almost a continuous hiccup, and repeated vomiting attacks during the first four days in the hospital. He received treatment for pyorrhea by Dr. Frederick B. Moorehead. The Wassermann test was negative. The patient gradually improved, could again walk, although he staggered somewhat, and a slight diplopia persisted. In August, 1912, he had a relapse for a time, and when examined again, presented analgesia of the right side of the face and the entire left side of the trunk and extremities. The right arm and leg were slightly weaker than the left. He had a bilateral ankle clonus, more marked on the right side; other tendon reflexes stronger on the right side. He again improved after his mouth had been treated. In December, 1912, left hemiplegia quite suddenly developed, and it was definitely stated that this attack was preceded by an aggravation of the pyorrhea. In June, 1913, he returned to the hospital for a week, when examination showed a right trigeminal anesthesia, left spastic hemiplegia, right hemianalgesia, and thermanesthesia.

Nov. 4, 1913, he became stuporous, and had dysphagia, bilateral Babinski reflex and ankle clonus; no voluntary movement of either extremity; abdominal reflexes absent, right corneal reflex absent, and left present. He developed a rise of temperature, and signs of pneumonia appeared. He died Nov. 6, 1913.

A necropsy was held, November 7, by Drs. F. R. Nuzum and Peter Bassoe. The only finding outside of the brain was a bronchopneumonia. The brain revealed moderate edema of the pia; the right half of the upper portion of the pons was distinctly softened. A pipet was introduced to secure material for culture. No pus was present. Subsequent examination of the brain after hardening with liquor formaldehydi revealed a distinct, nonsuppurative inflammation in the softened part of the pons, chiefly characterized by large accumulations of mononuclear cells about the vessels.

COMMENT

The history of these cases shows not only a history of focal infection, but also in two of the patients slight arthritic changes in the vertebrae, most pronounced at those points which correspond to the most definite changes in the central nervous system.

104 South Michigan Avenue.

ABSTRACT OF DISCUSSION

DR. H. T. PATRICK, Chicago: I am far from wishing to deny involvement of the central nervous system from focal infection, but I think Dr. Hall has hardly proved his case. In all his cases he found evidence of arthritis, and I do not see the necessity for assuming infectious involvement of the central nervous system to account for the symptoms. These could all be accounted for by secondary involvement of the nerve structure by way of the arthritides. In the last case we are in doubt whether or not there was softening due to vascular occlusion. If these cases were due to teeth and tonsils, they were hemogenic, which had nothing to do with direct invasion of the nerve trunks and thence by way of nerve roots to the spinal cord. This route is as yet hypothetical, but this does not prevent it from being an attractive field for investigation, and I am glad that Dr. Hall has called attention to it. My own experience has been that in the vast majority of these cases what seem to be neuritides are really arthritides.

DR. J. P. MUNROE, Charlotte, N. C.: I am inclined to agree with the last speaker. Most of these cases can be explained otherwise than by an involvement of the central nervous system.

DR. A. L. SKOOG, Kansas City, Mo.: It is interesting to note that we find infections of the central nervous system secondary to other foci in the body. In these cases I am inclined to think they are not conclusively proved. I believe the fault rests on the bacteriologic examinations, which have not been completely conducted.

DR. G. W. HALL, Chicago: I am entirely satisfied in my own mind as to the relation between cause and effect in these cases. I think in the course of two or three years these same

gentlemen will have changed their minds as expressed today. In the first case the patient was taken to a hospital where they found, according to the roentgenograms, changes in the cervical vertebrae, as I have reported. The same patient was taken to a different hospital, and Dr. Billings was called in and gave an independent opinion. He declared that there were no arthritic changes in the spine, and felt that the changes were of a multiple sclerotic nature and that the primary infection came from the teeth. This opinion was independent of mine.

A REPORT OF A GROUP OF ONE HUNDRED AND TEN CASES OF POLIOMYELITIS

FROM THE ACUTE ONSET TO THE PRESENT TIME*

CHARLES OGILVY, M.D.
NEW YORK

The group of 110 cases of poliomyelitis on which this report is based, with fifteen additional cases, represents the result of the study of an epidemic in a suburb of 35,000 inhabitants of New York City during the summer of 1916. These 110 cases were all isolated in hospital accommodations where each patient could be continuously observed.

