NOYES (Wm B.)

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Read in the Section on Diseases of Children at the Forty-sixth Annual Meeting of the American Medical Association at Baltimore, Md., May 7–10, 1895.

BY WM. B. NOYES, M.D.
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ENTERIC FEVER IN INFANCY.

The subject of typhoid fever in infancy is one which has been much discussed recently and in former years, but it is brought up again for new study because of the great uncertainty which still exists in the minds of many in regard to its occurrence, the indefiniteness of most of the literature on the subject, and the very great importance which the exact knowledge of typhoid fever must always have in all its different phases.

In medical literature, recent and old, some authorities of high repute speak of having seen scores of cases in early infancy and childhood and consider the disease not uncommon. The other extreme is represented by Northrup, of New York, who is exceedingly skeptical of its occurrence in infancy. His belief is based on his experience in the last twelve years at the New York Foundling Asylum where 1,800 children constantly under observation living inside and outside of the hospital, liable to every possible exposure which New York city can furnish, have never at any time developed a single case in children under 3 years of age.

Dr. O'Dwyer, with twenty years' experience in the same institution, has seen nothing of it. The physicians of the New York Infant Asylum, a smaller but active children's service, have never observed it. The Children's Hospital of Philadelphia, the largest service in the United States, according to the statement of the resident physician, Dr. Page, has never had a case of typhoid fever in early infancy.

With these statements and the negative records of most institutions in this country in regard to the occurrence of typhoid fever at this age, you will real-

ize that it is necessary to study very carefully the following statistics which I have collected from the entire medical literature on the subject, after which a careful discussion may enable us to reach more positive conclusions than have hitherto been possible:

I.—TYPHOID FEVER IN ENGLISH EPIDEMICS.

1. In London epidemics, according to the *British Medical Journal*, 1882, there occurred in 1870–71, 126 deaths under 5 years of age, or 18 per cent. of all cases. In 1880 there occurred fifty-eight deaths under 5 years, or 13 per cent. of all cases. In 1881, eighty-three deaths under 5 years, or 8 per cent of all cases.

2. In an epidemic in Stockport, England, 1890, there occurred 218 cases, 8 of which were under 5 years of age.

3. In Southend, Essex, from January to October, 1890, out of 152 cases, 65 per cent. occurred under 15 years, 13 per cent. under 5 years, including a male infant under 1, nine boys under 5.

4. Murchison reports in 5,911 cases of typhoid fever in the London Fever Hospital fifty-eight cases, thirty-four females, twenty-four males, under 5 years of age.

5. St. Thomas Hospital Reports record from 1878 to 1880, 3 cases under 5 years, out of 124 cases of typhoid fever.

6. St. Bartholomew Hospital Records from 1875 to 1880 report out of 113 cases of typhoid fever, 9 under 5 years of age, with 1 death.

7. Homerton Fever Hospital Records show an average of 2.4 per cent. of their cases of typhoid fever from birth to 4 years, 11.24 per cent from 5 to 9 years.

8. The Metropolitan Asylums Board of London, representing nine fever hospitals record from 1871–93, 266 cases of typhoid fever under 5 years, with 33 deaths.

Of cases older they report: From 5 to 10 years, 1,143 cases, mortality 102, or 8.9 per cent.; 10 to 15

years, 2,019 cases, mortality 265, or 13.1 per cent.; 15 to 20 years, 1,955 cases, mortality 346, or 17 per cent.; over 40 years, 338 cases, mortality 96, or 29.3 per cent.

The Northwestern Hospital alone, from 1889 to 1893, had 101 cases of typhoid under 5, with 9 deaths. (See report for year 1893 of Metropolitan Asylums Board.)

II.—EPIDEMICS OF TYPHOID FEVER ON THE CONTINENT.

1. Gassicourt, out of eighty-five cases of typhoid in Hospital Trousseau, Paris, records three cases from 1 to 2 years, eight from 2 to 5 years, thirty-four from 5 to 10, of which fifty-five were mild, twenty-two moderate, eight severe, and four fatal, or 4.6 per cent. (*Rev. des Maladies de L'Enfance*, 1890.)

