more generally and more profoundly in these cases than in adults. Again, the susceptibility of the nervous, digestive, and respiratory systems produces such variations in the form and type of the disease as to mislead, at times, even those most careful in diagnosis. Often, symptoms referable to one of these organs may overshadow completely the real disease, and give an entirely new clinical picture. The attacks are so incomplete and so fragmentary, that even death may follow, in the masked forms, before the diagnosis can be made. Another reason for obscurity in the diagnosis is the fact that the symptoms often come on insidiously, and that even the family doctor is not called until it has made some progress.

The closest observation on the part of both physician and attendants is often required, in order to establish the fact of periodicity in the symptoms, or the existence of a cold or sweating stage. Occurring at the time of dentition, its symptoms are often referred to that source; in winter, to diseases of the lungs or bronchi; and, in summer, to gastro-intestinal disorders. My own experience abundantly confirms the state-

ment made by Schmiedler, that there is scarcely any disease so changeable, so obscure, and so indefinite as intermittent fever in children.

Fortunately for both the physician and the patient, when once the diagnosis of malaria is established, prognosis and treatment usually present no difficulties.

I shall, therefore, in this paper, confine myself to symptomatology and diagnosis, as the etiology, pathology, and treatment of malaria in children do not differ materially from the same in adults; and this subject has been already pretty thoroughly investigated.

I have no theories to establish, but will simply give my experience as drawn from a study of 184 cases, whose histories have been pretty carefully recorded. Nearly all of them have been observed at my clinic at the North-Western Dispensary, which draws its cases mainly from the district west of Ninth avenue, between Eighteenth and Fifty-fifth streets—a district which I believe to be acknowledged to be the most malarial in New York. As far up as Forty-second street it consists of made ground for a distance of from one to two blocks from the river. Above this point, the district covers what was once a large pond and several small streams which have been filled up.

In regard to *sex*, there seems to be very little predisposition shown. Of my cases, ninety were males and ninety-four females. Six patients were under one year old. Of these, only one was under six months. Between one and four years there were forty-five cases; between four and seven years, fifty-four; between seven and nine years, thirty-seven; over nine years, forty-eight. The greatest predisposition, according to these cases, would seem to be between the ages of four and nine years. Bohn, from 465 cases, found it greatest between two and seven years, and most of all between two and three years. The discrepancy is to be explained by the fact that his cases are taken largely from hospital and private practice, while those children who are brought to dispensaries are of an older class. He saw twenty-one cases under one year of age, seven of these being under six months.¹ He calls attention to

¹ Any one interested in the subject of malaria in intrauterine life, will find a *résumé* of the reported cases in Bohn's article, in Gerhardt's Handbuch der Kinderkrankheiten.

the fact that one-third of the cases under one year were of the irregular or masked type.

The *invasion* of malaria is frequently much more gradual in children than in adults. In 117 cases in which I have recorded the manner of invasion, it was abrupt in forty-five and gradual in seventy-two. In the abrupt cases, the symptoms noted have been convulsions, vomiting, drowsiness and prostration, fever, severe pains in the head and in the epigastrium, less frequently over the liver or spleen, splenic enlargement and often tenderness, occasionally also hepatic tenderness.

The following case will serve as an illustration of the usual course.

CASE I.—Wm. M., aged sixteen mos., was brought to the Dispensary Nov. 10th. He was reported to have been as usual until the afternoon before, when he became very drowsy and heavy, and developed a high fever, which lasted all night. During the night he was thirsty and restless, often crying out. The fever remitted this morning, but without perspiration. It returned again this afternoon with all the symptoms of the previous day. The bowels are constipated, and the child has no appetite. Rectal temperature is found to be $103\frac{1}{4}^{\circ}$. The spleen is enlarged, and seems to be tender on pressure. The tongue is heavily coated. The child was put upon cinchonidia in doses of gr. v. The fever continued, the mother reported, until about midnight, when it subsided as before without a sweat. On the following morning the temperature was $100\frac{1}{2}^{\circ}$. The medicine was continued, and no further paroxysms of fever occurred.

In cases with a gradual invasion, I have noted anemia; frontal headache; constipated bowels, or diarrhea, more frequently the former; complete anorexia; muscular weakness, tiring on slight exertion; face pale or of icterode hue, with dark rings around the eyes; nausea, with occasional vomiting; a tongue heavily furred, usually of a dirty brownish color; epigastric pains, and often tenderness; drowsiness by day, restlessness at night; slight cough; hot and chilly by spells. In many cases, these symptoms recur rhythmically every day or every other day, but very often they occur without any periodicity. The spleen, in the great majority of cases, but not in all, will be found to be enlarged.

The following case shows very well a not infrequent type of the disease, and illustrates how quickly relapses occur when the

medicine is not continued for some little time after the fever is controlled, and when the patient remains in the malarial district:

CASE II.—Julia M., aged six years, was first seen August 21st. She was reported to have been well up to one week before, since which time she had been drowsy and heavy; had vomited occasionally, and several times had been noticed to have fever, especially in the afternoon, but not coming regularly. When this came on, she always complained of great pains at the epigastrium. She had had two previous attacks of a similar nature, and in both she complained of severe pains in the stomach. Had had no chill; bowels reported regular. She had vomited occasionally, and complained of headache. She is now worse about noon. The temperature was 100°, and the tongue heavily coated. Cinchonidia ordered. She returned four days later, having taken only gr. x. of the medicine, and with no improvement. Bowels now constipated. Ordered cinchonidia in full doses, and a cathartic. She was not seen again for six weeks, as she got relief in a few days after taking the medicine. She was then brought back for a relapse of one week's standing, with the former symptoms, but more severe in type, the temperature being about 103°. The bowels were constipated. Cinchonidia again controlled the fever. She subsequently had two paroxysms with a seven-day interval. The medicine was, however, kept up, and no more fever occurred while she was under observation—a period of three weeks. The spleen was much enlarged, and epigastric pains and tenderness were prominent symptoms throughout the whole course of the disease. Sweating and chills were noticed only with the later paroxysms.

The next case shows how insidious, at times, the invasion may be, and how the cumulative effects of the poison were finally manifested in distinct and unmistakable paroxysms. The case was to me a very instructive one, so I will report it in full.

CASE III.—Annie T., aged five years, came home from the country about September 1st in splendid condition. She was plump and hearty, with an excellent appetite, and a picture, in fact, of perfect health. In about a month, she began to lose appetite and flesh, and the school-teacher sent a note to the mother stating that the child must be sick, as she wanted to sleep so much during the day, and was noticed to sweat profusely. The drowsiness began soon after the school commenced in the morning. The mother whipped the child, and sent her back to school. She began to complain much of her head being hot, soon after this. At night, she was restless, and often perspired. When these symptoms had lasted about two weeks, she

was taken with a diarrhœa, the passages soon changed to a dysenteric character, and were accompanied by much tenesmus and griping. These symptoms were severe by day, but absent entirely at night. Squibb's diarrhœa mixture was administered, and the child ordered to be kept in bed. This gave considerable relief, but did not wholly check the bowels. Vomiting was soon added, and for two days was persistent in spite of treatment. The passages again became more frequent, occurring every few minutes during the day, and very often at night. A slight febrile movement accompanied the diarrhœa. Treatment directed to the bowels reduced the number of passages to four or five a day, but the child's general condition was growing steadily worse. She now began to complain much of epigastric pains, and still had her spells of drowsiness.

