The Journal OF Nervous and Mental Disease

An American Monthly Journal of Neurology and Psychiatry, Founded in 1874.

Original Articles

THE ABORTED FORMS AND PRE-PARALYTIC STAGE OF ACUTE POLIOMYELITIS AS OBSERVED IN THE BUFFALO EPIDEMIC¹

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The epidemic of poliomyelitis which has been prevalent in Buffalo and some of the surrounding towns during the past summer and autumn has been more extensive than any of the previous epidemics of poliomyelitis in Western New York.

In Buffalo the total number of cases reported to the Health Department up to November 1, 1912, was 310 cases with 41 deaths. Six of the cases occurred before July 1. In July there were 62 cases with 4 deaths; in August 124 cases with 16 deaths; in September 86 cases with 13 deaths; and in October 32 cases with 8 deaths.

Early in the epidemic the Health Department set aside two wards at the Ernest Wendt Hospital where the acute cases could be sent and kept under observation and treatment, and a number of the physicians took advantage of this arrangement to have the cases under constant observation. The Department also made provision to have some of the hospital staff examine any cases suspected to be poliomyelitis and to assist in the diagnosis and

¹Read at the joint meeting of the New York Neurological Society and the Section on Neurology and Psychiatry of the Academy of Medicine, November 12, 1912.

study of the disease in the cases not sent to the hospital. By these means it was possible to study a number of the cases before the onset of any paralytic symptoms, and also a number which did not develop paralysis.

From the standpoint of epidemiology and for the purpose of quarantine the cases were classified into three groups: (I) Suspicious; (II) Aborted; and (III) Paralytic. The aborted and paralytic cases were quarantined and the house placarded while the suspicious cases were not.

In the delimitation of these types the cases were considered suspicious if the child showed only constitutional symptoms of a general nature without any local nervous symptoms; the aborted cases were those in which some evidences of involvement of the nervous system were added to the general symptoms, but which did not go on to paralysis; and the paralytic cases included those in which a definite paralysis or prolonged weakness of muscles occurred.

If the delimitation of the aborted cases as given by Wickman had been followed most of the cases classified as suspicious would be considered as aborted. Gastro-intestinal disturbances have been quite frequent this year and a number of instances have occurred where one or more children in a family have had fever, vomiting and gastro-intestinal disturbances which cleared up in a few days and showed no signs of nervous involvement. Some of these have occurred in families where a definite paralytic case had developed and they should undoubtedly be classified as aborted rather than suspicious; in other instances the same gastro-intestinal symptoms have occurred in families where no other illness had been present.

As an example of the suspicious cases the following may be given as representing a not infrequent type. Two girls, twins, aged $3\frac{1}{2}$ years, had visited a summer resort early in September where a few cases of poliomyelitis had occurred. The following day they were taken ill with fever, diarrhea, vomiting and headache. No rigidity of the neck or back and no pains, although in one of the children the back was said to be slightly tender. Diarrhea, with foul stools, lasted for nearly two days and then all the symptoms subsided. Three days after the onset of the illness there was not the slightest trace remaining and no evidence of any involvement of the nervous system.

It is impossible to get statistics on the frequency of these gastro-intestinal disturbances, and, unless there was some suspicion on the part of the attending physician or anxiety on the part of the family that the case might be poliomyelitis, they were not brought to the attention of the Health Department. The statements of some of the physicians who see a large number of children confirms the opinion that gastro-intestinal disturbances of about the type described above, and even greater severity, have been quite frequent during the past season. None of the so-called suspicious cases have been included in the statistics of the Health Department.

Considering poliomyelitis as an acute infectious disease produced by a specific virus, the term aborted as applied to the disease has been used in the present classification to mean that the paralysis and not the infection was aborted. The definition has therefore been extended to include such types described by Wickman as meningeal, polyneuritic and ataxic, and even some of the cases where a slight weakness was present for a few days, but in which recovery was prompt and complete.

Thirteen of the cases reported were considered aborted poliomyelitis. This falls far short of the actual number of such cases, and even if a large percentage of the so-called suspicious cases were found to be a simple gastro-intestinal or febrile disturbance, there still remains a considerable number where some slight involvement of the nervous system places the case quite definitely in the class of aborted poliomyelitis.

