



TWENTY-FOUR CASES OF ACUTE EPIDEMIC ENCEPHALITIS

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While at the Philadelphia General Hospital in the capacity of psychologist, I had occasion to examine a considerable number of children in various stages of acute and post epidemic encephalitis who were under study and treatment in the Neuropsychiatric Clinic. Dr. Franklin G. Ebaugh has published a psychiatric and neurological study of seventeen of these cases, fourteen of which I am including in this study. The other ten cases have not to my knowledge been reported.

Since many of these children presented acute social problems, not only to the school, but also to their own families, it seems worth while to report the results of the study made of their reactions and mental ability as shown in complete psychological examinations. We would almost expect what is presumably a germ disease, directly affecting the central nervous system, to produce some changes, temporary or permanent, in the behavior of the afflicted, and this study was made in the attempt to ascertain whether the psychological examinations would throw any light on any of the behavior disorders; also to discover whether there is any similiarity of reaction patterns, and especially whether the encephalitis permanently lessens the mentality of the child.

ACUTE SYMPTOMS

Considerable study of epidemic encephalitis has been made, and the findings have scientifically and unscientifically been reported in various articles, so many already are familiar with the outstanding symptoms of this disease. But for those whose knowledge may be vague or confused, I will outline briefly the principal signs of which the physician recognizes and makes his diagnosis of acute epidemic encephalitis.

Many times the acute stages are so mild that the disease passes by unrecognized, and only when the grave after effects are noticed, is a very careful history obtained, and the diagnosis of epidemic

encephalitis made. In other cases, the acute symptoms are very marked and the residual practically negative. During the acute period, in various combinations occur the symptoms of headaches, fever, dizziness, and lethargy of from one day to several weeks. This lethargic period is followed by insomnia which may be marked for a year or more afterward. Visual disturbances, as diplopia and ptosis, choreiform movements, facial and other twitchings, delirium, hallucinations, delusions, convulsions, and oversalivation are other cardinal symptoms associated directly with the nervous system. Frequently encephalitis is associated with influenza. As to the neurological sequelæ, we find persisting for as long as three or four years, choreiform movements, twitchings in the sleep, paralysis agitans, partial paralysis of the limbs, internal strabismus, irregular pupils and over salivation.

BEHAVIOR SEQUELÆ

To the psychologist, because his aid is so often sought in explanation of non-conformed responses, the behavior sequelæ are perhaps most important and interesting. Therefore I will attempt to put before the reader in some detail, the malbehavior of these children, and later discuss the actual test findings. Following the acute period, appear, sometimes suddenly, nocturnal restlessness, hysterical tendencies, epileptoid attacks, overactivity, impulsiveness, over affectionateness, obscenity, and general incorrigibility. In other cases there are no behavior abnormalities resulting.

The decided change frequently noted in reaction patterns is a rather unique phenomenon. From well behaved acceptable children to those whom the regular school class excludes and the parents are helpless to control, is not an uncommon story. We find this especially marked in cases No. 9, 10, 12. *Nathan* (case No. 12), had a record of normal behavior at school and at home previous to his attack when eight years old, which altho the acute symptoms were severe enough to be readily recalled by the mother, were undiagnosed by the family physician and the residual hysterical attacks treated as epilepsy. After the illness there was a total change in the boy's disposition and character. He became noisy, abusive, impulsive and destructive. Many times was he untruthful. He begged for money on the streets altho the parents were well to do and supplied liberal spending money. In addition to hysterical

attacks which generally were brought on as an avoiding reaction when any disagreeable duties were at hand, the boy once tried to jump from a rapidly moving automobile, and once attempted self-strangulation, altho he denied wanting to die.

Charles (case No. 9), who came from a stable, lower middle class home, illustrates this same total change in disposition. School progress had been normal, the sixth grade reached by 11 years, and there was no report of conduct disorder. After the epidemic encephalitis, the boy showed marked emotional instability, fought on the least provocation, told many queer tales, and was unable to concentrate on his lessons. So unmanageable was he in the regular classroom that the principal transferred him to a disciplinary school.

Thomas (case No. 10), was another boy whose conduct after the attack forced the authorities to transfer him to a disciplinary school. Deceitfulness and fighting, and what the mother described as "just deviltry," were the outstanding difficulties.

In none of these three cases were there any environmental influences found which were at all accountable for the new difficulties, although very careful social investigations were made in each instance. Neither did the psychiatric or social studies explain why the disorders took the form they did.

With some of the other children, delinquent tendencies or obvious temperamental difficulties had existed previous to the epidemic encephalitis, but the disease seemed to aggravate the predispositions. *Anna* (case No. 3), was always quick tempered, high strung and difficult to discipline. However, after her attack in 1918 when eleven years old, she became much more unmanageable, both at home and at school, and as was the case with many of the children whom we observed, became sexually precocious. Her delinquency was so marked that she finally reached the district Probation Officer.

Ione (case No. 7), probably always had neurotic traits, but following influenza with two weeks lethargic period, which seemed to warrant the diagnosis of epidemic encephalitis, the child showed a marked domineering, selfish disposition, was very whiny, did not get along with her brothers and sisters, and was extremely destructive with her toys.

Victor (case No. 14), came from a congested Italian home, with very little if any, intelligent disciplinary training. Probably "naughtiness" would be an expected result of such an environment. After the attack of encephalitis at the age of 7, however, the boy's tendencies to incorrigibility showed a decided increase; they took a more violent turn and developed along the lines of sexual precocity. Aside from extreme overactivity and quarrelsomeness, which was probably more noticeable because the home was so small, the parents, after *Victor* had attempted to stab several members of his family with a carving knife, were terrified as to what mood would next be given vent to. The little boy would run up to strange girls on the street, throw his arms around them and try to kiss them. On one occasion he attempted intercourse. Another abnormal display of this precocity was sexual misuse of a cat which resulted in the animal's death.