She gradually failed, until November 12th, when she was seized with a severe chill at about 3 p.m. It was so severe as to make her teeth chatter. High fever followed, lasting until the night, when she was found in a profuse sweat, so as to necessitate her clothes being changed. The question of diagnosis seemed now to be settled definitely. Dextro-quinine, cinchonidia, pills and suppositories of quinine were all tried in succession. These she either refused to take, or immediately vomited or expelled, so that very little effect was obtained. I saw and examined the child for the first time on November 18th, having treated her until then according to the mother's account of the symptoms. The spleen was neither enlarged nor tender. There was some epigastric tenderness; the tongue was heavily furred, and of a yellowish-brown color, and the child was pale and anemic. The temperature was normal. That same afternoon, six days after the first, she had a second severe chill, followed by fever and sweat; the paroxysm being milder than the preceding one. Fowler's solution was now begun, ℥ v. t. i. d.

Dec. 2d. The child has taken the arsenic until two days ago, when she was so well the mother took the responsibility of stopping it. She has regained her appetite, the bowels are regular, she is lively, and complains of nothing whatever. She has had no repetition of the chill, and no fever has been noticed for a long time. She is ordered to continue the arsenic in ℥ iij. doses t. i. d.

Another child in the same family, and still another in the same house had, meanwhile, come under observation with well-marked symptoms of malarial poisoning.

In 106 cases in which the *hour of the invasion*, or the exacerbation, was noted, it took place in the forenoon in thirty-five cases, and in the afternoon or evening, in seventy-one; a proportion of one to two. It differs thus from the disease in adults, where the order is reversed. Bohn found, likewise, a great preponderance of cases in which the paroxysm came in the afternoon.

The division of the diseases into stages, as in adults, I think might be advantageously dropped altogether. Those who look, in children, for the regular succession of chill, fever, and sweat to establish the diagnosis, will be led astray in the vast majority of cases.

In 150 cases, I have noted the *chill* being present in nineteen and in only about one-half of these was it at all pronounced, these being in almost every instance over eight years of age. In fifteen other cases, chilly sensations, coldness of hands or feet, etc., were observed, making thus only thirty-four in which anything resembling a cold stage was present, or a little more than one in five. I admit that statistics taken from private or hospital practice, where children are more closely observed, might show a somewhat larger proportion than I have indicated.

Fever is one of the most important and undoubtedly the most constant of all the symptoms. Very few cases occur which, on close observation, do not show some rise in temperature by the thermometer at some period during the twenty-four hours. We have all shades and variations, as in adults. As regards the course of the fever, and this of necessity must be studied while the patient is not under the influence of quinine, my cases seem to fall into one of three groups, viz.: First, those in which the temperature rises quite high at the outset, and remains so with very little variation for twenty-four, forty-eight, or even seventy-two hours, when a marked remission occurs, and the fever thereafter assumes a distinctly remittent type.

Secondly, those in which the fever is at first slight, and only noticed at some particular part of the day, usually towards evening or at night, but gradually increases in its intensity and loses its periodic character until it may become a continuous fever, usually with slight daily remissions, not going above 103° at any time.

Thirdly, those in which the fever assumes a distinct type from the outset, remittent or intermittent, and recurs regularly until controlled by the quinine.

The last is the rarest form.

Out of one hundred and fifty cases, I have found the quotidian, in the proportion to the tertian, of five to one, and not a

single instance of the quartan type. In nearly one-third of the cases, no distinct type could be said to exist.

My own opinion is, that the general impression regarding the temperature is too high. I must admit that I myself was somewhat surprised to find, on analyzing my cases with reference to this point, that in only twenty-six, or about one-seventh of the whole number, was the temperature before the use of quinine above 104° . In only three cases did I see it above 106° . The highest recorded was $106\frac{3}{4}^{\circ}$. This occurred in an infant of ten months, and fell the next day to $101\frac{2}{3}^{\circ}$. The usual range of temperature has been from 101° to $103\frac{1}{2}^{\circ}$.

Sweating was noted in a little more than one-fourth the cases. It is thus more frequent than the cold stage. It comes later, and is very much less marked than in adults. It is stated to have been profuse in seven cases.

Cerebral symptoms of some form or other can be said to be the rule. They are noted to have been present in ninety-seven out of one hundred and fifty cases; they are noted absent in only four of my cases. Pain in the head is the most frequent. Of my ninety-seven cases, this was present in sixty-two. It has been almost invariably frontal in children old enough to describe their sensations. It has been seen quite as often in the chronic as in the acute cases. I have no doubt in my own mind that some of these were cases of supraorbital neuralgia; but in children under eight years of age, the differential diagnosis is extremely difficult.

The next most common head symptom is drowsiness or, as it is sometimes described, dullness, heaviness, or apathy. In certain cases it may amount to stupor even. In several cases children have been sent home from school because of this disposition to sleep during the day. This is usually noticed to come at some particular part of the day, and to be accompanied by fever; or it may mark the time of the paroxysm when febrile movement is altogether absent. It is always a significant symptom.

Convulsions have been recorded in four cases. In two cases the convulsion was not repeated, and occurred at the onset of the disease. One patient was a boy of eleven months, and another a boy of four years. Another case was in a girl

of twenty-one months, in which three convulsions took place on the same day, within a few hours of each other.

The fourth case, which I propose to report, presents so many points of interest that I will detail it in full. It illustrates what the natural course of the disease may be when uninfluenced by medicine.

CASE IV.—Daniel K., aged four months, was first seen October 4th. The mother was a very intelligent woman, and gave the following history:

The child had not been well for over a week, had a short cough, seemed to be losing flesh, and was not nursing as well as formerly. Four days before, about midnight, he was taken with a general convulsion, which was repeated twice that night. This was followed by fever, which lasted all the next day. The following night the convulsions were repeated early in the evening. On the third day they recurred in the afternoon. During the interval the child had been drowsy and sleepy, especially in the morning; later in the day he was very cross and restless. There had been no vomiting, and the bowels were regular until a dose of castor oil was given, which was followed by five or six evacuations. There had been more or less fever all the time. The cough had continued.

On examination he was found to be a well-nourished child, quite drowsy, and had a disposition to hold the head back. The extremities were quite cold, while the body was hot, the temperature being 105°. The respirations were eighty per minute. Physical examination revealed rude respiration over both lungs and a few fine râles, but no bronchial breathing anywhere. The diagnosis was obscure, but was thought to lie between pneumonia, meningitis, and malaria. The latter was recorded as the most probable, and treatment by cinchonidia begun.

The next morning, the temperature had fallen to 102° and the respirations to sixty, notwithstanding the fact that he had vomited every dose of the medicine. He seemed much brighter than on the day before, and the general prostration was decidedly less. The cough was loose, and the pulmonary signs much less marked. Powers & Weightman's "cinchonia alkaloid" was ordered, gr. v. q. 3 h.

The child was not brought back to the dispensary, and on November 15th I visited the house to learn the result of the case. The child was plump and hearty-looking, showing no evidence of present or previous disease. The mother said the fever had continued for about ten days after I saw the case, but it assumed after a little a tertian type, coming regularly every other day, so that the father had said "it must be the chills." The medicine I ordered was kept up only about a couple of days, and after that the child took no medicine except a little lime-water for his vomiting. The fever gradually wore off, appetite

returned, and the child rapidly regained his flesh. He had been, when I saw him, perfectly well for nearly four weeks. The family lived on the first floor of a house situated half a block from the North River.

All of the cases in which convulsions occurred terminated favorably, and only one was especially severe.

Vertigo, so characteristic a symptom in the adult, seldom occurs in children. I have only noted its presence in three cases.

Pains in various parts of the body are usually complained of by children who are old enough to talk at all. The most characteristic of these is the pain at the epigastrium. My attention was first called to this symptom by Dr. Ripley, who told me he regarded it as quite diagnostic. Since that time, I have carefully noted its presence or absence in all my cases. In one hundred and twenty-eight patients, I have found it present in one hundred and one and absent in twenty-seven. In about one-third of these, it is stated to have been severe.