2. In Berlin, 1878, 623 deaths from typhoid were reported, of which 98 were under 5 years, 39 from 5 to 10 years, (Keating, Arch. Pediatrics.)

3. In Heidelberg, from 1861 to 1879, Roth in the *Arch. fur Kinderheilkunde* 1881, reports eighty-two cases in the Luisenanstalt and Polyclinic under 15, five under 5 (one in the first year, three in the second) thirty cases from 5 to 10. These are endemic cases.

4. In Gerhardt's *Kinderkrankheiten*, vol. I, page 50, Wolff states that in an epidemic at Erfurt, 23.6 per cent. of all fatal cases occurred in children. From birth to 1 year, 7.5 per cent; 1 to 2 years, 12.7 per cent; 3 to 5, 42 per cent; 6 to 10, 28.2 per cent.

5. In Basel, out of 2,213 fatal cases of typhoid fever, between 1824 and 1873, from birth to 5 years there occurred 108 cases; from 6 to 10 years, 85 cases. (Same authority.)

6. Barthez and Rielliet (*Maladies des Enfants*) studied 1,113 cases of typhoid which passed under their observation; of these 90 cases occurred from 2 to 4 years, mortality 25 per cent.; 176 occurred from 5 to 7 years, mortality 26; 349 cases occurred from 8 to 11, mortality 37 deaths; 498 cases occurred from 12 to 15, 68 deaths.

7. Archambault (*Gaz. Med. de Paris*, 1880) out of 165 cases under 14, reports two cases at twenty-one months, nine from 2 to 4 years, seventeen from 4 to 6 years.

8. Griesinger out of 510 cases in Zurich, between 1850 and 1863, reports 3.3 per cent. between 1 and 9; 20.1 per cent between 10 and 20.

III.—AMERICAN STATISTICS OF TYPHOID EPIDEMICS.

1. Report of Board of Health, Michigan, 1884, records an epidemic of thirty-one cases, all but six under 9.

2. Pennsylvania Board of Health, in 1885, reported an epidemic at Plymouth of 1,071 cases, 220 cases under 10 years, including: 4 infants 1 year old; 14 infants 2 years old; 10 infants 3 years old; 24 infants 4 years old; 27 infants 5 years old; 31 infants 6 years old; 33 infants 7 years old; 42 infants 8 years old; 404 cases from 10 to 20 years, 260 from 20 to 30.

3. In Providence, R. I., in an epidemic in 1883, reported in the *Boston Medical and Surgical Journal*, 1883, out of 200 cases, there occurred 15 cases between the age of 1 and 5 years; 32 between 6 to 10.

4. In the Windsor, Vt., epidemic reported in the *Medical Record*, 1894, out of 130 cases, 24 occurred from 3 to 10 years; three cases under 3 years.

5. In the Montclair epidemic, 1894, to which I shall again refer, there were 115 cases of typhoid fever, 8 being infants under 3 years of age.

6. In *Boston Medical and Surgical Journal*, 1888, Holyoke reports an outbreak of typhoid in the Home of the Boston Children's Friend Society. Of fifty children over 6 years of age, thirty-five were infected with typhoid fever; of fourteen children from 4 to 6 years, six were infected; of ten under 4 years, one was infected.

These statistics, selected with care from a mass of less reliable reports, absolutely prove that during epidemics, typhoid fever is very common in childhood, and that in the first five years of life it occurs

in a regular proportion of cases quite as frequently as one would expect from the special diet and care infants receive. If we have been free to a certain extent from these epidemic cases in America, it simply indicates that we have guarded the children better than they have abroad.

IV.—DOES TYPHOID FEVER OCCUR IN INFANCY EXCEPT IN EPIDEMICS?

In the *Medical Record* March, 1895, Stowell published an elaborate table of eighty-five cases under 3 years, representing all the available sporadic cases, of which the diagnosis is strictly reliable. Gerhardt gives a series of twenty cases, Henoch thirty-five; Earl, Christopher and all who have written on this subject have reported cases. Some are entirely trustworthy, others not. It is not of very vital importance for our discussion to give a detailed account of these isolated cases. The question is not whether cases of this disease have at rare intervals been observed, but whether in cases always passing before us, especially in the class of intestinal troubles with a continued fever, that appear so frequently in clinics and general practice in the summer, there are not quite often genuine cases of typhoid fever in infants overlooked.