George (case No. 15), was another youngster whom the social investigation seemed to show had neurotic traits from an early age, and whose mother was "easy prey" for gratification of his various whims and desires. But the encephalitis seemed to greatly aggravate undesirable patterns. He showed streaks of marked cruelty, tried to stab another boy; was very unpopular with his playmates because of extreme "bossiness." Not infrequently *George* had periods of marked excitement, which took the form of yelling, or attempting to jump from the window, or psychical blindness or deafness. The psychical deafness was truly hysterical in character, occurring when something unpleasant or undesirable, often corrective discipline, was trying to be effected. After patient struggling, the school was finally forced to place him in a disciplinary class.

In order not to give the impression that most of the encephalitic aftermath is marked behavior disorder, let me mention some cases where this is not true. *Hazel* (case No. 1), a colored girl whose encephalitis occurred when 7 years old and whom we saw 6 years later, never presented a behavior problem, and only sought medical aid because of various nervous complaints. *Warren* (case No. 17), was examined over a year after his attack, and had developed no behavior irregularities. His residual complaints were restricted to neurological symptoms. *Carl* (case No. 21), who probably had one of the most severe attacks of any of the children in the group of 24 studied, had very marked neurological after

effects, but not the slightest abberance along behavior lines. *John* (case No. 23), a little colored boy of 8, had during the acute period, serious abnormalities which necessitated committing him to the Psychopathic Ward of the hospital, but after several weeks care he seemed to return to his former normal behavior, and now, after a period of over one year has elapsed, still presents no conduct problem.

The records of these boys and girls, although not by any means covering all varieties of post-encephalitic behavior, do help us, I think, to isolate certain types of non-conformity as possible encephalitic disorders, which should be referred to clinics where complete psychiatric and social studies will be made.

PSYCHOLOGICAL STUDIES—METHOD

The ages of the twenty-four cases ranged, at time of examination, from 2 to 19 years. The examinations were made from 6 years to 3 months after the onset of the disease.

6 years after onset	1 case
5 years after onset	1 case
4 years after onset	2 cases
3 years after onset	6 cases
2 years after onset	3 cases
1-2 years after onset	3 cases
less 1 year after onset	8 cases

In all cases except the two babies, *Doris* (case No. 20) and *Isadore* (case No. 6) a complete examination was given, including a series of performance tests selected as the case seemed to demand from the Witmer formboard, Witmer cylinders, Healy A, Healy B, Gwyn triangles, Dearborn formboard, Porteus mazes or Young's slot maze A, memory span (audito-vocal and visual audito-vocal for digits forward, and audito-vocal for digits reversed, and audito-vocal for syllables), and supplemented by the abbreviated Stanford Revision of the Binet tests. With the two babies the Kuhlmann tests were the basis of estimate. Each examination was conducted in a quiet room, with only the child, and sometimes his mother, and the writer (as examiner) present. The usual time per examination was one hour. The topical tables give the names of the cases, the date of the examination, the date of and age at onset of

the disease, acute symptoms, psychiatric and neurological sequelæ at the time the psychological examinations were made. It seemed interesting and most important to compare, if possible, the mentality before and after the encephalitic attack. There was, however, no accurate way to obtain information of mental ability previous to illness, so the varied statements as given by parents and schools had to be accepted for what they were worth, and hence nothing more than a rough estimate could be made.

The psychological diagnoses attempt to summarize the entire findings and give an understanding of the child's complex of abilities. The outstanding reactions are noted. The latest progress reports on the cases, obtained from the psychiatrist as recently as December 1924, were based on his personal observations after following the children from their initial clinic visit. Unfortunately some children did not continue under care, so their progress cannot be reported. I have tried by means of the tables to give not only a picture of each case, but also to put the material in form so that any one case can readily be compared with another and with the whole group. The tables probably give sufficient data for the majority of cases so the detailed histories and psychological findings of only 7 cases which are considered typical and especially interesting will be given.

SPECIAL CASE STUDIES

Edith (case No. 4), was 5 years and 8 months at time of examination, and the onset of the encephalitis had been at 2 years, with influenza followed by delirium and 5 days of lethargy. I believe that we can trust the report of the mother, who was unusually dependable and intelligent, that mental development until 2 years had been absolutely normal. This opinion was the result of experience with a number of older brothers and sisters who had all grown up and progressed well in school. Following the period of illness, the child was very restless, easily agitated, and the usual disciplinary measures had little effect. Regular and steady training had brought almost no improvement. In a kindergarten class she could not adjust to the other children, and accomplished nothing of the regular work. During the psychological examination at the Clinic Edith was distractible to the extreme. With constant urging to persistence and with some help three trials of the

Witmer formboard were accomplished, but discrimination of the various shape blocks was poor, and more at the level at which most $2\frac{1}{2}$ to 3 years olds fall. The circle was easily placed in its hole, but with star, triangles and cross, poor muscular control and coordination were especially marked. After the formboard test, the child cried and resisted all efforts to obtain further performance. The mother reported that this lack of persistence and the instability were the type behavior she had been trying to cope with for the past three years.

The entire picture presented was that of a development not more than low grade, or probably idio-imbecile. Since there has been no improvement in mental development or emotional balance during a period of over four years, the psychiatrist gives little hope for a favorable prognosis.

Jessie (case No. 5), was 10 years 4 months old when examined 4 years after her attack. The symptoms of fever, delirium, three weeks lethargy and visual disturbances unquestionably warranted the diagnosis of epidemic encephalitis. Ever since the child has been restless, overactive and very difficult to manage. Her display of affection was out of all proportion—she would throw her arms around and kiss people whom she had just met. While in the hospital for a period of study, the youngster upset the whole ward by her boistrous and uncontrolled behavior. The mother was Italian, most faithful and willing to follow all the physician's suggestions, but not very intelligent in planning possible methods of securing better behavior.