I am well aware of the liability to error when looking for particular symptoms in any disease. I have sought to escape this by avoiding direct questions altogether. In the majority of instances, I am sure, the parents volunteered the information. If it was not mentioned in reply to the question, whether the child complained of anything else than the headache, as that was usually the first thing mentioned, I put it down as absent. I have often found that the mothers had come to consider it a pathognomonic symptom, where several cases had occurred in the family or repeated attacks in the same child.

As a few illustrations take the following: One little boy of twenty months, who could hardly speak as many words, it was said, every afternoon about four o'clock would put his hand to his stomach, and say "Oh!" This occurred with the other symptoms, well marked, of the onset of a paroxysm. Another little fellow of two years complained constantly, the mother said, of being "sore in his stomach." In two or three cases, the pain was described as gnawing; very often it was so severe they cried from it, and not unfrequently it formed the most prominent symptom of the disease. The pain seems to have no relation to the taking of food, coming on indifferently at any hour when the paroxysm begins, or if slight before, now

becomes more severe. In twenty-nine cases, epigastric tenderness was also present. In some patients it was so acute that they could not even bear the weight of the clothing.

I believe the epigastric pain to be neuralgic, depending perhaps upon congestion of the stomach, which is found as one of the lesions in most of the fatal cases. The pain, in almost every instance, has been promptly relieved by antiperiodic treatment, so that its dependence upon the malarial poisoning was unquestionable.

Pains in the splenic and hepatic regions are occasionally complained of, but much less frequently than at the epigastrium. Splenic tenderness is more frequent. I have noted it in about one-fifth of the cases, in many it was acute. But it is by no means so characteristic as many writers would lead us to suppose. Hepatic tenderness was seen in a few instances. Neuralgic pains in the back, the extremities, the neck, and general soreness have all been noted occasionally. This general cutaneous hyperesthesia is often acute, and, when accompanied by fever, may lead to the diagnosis of some affection of the central nervous system. In the subjoined case, the febrile symptoms were slight. It, however, illustrates well the point under consideration.

CASE V.—Robert M., aged eleven years, was brought to the Dispensary May 19th, 1882. His mother stated he had been complaining for several weeks of headache, and of late had seemed to be growing stupid. She thought he was losing his memory. For two days he had been having very severe pains in the calves of both legs of a neuralgic character, and had also complained of the parts being sore to the touch. His limbs were so weak he could scarcely walk a block and a half. A slight fever had been noticed to come on toward evening, but there had been no chill, no sweating, and no vomiting.

His axillary temperature was found 101°; he was pale and anemic; pulse regular; pupils normal. He walked unsteadily, not clearing the floor well with his feet, and seemed inclined to drag the left limb slightly. On testing the different muscular groups separately, no real paralysis could be discovered, but all the muscles seemed weaker than normal. Over the whole of both lower extremities there was great hyperesthesia, so that even moderate handling caused him to cry out with pain. This was much more acute in the thighs than in the legs. None was present in the upper extremities. Cinchonidia was ordered, and two days after he reported. There was then no hyperesthesia to be found, and he said the pains were much less severe. He could walk much better

than before. Slight fever continued for a few days, and the pains steadily improved, the medicine being kept up.

He was not seen, after a week from his first visit, until Nov. 8th, when he was found walking perfectly well, and said he had had no return of the symptoms since I last saw him.

The condition of the *spleen* was recorded in seventy-nine cases; in sixty-four, it was found enlarged, and in thirty-eight of these very markedly so; in four, doubtful enlargement is stated; and in eleven, no increase in size was found.

A word with reference to the size of the spleen in children. Canteteau gives the following dimensions, taken mainly from Sappey.

At birth, the spleen is $1\frac{1}{4}$ inches long, $\frac{9}{10}$ broad, $\frac{4}{10}$ thick; from four months to one year, 3 inches long $1\frac{1}{4}$ broad, $\frac{1}{2}$ thick; at five years, $4\frac{1}{2}$ long, $2\frac{1}{2}$ broad, 1 inch thick; at eleven years, $4\frac{1}{2}$ inches long, $3\frac{3}{4}$ broad, 1 inch thick. At birth, the weight of the spleen is to the weight of the body as 1 : 288; from four months to one year, as 1 : 103; at five years, as 1 : 88; in the adult, as 1 : 403.

The spleen is thus relatively larger at five years than at any other period of life. The capsule being less resistant than in the adult, the organ undoubtedly enlarges more readily and quickly in children. It, however, subsides quickly, and hence may be absent at the time of the examination unless this be made at the height of the paroxysm, or after the disease has existed for some time. Hence too much stress should not be laid upon the absence of splenic enlargement at a single examination. My own experience accords with the teaching of Dr. Janeway, that the spleen, unless enlarged, does not come in front of the middle axillary line. In children, the enlargement may be overlooked from the fact that it takes place in a considerable number of cases chiefly upwards and backwards. This occurs oftener, I think, than in adults. I have frequently found its upper border, as made out by percussion, as high as the seventh rib, and, in several cases, it has reached the height of the nipple, while it has been found below the free border of the ribs in a very much smaller proportion. This explains the fact why palpation does not give us more information in children. We are also deprived here of the advantage to be derived from a forced inspiration.

Personally I have found palpation without value except in an extremely small proportion of cases.

Most authorities assert that splenic enlargement is a more constant symptom of malaria in children than in adults. My own experience in adults has not been sufficiently large to enable me to generalize upon this point.

Enlargement of the liver is often present, but is less marked and less constant than the changes in the spleen.

Disturbances of the digestive system are almost uniformly present and are usually pronounced. Vomiting was present in seventy-eight out of one hundred and twelve cases in which it was mentioned. It most frequently occurred at the onset of the paroxysm; in nineteen it was persistent. In almost all cases complete anorexia exists. I have recorded the appetite as being unaffected in only eleven cases. The condition of the tongue is to be reckoned among the diagnostic symptoms. Almost all writers agree upon this point. The typical tongue is normal or slightly reddened at the edges and tip, while the centre is heavily furred, of a brownish-yellow color, which shades off into a dirty-white. A clean tongue I have noted in only nine cases. Dr. Fruitnight has called attention to the fact that the clearing up of the tongue is one of the best guides to the fact of cure. I can fully indorse this statement from my experience.

In one hundred and forty cases in which the bowels were mentioned, they were reported regular in fifty-eight. In fifty-five cases there was constipation; in many it was obstinate. Looseness of the bowels or diarrhea was present in twenty-seven cases. My statistics on this point are somewhat at variance with those given by other writers. Season and locality may explain the discrepancy. The diarrheal cases were usually in the younger children, and constipation in the older ones.

The countenance and the appearance of the skin are usually altered in malaria. The face is pale and anemic, occasionally of an icterode hue. Dark-bluish rings beneath the eyes and about the mouth are very common, and the features have a sunken aspect. This is usually marked only in the subacute or chronic cases.

In regard to *thoracic symptoms*, we may say that there are none in the simple cases, beyond a little cough, from bronchial

catarrh, which is exceedingly common. Occasionally the poison seems to be localized chiefly upon the lungs, giving rise to very obscure and very threatening symptoms, resembling much, both in symptoms and physical signs, the onset of acute pneumonia. This will be discussed more at length in speaking of complications and diagnosis.