The diagnosis wrongly applied may be malaria, gastro-enteritis, broncho-pneumonia, tuberculosis or meningitis. For this reason a very careful consideration of the symptoms is necessary.

V.—PATHOLOGIC LESIONS.

A study of the ordinary lesions of typhoid fever as it appears in adult life need not detain us. In infancy, all the abdominal viscera will be found more or less congested. The spleen is enlarged and swollen to far beyond its usual size. The entire mucous membrane of the intestine is congested, especially in the Peyer's patches and in the solitary follicles, which increase in size through proliferation of the lymphoid

cells, forming what Henoch and Rielliet called "plaques molles." This hyperplasia may be followed by fatty degeneration of the new formed cells, terminating in resolution; or it may develop into what they call "plaques dur," which indicate that an infiltration of the entire follicle and the tissues beneath has taken place. This stage may be followed by exfoliation of superficial epithelial cells, necrosis, ultimate formation of ulcers. This swelling of Peyer's patches occurs earlier in children than in adults and is sufficient to make the patches protrude beyond the mucous membrane in projections which are frequently the seat of little excoriations, which may later develop ulcers and sloughs, as occurred in twenty-nine out of forty-four of Gerhardt's post-mortem examinations. But in infants this simple hyperplasia generally clears up without ulcerations, which Vogel, Friedleben and other authorities claim never to have seen under 5 years. Henoch found ulcers thirteen times in 23 autopsies out of 239 cases of typhoid fever in young children, and noticed that they were generally small, shallow, occupying a part instead of the entire Peyer's patch. All this process inevitably causes the mesenteric nodes to swell as in lymphatic infections in other parts of the body. The swelling is not a condition peculiar to typhoid fever. But it is more marked than in almost any other intestinal trouble.

The pathologic changes in the cases in infancy, while distinct, are much less severe than those occurring in adults. It is a very interesting fact that in a series of animal inoculations with typhoid bacilli by Sanerelli (*Annals de L'Institute Pasteur*, 1892-1894) the changes in the intestine and other viscera were almost identical with those we have just described in children. These experiments consisted of a series of inoculations of rabbits, guinea pigs, white mice and monkeys with pure cultures of the Eberth bacillus, and were followed by a second series of experiments of inoculations with sterilized

filtered products of the Eberth bacillus. The results were similar in the two cases. Swollen hyperemic spleen, congested intestine, diarrheal intestinal contents, infiltrated and congested Peyer's patches, red and hypertrophied solitary follicles. Hardened microscopic sections of the intestine showed a change in the epithelial lining especially, and detachment of masses of epithelial cells together, such as occurs in a poisoning by arsenic or other corrosive drugs. Enormous infiltration of Peyer's patches occurred, abundant accumulation of lymphoid cells in and around the follicles and invading the submucous spaces. This change was not a simple hypertrophy of lymphatic plaques, but a condition just short of a beginning purulent infiltration. No typhoid bacilli could be found in these Peyer's patches in the animal, but enormous numbers were seen in the adjacent lymphatic glands and in the connective tissue of the mesentery. From these experiments, Sanerelli comes to the conclusion that typhoid fever produced in animals is by preference an infection of the lymphatic system, and the toxin produced by the Eberth bacillus causes the anatomic lesions. These changes occur in all mucous surfaces and we should expect to find in both animals and in man lesions in the mucous membrane of the mouth, larynx, bronchi and stomach with resulting symptoms, which as a matter of fact occurs very frequently. Typhoid fever can no more truly be called a disease of the intestine than smallpox of the skin, though both have their characteristic lesions in those places.

V.—DIAGNOSTIC SYMPTOMS.