If the mother's judgment can be relied upon, *Jessie's* school work of one term had been entirely satisfactory before the encephalitis. Since then attendance has been very irregular, and this undoubtedly affected the results of the Binet tests, where the mental age and upper limit was 9 years, and the I.Q. 87. The reading test at the 10 year level was a complete failure, and the vocabulary was just passed at the 8 year level. The Italian environment may have contributed to the difficulty along language lines. The time results with the performance tests were somewhat variable, ranging from lower 10 to upper 75 percentile, but as to quality, there was nothing unusual. Attention factors were good thruout, the work was planfully attacked, altho somewhat slowly executed. Memory span in all its aspects, visual and auditory for digits forward,

digits reversed and syllable span, was well up to age median. As a whole the tests results showed nothing unusual as to quality, and on the quantitative side the diagnosis is probably lower average, which seems to have been her level before the encephalitis.

Jessie had the good fortune in 1923 to be admitted to the school class at Episcopal Hospital, of which more will be said later. Under the steady, even régime and discipline, there was great improvement. Her school work was of about 3B quality, age 11½ years. She was usually slow and the teacher felt not more than dull normal. Emotional instability is still very evident to anyone who sees the child over any length of time. Little things irritate and upset her, and the tears come easily. But the marked overaffectionateness which was so noticeable, has either disappeared or been suppressed, and her behavior is more normal and tractable. Since returning home, however, after the Episcopal Hospital experiment ceased, she again was such a problem to the family that they have asked the Juvenile Court for placement.

Isadore (case No. 6), was 3½ years when referred to the Clinic by a social agency. The family are Polish, and have standards as good as most of their social group in South Philadelphia. Eleven siblings all seemed normal mentally. During the middle part of pregnancy, the mother had a rather severe attack of influenza, otherwise the prenatal history was negative, and the birth was full time and normal. Following birth the baby slept continually for eight days, only being awake during feedings. This apparent lethargy was followed by 11 weeks insomnia with almost continual crying. The baby had, at time of examination, never learned to walk nor talk. He showed signs of recognizing his mother and the one sister who had considerable part in his care. This recognition of two members of the family was about the only evidence of any mental development. Stolid, indifferent, unalert was Isadore and by the Kuhlmann standards he did not reach the 12 months level, and seemed to present a picture of typical idiocy. Altho the diagnosis of epidemic encephalitis cannot certainly be made, when presented at a large pediatric clinic, the diagnosis was not refuted. It seems that either in utero or, immediately after birth, the disease attacked the central nervous system, leaving its permanent mark.

Nicholas (case No. 11), was 19 years old when examined and had for the past three years been suffering from the after effects

of epidemic encephalitis. The boy came from a congested home in the Italian district. On the charges of truancy, vagrancy and using dope, he had been committed to a reform school. While there the pronounced symptoms noted in the table appeared. Of all the cases observed in this group, the neurological sequelæ are most pronounced. There is a typical Parkinsonian or paralysis agitans syndrome, with the mask like facial expression and tremor of the hands. In addition, lachrymation is very apparent. The boy's demeanor is that of extreme slowness and laziness. With the performance tests the tremor was very evident and naturally prevented good control and coordination so that the time results were considerably below median. However the quality of the work was quite fair and the Dearborn formboard showed especially good comprehension and grasp of the problem. The score of the Porteus maze test was $11\frac{1}{2}$ years, lack of foresight seemed to prevent better score. Memory span for digits forward and reverse was not above the 10 year median. With the Binet tests the I.Q. was 64. The 10 year tests were all passed, but at the 12 year level the only success was the picture interpretation. It is evident that the boy has a definite handicap with language and abstract concepts, but it is very probable that intellectually he has always been slow. The encephalitis in this case does not seem to have lessened the general intelligence level, but has slowed down all the motor responses, thus lessening efficiency in the direction where he probably had the greatest competency. The prognosis after long hospital treatment, seems so poor that an application is on file at the Home for Incurables.

The actual test findings seemed to warrant considering him a doubtful or borderline case, and while there does not seem to be any chance, because of the neurological sequelæ that social competency can be hoped for, still as far as the actual mental ability goes, Nicholas would very probably have met the problems of a simple rather routine existence fairly well.

Nathan (case No. 12), from the behavior angle was extremely interesting. At time of examination in April 1922 he was 10 years and 8 months old. The onset of the encephalitis had been just two years before, with acute delirium, facial twitchings, diplopia, and later insomnia. Earlier in this paper, the boy's serious behavior changes, which so distracted his family and school, are described.

Previous to April 1922, Nathan had an excellent school record and was promoted every term. When he first came to the Clinic it was for consultation advice regarding "epilepsy," which had developed since the encephalitis, and had not responded to a regular course of treatment. Altho the boy's attacks did have resemblance to petit mal, careful description and finally observance of a "spell," changed the diagnosis to hysteria, an occasional residual of encephalitis. *Leon* (case No. 8), presented a similar history of hysterical attacks.

A typical hysterical attack was brought on during the psychological examination. Nathan was first given the Witmer form-board. Altho done a little slowly, qualitatively the performance was good. When presented with the cylinder board, it seemed as if the boy realized a real problem was before him, and for some reason did not want to exert himself, so as an avoiding reaction, gradually developed an hysterical condition to see if Examiner or his mother, who was in the room, would let him stop work. He first complained that his hands were getting stiff, which made replacing the blocks difficult. The Examiner paid no further attention to his complaints than to urge continuance. With such motivation we are not surprised that the first trial of the cylinders was not solved alone. In 3 minutes, all the blocks were placed but only three correct. Teaching was required. The second trial was completed in 145 seconds and the third in 117 seconds both of which are quite poor for age. The solution was entirely planless.