Symptoms referable to the genito-urinary system, so far as I am aware, have not been mentioned by authors. I have noted their presence in seventeen cases. Two cases of nephritis will be mentioned under the complications. The remaining fifteen were cases of functional disorders. It is a fact worth noting that eleven of these were in females, and that ten were in patients over six years of age. Five were over nine years. It will be evident that these symptoms in children under three years of age would often pass unnoticed, hence their frequency is undoubtedly greater than the figures would seem to indicate. Retention of urine occurred in three cases, incontinence in six, and in six the micturition was reported frequent and often painful. Several cases were brought for treatment for this symptom. Examination of the urine was made in most of the cases, but gave no clue to the cause of the symptom. Prompt relief followed the use of antiperiodic remedies in almost every instance.

CASE VI.—Honora B., aged twelve years, was brought to the Dispensary Oct. 6th, with the history that for six weeks past she had been troubled exceedingly with her water, being obliged to pass it every ten or fifteen minutes during the day. At night she slept well, and was not disturbed from this cause. At no time had there been nocturnal incontinence. She had never been troubled in this way prior to the present attack. Examination of the genitals gave negative results. The bowels were regular and the appetite reported good, though she was pale and anemic and her face suggested strongly the malarial cachexia. She had had epigastric pains, but no headache. The spleen was found immensely enlarged, extending from the level of the nipple to near the crest of the ilium. There was also splenic tenderness quite well marked. A possible dependence of the urinary symptoms upon the malaria was considered, but a positive diagnosis reserved until the examination of the urine could be made. This was made the following day. Urine was of an amber color, spec. gr. 1.012, neutral or faintly acid in reaction, a slight cloudy deposit of mucus, no albumen. Cinchonidia ordered.

Four days later she reported that she was feeling very much better, and that the trouble with the water had almost entirely

ceased. On October 13th, one week after coming under observation, there was no trouble whatever with the urine, but epigastric pains and tenderness with marked splenic enlargement still existed. Ordered to continue the cinchonidia.

Nov. 10. She reports that she is feeling quite well, and has had no return of the urinary symptoms. Spleen still very much enlarged. Another child in the same family has been under treatment for malaria also, with well-marked symptoms, relieved entirely by cinchonidia.

CASE VII.—Ella K., 7 years of age, was brought for treatment Oct. 23d by her mother, who stated that the child had been troubled with nocturnal incontinence of urine at intervals for a year. She had been much worse for a few months past, scarcely a night passing without incontinence. During the day, micturition was very frequent, often every few minutes. The child had been sent from school by the teacher, because of this annoyance. For the past few days she had complained of hypogastric pains while passing water. She had had much frontal headache and pains in the stomach. The tongue was coated, the appetite poor, and the general appearance one of anemia. Drowsiness in the afternoon, and occasionally slight fever had been noticed. The temperature was normal, but the spleen was decidedly enlarged. The urine was examined with the following result: Reaction faintly acid; spec. gr. 1.008; a dense yellowish-white turbidity, which, after standing, subsided, forming a heavy deposit nearly one inch deep in a four-inch conical glass. The supernatant fluid gave albumen about five per cent by bulk. The microscope showed the deposit to be almost pure pus; there was some vaginal epithelium, but nothing else abnormal. The patient was put upon cinchonidia in moderate doses, and four days later, micturition by day was reported much less frequent. No incontinence at night since beginning the treatment. The urine was strongly acid, perfectly clear, no appreciable deposit after standing, no albumen, and only a few scattered pus-cells under the microscope.

Two and a half weeks later, the mother reported that the medicine had been taken regularly until about a week ago, when the child was so much better she had discontinued it. The epigastric pains and the headache were relieved; the appetite had improved, and there had been no recurrence of the urinary symptoms. It was normal in frequency by day, and there had been no incontinence at night. Urine was examined both chemically and microscopically, with negative results. The spleen was still enlarged, and for a few days a disposition to sleep and slight fever had been noticed every day about three o'clock. Ordered to take the cinchonidia again.

She was not seen until Dec. 8th, about seven weeks after the first visit. She had taken no medicine for nearly two weeks, and had had no incontinence until two days before, when it had returned accompanied by a fever, which came on every afternoon.

This last case presents some difficulties in diagnosis which I

myself have not been able satisfactorily to clear up. The amount of pus present is of course a sufficient explanation of the albumen which was found. The source of the pus may have been from a pyelitis, a cystitis, or some abscess rupturing into the genito-urinary tract. Its abundance and prompt disappearance would seem to justify the last theory. Hypogastric pains would look more like cystitis. The fact that the urine remained acid throughout the disease, and the absence of mucus in any considerable amount, seem to support the supposition of a pyelitis. The examination of the external genitals threw no light on the case. The existence of malaria seems to me to be unquestionable. It seems quite as clear that the incontinence depended upon it.

Under the *complications* of malaria, I shall include not only those which we see when the malarial symptoms are prominent, but also the cases sometimes termed the irregular or masked forms, which are due to the predominance of certain symptoms referable to the particular organ upon which the poison seems to be localized.

We may divide the complications for the most part into three groups: the respiratory, the gastro-intestinal, and the nervous. These, of course, vary somewhat with season and with locality. The frequency with which the respiratory and gastro-intestinal tracts are implicated is partly explained by the fact, quite generally admitted, that the malarial poison may find access to the body by either of these avenues, and thus its effect may be considered as in a measure local. But far more important, it seems to me, is it for us to remember that these form the most vulnerable portions of the child's organism. Hence we should naturally expect them to be deranged. The peculiar susceptibility of the child's nervous system, which we see daily demonstrated to us, is a sufficient explanation of the complications referable to those organs.

Commencing with the respiratory tract, I would say that I have not met with any well-marked cases of laryngeal symptoms of malarial origin. Bohn, in the *Jahrbuch für Kinderheilkunde* for 1873, reports the following case:

CASE VIII.—A child, eleven months of age, was brought to the Polyclinic May 7th, 1864, with very hoarse voice, short, hard hollow cough, in- and expiration labored, "sawing," and of

croupy quality; skin hot; pulse 160; resp. 30; fauces reddened; tonsils swollen; glands at angle of jaw enlarged and painful; lungs and bronchi free from evidence of disease. A history was given of an ordinary cough for a few days, and since noon of the same day, high fever with laryngeal symptoms had come on, increasing until they had assumed their present severity. Ice ordered locally, emetics and senega internally. Toward evening, there was an improvement in the symptoms, and no return during the night. On the following morning when seen, the stridor was all gone, and all that remained of the symptoms was a slight catarrhal cough. Temperature normal, pulse about 100. The child remained in this condition until about 5 P.M., when a return of the severe symptoms of the previous day took place: high fever, great restlessness, dyspnea, hoarseness, stridulous breathing, etc. In spite of the use of emetics, these continued until about two o'clock the next morning, when they all passed off, and the child slept well until seven o'clock. On the morning of the third day, the same favorable condition was present as on the two preceding days. Treatment by quinine was now begun. Between seven and eight in the evening, a shorter and much milder paroxysm occurred, followed by a quiet night. The quinine was continued, with the effect of preventing any return of the paroxysms. All that remained was the slight catarrh of the larynx and pharynx. The examination of the spleen was unfortunately omitted. "A new warning," says Bohn, "to omit no organ in the examination of a child." He met with another similar case in the same month, of the tertian type, in an infant, also cured by quinine.

Bronchitis is, perhaps, the most frequent of all the complications. I have found it in about one-fifth of my summer cases, and in fully one-half of my fall and winter cases. Again and again, after treating bronchitis with the usual remedies for a considerable time without making any impression upon it, have I found, upon more careful examination, an old malaria as the underlying cause. It accompanies both the acute and the sub-acute cases. In the former, occurring with acute febrile symptoms, it frequently leads to the diagnosis of broncho-pneumonia. In the latter, it often, by its protracted course, brings about an anemia and a cachexia, in which condition the children fall a ready prey to the acute pulmonary diseases.