The symptoms in adult life are familiar. The following symptoms may be regarded as characteristic of the cases in infancy:

1. Any long-continued fever that will not yield to appropriate doses of quinin should suggest typhoid, especially if of gradual onset, high in the evening,

and when no existing condition of the throat, lungs or bowels offers an explanation. It is more suggestive if remaining continuously high for several days, increasing a little each day for three or four days, yielding after several days of observation some resemblance to a typhoid chart. And if the continuous high fever is well borne by the child, as Jacobi first noticed, with so little prostration perhaps that the child will play around, it is still more suggestive of typhoid fever.

2. The second symptom is gastro-intestinal disorder, especially when a decided tendency to constipation is present; putrid stools, of an especially offensive character and odor, if there is diarrhea. These, when only seen on the diaper, may not look very different from the green spinach stools that occur in other diarrheas, because the fluid is soaked upon the napkin. If seen in a vessel, the thin, semi-fluid character, greenish-yellow particles, and all the characteristics of a typical peasoup stool are present. If there is trouble with insufficient digestion of milk, the lumps of undigested casein or other food will somewhat change the appearance. The lack of acute symptoms of an intestinal nature is more characteristic of typhoid fever than are violent symptoms.

Henoch noted normal movements in 26 out of 233 cases, absolute constipation in 23 cases, and in 184 cases, first constipation, succeeded by diarrhea about the end of the first week. Vomiting may or may not occur. Loss of appetite is present from the beginning. A tongue coated with yellowish or brownish-white, or red at the tip and sides, sometimes moist, generally dry, will be noticed. It may be so heavily coated and the entire mouth so affected that a condition resembling aphthous stomatitis may be present, which in one case in the Montclair epidemic first led the family to call in a physician.

But the condition of sordes is far less frequent in infants than in adults. The tongue may vary from day to day, the excessive dryness of the tongue, with

foul odor, the coating of the lips and gums, and rhagades is a later condition, keeping pace with the advance of somnolence and severe nervous symptoms.

3. In addition to the fever and intestinal symptoms, an examination of the skin may yield the lenticular rose spots familiar in ordinary typhoid. These may come early or late, or in two or three crops, and are to be expected in most cases in children. Stowell found them in 66 per cent. of his cases. Cadet De Gassicourt in the same proportion. Earl in all his cases but three. Henoch in nearly all. Ashby in thirty-nine cases out of fifty, or 78 per cent. Roth in thirty-seven cases found them present, in forty-three absent.

4. Symptoms of headache frequently occur, which a baby will indicate by rubbing or picking at its head, nose or ears, or burrowing its head back in the pillows, but not by active cerebral symptoms, which would characterize meningitis. As the disease goes on, these head symptoms will frequently increase.

5. Enlarged spleen is very important when found, but not always to be accurately demonstrated in a young child, especially if tympanitis is present. A painful spleen is a more important point. The spleen ought to be felt below the border of the ribs to be pronounced enlarged, percussion not being a satisfactory test. According to Eustace Smith, it begins to enlarge by the sixth or seventh day and is soft and tender, the change being simply hyperemia, not a production of new tissue.

6. Tympanitis is sometimes excessive, but in mos recorded cases moderate. This swelling is due to th accumulation of gas through decomposition of food and inability of the bowels to expel the gaseous contents in consequence of loss of nerve power or local injury from ulceration. The more ulceration the more distension.

7. Bronchitis seems to be as regular a symptom as in measles, agreeing with the pathologic changes, red-

ness and swelling of the bronchial tubes demonstrated by Uffelman and others, but the breathing is later too superficial to make râles. It has been demonstrated that the bronchial mucous membrane excretes the Eberth bacilli and its products, and is irritated by it. The younger and sicker the children, the less the cough, as the sensibility of the mucous membrane is so blunted that mucous accumulates in the posterior and lower parts of the lung, diminishing resonance but causing no new real pneumonic dullness. Pneumonia in these cases is rare; Roth in eighty-four cases having four; Henoch very few.

8. The author has seen angina twice, and finds that Henoch, Eustace Smith and Parrot mention its occurrence in infants. In 6,500 cases of typhoid fever in St. Petersburg, Ouskow notes that in 5 per cent. of the cases there was marked redness or ulceration of tonsils. Gassicourt states that in the Paris epidemics, 1865 and 1882, sore throat was very common, but in other epidemics, 1876 for instance, it was rare. In the cases in children the occurrence of sore throat when found will generally confuse rather than help the diagnosis.