Healy A was not completed in 5 minutes, so the solution was shown. The second trial was done in 14 seconds, which indicates good imageability. Healy B was fair—time 120 seconds; Gwyn triangles 185 seconds or lower 10 percentile. Numerous times while working with these games, Nathan repeated his complaint of stiff hands. When he did not receive sufficient consideration, he apparently planned a more radical onslaught. A severe headache was developed and he began rapid puffing movements and rolling his tongue. This was during the Porteus maze tests, where years 5, 6, 7, and 8 were failures. Technically the Examiner should not have proceeded, but feeling sure that failure was due to emotional causes only, the higher levels were given with years 9, 10 and 11 passed on second trial each. The 12 and 14 year tests were failures. Having so often witnessed such attacks and the physician having recently explained their real nature, the mother lost her

patience, upbraided poor Nathan, and left the room. Like a flash the spell was gone and not another abnormal symptom was shown while the tests were being completed. Memory span, audito vocal and visual for digits was 7, and reverse span 4, which is entirely up to average.

With the Binet tests, a good rating was made, basal age 10 years, upper limit 12, mental age 11 years and 8 months, and I.Q. 109. An especially good grasp was shown for school work and life situations. There seemed to be little doubt that the youngster has ability at least up to average and probably above. It would have been very interesting to retest him under more normal conditions, but the opportunity did not present itself.

In this case we seem to have ample proof that the encephalitis has not lessened the boy's real ability or intelligence, but the resulting emotional instability has been so marked that proper functioning is far from being approached. The parents are intelligent Jews and have tried to follow the recommendations given by the Clinic. Hospital residence of about a month, with the regular treatment of spinal drainage and serum, seemed to effect no permanent improvement. He is impossible in the school room and tormenting at home. The family were finally advised to try placement in a reform school or a strict military institution to see if strenuous disciplinary training would clear up some of this behavior, but they have been unwilling to carry out this plan. It is impossible to give a prognosis as to eventual adjustment.

Dora (case No. 16), is a very grave after problem of encephalitis with outlook for recovery very doubtful. At time of examination she was 11 years old, the onset having been 15 months earlier. The home conditions were very unsatisfactory. The mother, being forced to work, *Dora*, when not in school, had to spend her time in a day nursery. The father had deserted 9 years previously. From a social agency who had known the family, it appears that he had a violent temper, a peculiar disposition, was a "trouble maker" and a generally unsatisfactory workman. The mother as a girl had been incorrigible and placed in a reform school, where she did make a good record. Her oldest child is said to be illegitimate, and it is doubtful if she was ever formally married to *Dora's* father. When we knew *Dora*, a rather elderly man was living with the mother, apparently as a paramour. This record

of instability on the part of the parents might very possibly have contributed to the child's inherent instability.

Following an acute illness with 16 days lethargic period, she became extremely overactive, and generally incorrigible. Altho she had always been a nervously active child with delinquent tendencies, and two years before the encephalitis had had intercourse with two boys and was a masturbator, after the attack these proclivities increased. She masturbated to excess and tried to teach the habit to the other nursery children. She was domineering, resented any restraint, and the day nursery could not correct any of her bad sex habits, nor could she respond to any form of training. As an aid to understanding the child better, the nursery referred her to the Child Study Department of the Children's Aid Society, and she was examined there June 1921 by Miss Eleanor Bremer, assistant psychologist. The results of this examination were consistently poor,—Sequin formboard was lower 20 percentile, Healy A not completed which is 0 percentile, and the Porteus mazes results were but 6 years. The Binet tests showed a wide scattering, which is often noted with psychopathic cases. The basal age was 5 years, upper limit 10, mental age 6 years and 8 months, and I.Q. 66. From the actual test results, her mentality seemed of doubtful level, but the way the problems were approached was also very significant. Dora reacted against practically all suggestions that were made to her. Whenever questions became at all difficult, she would say, "I don't know," or "I won't," and if the matter was pressed she would begin to cry. She had no perseverance, would give up immediately, and it was almost impossible to hold her to any test which required attention over a fairly long period of time. Great impulsiveness was displayed during the interview, and she would rush ahead before directions could be completed.

Before illness the child's conduct in school had been satisfactory, altho her work was of poor quality, at 10 years of age she had only progressed to 2B grade. But after the encephalitis, the school was forced to transfer her to a special class. It was just about this time, when 11 years old, that a re-examination was made at the Neuropsychiatric Clinic. There was a marked improvement in stability over the earlier examination at the Children's Aid Society, and some little improvement in ability. The Witmer formboard performance was lower 25 percentile. The first trial of the Witmer cylinders was 76 seconds with 11 errors. After being

taught, the next trial was 139 seconds with no final errors, and the third trial was 69 seconds, which last result is about median for 8 years or lower 25 percentile for age. Healy A was not completed. The attempt was planless, impossible moves were tried and repeated. Gwyn triangles were median for age. Porteus maze test received a score of $8\frac{1}{2}$ years,—it entirely lacked plan and foresight. Memory span for digits on auditory presentation was 5, with 6 on 4 repetitions. Visual span was the same, and reverse digit span only 3, all of which memory span results are subnormal.

With the Binet tests the basal age was 7 years, upper limit 12, mental age 7 years, 10 months, and I.Q. 71. Dora seemed still of doubtful or borderline mentality. Quantitatively and qualitatively her work was inferior. There was plenty of initiative shown during the examination, but very little persistence of attention. Restlessness and planlessness were outstanding. The Episcopal Hospital can add another chapter to this story, with very little change in conduct report. Dora was placed with them in the summer of 1923. Her behavior at times was hyperactive to say the least,—she broke windows and tore the nurse's uniform off twice. The inciting cause for these outbreaks seemed obscure. Following such periods, which are genuinely maniacal in character, are depressed moods, thus forming the usual cycle. The school has done less for this child than any in their group. Apparently little progress had been made along academic lines, for the teacher does not feel her real proficiency was above 2 A grade. The opinion that the only eventual outcome would have to be a mental hospital has been fulfilled and Dora is now a committed patient in Philadelphia Hospital for Mental Diseases. As far as our history can help us, Dora's acute period was no more severe than that of many of the other 23 children whom we observed. One wonders whether the girl inherited such an unstable makeup that her nervous system was unable to withstand the additional stain of the epidemic encephalitis. The disease did not seem to have lowered her general mental ability, but has disordered its functioning and given a most unbalanced emotional condition.

