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## THE OCCURRENCE OF INFANTILE PARALYSIS IN MASSACHUSETTS IN 1908. (SECOND PAPER.)

REPORTED FOR THE MASSACHUSETTS STATE BOARD OF HEALTH.

BY ROBERT W. LOVETT, M.D., BOSTON.

IN pursuance of the policy inaugurated in 1907, the State Board of Health in 1908 continued the investigation into the occurrence and distribution of cases of infantile paralysis in the State of Massachusetts with especial reference to etiology. As in the previous year circulars were sent to all physicians asking them to report to the Board cases coming under their observation, and to physicians reporting cases, blanks were sent to be filled out. From these blanks the following data were obtained.

Physicians seeing such cases were also requested to forward to Dr. Theobald Smith, pathologist of the Board, fresh specimens of stools from acute cases for bacteriological study with reference of course to etiology. It is not possible as yet to state the results of these examinations. The Board has already started on the investigation of these cases for 1909 which will follow much the same lines as those of the two previous years with especial efforts to obtain fresh stools for examination. Again the Board desires to express to the medical profession its gratitude for the most willing and helpful co-operation,

The present paper will first present a brief abstract of the literature dealing with the epidemiology of the affection appearing since the last report (*BOSTON MEDICAL AND SURGICAL JOURNAL*, July 30, 1908), and second an account of the features of the disease as occurring in the state in 1908. The serious epidemic which occurred in 1908 in Franklin County will be dealt with separately by Dr. H. C. Emerson, who investigated it on behalf of the Board.

### ABSTRACT OF IMPORTANT LITERATURE.

*Bacteriology and experimental production.*—The most valuable contribution of the year toward our knowledge of the disease has been made by Landsteiner and Popper, of Vienna,<sup>1</sup> who have apparently succeeded in producing the disease in monkeys by inoculation. A boy of eight died of the disease on the fourth day. The autopsy showed typical anterior poliomyelitis. In the spinal cord and cerebrospinal fluid there were no organisms to be found and cultures were sterile. Parts of the spinal cord were then emulsified in salt solution and injected into the abdominal cavity of rabbits, guinea pigs, mice and two monkeys. In the first three named no paralysis ensued and the spinal cords were normal.

The first monkey became violently ill on the sixth day and died on the eighth. He lay on the floor of his cage and his power to move his limbs was not investigated. After death changes typical of anterior poliomyelitis were found.

The second monkey was noted to have lost all power in the hind legs on the seventeenth day. No paralysis was present on the twelfth, although it may have been present before the seventeenth in some degree. He was killed on the nineteenth day and again typical pathological changes were found in the central nervous system.

From the spinal cord of this monkey inoculations were made into two other monkeys with negative results.

The conclusion of these authors is that "a so-called invisible virus, that is, one belonging to the class of the protozoa, is the cause of the disease."

With regard to the affection of domestic animals in epidemics of infantile paralysis, this was alluded to in the Rutland epidemic reported by Caverly<sup>2</sup> in 1894 (horses and poultry). Dana investigated a hen with paralysis and found the bacteriology negative and the changes in the cord "acute infectious softening rather than myelitis."<sup>3</sup> It was noted by Wickman that in the Swedish epidemic of 1903 dogs were apparently affected in many instances with the children, but he was not convinced of the identity of the two affections.<sup>4</sup> Free reported that pigs and chickens were affected in the Michigan epidemic alluded to below. The attention of the State Board of Massachusetts has been called to the occurrence of infantile paralysis in a mother and daughter shortly after an epidemic of "leg weakness" in the chickens of the household, and the matter is under investigation.

Pasteur,<sup>5</sup> Foulerton and MacCormac investigated the cerebrospinal fluid of a case of poliomyelitis, finding in it mononuclear round cells. On staining, large cocci grouped in pairs and tetrads were found eleven days and four weeks after the onset of the disease. Cultures were negative. Nine rabbits were inoculated with the fluid, of which some were paralyzed after about six weeks and the cord and spinal fluid of one of these was again inoculated into other rabbits with positive results. The inoculation from this series was negative.

Cocci which did not grow were found in the spinal fluid of affected animals, but in the one cord examined there were no changes in the ganglion cells or about the vessels. The conclusion of these authors, that anterior poliomyelitis is not the result of a specific cause, is disputed by others on the ground that the experimental paralysis is not anterior poliomyelitis (Wickman, Landsteiner and Popper).