The following case was considered at the time of the illness as a simple gastro-intestinal disturbance and was not reported. A child two years old was taken ill with malaise, fever and vomited once. The fever lasted several days and the child would not take food. No pain, tenderness or stiffness of the neck or back. After one week was well but showed some weakness in the legs for a day or two. On examination, one month after the illness, no evidence of the attack could be found, but the clinical history, stating that weakness was observed for a day or two following the constitutional symptoms, would indicate a slight involvement of the nervous system, and the attack should have been considered as aborted poliomyelitis. This opinion is further strengthened by the fact that three days before the onset of the illness a sister 4 years old was taken ill with the same initial symptoms and became paralyzed.

In the examination of 180 cases (which includes a few from the surrounding towns) there were only 29 which are suitable for the present study, that is, those cases which were seen in a stage before the paralysis developed or which remained aborted.

The results of the examination in these cases are tabulated in the accompanying chart (Chart No. 1).

The earliest symptoms in all these cases were very similar and there was nothing to indicate which would become paralyzed and which would stop short of this. A similar history was obtained in most of the other cases examined, but as they were not under observation during the pre-paralytic stage, the data have not been utilized in the present summary.

Fever was noted in all the cases as one of the earliest symptoms; the usual course being a rather rapid rise, reaching its height about the second day. In the cases with marked meningeal symptoms the fever continued high longer than in the paralytic cases where there was a rapid decline to normal soon after the development of paralysis.

In 17 cases a more or less sudden onset of the symptoms occurred, while in the remaining 12 cases the onset was described as gradual. 10 of the cases showed a remission in the symptoms a day or two after the onset and the child was apparently well and allowed to run about. After a day or two intermission the symptoms returned with greater severity, and the majority of these cases appeared more severely affected than those without remissions.

The symptoms referable to the gastro-intestinal tract were those ordinarily accompanying any febrile disturbance and showed no distinctive character. Vomiting, although common, was not a troublesome symptom except in two of the meningeal cases where it was quite severe and of somewhat projectile character.

Constipation was present at the onset in 22 cases, and in some of them it had existed for several days before the appearance of other symptoms brought it to the attention of the parents. In two cases the constipation was of an obstinate degree and required active cathartics for several days before an evacuation could be obtained. One of these cases was so obstinate that a paralysis of the bowel was suspected.

In some of the cases, after the initial cathartic, the stools became thin, greenish and foul smelling for a few days. Diarrhea as an initial symptom was recorded only once.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Totals.
Sex.....	M	F	F	F	F	F	M	M	F	M	M	M	M	M	F	F	M	M	F	F	F	M	M	F	F	F	F	F	M	{ M=14 F=15
Age (in years).....	4	7	5½	7	3½	7	2½	1	6½	11	4½	2	4½	19	6	5	5½	7	12	3½	5	6¾	7	5	11	16	20	6	½	{ S=17 G=12
Onset { Sudden... } Gradual... }	S	G	S	S	S	S	S	G	G	G	S	G	S	S	S	S	S	G	G	S	S	S	S	S	S	S	S	S	{ S=17 G=12	
Remissions.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	10	
Fever.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	29	
Vomiting.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	14	
Constipation.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	22	
Headache.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	20	
Vertigo.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6	
Irritable.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	20	
Drowsiness.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	26	
Jerking—twitching.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	19	
Tremors.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	9	
Nystagmus.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	2	
Pain in neck.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	19	
Stiffness of neck.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	23	
Retraction of head.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	9	
Pain in back.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	18	
Rigidity of spine.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	13	
Pain in extremities.....	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	11	
Kernig. Brudzinski.....	+	+	+	+	+	+	+	+	+	K	K	KB	KB	KB	+	w	+	KB	K	K	+	K	K	K	K	+	+	KB	+	{ K=9 B=4
Reflexes.....										++	+	+	+	+	+	+	+	++	+	+	+	+	+	+	+	+	+	+	+	8
Ataxia.....																														2
Dysarthria.....																														8
Temporary weakness.....																														4
Cerebro-spinal fl.....																														4
Types.....	P	P	M	A	W	A	W	S	P	M	M	M	M	P	M	S	S	M	S	W	W	W	M	W	W	W	M	P	S	..
Time before P or W.....	3	3	3	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	..
Result.....	R	P	P	R	R	R	R	R	D	R	R	R	R	P	P	R	R	R	R	R	R	R	R	R	R	R	R	R	R	..