A very unusual case was *Carl* (No. 21). He was examined 7 months after onset of encephalitis, and was 11 years and 9 months old. The acute period had been severe with muscular twitchings and choreiform movements, diplopia, and delirium lasting 3 weeks, and several times he spoke of suicide. When brought home from the hospital, the boy apparently did not recognize his parents, or at

least he could not call them by name. Everything in his home seemed strange, he had to be told what a chair was, etc. No longer could he read and write, altho before his illness he was in 4 B grade, and very bright in all studies. He showed a distinct aphasia for everything preceding the encephalitis. Physical improvement was gradual. There were no twitchings of any kind. His behavior was normal, and he showed ability to talk and reason about things as an 11 year child should. He remembered everything after the attack, and if he heard a new thing once could remember it a second time. There were no over nervous or abnormal signs.

With a history of such a wide spread memory wipeout, it was intensely interesting to see what the psychological examination would show. The Witmer formboard was done slowly, but with no errors. The cylinders were median for time and qualitatively good. The best trial was 44 seconds. Healy A results were 34 seconds, which is upper 60 percentile. The first trial of the Dearborn formboard was 130 seconds, second 42. This showed quite excellent grasp of the problem, and was above median for 11 years. Memory span for digits auditorily was 7, 8 on 4 repetitions; visual span 8; and reverse 4, which is a normal span.

The design blocks indicated excellent visual imagery. The Binet results did not show the boy's potential ability, but were interesting because of the handicaps which were revealed. The basal age was 9 years. At the 10 year level, vocabulary score was 32. We could not find out whether knowledge of these words was retained or relearned. Absurdities were passed and also social comprehensions. Only 57 words were named in 3 minutes, showing the boy's characteristic slowness in language responses. The reading test was not given here, as the abbreviated Binet form was used, but when tested Carl knew the alphabet which he had relearned, but he knew no words. He quite pathetically said, "I can't read although they say I used to read." This reading disability of course caused failure with the dissected sentences. At the 12 year level the fables were well interpreted, and pictures were described, but no other successes. Twelve years was the upper limit. This gave a mental age of 10 years, 5 months, and an I.Q. of 88.

Attention factors were normal. Excellent method was used in solving the performance tests, and no defect in visual or auditory memory was noted. Abstract reasoning and judgment were quite normal. In making an analytical diagnosis, the only factor below average was speed of execution, which held for motor movements,

but was more noticeable in language work where there appeared to be a definite blockage in association. The transient memory wipe-out seemed to be an aphasic thing. The non-recognition of his parents was most likely an aphasia symptom, but it could also have been a temporary destruction in the visual psychic area. It is probable that the difficulty was all of one kind, a break in the association pathways between the visual psychic area in the occipital lobe and the motor language area or Broca's area in the pre-Rolandic region. The opinion is that the loss of memory was produced by the encephalitis being accompanied by an inflammatory condition with edema, which struck a restricted brain area, and that the brain, if brought to autopsy, would probably show some definite pathology.

The boy's mind was so keen that he could quite possibly have built up very rapidly new association tracks, or it is also possible that the old pathways were brought again into function. The latest report is that Carl is back in his regular grade, has his former facility in speaking English, can speak Swedish again, and there are absolutely no after effects. The excellent home conditions may have helped the rapid recovery.

GENERAL PSYCHOLOGICAL FINDINGS

Let us now summarize the findings and see what common features the 24 cases present. As to the epidemic encephalitis permanently lessening the mentality of the child, what did we find? Three cases, or 12½%, were definitely diagnosed as feeble-minded, attributed to the encephalitis, with no chance for normality being attained. *Edith* (case No. 4), is an idio-imbecile; *Isadore* (case No. 6), is an idiot; and *Doris* (case No. 20), is also an idiot. In these three cases the disease occurred in either the first or second year. Hence it would seem to appear that if epidemic encephalitis occurs during the first two years of infancy, feeble-mindedness is apt to result. The central nervous system still seems to be too sensitive to withstand the attack of the encephalitic germ. The other 21 children, with onset at 3 to 16 years, as far as our earlier reports form a reliable comparative basis for diagnosis, seemed to suffer no change in degree of mentality.

As to similarities of reaction patterns shown during the psychological examinations which denoted some emotional imbalance, or other unusual condition, we found hyperkinesis in some cases,

and extreme slowness in others. In 11 cases (Nos. 2, 3, 4, 9, 12, 13, 15, 16, 18, 19, 22), or almost 50% overactivity or restlessness were apparent. This sometimes took the form of motor fidgetiness. *George* (case No. 19), was almost continually playing with his necktie. *Ernest* (case No. 22), was twisting locks of hair or picking his fingers. Other children squirmed unduly in their chairs. Then again the restlessness seemed not to show in particular overt movements, but in lack of concentration of attention or distractibility. *Charles* (case No. 18), showed this trait—his general ability was quite up to average, but at times during the Binet tests, his mind would wander. This was especially true between questions. It seemed as if he had no ability to put himself at ease or relax, but rather as if something within kept him continually active. *Edith* (case No. 4), was an extreme case of distractibility and overactivity—we could not even put thru a complete test. I remember another child, *Sophie* (case No. 12 in Dr. Ebaugh's study), who was so disturbed on her visit to the Clinic that a single glance convinced one that it was futile even to attempt formal tests. Opportunity did not present itself for further examination, but she was one of the children seen at Episcopal Hospital. A marked improvement had taken place, her behavior was quite acceptable, school progress was fair, and the physician has returned her to a regular class where she is adjusting quite well.