#### EPIDEMICS RECENTLY REPORTED.

In Salem,<sup>6</sup> Va., and vicinity occurred between June 2 and Aug. 10, 1908, 25 cases; the neighboring city of Roanoke, seven miles distant in close communication with Salem, escaped with 1 case. The cases all occurred in children under six, the youngest being thirteen months old. The death-rate was 12%.

In September, 1908, there occurred "a number of cases" in and about Whittemore, Ia.<sup>7</sup> The following regulation was passed by the State Board of Health of Iowa: "It is hereby ordered by the State Board of Health that all physicians and osteopaths practicing in Iowa shall promptly report to the mayor or township clerk all cases of poliomyelitis occurring in their district, etc."

In central Wisconsin<sup>8</sup> in the summer of 1908 there occurred an epidemic with 60 cases in one of the smaller cities and 14 deaths.

In central Pennsylvania the disease was active in the summer of 1907,<sup>9</sup> 100 cases having been seen in and about Dubois, and Sinkler<sup>10</sup> estimated that in Philadelphia 30% more cases than usual were seen in that summer. Sinkler elsewhere<sup>11</sup> speaks of the etiology as follows: "The nature and progress of the disease indicate clearly that it is due to an infection. It is obvious, therefore, that the micro-organism which produces the infection is one which is developed by hot weather. A large proportion of cases have some form of intestinal trouble. . . . It is probable, therefore, that the micro-organism producing the disease has found its entrance into the system through the intestinal tract and thence to the spinal cord."

McCombs<sup>12</sup> contributed a study from the Philadelphia Children's Hospital of the disease as observed at that institution between 1903 and 1907 showing 50% more cases occurring in the summer of 1907 than the sum of all cases for the preceding four years. Forty-three cases in all were analyzed.

Manwaring<sup>13</sup> reported an epidemic of 30 cases in Flint, Mich., occurring in the summer of 1908 and alluding to<sup>14</sup> other epidemics in the

state, one in western Michigan reported by Ostrander and another in Chesaning.

In the Flint epidemic the average age of affected cases was ten years. Of cases under ten all lived, between ten and twenty the mortality was 25%, over twenty the rate was 75%, corresponding to Wickman's observations.

Griffin<sup>15</sup> described an epidemic of 20 cases in Oceana County, Mich., occurring between July and September, 1907.

Twenty-nine cases were reported by Clowe<sup>16</sup> as having occurred in Schenectady in the summer of 1907. There were 2 deaths in adults and 10 of the cases were seriously sick, 5 were classed as having made a complete recovery, 19 cases were less than four years old.

Partial reports<sup>17</sup> of the New York epidemic of 1907 have already appeared in various articles. It seems best to wait for the published reports of the committee appointed to investigate the epidemic, before analyzing the conclusions reached.

In and about Vienna, in the summer of 1908, between the end of July and October, there occurred many cases of infantile paralysis, more according to Zappert<sup>18</sup> than had been seen since 1895. He notes the large proportion of older children to be affected and speaks of it as a frequent occurrence in large epidemics.

An epidemic occurred in Victoria,<sup>19</sup> Australia, in their autumn of 1908, selecting the months of March to June. It occurred chiefly in the most densely populated suburbs of Melbourne. There were 6 deaths in 135 cases recorded and the bacteriological findings are not sufficiently clearly given in the abstract, which alone is available, to be commented on.

Byron Bramwell<sup>20</sup> presented an analysis of 76 cases observed by him reaching over a period of years.

One of two inferences is possible from the literature of the last year or so: either the disease is increasing rapidly in this country or the attention of the medical profession has been called to the disease and more cases and epidemics have been recognized and reported.

#### CASES REPORTED IN MASSACHUSETTS.

*Occurrence and distribution.* — As against 234 cases of infantile paralysis reported in 1907 only 136 cases were reported in 1908. It is interesting to note in this connection that in 1907 444 cases of cerebrospinal meningitis were reported, while in 1908 there were only 183 cases. It was noted in the previous report that the two diseases, however, reached their maximum at different seasons.

In 1907 the cases of infantile paralysis in their distribution in a general way corresponded to the density of population in the state, grouping themselves as a rule about the centers of densest population, and only in and about Pittsfield, where some 28 cases occurred, was there evidence of any marked epidemic.