CHART No. 1. Results of Examination in Aborted Cases and Pre-paralytic Stage of Acute Poliomyelitis.

In nearly all the cases the tongue had a thin grayish-white coating, through which the papillæ could be seen as minute punctate spots.

In twenty of the cases more or less severe headache occurred at some stage of the disease, usually at the time, or just before, other symptoms of meningeal irritation were appearing. Some of the younger children may have had headache which was only manifest in the tendency to cry.

Vertigo was complained of in six of the older children.

Twenty of the children were described as being very irritable and restless. This was noticed particularly when the child was aroused from its state of drowsiness or tendency to sleep most of the time, which latter symptom was more or less marked in all but three of the cases.

All of the above mentioned symptoms are of such a general character that a diagnosis of poliomyelitis might be questionable without some more definite evidence of local nervous involvement. It is for this reason that the cases which showed nothing more than these general symptoms, although occurring during the epidemic, were considered as suspicious rather than as aborted poliomyelitis.

When, to the above symptoms, some evidence of meningeal irritation, or other involvement of the nervous structures was added, however slight they might be, the cases were more confidently considered as aborted poliomyelitis.

Jerkings or twitchings in the muscles was observed in 19 cases. Usually this was present only during sleep. In the cases which later showed some paralysis the jerkings or twitchings had not been observed to be more severe or localized in the muscles which became paralyzed.

A number of the cases showed such severe meningeal symptoms that they might be classed under the meningeal type of Wickman.

Pains in the neck and back, most marked on movements of the spine in anterior flexion, and stiffness of the back with tenderness along the spinous processes, and more or less retraction of the head were the symptoms characteristic of the meningeal cases.

In case No. 12 the meningeal symptoms were so severe that at first tuberculous meningitis was considered more probable than poliomyelitis. The child, 2 years old, was taken ill with malaise,

fever and constipation. Two days later he vomited the castor oil which had been given and then had frequent vomiting spells of almost projectile character. Stiffness of the neck and back were observed at this time, increasing in severity and these parts became rigid and extremely sensitive to any movement. The Kernig and Brudzinski signs were present. The child would lie on the bed with the head retracted, but was able to move the extremities if the spine could be kept rigid. The cerebro-spinal fluid showed a considerable increase in lymphocytes. The child made a complete recovery, and within two weeks no evidence of the former illness could be demonstrated.

In some cases the meningeal symptoms have been very severe before the development of paralysis.

Case No. 28, a girl 6 years old, was taken ill with fever,

CHART No. 2. Case No. 28. Showing extent of muscle involvement after paralysis had reached its height.

vomiting and pains in the head for two days. Then felt somewhat better but was unable to walk on account of pains in the back and legs. There was no definite weakness. One week later was admitted to the Ernest Wende Hospital. At that time the meningeal symptoms were very severe; the head was held retracted; the spine rigid in opisthotonos; the lower extremities flexed at the hips and knees and very painful on any attempt to move them. The child would lie on the left side and was so stuporous that she could not be aroused by shaking, but awakened with a scream when the legs were extended. At this time all movements were present and were limited only by the pain. During the first week in the hospital the meningeal symptoms gradually subsided, and with this a paralysis of the lower extremities developed. The right extremity became motionless and the left showed considerable loss of power. On September 4, one month after the onset of the illness, the paralysis was as represented in the accompanying chart (No. 2). There was loss of all movements in the right lower extremity, except abduction with slight outward rolling of the thigh produced by the action of the tensor of the fascia lata and a weak sartorius. The left side showed considerable weakness of the adductors and some weakness of the quadriceps and glutei. All the other functions were normal.

Pain or some sensitiveness in the extremities was complained of in ten of the cases, and in four of these the tenderness was definitely limited to the course of the nerve trunks. The pain and tenderness usually increased with the onset of the paralysis and became a troublesome symptom during the first week or two. In the cases which did not go on to paralysis the pains and tenderness subsided with the decline in the other meningeal symptoms. In the latter class the pains appeared definitely of a meningitic character, while in the former they had the character of a peripheral neuritis.

The tendon reflexes were present during the early stages, and in the meningitic types they were greatly exaggerated. With the onset of weakness or paralysis the tendon jerks diminished and were finally lost on the paralyzed or weakened extremity.