The pulmonary congestions which we sometimes find in the most acute cases have been in my experience among the most misleading in diagnosis. They are analogous in their pathology to the congestions of the spleen and the liver. Occurring in a severe form in the adult, they are described as one of

the types of pernicious fever. I have not found them well described by any author who has written on malaria in children. I have seen seven well-marked cases without a fatal result. These, I believe, often pass under the diagnosis of malaria complicated by pneumonia.

The symptoms in my case have been quite uniform, and very characteristic. The invasion has been always acute, the temperature high, from 104° to 106° ; the respirations exceedingly rapid, in three or four instances reaching 100 per minute, and resembling more the superficial panting breathing of lobar, than the labored breathing of lobular pneumonia; the face is often cyanotic, and the pulse very rapid, from 160 to 200 per minute. There have been in one or two cases head symptoms, generally marked drowsiness.

The physical signs which I have usually found have been a slight increase of vocal fremitus, dulness on percussion, sometimes marked, but usually slight; respiration always high-pitched, sometimes broncho-vesicular; resonance of the cry exaggerated, sonorous râles, and occasionally coarse and fine mucous râles, all of these likewise of a high pitch. The signs have been sometimes general on both lungs, but usually most marked behind and toward the apices. In two instances, they have been more marked in the axillary region of one side than elsewhere. I have seen them confined to a single lung, and once to a single lobe.

Some may be inclined to take issue with me in regard to the diagnosis of these cases. To such I would say that in several of them my first diagnosis was unhesitatingly made of pneumonia; only the subsequent progress and termination of the cases convinced me of their true nature. When I have seen patients in the afternoon with the symptoms and signs such as I have above described, and found them on the following morning running about the house, with temperature, pulse, and respiration normal, and only the signs of an insignificant bronchial catarrh found in the chest; when I have seen these recur on the following days until quinine was administered, or the disease cut short with a single paroxysm by full doses of this drug; and when I have found marked splenic enlargement co-existing, I have become convinced that the explanation I have offered best accords with the symptoms.

A few illustrations will make the subject a little clearer.

CASE IX.—Hugh M., aged three years, came under observation May 15th, for slight eczema of ear, naso-pharyngeal catarrh, and bronchitis, which had existed since March. He was pale and anemic, and had no appetite. There was no fever. Cod-liver oil and tonics were ordered. Two days later, he was brought back with the history that he had been as well as usual until the evening before, when he was taken quite abruptly very ill, the cause of which was thought to be an exposure to cold upon the roof of house, in the afternoon. He had a very high fever, which lasted all night, and, in fact, until he was seen in the afternoon. This was accompanied by a cough, great restlessness, and complete anorexia. On examination, there was noted a good deal of prostration, the temperature was found $104\frac{1}{2}^{\circ}$, pulse 160, and respirations 70 per minute. Well-marked signs of engorgement at the apices of both lungs were present, and also in the right axillary region. Here were heard very high-pitched breathing, some sonorous, and a few mucous râles, but no bronchial breathing. There was slight dulness on percussion.

The diagnosis of pneumonia was unhesitatingly made. Poultices were ordered to the chest, a mixture of ammon. carb. to be given every two hours, and, in view of the height of the temperature, cinchonidia gr. x. to be taken at night, and repeated in the morning. My friend, Dr. Cauldwell, visited the boy the next day. He found him lively, playing about the bed, with a temperature of 99° , and respirations 35. The fever was reported to have kept up until about four o'clock in the morning, when it passed away, with a profuse sweat, and had not been noticed since. The signs in the chest had all disappeared, except a few scattered râles, probably the result of his previous bronchitis. The cinchonidia was continued, and no return of his febrile symptoms took place.

CASE X.—Mary S., aged fifteen months, was brought to the dispensary, August 18th, with the following history: She had been well until April last, when she had, the mother reports, "pneumonia," from which she recovered in a week, without being very sick at any time. A slight cough has persisted since that attack. For four days before she was seen, she had had fever, which had been quite high, and accompanied by a short cough, and very rapid breathing. The bowels were reported loose. No more satisfactory history can be obtained, as the child has not been very carefully observed.

On examination, she was found a stout, well-nourished child. Countenance somewhat cyanotic. Respirations 100 per minute, pulse 120, temperature 104° . There seemed to be very little prostration. An attempt was made to examine the chest, but the child made so much disturbance, nothing satisfactory was obtained. A positive diagnosis was reserved until the temperature could be watched for a day or two, the absence of prostration being the chief point against the diagnosis of pneumonia.

On the following morning, the temperature was found $104\frac{1}{2}^{\circ}$,

respirations 100, as before, but very superficial, and much less labored than is usually seen with pneumonia. Occasionally they sink to 60 or 70, but soon rise again, the child remaining quiet all the while. The cry is strong, but short and interrupted. On examination of the chest, nothing is found anteriorly but exaggerated breathing, and nothing posteriorly, except over the middle lobe of the right lung, where the breathing is very high-pitched, and at times broncho-vesicular; the resonance of the cry is exaggerated, and a few sonorous and fine mucous râles are heard. The rational symptoms are no more severe than yesterday. The child was not seen the next day, but the mother reported she was free from fever and played about during the whole day, and was not drowsy, as she had been on the previous days.

On the following day, August 21st, the fever was reported to have come on again, about noon, and when seen in the afternoon, she had a temperature of 103° , and the respiration had become accelerated to 96 per minute. Cinchonidia was now begun in gr. iij. doses every three hours. The next morning, the temperature was 100° , and respirations 48. The breathing over the right middle lobe behind is still high-pitched, but no râles and no dulness. She is ordered to continue the cinchonidia gr. iij., t. i. d. The case was not seen for two weeks, when the mother reported there had been no return of the fever, but that some cough had been present up to the present time. All the former pulmonary signs had disappeared, and only a few coarse sonorous and mucous râles were heard scattered over the whole of both lungs. Two or three other members of the family had been sick, meanwhile, with fever, which, from the meagre accounts given, seemed to be malarial. They lived on the ground floor of a tenement house, about one block from the North River.

Schmiedler seems to have seen at least one case belonging to the above category, if we may judge from the meagre history which is given in his article, in the *Jahrbuch für Kinderheilkunde* for 1879.

It is as follows:

CASE XI.—A girl, aged seven years, daily about six o'clock was taken with high fever, great restlessness, severe dyspnea, with asthmatic attacks, great precordial oppression, no known cause. All these symptoms subsided with sweating. The spleen was found enlarged, the temperature reached $104\frac{1}{2}^{\circ}$. Daily complete apyrexia. Treatment by quinine begun on the third day, abortive attack the same evening. Quinine was continued with the effect of accomplishing a complete cure by the fifth day.

That pneumonia, both lobar and lobular, do occasionally complicate malarial fever, there can be no doubt. I have seen examples of both varieties in which the physical signs were

typical. The following case affords an excellent illustration of the way in which the symptoms of the two diseases may be blended. The fever was at first distinctly remittent, then became continuous as the pneumonia developed. It declined abruptly when resolution began on the tenth day, but rose again without any change in the physical signs, being finally and permanently controlled as soon as full doses of quinine were retained.

CASE XII.—Mary O., aged twenty months, was brought to the dispensary for treatment November 8th, with the history that she had not seemed well for five days; no fever was noticed until three days before. It came on every day about 10 A. M., and lasts all day and most of the night. There had been slight delirium at night occasionally. During the day much drowsiness accompanied the fever. The child had vomited once; the bowels were regular; the tongue was heavily coated. Rectal temperature was $104\frac{1}{2}^{\circ}$, respirations 40. The lungs and the throat were examined, with negative results. There was not much general prostration. The spleen seemed tender, but the child was so irritable its size could not be made out with certainty. A brother was under treatment for malarial fever, and that diagnosis was made in this case. Cinchonidia, gr. xx. a day ordered.