In three cases or 12½ per cent (Nos. 11, 17, 21), unusual slowness was evident which seemed traceable to the epidemic encephalitis, because the neurological sequelæ indicated motor difficulty. Several other children showed slowness of movements, but there was nothing in the general condition to make us feel that the encephalitis was contributory, it seemed that the lack of normal speed was simply an innate characteristic.

In 7 cases (Nos. 1, 5, 8, 10, 14, 23, 24), or 29 per cent, no abnormalities were noted during the mental tests. *Hazel* (case No. 1), and *John* (case No. 23), at the time of examination presented no psychiatric symptoms, altho at times *Hazel* gave evidence of neurological symptoms by choreiform movements. But from their general conditions we should have been surprised to note any qualitative abnormalities. The other five, *Jessie* (case No. 5), *Leon* (case No. 8), *Thomas* (case No. 10), *Victor* (case No. 14), and *Emol* (case No. 24) did present real behavior problems, but apparently

they had emotional stability over longer periods of time than those eleven cases where hyperactivity was noticeable during the psychological examinations.

Thus according to this study, the psychological examination in 71 per cent of epidemic encephalitis cases would seem to reveal some abnormality, either feeble-mindedness, hyperkinesis, or abnormal slowness. It would be necessary to make a much wider study of encephalitic after effects to determine if this generally holds. It is quite possible that many individuals in the community make perfect recoveries and consequently do not seek the aid of clinics such as the Neuropsychiatric Clinic at the Philadelphia General Hospital, so that our proportion of emotional disturbances and other disorders may be entirely too high.

TREATMENT

After learning of the disorders resulting from epidemic encephalitis, we naturally ask, what can be done to cure them?

It is chiefly within the province of medical science to carry on the investigations which will make it possible to answer this question. The syndrome of the disease is so new, the actual germ, if epidemic encephalitis is indeed a germ infection, has not been isolated, and hence little has been definitely accomplished. Meanwhile supplementing medical treatment are to be recommended the usual measures of hygiene,—rest, good food, regular living habits, steady and even disciplinary training, and non-exciting environmental conditions. These recommendations are indeed no different than those which any unstable child showing neurotic or abnormal mental functioning needs.

An effort to grapple with the problem of treatment, institutionally, was recently undertaken in Philadelphia at the Episcopal Hospital, where they attempted to bring together the best medical and educational service along with careful, routinized living conditions. Through the courtesy of Dr. Gladys G. Ide, Director of Special Education, Philadelphia Public Schools, I was privileged to visit this combined hospital and school. In the summer of 1923 the plans matured, and gradually eleven children were accepted. Five of these are girls and six boys, all of pre-adolescent age, the oldest being 12. The children lived at the hospital in a special building assigned to them. A regular routine existence was lead and the

best physical care given. All had complete eye studies, and some minor operations like tonsilectomy and circumcision. Most were subjected to a course of serum treatments. Added to this physical care was educational treatment. A regular public school teacher was assigned to the group, and in a fitted up class room, regular sessions were held. A visit to the class showed a little group of children, who over a period of an hour and a half, showed reactions no different than a normal group. A description of the early beginnings of the class with continual fighting among themselves, window breaking, and such restlessness that the group could not all sit still while the teacher counted to five, could hardly be believed a few months later. The school treatment, patiently conducted, with much individual help, was largely academic, with the attempt to cover regular grade work in as far as each child was able. Nearly every child improved tremendously, and several were able to return to regular classes. Unfortunately the experiment, because of financial reasons, could not continue, but complete information of this type study which is shortly to be published by the psychiatrist and the psychologist in charge, should be very valuable in the future treatment of epidemic encephalitis.

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Tabulated Findings on Twenty--our Cases of Acute Epidemic Encephalitis

Name	Age at Examination	Date onset and Age onset	Acute Symptoms	Psychiatric Sequelae at time of Psychological Examination	Neurological Sequelae at time of Psychological Examination	Previous Mentality as stated by parent, school, examination.	Psychological Diagnosis	Reactions during Examination	Date of Examination	Latest Report
Hazel (1)	13	1916 (7 yrs.)	Diplopia, followed by choreiform movements of right arm & leg. Thick, heavy speech disturbance.	Nervous complaints.	Choreiform movements.	Sister states normal.	Average intelligence, slow reactions I.Q. 96	Normal behavior	3-28-22	Same condition.
William (2)	11 ³	1918 (6 yrs.)	Influenza, followed by diplopia, dizziness, headaches, insomnia. At night saw ghosts and devils. Depression. Tried to jump out of window.	Change in behavior, nervous, fidgety. Never quiet, at times talks like "crazy person" Sometimes awake all night.	Slight left facial weakness. Weakness external recti muscle.	Parents say normal.	Average intelligence, slight language handicap, due to Italian environment. I.Q. 91	Slight over activity. Very alert.	1-29-23	Placed in country. Quieter, more manageable. Has corrected some of bad habits.
Anna (3)	15 ³	10-1918 (11 yrs.)	Influenza, followed by 1 wk. lethargy. Diplopia, dizziness, headaches, short period of visual hallucinations (saw ghosts & dead mother). Over salivation. Illness lasted 1 month.	Always quick tempered, high strung, slightly incorrigible tendencies. Increased incorrigibility, sexual precocity. Unmanageable at home & school. Apprehension, insomnia. Spells of depression & elation. Over active, capricious, irritable, defiant.	Always had slight internal strabismus both eyes.	Apparently normal. School progress average	Dull normal. Intellectually slow. I.Q. 88 Performance tests somewhat below median	Fidgetiness Planfulness & foresight not good.	10-16-22	Did not return to Clinic.