9. Epistaxis, according to Keating and others, is as rare in children as it is common in adults. I find it occasionally reported. Hemorrhage from the bowels seems to be rare in childhood and infancy.

10. Neither in children nor adults can the Eberth bacillus be demonstrated in the stools until the tenth to the twentieth day (Chantemesse, Sanerelli;) it is doubtful whether reliable bacteriologists have as yet succeeded in demonstrating this in the stools in infants. A number of excellent authorities have never been able to do this even in adults. Though it has been claimed both in infants and adults, more recent methods make it doubtful whether older observers may not have at times confused the bacillus coli communis with Eberth's bacillus. The stools will, from the outset, be swarming with all sorts of bacteria, especially the bacillus coli

communis. It seems to be true that as the typhoid fever progresses, these ordinarily innocuous bacilli assume a more virulent character and multiply enormously, but if the Eberth bacilli can not be found in the stools in children, they frequently can be demonstrated in the lymphatic tissues and spleen. In the same way, in the animal inoculation experiments of Sanerelli, the stools never seemed to contain the Eberth bacillus, while the spleen and the lymphatic system had numbers.

11. The study of the blood in typhoid fever may yield some results of value. It will certainly exclude malaria. I note results reported by Loisan, Simonin and Arnaud, of examination of blood from the finger in 241 cultures made from 65 adult typhoid patients. In a few cases the Eberth bacillus was found alone or associated with staphylococci. In forty-five cases, staphylococci alone were found. (*Rev. de Med.*, April, 1893.) But the Eberth bacillus is not a regular blood parasite, being in all cases found much more abundantly in other parts of the body. These authors have also pursued similar investigations in fresh urine and in the buccal secretions, finding Eberth bacilli in a few cases.

12. There are not commonly marked kidney symptoms, though transient albuminuria in the second week or after the end of the fever may occur.

13. Relapses are infrequent, but at times occur.

14. Ehrlich's test, which is yielded only by typhoid miliary tuberculosis, septicemia and cancerous cachexia may assist in the diagnosis.

COURSE.

The disease seems to appear in three forms; an abortive type of short duration, a type resembling ordinary adult typhoid lasting about three weeks, and a malignant or prolonged form. These bear to one another about the same relation as varioloid, ordinary variola and malignant variola in its more fatal form. The cause of these variations may be the an-

atomic difference in the extent of the lesions, *i. e.*, whether there is simple congestion, or some considerable infiltration of new cells, or ulcerations varying in size, depth or number. But going further than these gross changes, the occurrence of the Eberth bacillus alone, or its occurrence together with other pathogenic microbes and their ptomaine products, may be the more important condition which determines in which of these three forms the disease may appear. In other words, not how extensive is the change in the coats of the intestines, but how much actual poisoning is taking place? And if the lymphatic theory of the disease is true, the intestinal changes are merely the result of the severity of the disease, not the cause.

The convalescence in children is, as a rule, quicker and less complicated. It is evident from the different series of cases of typhoid in childhood that autopsies are not very abundant. Stowell in his list of eighty-five reliable cases records but twenty-four autopsies. Hoelscher reporting 2,000 typhoid autopsies in the *Munchner Med. Wochenschrift*, January, 1891, reports but eight under 10 years, two being babies of two and nine months respectively. Even in epidemics affecting many children, very few deaths occur. This seems to me to indicate that, as a rule, typhoid is a much milder disease in childhood than in adult life, as many infants may pass through it with less severe and distinct symptoms than adults present.

Out of 265 cases of typhoid fever treated in the Manchester Hospital for sick children, Ashby noted a frequent tendency to an abortive or two weeks' course. While from 2 to 12, the mortality was 10 per cent., he found as a rule, that the children were rarely acutely ill. Though indicating their disease with rose spots, remittent temperature, rounded abdomen and other symptoms, they would frequently be playing around the room and show little prostration.