Two days later, it was reported the fever had been continuously high since the last visit. She vomited three or four times this morning; bowels loose; was too ill to sit up at all yesterday, and took nothing to eat. She lay drowsily upon the mother's lap and made no resistance to the examination. Temperature, $101\frac{1}{2}^{\circ}$; there was considerable cough, but nothing important was found in the lungs. The spleen was found by percussion to be much enlarged, and its lower border could be distinctly felt an inch and a half below the free border of the ribs. The same treatment was continued. When she was next seen, three days later, the temperature was $103\frac{1}{2}^{\circ}$ and the respirations 50° . There had been little or no remission in the fever, but every night about ten o'clock the hands and feet were noticed to be very cold. She is drowsy and stupid all the time. Has vomited about one-half of the medicine. There was found at the inferior angle of the right scapula a small area of marked dulness, bronchial breathing, and bronchophony. Elsewhere the lungs were free from abnormal signs, except a few scattered râles. The diagnosis of pneumonia was now made unhesitatingly. Stimulants ordered in addition to the cinchonidia. On November 15th, two days later, the temperature was $101\frac{1}{4}^{\circ}$ and respiration 78. Fever had continued until this morning, when a decided remission occurred. Dulness, bronchial breathing and voice are still present over the same area, but there are heard also moist, mucous, and subcrepitant râles. The pneumonia is evidently resolving. The next day the signs of resolution were more marked, but the temperature had

risen to $102\frac{3}{4}^{\circ}$, the reason for which became apparent when it was learned she had had no cinchindia for nearly three days. It had caused so much vomiting the mother had discontinued it altogether. Dextro-quinine was ordered, gr. v., q. 4 h., and on the next day, the 17th, the temperature was $98\frac{1}{2}$, respirations 32, and the spleen normal in size. This medicine was continued; no further rise in temperature took place; the lung cleared up completely in a few days, and a rapid convalescence took place.

She was examined about two weeks later, and no relapse had occurred.

I have seen another case in which malarial symptoms were so interwoven with those of lobular pneumonia as to obscure the diagnosis for a long time.

The explanation of these cases, it seems to me, is that the repeated congestions which occur in the lung finally lead to the development of the inflammatory process, rather than that, debility induced by the pneumonia leads to a manifestation of malarial poisoning which had been latent. I have, however, seen one case which seemed to have developed in this way.

Pleurisy with effusion I have seen in only one case; its occurrence with malaria seems to have been a coincidence merely.

True spasmodic asthma of malarial origin I have seen in six cases. I am indebted to Dr. Ripley for first calling my attention to this complication. Bohn merely alludes to it. I have been unable to find any description of it in any of the works on malaria in adults which I have consulted. In one of my cases it followed an acute pulmonary congestion and was accompanied by slight bronchitis. In four cases the febrile symptoms were very slight and in some absent entirely. The occurrence of repeated attacks with marked splenic enlargement and the prompt relief on the exhibition of antiperiodics were the characteristics of the cases. In most of them the paroxysms were accustomed to come on early in the evening of each day. It was for relief from these attacks that the patients usually applied for treatment. Their dependence upon malarial poisoning was not made out in some cases until several attacks had been observed, which were very slightly or not at all affected by the usual remedies.

CASE XIII.—James O., aged six years, came under observation at the Dispensary October 15th, 1882, pale and anemic, with a

coated tongue and a loose cough; slight fever reported at night, bowels regular. Only a hurried examination was made and a cough mixture and a tonic ordered. He was not seen again for two weeks when he came back with his cough aggravated, a history of marked febrile movement for a week, higher every night, and frequent sweats occurring irregularly. For the past two weeks he had had severe dyspnea which came on in paroxysms every night, so severely he could scarcely lie down. Breathing was accompanied by a loud wheezing which could be heard all over the room. During the day he suffered little from dyspnea, but complained much of pains in his stomach which he had never done before, and of severe frontal headache, gradually growing worse for the past week. Never any symptoms of asthma present before this attack. A maternal grandfather was reported to have had asthma, but no other cases in the family.

The spleen was found enlarged. Over the whole chest, but especially behind, were heard an abundance of sibilant, sonorous and musical râles, and some of a mucous and suberepitant variety. The breathing was somewhat labored and expiration was prolonged. Temperature about 100°. On the following morning râles of the same character were heard, though much less abundant, and the temperature was normal. Diagnosis of asthma of malarial origin was now unhesitatingly made and cinchonidia gr. v., 4 t. d. ordered.

A note made four days later, states that he had had little or no return of the fever. The dyspnea and wheezing at night had been much less marked though they had existed. A few mucous and sonorous râles were heard at the lower half of the chest behind, pain in the stomach was still present. Temperature was normal; ordered to continue the medicine.

On November 6th, three days later, it was reported he had had no more pains, fever only once and then slight, still some cough and a little wheezing at times. Continue the medicine.

November 9th, on examination of the spleen, a few days ago, no enlargement could be found. He has had no more fever and no more pains, the tongue is clean, the appetite good, and no abnormal signs found in the lungs. To continue the medicine in gr. iiij. doses t. i. d. for a week, and then stop it altogether.

CASE XIV.—Peter K., aged six years, was brought for treatment July 24th. The notes taken at that time state that he had been complaining for a month of attacks of dyspnea and had been worse for two weeks; dyspnea being especially marked when he was lying down. He had had similar attacks previously. The lungs were not examined for lack of time, as I had thirty-two other new cases that afternoon. The case was regarded as one of chronic bronchitis, a simple cough medicine and a tonic ordered. The next morning the lungs were examined with some degree of care. Over the whole chest, in front and behind, were heard an abundance of sonorous and sibilant râles, some being musical in quality; no moist râles; there was considerable dyspnea manifest. The temperature was normal. No history of asthma in

either parent could be traced, but a maternal uncle was said to have suffered from this disease. The diagnosis of asthma was made and a belladonna mixture ordered. About a week later, he was reported a little improved.

He was not seen again until August 30th, when the mother brought him back, saying that the previous attack had gradually worn off, the medicine not being continued. He had then been quite well until about five days ago when his symptoms returned. The mother volunteered the information that with each one of these attacks he had complained of severe pains at the epigastrium, which seemed to her a singular coincidence. Our suspicions were aroused and on examining the spleen it is found immensely enlarged, extending downward to the crest of the ilium. The following history was obtained :

The first attack occurred about three and a half years ago. She lived then in the same neighborhood as now. Since that time he has had frequent attacks, always more often in spring and fall, lasting usually from four to six days. Never has there been marked fever, but often slight; bowels usually regular; vomiting often occurs in the attacks. No exciting cause known. All the attacks have been very similar to this one. Severe dyspnea always worse at night, at times amounting to orthopnea, when he assumes the characteristic asthmatic position. Attacks do not come suddenly, but are from twelve to twenty-four hours in developing.

Physical examination of the chest reveals all the signs of spasmodic asthma. The breathing is loud and wheezing and can be heard some distance from the patient. The heart is slightly enlarged, but no valvular disease can be made out. He is very pale and anemic. The tongue has a dirty brownish coating. Temperature $101\frac{1}{4}^{\circ}$, respiration 32, pulse 120. The bowels are loose. There is some tenderness over the epigastrium. Cinchonidia sulph. gr. v., 4 t. d.