In 1908, however, the grouping of cases was largely different and bore slight relation to the density of population, and as a rule where the

disease was prevalent in 1907 it was rare in 1908, thus corresponding to the conclusions reached by Scandinavian investigators that regions severely affected one year were for a while comparatively immune. As against 28 cases in the western end of the state in 1907 there were only 3 in 1908. In and about Lowell, Fall River and Haverhill there were in 1908 as in 1907 apparent slight centers of infection.

About half (69) of the cases reported in the state occurred in Franklin County, the remainder (67) being distributed through the state.

Cerebrospinal meningitis, however, in the year 1908 showed practically the same distribution as in 1907, in general being grouped about the densest population. These comparisons are made because cerebrospinal meningitis is an infectious disease apparently mildly contagious<sup>21</sup> affecting many children, and manifested in the central nervous system. Presenting these points of similarity it has been thought that its characteristics might possibly in the future throw some light on the disease under consideration.

For purposes of simplicity the epidemic in Franklin County will be dealt with separately by Dr. Emerson and in the following analysis will be considered *only* the cases occurring in the state at large. The two analyses taken together will give the occurrence of the disease in the whole state.

The *distribution* of the 67 cases may be seen in the map.

*Contagion* has been so carefully studied in the epidemic that it will not be dwelt on here.

*Traumatism.* — In one case a history of exposure to dampness was given and in 9 cases histories of trauma preceding the disease. These histories, however, were in many instances vague and unreliable.

*Season of onset.* — Cases occurred as follows: January, 1; February, 1; March, 1; May, 2; June, 1; July, 9; August, 11; September, 14; October, 15; November, 7. Date not given, 5.

The season of onset does not differ materially from that in 1907, but does differ essentially from the season of onset in Franklin County where it was as follows: March, 1; April, 1; June, 6; July, 28; August, 26; September, 5; November, 2.

*Age.* — The largest number of cases (19) occurred between the ages of one and two and for the years from two to eight there were reported from three to eight cases for each age, after this the reported cases were one or two a year up to sixteen. There were two adult cases reported, one twenty-one and one forty.

*Sex.* — There were 39 males, 26 females and 2 not stated.

As to other factors of possible interest in the etiology, 38 lived in detached houses and 27 in tenements, while 2 were not stated. Of the cases in tenements, 12 of the patients lived on the first floor, 10 on the second, 4 on the third and 1 in the basement. Sanitary conditions were described as excellent in 24, good in 20, fair in 16, bad in 5.

*Symptoms.* — In 54 cases fever was present,

the temperature ranging from 100 to 104. In one case no fever was present. In 12 cases no record given. Brain symptoms occurred in 15 cases. There was usually delirium during the febrile state. Vomiting is recorded in 21 cases, constipation in 20, and diarrhea in 8. Retraction of the head present in 10 cases. Pain is recorded in 46 cases, absent in 2. The pain was usually along the distribution of the paralysis and did not, as a rule, subside at once after the acute attack. Incontinence of urine and feces in 2 cases, incontinence of urine in 1, retention and later incontinence of urine 1.

#### RELATION OF BEGINNING OF PARALYSIS TO ONSET OF FEVER.

Paralysis preceded the attack by two days,	1
Occurred on the same day,	5
On the next day,	6
Two days later,	11
Three days later,	13
Four days later,	8
Five days later,	4
Six days later,	1
Seven days later,	3
Eight days later,	1
Ten days later,	2
Two weeks later,	1

Complete recovery is said to have occurred as follows:

Five days from beginning of disease,	1
Ten " " " " " "	1
Two weeks " " " " "	3
Six " " " " "	1
Three months from beginning of disease,	1

#### DISTRIBUTION OF PARALYSIS.

One leg,	15
Both legs,	7
One arm,	8
One arm and one leg,	11
One arm and both legs,	5
Both arms and one leg,	1
Four extremities,	6
Not stated,	14
	67

*Mortality.* — Four cases terminated fatally, 2 dying of respiratory paralysis and 2 of exhaustion, stupor and convulsions.

#### CONCLUSIONS.

The conclusions which would seem warranted by the investigation of 1908 are as follows:

That the disease was less prevalent in the state than in 1907, as was also cerebrospinal meningitis.

That the distribution of cases was unlike that of 1907, localities affected seriously in 1907 largely escaping in 1908. That this is quite the opposite of the almost identical distribution of cerebrospinal meningitis in the same two years.

That half of the cases occurring in the state were comprised in an epidemic in Franklin County.