Jurgënson, in the Transactions of the Sydenham Society, makes a study of eighty-seven cases of abortive typhoid, sixteen terminating from fourth to seventh day, nineteen from eighth to tenth, twenty-four from eleventh to thirteenth, twenty-eight from fourteenth to sixteenth. He holds that if the pyrexial state lasts longer than the twenty-sixth day it is probably due to a progressive ulcerative enteritis. Henoch, out of 190 cases in which he could calculate from the beginning with some degree of certainty, found 11 cases that lasted from seven to nine days, 11 cases ten days, 17 cases eleven days, 8 cases twelve days, 45 cases thirteen to fifteen days, 15 cases sixteen to seventeen days, 25 cases eighteen to nineteen days, 39 cases twenty to twenty-three days, 14 cases twenty-four to thirty days, 1 case thirty-five days.

Gerhardt regards it absolutely demonstrated that these abortive cases are frequent, indicating a light and incomplete working of the typhoid fever on the infant organism. He holds that it is characterized by some degree of suddenness in the onset, at times beginning even with a chill. And this, with the rapid increase of the temperature, seems to portend something of a dangerous nature. The spleen swells early, roseola comes early, and the abdomen is usually protruded and sensitive. The fever may drop rapidly and the child soon become convalescent.

Barthez and Rielliet in *Maladies des Enfants*, in 837 of their cases of typhoid in young children which recovered, find a longer duration; 47 lasting from eleven to fourteen days, 298 lasting from fifteen to twenty-one days, 317 lasting from twenty-two to thirty-one days, 133 lasting from thirty-two to forty-five days.

In the 143 fatal cases which they report, 4 lasted five days, 6 lasted two days, 33 lasted eight to fourteen days, 40 lasted from twenty-two to thirty-two days, 18 lasted from thirty-two to forty-five days, 12 longer.

Yet the diagnosis of these abortive cases must in-

evitably and at all times be difficult, from the insidious onset and irregular character of all the symptoms, and for awhile, at least, if there is diarrhea, a diagnosis of gastro-enteritis will adequately explain all symptoms; if there be constipation, or merely occasional movements of altered or putrid stools, a diagnosis of ptomaine poisoning from some undigested fermenting substance in the intestines will also account for all the symptoms. And this is not really a false diagnosis. It merely does not state what is the bacterial agent that causes this ptomaine poisoning.

To illustrate this, I will give a history of a case of my own already published. (*Medical Record*, July, 1894):

An infant aged eleven months was brought to me (had been staying for a ten days' visit in Montclair, N. J., where he had been weaned and fed on unsterilized cow's milk diluted with barley water. On his return to New York he was fretful, restless and had a slight temperature of 102 degrees, attributed by his mother to cutting teeth, but had nothing else characteristic in his condition. Slight bowel trouble with colic. For two days he seemed to improve a little, though still with a slight fever; on the third day the temperature was 102.6 degrees, A.M; 103.8 degrees. P.M, and for the first time he appeared very sick. Moderate diarrhea with colicky pains, coated tongue, occasional vomiting, negative chest signs. Diagnosis; gastro-enteritis. On the fifth and sixth days the temperature was 102.6 A.M., and 104 P.M. Frequent stools of foul odor, tongue coated white, with red tip and sides. Lungs gave only physical signs of bronchitis. Great fretfulness. Hands brought frequently to head, as if suffering great pain. There were no other definite symptoms.

After another day of slight improvement the child was taken back from the city to Montclair. During the two weeks which had elapsed since he had left Montclair, about fifty cases of typhoid fever had developed, and this time it was publicly recognized that the origin of every one of these cases was due to one cause alone; the polluted milk served to the families in all cases by one dairyman, who had himself had two cases of typhoid in his family one month before, and had infected his well and washed the cans and bottles, if not watered his milk, with the infected water. The baby had fed for ten days on this milk. The combination of symptoms which the child had developed, of high and continued fever during the past week, the tongue with clean margin,

the character of the stools, the absence of other symptoms, all suggested a diagnosis of typhoid fever. On the eighth day temperature was 104, pulse 160, respiration 25, stools four. Rose spots appeared on the abdomen very distinct, disappearing on pressure.