The next day the mother reported that the severe dyspnea which had been accustomed to come on about eight o'clock, often so as to prevent sleep altogether, was not seen yesterday and that during the night no wheezing whatever was present. His temperature was then 100° , the breathing was natural, and the pulmonary signs normal. He said he was feeling much better. On the following day he was seen. His temperature was normal and he had had no return of his dyspnea. He did not appear again for a month. I visited the house and learned from his mother that the medicine had been discontinued a few days after I saw him and that he had had a relapse a few days before my visit. He did not come again under treatment.

The gastro-intestinal disorders which accompany malaria have been, for the most part, considered under the symptomatology. It only remains for me to mention here a class of cases in which we have the following symptoms: Vomiting and diarrhea, or diarrhea alone, recurring periodically every day or

every other day, usually accompanying a febrile attack, the symptoms during the apyrexia being slight or absent entirely. The passages are often of a dysenteric character, being streaked with blood and accompanied by tenesmus. In some cases the febrile movement is absent entirely. The spleen is usually enlarged. The symptoms are but slightly affected by ordinary remedies, but yield readily to anti-periodic treatment. Case III. reported above illustrates this point. I have seen several which resembled it. I have not, however, met with any such typical cases as the following which are reported by Schmiedler. They occurred in Breslau, one of the most malarial cities in Germany.

CASES XV., XVI. and XVII.—Two little girls, aged respectively eleven months and two and a half years, on returning to the city from the mountains, were immediately attacked with a severe diarrhea without any evident cause, and which would not yield to any of the ordinary astringent remedies. The youngest became very weak and emaciated. He found on close questioning that the diarrhea came on every night at about three o'clock, with considerable prostration and great restlessness, but without fever being especially noticeable. Toward noon improvement always took place, the appetite returned and for the rest of the day they felt quite well, resting quietly until the hour named, when they awoke with erying, and diarrhea followed. Considerable enlargement of the spleen was found in both cases. Full doses of quinine were ordered; the attacks were immediately controlled; the splenic enlargement disappeared and no relapse occurred in either instance.

In the third case, in a girl of six years, every evening punctually at seven o'clock, severe diarrhea took place, the passages being streaked with blood and as many as a half-dozen occurring in the course of three hours. The spleen was enlarged, the temperature ranged from 103 to 104°, with the general symptoms of very great prostration. By day there was complete apyrexia. The ordinary treatment was without effect. Quinine in full doses was then given and controlled the attacks. One relapse occurred after a few days with the former symptoms. This also was controlled by quinine, and no further trouble followed.

The derangements of the nervous system in children depending upon malaria are numerous. Neuralgias, though by no means so frequent as in adults, yet do occur. I have notes of several cases of the supra-orbital type. The epigastric pains are, I think, often to be regarded as purely neuralgic. Schmiedler records a case of sciatica in a child of two years and a half recurring in paroxysms of a tertian type until quinine was admin-

istered. I have notes of ten cases in which neuralgic pains in the extremities were prominent; in two cases it was for these that the patients were brought for treatment.¹ In two instances the pains were associated with very marked hyperæsthesia of both lower extremities, especially acute in the thighs; here handling the parts gave so much pain that they cried out. All these cases were in patients presenting other well-marked symptoms of malarial poisoning and were promptly relieved by quinine.

Motor disturbances are less frequent than the sensory. I have met with three cases in which paresis of the lower extremities was present. In two cases it was associated with severe pains, and improved rapidly under anti-periodics until a perfect cure took place. The third case was not traced; when last seen there was some improvement, but some lameness existed. Various spasmodic disorders have been observed as complications. Cases of torticollis of malarial origin in children have been recorded by Thornberry, Schmiedler, and Bohn. My friend, Dr. Cauldwell, who had charge of my clinic in my absence last summer, met with a case in a girl, seven years old. It came on with acute febrile symptoms and had existed two days before the patient was seen. It was promptly relieved by the use of antiperiodics. The only case I have myself seen, has come under my observation since I began the preparation of this paper. It occurred in a boy of eight years. Every afternoon about one o'clock he had fever and his neck became perfectly rigid and rotated to the left side. Both symptoms lasted until he went to bed. On awaking in the morning he was well and the neck was perfectly mobile until the time of the paroxysm. He had an enlarged spleen and other symptoms of malaria. The paroxysms were immediately controlled by quinine, and up to the present time they have not returned.

I have seen chorea as a complication of malaria in two cases in which some etiological connection could be traced. May it not be that this occurs oftener than we imagine, and that the very prompt improvement which takes place under the use of arsenic is in part explained by this fact?

¹ See case V.

Epilepsy and malaria have been associated in one case; this was probably a coincidence.

Of nervous origin certainly are to be considered the disorders of micturition which have been mentioned as existing in fifteen cases. The cases of malarial asthma might also be classed under this head.

Among the *other complications* occasionally met with was vaginitis, which was seen in three patients. It seemed to result only indirectly from the general debility produced by the malarial poisoning. In one of these, frequent small hemorrhages occurred from the vagina. Hemorrhages from the gums I have seen in two cases and epistaxis in one. None were severe.

Nephritis was seen twice; in one case it was mild and disappeared in a short time under treatment. The urine in this case was scanty, about four ounces in twenty-four hours, sp. gr. 1016, and contained a small quantity of albumen, hyaline and blood casts, and also blood and pus corpuscles under the microscope. The second case also occurred in a boy of four, who came under observation on the fourth day of his illness with a temperature of $105\frac{3}{4}^{\circ}$. About five days later, just as his malaria was being controlled, almost complete suppression of urine took place, only three ounces being passed in forty-eight hours; persistent vomiting had been present for two days previous. There was no dropsy at any time. The examination of the urine showed: sp. gr. 1014, color reddish-brown, albumen about ten per cent bulk, and under the microscope large numbers of hyaline, granular and epithelial casts, granular matter and blood in large amount. He subsequently passed out of my hands, was circumcised by another doctor for retention, under whose treatment he died comatose, the mother told me, on the sixteenth day of his illness.

I have seen urticaria in two cases. Jaundice I have never met with, nor did Bohn among four hundred and thirty-five cases. Herpes about the mouth is not uncommon. Tonsillitis I have seen associated with malaria in a few cases.

The *prognosis* of malaria in children is good in the vast majority of cases. The acute attacks are usually readily controlled, provided only the patients can be made to take and retain the quinine or some of its substitutes, which is often a matter of a

great deal of difficulty. When the disease is seen in its chronic form the system has usually become so saturated with the poison that, although we may relieve the symptoms for the time, relapses take place unless the medicine is continued for a long time, or the patient is removed from the malarial district. Neither of these latter conditions can be often fulfilled in dispensary patients and hence relapses occur in an immense number of the cases. The general impression among authors seems to be that these are more frequent in children than in adults. Griesinger found relapses in sixty-four per cent of the cases from one to ten years of age; and in thirty-eight per cent of those from twenty to thirty years.

The case which proved fatal by a complicating nephritis has just been referred to. The following is the only other fatal case I have seen, and is reported in order to impress the fact that even in this climate an uncomplicated intermittent fever may produce death.

CASE XVIII.—Lena M., ten years, came to the Dispensary Sept. 4th, 1882. She had lived on Staten Island until ten days before, when she came to the city. Was well until five days ago when she was taken in the afternoon with a severe chill followed by high fever. The fever had continued since, with morning remissions and evening exacerbations every day. The chill had not been repeated until this afternoon, when it came on tolerably well-marked. She complained, during the exacerbation of the fever, of pains in the back and extremities. Vomited occasionally. On examination she was found very weak, hardly able to walk. All the muscles in a state of tremor. Spleen greatly enlarged; axillary temperature 106° . Ordered cinchonidia gr. xl. a day, patient to be put in bed and kept there.