Finally it may be stated that it is not to be expected that any material light will be thrown on the etiology of the disease by its observation during any one year, but it is hoped that by a study of the disease for a period of years in the same territory, conclusions of value may be established. It is also to be hoped that by the

study of the stools of fresh cases some light may be thrown on the etiology.

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## AN EPIDEMIC OF INFANTILE PARALYSIS IN WESTERN MASSACHUSETTS IN 1908.

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District 14.

NOTE. — The details of this investigation will appear later in a publication of the Massachusetts State Board of Health.

THE following investigation of this epidemic here published in abstract was made at the suggestion of Dr. Henry P. Walcott, chairman of the State Board of Health. The information was obtained through the courtesy and assistance of the physicians which enabled the writer to visit the homes of all the cases reported in this epidemic. The writer spent a month living in the towns in which the epidemic occurred and made several subsequent visits to these places.

Sixty-nine cases of infantile paralysis, or approximately one half the total number reported in the state during 1908, occurred in western Massachusetts and were distributed as follows:

Colrain,	24	Erving,	2
Buckland,	9	Adams,	1
Shelburne Falls,	8	Cheshire,	1
Montague,	7	Deerfield,	1
Bernardston,	5	Gill,	1
Greenfield,	4	North Adams,	1
Heath,	4	West Hawley,	1

### GEOGRAPHICAL DISTRIBUTION.

With the exception of three isolated cases in Adams, North Adams and Cheshire, the cases occurred in a sparsely-settled portion of the state in the larger towns (Shelburne Falls, Buckland) on the Deerfield River, and its main feeder, the North River (Colrain), and at that point on the Connecticut (Turners Falls) where the Millers and Falls rivers empty into it. As both the valleys of the Deerfield and North rivers are very narrow, the bulk of the population lives naturally very near these streams.

Twenty-four cases occurred in Colrain (population 1,800), a town of five villages containing three cotton mills in the narrow North River val-

ley. Nine of these cases occurred in Griswoldville (population 350), the largest of the three mill villages. Thirteen cases occurred in the village of Shelburne Falls, a manufacturing town with a population of 2,500, which includes the villages of Shelburne Falls and Buckland which are separated by the Deerfield River only. Six cases occurred in Turners Falls, a large manufacturing town on the Connecticut River, and two cases were in other towns across the river.

Fifty-two of the 66 cases were located in the valley on these streams, while 10 of the remainder were hill cases in country districts adjacent to these towns. There were 3 scattered cases in Greenfield. The actual distance from the houses where the cases occurred to these streams above mentioned, including mill ponds, canals, etc., was found to be as follows: Four cases were one quarter of a mile distant, 15 cases were one eighth of a mile distant, 33 cases were less than 500 ft. distant, of which 20 cases were from 10 to 200 ft. distant.

The relation of the hill cases to those in the valley was noted, and in every case it was found that the hill cases gave a history of visiting, driving or in some way spending time in the nearby towns which were upon the streams as above mentioned. It may be stated that there was no case in the 66 under consideration which had not been exposed recently to the valley influences, if any.

In addition to the above 69 cases in western Massachusetts, 6 cases of infantile paralysis occurred in southern Vermont in territory contiguous to the Colrain-Heath district. They all appeared to be independent cases and 4 of them were located near the Deerfield River or its branches.

### SEQUENCE OF CASES.

Sixty-five of the cases occurred in the summer months as follows: June, 6; July, 28; August, 26; September, 5; while isolated cases occurred in March 1, April 1 and in November 2. The height of the outbreak appears to have been July 25 on which date 6 cases occurred in four towns as follows: Bernardston 2 (one family), Buckland 2, Shelburne Falls 1, Colrain 1. The early cases occurred at various points throughout the district concerned as follows: In Turners Falls district June 4 (the earliest case), in the Shelburne Falls district June 20, in the Colrain district July 1 in the southern part of this territory, and July 4 in the northerly part of this section. The outbreak in the various towns, with the exception of a few small groups, was not an explosive one, but cases occurred from time to time, covering a period of from six to eight weeks in each town.

### CONTACT AND RELATION OF CASES TO EACH OTHER.

*Turners Falls Village and suburbs.* — The first case occurred in Turners Falls village on June 4, and from this time on to July 20 there were 7 additional cases in this district. There was 1 case of known contact and 2 of possible contact.

*Greenfield-Deerfield.* — Four independent cases occurred in these towns from July 9 to Sept. 8.