A second case of typhoid, the nurse of the baby, was detected at this time. She had used the same infected milk. A third case of an aunt of the baby appeared a day after, and other cases in the neighborhood and milk route to the number of 150 occurred.

From this time the case followed a fairly typical course, with exceptionally severe nervous symptoms. Death in fourth week from exhaustion.

I failed to make a diagnosis of this case, until confirmed by the epidemic, and yet it seemed to me that this history of the early symptoms has something characteristic in it which will help in making diagnoses, in an abortive case that goes no further than the first or second week.

The later history in this case followed a course which I find not at all uncommon in recorded cases of typhoid in infancy, characterized by certain symptoms which simulate meningitis. At the beginning of the third week, following a little gastric irritation, vomiting and general irritability increased, the temperature rose 4 degrees. There developed a stiffness of the neck and back which reached, after a time, a condition of opisthotonos. Incoördination and continued movement of the eyeballs, great hypersensitiveness to sound, light and touch especially in the head. Irregular and at times convulsive movements especially marked in the left arm and leg. Continued twitching of the fingers, a peculiar cry, a rapid, feeble and irregular pulse, 160 to 180, rapid respiration. This seemed almost certainly an acute meningitis. Careful examination of the case, and consultation with one of the most reliable authorities on children's diseases in New York, made it seem probable that this was not an acute meningitis: (1), fontanelle was not elevated; (2), the child was bright enough to take notice of its surroundings; (3), not ache-cerebral; (4), no boat-shaped abdomen; (5), no expulsive vom-

iting; (5), photophobia and hypersensitiveness to sound, were not sufficient. The entire condition, acute as it seemed, was judged to indicate a passive congestion of the brain caused by the weak heart, and an attempt was made to remedy this condition by heart stimulation which proved successful after a few hours, there being no return of those cerebral symptoms during the remaining days of the case.

This history suggests cases of Henoch with tremor, and stiffness of the extremities with frequent jerking or twitching, which showed no brain lesion at the autopsy. Also one where there was contracture of both legs and right arm and continued grinding of teeth. Autopsy with only slight changes in the brain; also one of a little girl who showed distinct stiffness of the neck, later, actual opisthotonos and marked contracture of the neck, but on autopsy showed no brain lesion. Another case in the Montclair epidemic of Brown, which I reported with other cases in the *Medical Record*, July 1894, showed marked nervous symptoms, great restlessness, tossing of head from side to side, rigidity of muscles of neck, opisthotonos, almost complete blindness for five days, strabismus at times, hydrocephalic cry, complete recovery after twenty-eight days.

In Gerhardt's *Kinderkrankheiten*, Soltmann speaks of this condition. After intestinal symptoms have almost entirely disappeared, symptoms indicating motor irritation, such as twitching, contractures, light convulsive symptoms, later genuine convulsions, succeeded by stupor as death approaches; even aphasia and paralysis have been noted. Autopsy in these cases excludes actual meningitis. The observers agree in considering the actual cause to be anemia or a diseased condition of the blood, or else excessive weakness in its circulation.

Simon (*Gaz. des Hopitaux*, 1886,) thinks that the congestion always present in spleen, lungs and other organs in these cases of typhoid is always more or less present in the brain, cord and meninges, and he

thinks that edema of the brain is the chief cause.

Rielliet and Barthez (*Maladies des Enfants*) refer to a case at fourteen months, with convulsions, preceded by general irritability, agitation, strabismus, contracture of the neck and limbs, a condition which lasted three days. Autopsy indicated sero-bloody effusion in and under the arachnoid. Of their 143 fatal cases, 5 showed thick serous exudate, adherence of membranes, softened brain substance, or, in other words, were genuine meningitis. In nearly all cases of this nature on record, however, simple hyperemia is all that the autopsies develop. These cases all belong to the third or malignant type. The condition is more than a simple change in the circulation or in the character of the blood. It means a more or less absolute overwhelming of the nerve centers by a poison, whether this be the product of the Eberth bacillus or some other bacteria.