The origin of the disease in this community was definitely traced through a carrier coming from an infected household in Brooklyn. The district first infected was an Italian community, in which particular section forty-two cases developed. This community was somewhat crowded, although in a comparatively clean neighborhood.

The first case developed on July 13 and the last one on Oct. 25, 1916. No other cases have developed from that time up to the present date.

Early Diagnosis.—The majority of the cases were somewhat similar and developed as follows: The child was said to have been sick from one to four days with fever, usually vomited and frequently gave a history of pain in the head, neck, back or extremity. On examination, the child was found to be lying on its side, with the head thrown back, quiet or asleep. When aroused it was usually irritable. In 81 per cent. of the cases there was stiffness of the neck.

Other evidences of the disease were found to be an abnormal condition of the knee jerk, and disturbances of reflexes throughout. In addition to these clinical findings, the diagnosis was corroborated by a spinal fluid examination. These specimens were all examined at the von Wedel Laboratory of the New Rochelle Hospital, and the diagnosis was confirmed in many doubtful cases by this examination. A lumbar puncture was made in eighty-two cases.

One course of the disease frequently seen was that in which the child was sick for a day or two and then apparently better, being allowed to get out of bed, after which the fever returned and the typical symptoms developed. It may be here remarked that there was but one case resembling the classical picture so often described in textbooks, of the child going to bed perfectly well, taken ill during the night and found to be paralyzed in the morning.

There were twenty-five cases of suspected poliomyelitis in which the spinal fluid gave negative findings. In each instance, the cell count was under 20.

* Read before the Section on Orthopedic Surgery at the Sixty-Eighth Annual Session of the American Medical Association, New York, June, 1917.

The fluid was normal, Fehling's always unreduced. The fluid was always clear, and there was no increase in albumin or globulin. In none of these twenty-five suspected cases of poliomyelitis giving negative spinal fluid findings did poliomyelitis subsequently develop. On the other hand, in none of the cases in which the spinal fluid gave positive findings was a mistaken diagnosis made—all developed poliomyelitis. From these data, it is fair to assume that a definite early diagnosis can be made by carefully studying the clinical symptoms in conjunction with the laboratory findings of the spinal fluid.

During the first week nineteen patients were admitted to the hospital. In one month there had been eighty-one patients admitted. By October 25, 110 patients had been admitted, the time of detention in each case being not less than six weeks. There were fifty-six male patients, or 50.9 per cent., and fifty-four female patients, or 49.1 per cent. There were only three colored children, or 2.7 per cent. This is undoubtedly due to the fact that a small proportion of the population are colored people.

The ages varied from 2½ months to 45 years. Those patients under 5 years numbered eighty-five, or 77.3 per cent.; from 5 to 10 years of age, fourteen, or 12.7 per cent.; from 10 to 15 years, eight, or 7.3 per cent.; over 15 years, three, or 2.7 per cent.

It is interesting to note that in eight families there was more than one case. Also, that the houses having more than one case, not in the same family, were six in number, so that no fewer than seventeen cases of the disease might be assumed to have been contracted from other members in the same house, a percentage of 14.5.

On further study of this subject, however, we learn that in but six of these seventeen cases did a sufficiently long period elapse to justify the conclusion that the disease was contracted from other members of the same household, as explained in the accompanying table.

CASES OCCURRING IN SAME HOUSEHOLD

Name	Date of Onset	Name	Date of Onset
J. C.	July 24	B. T.	September 4
T. C.	July 26	S. G.	July 13
J. H.	July 27	M. M.	July 18
P. H.	September 8	J. P.	July 19
P. F.	August 9	A. P.	August 1
T. F.	August 10	M. D.	August 3
J. P.	August 9	D. C.	July 21
I. P.	August 10	A. L.	July 26
G. P.	August 17	F. O.	August 5
J. H.	August 24	W. D.	August 7
A. H.	August 26	R. H.	July 31
E. N.	August 11	W. S.	July 31
H. N.	August 14	R. T.	August 10
D. S.	August 15	H. S.	August 4
F. S.	August 21	M. H.	August 15
I. T.	August 26		

In one family three out of seven children contracted the disease, two of whom died. In another family, two of three children developed the disease. In another, two out of five and in a fourth family, two out of four children. In a fifth family, two out of six children, and in two other families both of the children in each family were affected.