The following facts were learned from the aunt who came two days later for a death-certificate. She took her medicine regularly and kept it down, rested poorly on the night after her visit to the Dispensary, but the next morning felt so well she was allowed to get up and seemed to be free from fever. Vomited once. Lay about on the lounge the greater part of the day, feeling weak and very tired. Bowels moved and water passed normally. She took a little food, without much relish, however. About 7.30 in the evening had a very severe chill so that she shook, lasting about half an hour, followed by very high fever. Great pains in back and legs; no vomiting; mind clear. Took medicine at ten o'clock and kept it down; no marked dyspnea noticed; about an hour and a half later "great cramps in the stomach," so she groaned and rolled off the lounge where she was lying, and died easily in a few moments. Up to this time she had been lying quietly.

Autopsy made eighteen hours after death.

Head not examined.

Extensive adhesions over a great part of the left pleural surface. No adhesions on the right side. Both lungs showed very marked edema and congestion, the left a little more than the right, but were in other respects normal.

About half an ounce of clear serum in pericardial sac. The heart was flabby, empty and showed no valvular disease. Liver seemed enlarged and was markedly hyperemic. Spleen very much enlarged, measuring $6 \times 4\frac{1}{2}$ inches. It was of a dark color, friable and intensely congested.

Kidneys seemed normal to naked-eye examination.

With reference to the *diagnosis* of malaria in children, it is evident from the foregoing that there is no single symptom which can be regarded as pathognomonic. The history of the symptoms is often far more important than the symptoms themselves. Yet we must not lay too much stress on periodicity. I have seen many well-marked cases in which it was wanting. The enlargement of the spleen is without doubt more important than any other single symptom; but this I have found absent in nearly one-seventh of the cases. Next in value to this symptom I would place the existence of fever, which careful thermometrical observation will show to be present in most of the cases at some time during the day, usually toward evening. The peculiar drowsiness with frontal headache, the severe epigastric pains, the brownish-yellow coating of the tongue, the complete anorexia, the constipation of older children, the looseness of the bowels of the younger ones, the anemia and the peculiar sunken expression of the face with the dark rings about the eyes, are about all the other symptoms I have found valuable as a means of diagnosis.

The recognition of the irregular or masked forms is often more difficult, because the fact of the frequent dependence of these disorders upon malaria is not appreciated, even in a district so malarial as New York.

Thus the bronchitis, the asthma, the neuralgias, the torticollis, the urinary and gastro-intestinal disorders, may present nothing in themselves which at first would excite a suspicion of malaria. The fact of their dependence upon this is to be established mainly by four points:

1st. Periodicity in the symptoms.

2d. The co-existence of splenic enlargement.

3d. The failure of the usual remedies to relieve the symptoms.

4th. Their prompt disappearance under the use of anti-periodics.

The *differential diagnosis* of malaria in children is to be made from intestinal worms, dentition, gastritis, gastro-enteritis, bronchitis, pneumonia, the exanthemata, typhoid fever, and meningitis.

The coated tongue, the deranged bowels, the abdominal pains and the slight fever, are not infrequently referred to worms. The administration of anthelmintics is sometimes the only means of establishing the diagnosis.

An examination of the gums will usually settle the fact of dentition. The gastritis which is so often accompanied in young children by a considerable febrile disturbance, and with frequent vomiting and abdominal tenderness, I have found extremely difficult to differentiate from malaria. Often nothing but the effect of treatment will decide the question. The spleen should always be examined in doubtful cases, and the symptoms closely watched for any periodicity. The same may be said of many cases of gastro-enteritis.

In differentiating between the pulmonary congestion which accompanies malarial fever and the invasion of pneumonia, there must always be a degree of difficulty. The condition of the lung in the two cases is very nearly, if not quite the same. The temperature in both is high, the pulse and respiration rapid. Either may begin with a chill or convulsion. The pain and tenderness in the region of the spleen or the liver may be thought to be pleuritic. The enlarged spleen and liver, and the consequent compression which these make upon the lung, give rise to dulness, which may be mistaken for consolidation of the lower lobe of either side. The auscultatory signs may be identical in both diseases.

To distinguish between them I have found two points of especial value. The amount of general prostration which exists in pneumonia is much greater than that which I have found in the malarial cases. This want of correspondence between the temperature, respiration and physical signs in the chest on the one hand, and the general symptoms on the other, forms a striking picture and should always arouse the suspicion of ma-

laria. In two or three cases I have been able to make a correct diagnosis at the first examination by this fact. The second point is the existence of splenic enlargement. This will almost invariably be found, as these cases are acute, and it is only during the paroxysm that real obscurity exists. The difficulty of deciding positively regarding the condition of the spleen is much increased in children too young to take a forced inspiration. As the disease advances, the course of the temperature, and the variable character of the physical signs in malaria, place the diagnosis beyond all questions.

The onset of measles is not often mistaken for malarial fever. An error is much more likely in the case of small-pox or scarlatina. In some cases we are obliged to wait for the eruption before making a positive diagnosis; but usually the course of the temperature, the fact that any one of these diseases is prevalent, and the condition of the spleen are sufficient data.

The headache, the attacks of drowsiness, the slight fever, the irritable stomach, the constipation, and the cachexia may lead to the opinion that tubercular meningitis is developing; while in the acute cases the initial convulsion, the high fever and the hyperesthesia, when taken with drowsiness, headache and stupor, may cause cerebro-spinal meningitis to be suspected. The symptoms above given must here be relied upon for the diagnosis; the especial points being periodicity in the head symptoms and the condition of the spleen. The *experimentum crucis* is the administration of a few full doses of quinine.

Still more difficult is it to distinguish between typhoid and malarial fever. The mistake is much more often made of regarding cases of typhoid as malarial, than *vice versa*. Typhoid in children is usually milder than in adults; its course is shorter, the temperature is more likely to be high at the outset and the eruption is more often absent, especially in the mild cases. Prof. Janeway has called attention to the fact which he has often observed in epidemics of this disease in institutions, that in quite a considerable number of cases where it has come on with well-marked symptoms at the outset, it has aborted after four or five days or a week. Others beginning in the same way proved fatal, and autopsies revealed the characteristic lesions of typhoid. These considerations, taken in connection with the fact that bronchitis, looseness of the

bowels, splenic enlargement and abdominal pains and tenderness, are prominent symptoms in both diseases, show how exceedingly difficult it may be at times to distinguish between typhoid fever and malaria. The course of the temperature and the effect of quinine are about all the differential points we have. A normal morning temperature, and an evening one below 102° on the third or fourth day of the disease almost certainly excludes typhoid. The different etiological factors should be carefully weighed in every doubtful case.

From the foregoing discussion the following conclusions are drawn :

1st. Malaria in early life presents symptoms peculiar to that period, and differs from the same disease in adults as widely as does pneumonia.

2d. The classification of the cases as remittent or intermittent, and the division into hot, cold and sweating stages as in adults, leads to misapprehensions regarding the course of the disease and confusion in diagnosis.

3d. In any acute febrile disease presenting an unusual course the spleen should always be examined, especially in a district as malarial as New York.

4th. In obstinate cases of diarrhea or bronchitis not affected by ordinary remedies, especially if these symptoms show a tendency to periodicity, malaria should always be investigated as a possible cause.

5th. Spells of drowsiness and frequent attacks of epigastric pains should always excite suspicion.

6th. In children, it is even more necessary than in adults carefully to interrogate every organ before making a diagnosis where the symptoms are at all obscure.

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For an extensive bibliography of Malaria in general, see the articles of Hertz and Griesinger.