Edith* (4)	5 ⁶	1-1919 (2 yrs.)	Influenza, followed by delirium. 5 days lethargy.	Imbecility. Agitated. Restless.	Twitchings during sleep.	Mother states normal development until onset at 2 years.	Low grade Imbecile. Impossible to complete Binet tests.	Distractibility marked. No form discrimination. Motor control poor.	3-23-22	No improvement in mental development or stability.
Jessie* (5)	10 ⁴	2-1919 (6 yrs.)	Fever, acute delirium, lethargy 3 wks. Visual disturbances.	Restless, overactive. Incurable, sexually precocious.	Choreiform movements. Endocrine disturbance of hypopituitary type.	School work had been satisfactory.	Lower av. I.Q. 87 Intellectually retarded, probably because of irregular schooling since onset.	Movements slow. Attention factors good.	10-3-22	Little improvement. Family have asked Court for placement.
Isadore* (6)	3 ⁸	2-1919 (at birth)	Normal birth. Slept continually for 8 days, followed by inability to sleep for 11 wks. crying continually. Mother had influenza in middle pregnancy.	Practically no mental development. Unable to walk or talk.	Typical idiocy.		Idiot.	Stolid, unalert.	8-1922	No improvement.
Ione (7)	6 ⁸	1919 (3 yrs.)	Influenza, followed by 2 wks. lethargy.	Domineering, selfish. Cries a lot, destructive. School refused to accept second term. Probably always neurotic.	None.	Mother states was always slower than siblings.	Normal mentality. Fairly even performance. I.Q. 97	Slow reactions. Persistence good. Distributance attention below normal.	11-20-22	No improvement.
Leon (8)	12 ²	Summer 1919 (9 yrs.)	Diplopia. Later insomnia.	Restless, disobedient at home and school.	Attacks resembling petit mal brought on at will. Twitching shoulder for 1 yr. following onset. Internal strabismus, nystagmoid movements.	School progress slow, but probably because of English handicap; Armenian spoken in homes.	Normal intelligence. Language, handicap. I.Q. 80. Excellent work with performance tests.	Attention factors good. No behavior abnormalities noted.	11-20-22	Improving since placed on a farm under regular routine.

Tabulated Findings on Twenty-four Cases of Acute Epidemic Encephalitis

Name	Age at Examination	Date onset and Age onset	Acute Symptoms	Psychiatric Sequelae at time of Psychological Examination	Neurological Sequelae at time of Psychological Examination	Previous Mentality as stated by parent, school, examination.	Psychological Diagnosis	Reactions during Examination	Date of Examination	Latest Report
Charles (9)	14	3-1920 (7 yrs.)	Heard voices. Apprehension. Over-salivation.	Transferred to disciplinary school, constantly fighting. Complete change in behavior 3-20. Hyperkinetic, marked emotional instability, tells queer tales. Unable to concentrate in school, no progress since onset.	Irregular pupils. Some evidence of paralysis agitans.	School progress had been normal, reaching 6th grade at 11 yrs.	Dull normal I.Q. 81. Performance tests about lower 20%	Some confusion. Poor mental control. Slow in grasping abstract situations.	1-16-23	Improving a little. Now working, but irregularly.
Thomas (10)	15 ²	4-1920 (12 yrs.)	Sleeping, vomiting for 10 days. Over-salivation. Later insomnia. Hand twitchings. Apprehension, —something after him.	Change in behavior, sent to disciplinary school. Also in House of Detention because of behavior. Tantalizing, deceitful, fighting.	None.	Repeated grades a number of times.	Lower average I.Q. 87. Performance tests median.	No behavior abnormalities.	1-11-23	Condition about the same. Working irregularly.
Nicholas (11)	19	4-1920 (16 yrs.)	Diplopia, oversalivation, eyes moist. One month later left arm stiff. Then became slow, lazy, somnolent, sleeping most of day & night. No pain. Few months after onset, Parkinsonian syndrome. Shoulders stiff. Face rigid, coarse irregular tremor, first in legs, then arms. Movements slow, difficulty in doing any fine work.	Previously vagrant, truant, dope user. Had been sent to Reform School. Slow, lazy. No other behavior abnormalities.	Fixed expression. Increased reflexes. Lachrymation. Parkinsonian syndrome. (paralysis agitans)	Probably always slow intellectually.	Borderline mentality. I. Q. 64. Fair intelligence with performance tests. Poor in abstract concepts. Italian language handicap may prevent higher I.Q.	No speed. Marked tremor of hands. Lack of foresight.	10-25-22	No change, Application in for Home for Incurables.

Nathan* (12)	10 ^s	4-1920 (8 yrs.)	Acute delirium, diplopia, facial twitchings, insomnia.	Total change in disposition & character, noisy, abusive, destructive, impulsive, untruthful, hysterical attacks, threatened suicide. Odd behavior (begs on street), tics many fears.	Irregular respiratory movements. Internal strabismus. Over salivation	Had been reported every term in school.	Upper average intelligence. I.Q. 109. Work with performance tests poor, but not considered indicative because done during hysterical attack.	4-6-22	Little improvement. Running wild. School finds him impossible problem.
George* (13)	6 ^s	11-1920 (4 yrs.)	Fever, jaundice, delirium, lethargy, twitchings.	Extreme overactivity especially nocturnal with insomnia. Became obscene, destructive, unmanageable.	Internal strabismus.	Family say average.	Average intelligence. I. Q. 100. Performance tests median.	10-26-22	Improving, but restless and difficult in school. Insomnia at times.
Victor* (14)	8 ^s	1-1921 (7 yrs.)	Headaches, diplopia, delirium, prolonged lethargic period.	Incorrigibility before illness showed marked increase. Over active, quarrel some, antagonistic. Attempted to kill brothers & sisters. Impulsive, kisses girls on street. Vagrant. Sexual precocity leading to Court commitment.	None.	Reported by school to be very bright before attack. Examiner questions this.	Borderline mentality. I. Q. 65. Performance tests variable, but most fall at about lower 25%. Memory span not above 4 yr. level.	5-16-22	Normal behavior under hospital régime. Uncontrollable at home where conditions are bad. Improving under steady routine environment.
George* (15)	10 ^s	2-1921 (9 yrs.)	Headaches, convulsions, delirium, diplopia, lethargy.	Periods of excitement, attempted to jump from window. Streaks of cruelty, tried to stab another boy. Bossy, domineering, increased hysterical attacks.	Oversalivation. Irregular pupils.	Mother states he was normal before illness, but repeated several grades because of various illnesses.	Average intelligence. I. Q. 96. Performance tests median.	10-25-21	No change; still has hysterical attacks. Transferred to Special school.