Of houses in which more than one case occurred not in the same family (tenement and two family houses) there were three cases each in two houses and two cases each in three houses. This gives us a total of twenty-nine cases, or 26 per cent., all of which were associated with one or more cases in the same family or house.

Paralysis.—Paralysis occurred within the first few days of the disease. The average time of the onset

of the paralysis was the fourth day. The percentage of paralyzed and nonparalyzed patients was from fifty-eight to forty-two. The day on which the largest number of cases of paralysis occurred was the third day. The result of my observations led me to expect a recovery without paralysis, if the patient showed no signs of it within the first eight days of the disease.

It is of interest to note that eight patients in whom facial paralysis developed had no other paralytic involvement, and but two of the other paralyzed patients had facial involvement. Deducting the patients who died, 55 per cent. of the paralyzes involved the lower extremities.

In studying the relation of the paralysis, both in degree and extent, to the cell count in the spinal fluid, I found that there is nothing to indicate either the type, degree or extent of paralysis by this means. In some cases, in which the paralysis was very extensive, the cell count was low, as in Case 2, cell count 43; Case 5, cell count 80; Case 7, cell count 65. In cases in which the paralysis was nil, the cell count was high, as in Case 46, cell count 265; Case 83, cell count 380; Case 84, cell count 392; Case 91, cell count 880; Case 107, cell count 1,160. In taking an average of the cell count, I have found that it did not average as high in the paralyzed as in the non-paralyzed patients.

It may also be here stated that the degree of temperature in no way indicates the amount of paralysis which may or may not follow.

It was occasionally noted that shortly after admission the child would become quite rigid with tetanic spasms. These patients recovered without paralysis.

Deaths.—There were nineteen deaths, or 17.3 per cent. One of these patients died of bronchopneumonia on the twenty-third day of illness. With the exception of two other patients, all died within the first five days of the disease, so that I learned to look for recovery, provided the child did not die within the first few days of the acute attack.

A large majority of the patients died from respiratory paralysis. With one exception stupor set in early, the temperature running from 102 to 105 F. The majority of the patients, also, had difficulty in swallowing—involvement of the glossopharyngeal nerve. Stupor and inability to swallow were invariably looked on as precursors of death.

Immunized Serum.—Fifteen patients were treated with immunized serum. Administration was begun in each patient at the onset of the disease (the first to third day). Two groups of cases were selected for treatment; namely, the first, the nonparalyzed patients with but mild symptoms, the other, the severely affected patients. Seven were selected for the first group, eight for the second.

Of the seven nonparalyzed patients, but one subsequently developed paralysis. It was at first thought that this case was rather promising and that the serum in all probability had been a factor in preventing paralysis from occurring in the other six cases. In this relation, however, in studying twenty-nine other patients who were not paralyzed and who did not receive serum, only five developed paralysis subsequently. This percentage is practically the same as might have been expected had serum been used, so that I feel justified in concluding that the administration of serum in the nonparalyzed patients does not materially affect the prognosis. In the eight severely prostrated patients, six died, and of the two who

recovered, one gradually became more severely paralyzed, the other recovered without paralysis. It is very doubtful, therefore, that serum affected in any way these severely paralyzed patients.

Epinephrin.—This was administered in three patients without any apparent beneficial effect.

After-Care.—All the patients, without exception, on their discharge from the hospital were referred directly to an orthopedic clinic which was organized specifically for this purpose. To this immediate and continuous supervision and treatment I attribute in great part the excellent results which are now being obtained. The plaster of Paris fixation splints which were used in the hospital have been continued in the clinic with the same object in view.

That which has most impressed me in regard to the recovery from paralysis is the fact that long continued rest extending, if possible, over six months' duration in a light fixation splint, such as a posterior plaster of Paris shell, has been the one greatest factor in obtaining the best results.