In the accompanying chart (No. 1) there are only five of the cases which are classed as simple aborted. These cases showed only slight meningeal symptoms in addition to the constitutional disturbances.

In ten of the cases the meningeal symptoms were very severe, giving the course of the illness a distinctive type. They all recovered without paralysis, except one (Case 13) in which a slight weakness of the right leg was present for a few days.

Some disturbance of the motor functions of the cranial or spinal nerves occurred in 19 of the cases.

Ataxia was observed as a temporary condition in eight cases, and in two of these it was of sufficient prominence and not associated with severe meningitis or muscle weakness that the cases were classed as ataxic. Two of the cases were associated with a slight nystagmus of temporary duration.

In seven cases there was a slight temporary weakness of one or more extremities followed by complete recovery in a few days.

A slight disturbance in speech was observed in two cases, in one of which a transient weakness of the left face, with slight dysphagia and double vision, occurred. All these disappeared in a day or two.

While it might be claimed that the cases showing these temporary motor disturbances should be classified as paralytic rather than abortive, the condition was so slight and fleeting in most of them that the term paralytic applied to such cases gives an erroneous impression of the clinical course of the disease.

Five of the cases developed a severe degree of paralysis from 2 days to a week after the onset. One of these has apparently recovered in two months. One case died of a rapidly advancing Landry type of the paralysis with involvement of the muscles of respiration. In the other three cases the paralysis persists and is probably more or less permanent.

Summarizing the findings in these 29 cases and comparing them with the suspicious cases and the remainder of the paralytic cases observed during the epidemic, it is found that all grades of transition occur from the mildest gastro-intestinal or simple febrile disturbances to the severe paralytic and rapidly advancing fatal cases. While the majority of the cases observed during the epidemic conformed to the regularly recognized types of the disease, transitional and mixed types were not uncommon.

Until some reliable diagnostic criterion can be found, based on chemical, bacteriological or other laboratory evidence, the etiology of many of the febrile disturbances of early life must

remain questionable. That some of these are produced by the virus of poliomyelitis appears highly probable.

The work on the cerebro-spinal fluid obtained by lumbar puncture has been done by Dr. Nelson G. Russell and his report is included in this paper to complete the clinical data.² It is as follows:

"It would be a very great aid in this study if one could add the spinal fluid examination in each case, but the indefinite variety of the early symptoms coupled with the doubtful value to the patient renders this almost out of the question.

"The findings in the aborted cases do not differ very much from those in the paralytic cases.

"The examination of thirty-five cases of poliomyelitis in the paralytic stage from the second to the eleventh day gave an average count of thirty-seven cells to the cu. mm. and a polynuclear count of not more than 3 per cent.—eight cells on the fourth day and 132 on the third day being the limits. Two cases in the pre-paralytic stage gave an average count of 78 cells, one showing a 10 per cent. polynuclear count and both giving strong globulin reaction. Four cases which were classed as aborted gave an average count of 27 cells, the lowest being 19 cells.

"During the epidemic we had four cases of tuberculous meningitis, which gave counts not differing from a poliomyelitis count, although one gave over 300 cells. In two of the cases the tubercle bacillus was found in the spinal fluid, but in the others we were unable to determine the diagnosis definitely until post mortem.

"Unfortunately for the diagnostic value of the examination of the spinal fluid, we encountered, toward the end of our series, at least one other condition which gave the characteristic poliomyelitis findings and which proved to be typhoid fever with meningeal symptoms. The patient had symptoms of digestive disturbance, meningeal irritation, stupor and irritability; at times pain in the neck and slow reflexes. The spinal fluid gave a count of 23 cells, 12 per cent. polynuclear and an increased globulin reaction. This seemed to be quite like an aborted case of poliomyelitis but he was probably suffering from typhoid fever, for he gave a positive Widal reaction three days later and had a perfectly normal typhoid fever course.

² Presented in the discussion of the foregoing paper.

"The globulin reaction showed some increase in every case, although not in proportion to the cell count.

"Fehling's solution was reduced in all cases but one, that being the fluid in the pre-paralytic stage in one case. In this case the fluid had been kept over night, which may have modified the reaction to some extent.

"While the spinal fluid examination is of great value as an aid, the fact that tuberculous meningitis and the meningeal irritation of acute infectious diseases give such similar symptoms and spinal fluid findings, the result of a single examination is only an aid and is not by any means positively diagnostic."