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Dora* (16)	11	2-1921 (10 yrs.)	Acute illness followed by lethargic condition-16 days.	Numerous behavior abnormalities. Marked hyperkinesia leading to general incorrigibility. Precocious sex characteristics. Vagrancy. Transferred to Special class 5-1922.	None.	Always slow in school, but behavior satisfactory. Examination 3 mos. after onset, I.Q. 66-cried, work planless.	Borderline mentality. I. Q. 71. Performance tests about lower 20%. Memory span restricted.	Restless, playful. Lacks persistence.	5-23-22	No improvement. Hypomanic. Committed to Mental Hospital.
Warren* (17)	8 ¹	6-1921 (7 yrs.)	Headaches, diplopia, delirium, shooting pains in arms & legs, twitchings, choreiform movements.	No behavior abnormalities.	Choreo-athetoid movements of left arm. Typical chorea of left arm & leg. Oversalivation. Left side facial weakness, mask like expression, rigidity left side of body.	Had repeated 1st & 2nd grades before attack, but got along well in social relationships.	Lower average intelligence. I.Q. 92. Performance tests median.	All reactions very slow. Attention factors normal.	8-17-22	Not seen since discharge from Hospital. Relative reports improvement.
Charles* (18)	14 ⁴	2-1922 (13 yrs.)	Headaches, dizziness, radiculitis diplopia, masticatory tenderness. Nocturnal restlessness.	Threatened suicide because of "heavy heartedness." Insomnia. Frequent masturbation.	Frequent headaches.	School progress about average, repeated only 1 grade.	Average intelligence. I. Q. 97 Performance tests slightly above median.	At times lack of concentration very evident. No other abnormalities noted.	8-19-22	Working regularly.
George* (19)	7 ¹⁰	3-1922 (7 yrs.)	Ptoosis, diplopia. Delirium, insomnia.	Odd antics at night, fights with pillows for prolonged intervals. Sleeps till noon. Overactive.	Irregular pupils, left internal strabismus Occasional choreiform movements.	Family thought normal.	Dull normal. I.Q. 82. Immature performance. Concrete tests lower 20%.	Very playful. Poor concentration and persistence. Little self-reliance.	12-12-22	Improving, but still agitated at times & suffering insomnia.

Doris* (20)	2	4-1922 (1½ yrs.)	Acute illness characterized by eyes crossing & total absence of mental development since.	Overactive, irritable, fussy, whiny. Typical picture of idiot.	Strabismus, choreiform movements of both arms. Movement of head.	Family report normal baby until attack.	Idiot-profound	Appears to be deaf & blind. No response of any kind elicited. Like a mass of helpless flesh.	10-26-22	Evidently permanent sequela. No improvement.
Carl (21)	11 ^o	4-1922 (11 yrs.)	Persistent coughing. 2 days later diplopia. Few muscular twitchings of legs. Later choreiforms like rowing boat. Insomnia. Delirious 3 wks. Spoke of suicide. Transient memory wipeout for language & recognition of people & objects.	No behavior abnormalities. Slow in talking. Gradually relearning. Ability to reason not impaired.	Aphasia like condition.	Good work in studies.	Normal mentality. I.Q. 88. Excellent work with performance tests, about upper 60%. Memory span median.	Attention factors average. Slow reactions with language work amounting to some definite inhibition.	11-7-22	Improving. Now up to regular grades.
Ernest* (22)	14 ^o	5-1922 (13 yrs)	Marked abdominal pain, headache. Lethargy 1 wk.	Became silly, obscene, masturbated in public. Vagrant, many fears. Apathetic about school work.	Mild optic neuroretinitis.	School progress had been average.	Average intelligence. I. Q. 95. Performance tests variable mostly about median.	Restlessness marked. Always fidgeting something.	10-3-22	Improving. Working regularly.
John* (23)	8 ^o	6-1922 (8 yrs.)	Convulsion, fever, twitchings, insomnia, nocturnal restlessness. Spinal fluid findings positive. Caused much disturbance in Psychopathic Ward.	No behavior abnormalities after acute illness cleared up.	Bilateral twitching of temporal muscle. Over-salivation.	Considered average by family.	Dull normal. Binet not given. Performance tests about lower 20%. Memory span median.	Slow reactions. No abnormalities	9-20-22	Seems entirely recovered.

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Emol (24)	10*	11-1922 (9 yrs.)	Twitchings in arms & legs. Diplopia, oversalivation. Burning sensation in stomach & neck. Insomnia. Apprehension at night. Said world going upside down. Idea of big black thing in his neck & neck getting smaller & smaller.	Troublesome behavior.	Lateral nystagmus. Right facial weakness.	Left down once in school before illness but as whole got along well.	Dull normal. I.Q. 88. Language handicap, probably due to Italian spoken in home. Performance tests variable 20-80%. Memory span below median.	No behavior abnormalities.	2-6-23	Improved.

* INDICATES CASES ALSO REPORTED BY DR. F. G. EBAUGH IN ARTICLE REFERRED TO.