There are a large number of cases of typhoid in infancy reported from time to time, with inconclusive clinical histories, which are very definite on the subject of the changes in the intestine found on autopsy, which are called "undoubted typhoid lesions," because they yield swollen and ulcerated Peyer's patches, enlarged mesentery, lymph nodes and other similar changes. Are these lesions always peculiar to typhoid fever, or do they occur in other intestinal diseases? Northrup exhibited to the New York Academy of Medicine, an intestine showing all these changes coming from a child sick for only a few hours with some acute trouble, positively not typhoid fever. He asserts that he has frequently met with this condition in autopsies. He explains, and I think justly, many of the so-called typhoid lesions in this way. It is desirable that a very careful consideration of pseudo-typhoid intestinal lesions be made, for it brings up a condition which is not recognized by our existing classifications of intestinal diseases. It is not impossible that the name enteric fever, if it does not include more than one distinct disease, may pos-

sibly be a disease of more than one cause. That is to say, beside the cases undoubtedly caused by the Eberth bacillus, there may be other elements at work, whether bacillus coli communis, or the bacteria connected with milk infection which produce an analogous condition. Whether it will, at a later day, become possible to clearly distinguish these divisions is impossible to say.

The later stages of typhoid fever after the formation of ulcers when they exist, are essentially a septicemic condition from the poisoning by various bacteria and their ptomaine products, but more especially by streptococci. It is certain that, as the disease progresses, the Eberth bacillus becomes less numerous and the streptococci and staphylococci more numerous. The picture of the disease, then, is indistinguishable from the condition so common in severe, long-continued gastro-enteritis, or milk infections which we observe in summer.

Vincent, in the *Annales de l'Institute Pasteur*, 1893, studies this later and secondary condition of infection by a combination of Eberth bacilli and streptococci. In the bacteriologic examinations from the spleen and other organs, in thirty-one autopsies of typhoid cases he found six times streptococci associated with typhoid bacilli. He regards the typhoid patients peculiarly exposed to streptococci infection, since the system in a great measure has lost its resisting power, and only an angina, parotitis, otitis, or some other source of pus is needed to start this double infection. Even the saliva contains numerous streptococci, and ulcers in the intestine may permit absorption. Furunculosis is common.

He examined forty-one abscesses occurring in typhoid cases, and in thirty-two he found staphylococci pyogenes aureus or albus, and found that these cases happened to recover. In eight cases he found the Eberth bacilli also, five of which cases died. He claims from his test that typhoid bacilli and streptococci combined, cause a more virulent poisoning and

thus a special danger to the patient. In a fatal case of typhoid fever with rose spots and clear history, on autopsy he found very slight lesions in Peyer's patches and intestinal follicles, spleen not much swollen, and in the different organs typhoid bacilli and streptococci.

In a series of animal inoculations he found that injection of the Eberth bacilli cultures alone, was followed by an active phagocytosis, but injection of Eberth bacilli and streptococci together was followed by no phagocytosis, the animal eventually succumbing to this double infection. This, though only a limited work, opens up a new field of investigation in typhoid fever, and a possible explanation of its characteristic course and exceptional features.

Our present state of knowledge will perhaps enable us to decide that these aborted and short cases, with their early symptoms as described, are more purely the result of simple infection by the Eberth bacillus, while the more prolonged cases, in common with the condition occurring after simple gastro-enteritis or milk infection, may become a simple streptococci infection or a septicemic condition.

This conclusion is simply analogous to conditions present in other diseases. The severity of an attack of diphtheria varies largely in proportion to the extent the infection by the Löffler bacilli is complicated by streptococci.

In scarlet fever the same is true, and in tuberculosis of the lung, as Prudden has so forcibly demonstrated, the lesions and symptoms vary according to the complication of tubercle bacilli with streptococci.

In conclusion, we would once more emphasize that typhoid fever in early infancy in a typical form is rare in this country, though not uncommon abroad. It is in a mild or abortive form that we must look for it here, if we wish to separate it from other intestinal or meningeal diseases that may appear.

And, lastly, when we have a case which is severe and prolonged, we may see in it not the result of the simple infection by the typhoid fever bacilli, but a complication by other pathogenic bacteria.

162 W. 73d Street.

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