Massage was begun within two months after the acute onset. It was soon learned that patients so treated did not do as well as those in which the massage was postponed until the third or fourth month.

The greatest difficulty has been to keep the limb at perfect rest after it has recovered sufficiently to allow the child to get about. In those cases in which it has been practically impossible to keep the children off their feet, light, carefully adjusted braces have been supplied. These braces have been furnished simply to prevent deformity in carrying the body weight. Overfatigue in these cases has been noted time and time again, with resultant arrest of progress in the return of function.

In paralysis of the deltoid, I have found the most convenient and comfortable brace to be that of a plaster of Paris splint molded to the side of the chest and extending out at right angles to support the arm. This is bandaged to the body and has proved a practical application.

Muscle Testing by the Balance Weight.—At first, I regarded this measure with a good deal of scepticism. My opinion, however, has now changed since I have learned that in patients on whom it can be applied, the physician will have a much more definite knowledge of the progress of the case and can then more intelligently advise regarding muscular activities. I have in several instances, for example, passed opinion on the extent of the progress of a case by an ordinary manual examination, after which muscle testing by the balance weight having been made, I have recognized decided errors which otherwise it would not have been possible to check up.

A large majority of the patients affected, namely 77 per cent., were under 5 years of age. This necessarily eliminated all but 23 per cent. of the patients, some of whom were not paralyzed, and other of whom died, leaving a small minority of patients in whom muscle testing by the balance weight was applicable. This muscle testing should be made by the same individual each time in order to be accurate.

Muscle Training Exercise.—The exercises have been attempted in all the patients. My experience has been that these exercises are of great value when they can be closely supervised by both the physician and nurse. When, however, this supervision must be left in great part with the parent, the results are not

nearly as good, although it may be said that they appear to be better than would be expected if no such muscle exercises were undertaken. I have not employed electrical currents of any kind in the treatment of any of these patients.

Bath Exercises.—A method which I have found to be of great advantage, both in examination and in muscle training exercises, has been bath exercises. For this purpose, I have had installed in our clinic a bath 4 feet by 3 feet. In this bath, the slightest response of returning power in a muscle or group of muscles can be detected and recorded. In addition to this, the patient is encouraged to attempt and obtain motion which would otherwise be impossible—and this without the slightest overfatigue.

Thirty patients have been discharged from our clinic, having completely recovered and being in need of no further supervision. This number represents 33 per cent. of all the patients, exclusive of those who died. To these, I may add another 26 per cent. who will in all probability be discharged as cured within six months' time. This leaves 41 per cent. who will require further treatment. Of these patients, 26 per cent. are able to walk comfortably, but 15 per cent. are unable to do so. Of this 15 per cent., however, one half of the patients are 2 years old or under; which accounts in part for their disability.

CONCLUSIONS

1. A reliable early diagnosis can be made in a large majority of the cases.
2. We are unable to prognosticate regarding the subsequent severity of the paralysis, either by the acuteness of the febrile stage or any laboratory findings thus far submitted.
3. When death occurs, it takes place with few exceptions during the first few days following the acute onset.
4. Treatment outdoors during the convalescent stage is most beneficial.
5. In my experience, immunized serum treatment has not proved efficient.
6. Although there is nothing to disprove the possibility of an insect carrier, the evidence herewith submitted would sustain the assumption that poliomyelitis is a contagious disease.
7. Although muscle testing by balance weight is applicable in only a small percentage of the patients, in these patients it is of much value.
8. Continuous supervision is most important.
9. Continued electrical treatment is not essential for the recovery of lost muscle function.
10. Bath exercises in relation to muscle training form one of the most practical and useful lines of treatment that can be followed out.
11. Complete rest extending over six months is one of the most important factors in obtaining perfect return of function.
12. Overfatigue is of the greatest detriment to improvement, and is most difficult to guard against.
13. Braces should be made as light as possible and should be supplied immediately when body weight-bearing tends to produce strain or deformity.
14. The percentage of paralyzed and nonparalyzed patients in an epidemic may be expected to be about 58 per cent. paralyzed, 42 per cent. nonparalyzed; or, excluding those who died, 49 per cent. paralyzed, and 51 per cent. nonparalyzed.

40 East Forty-First Street.