

help and worked harder than they had for years.

4. *Occupation*.—No significant information under this head was elicited, except that out-of-door workers did predominate.

From the results of many workers we know that many birds and animals, both wild and domestic, may harbour the virus. We also know that experimentally, mosquitoes have transmitted the infection. With contact ruled out on epidemiological grounds, it would seem that birds or animals, or both, may be the reservoir and that some insect vector may be the transmitting agent. More work must be done on the birds, animals, and biting insects common to the various areas where encephalitis has appeared. Weather may perhaps affect the vector and so the disease. It would appear that encephalitis will be a problem and impossible of control until this knowledge has been gained.

SUMMARY

1. We submit a brief report on encephalitis in Manitoba from 1938 to 1941, inclusive, dealing mainly with an outbreak of 509 cases during 1941 and referring to a concurrent epidemic of 966 cases of poliomyelitis.

2. During the four years serological tests have been reported positive in 83 cases for Western equine virus, one for St. Louis and one for Japanese B.

3. The 1941 cases were distributed widely throughout the province and occurred mostly during August. Roughly 70 per cent were among males. Eighty-one per cent of all cases were 20 years of age and older.

4. There were 78 deaths, giving a case fatality rate of 15.3 per cent.

5. There is no evidence that person to person spread was a factor in this epidemic. The disease may be insect-borne. The reservoirs of infection may be various and many.

CLINICAL FINDINGS IN ENCEPHALITIS (WESTERN EQUINE)*

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THE term "acute encephalitis" arouses in the minds of most of us vague recollections of the "lethargic" epidemics of twenty years ago and also the memory of occasional isolated cases of cerebral inflammation which have followed acute infectious fevers or vaccination, or have appeared for no apparent reason. Till recently these latter have been rare and regarded as clinical curiosities, and only in the past few years have epidemics of encephalitis become more frequent on this continent. It seems likely that they will be still more common in the future, and any community in Canada must anticipate possible outbreaks. Clinical and epidemiological studies are therefore of some importance.

The various sorts of encephalitis can still not be differentiated by clinical means. Differentiation should become possible since the antibodies of several types are now discoverable in the blood of persons who have been infected. Four varieties (Western equine, Eastern equine, St.

Louis and chorio-meningitis), may now be recognized by complement-fixation and neutralization tests. Unfortunately, the blood is not positive until the acute stage is past, so that one can classify individual cases only in retrospect. But with this method of identification, groups of each variety may be studied with the hope that the characteristics of each may be discovered.

The widespread epidemic of the Western equine type in Manitoba in the summer of 1941 offered an excellent opportunity for study. The Department of Health and Public Welfare made a thorough investigation possible by encouraging hospitalization and providing all possible assistance. We were able to examine 266 cases with a tentative diagnosis of encephalitis admitted to hospitals in Winnipeg and St. Boniface. After thorough examination, lumbar puncture and hospital observation in all and serological tests in 125, the diagnosis was confirmed in 212 cases. This number constituted 50 per cent of all the cases notified in the Province. Each case was subjected to a searching scrutiny, because we were continually confronted with the problem of differentiation from

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poliomyelitis which was epidemic at the same time. The material presented here was derived from an analysis of the findings in definite cases of encephalitis (Western equine).

SYMPTOMS

As is the case with most virus diseases there was an enormous variation in severity; some fell into profound coma within twenty-four hours and remained so for a week, others had symptoms that were almost negligible. But there was a common pattern which was usually not hard to recognize. Before going into details we shall describe a moderately severe case.

The patient is a male adult who has been vigorous and active and employed at an outside job. In July or August he becomes ill. While working in the field he develops a headache which is predominantly frontal. At the same time, or soon after, deep aching pain is felt in the neck or spine and he becomes drowsy, but for a night or two may have insomnia, usually attributed to the headache. During the first few days he continues at his work in spite of severe headache, drowsiness, abnormal sweating and chilliness. Vomiting occurs during this period; anorexia and constipation are severe. His associates notice that he is dull, listless, confused and slightly disoriented, so that his behaviour may be described as "funny". In spite of this he admits nothing except headache and may be resentful of any effort to help him.

Within the first few days of the onset he stops work and spends most of his time in apparently normal sleep. He may lie for hours clasp his forehead in both hands and may be restless and complain of pain. On being aroused he shows all the evidences of disorientation in space and time, though he takes fluids and responds to questions intelligently, but very slowly. His only complaint is of headache and backache. He is quite oblivious of his mental torpor and though denying somnolence blandly dozes off while being examined. At night he may be restless or mildly delirious, but is amiable and easily controlled. This state continues for several days, after which rapid improvement takes place.

The following table lists the common symptoms and shows the percentage incidence of each in the cases reviewed.

Headache was almost a universal symptom—only 3.7 per cent having escaped. It was usually frontal (81.8 per cent) and confined to that region in 34.2 per cent. Headache con-

TABLE I.

<i>Symptom</i>	<i>Percentage occurrence</i>
<i>Headache</i>	96.3
<i>Frontal</i>	81.8
<i>Frontal alone</i>	34.2
<i>Temporal alone</i>	7.5
<i>Occipital alone</i>	4.8
<i>Sleep disturbance</i>	92.2
<i>Somnolence alone</i>	71.3
<i>Insomnia alone</i>	6.2
Both (insomnia followed by somnolence)	14.7
<i>Cerebral symptoms</i>	73.7
<i>Muscle pains</i>	62.5
<i>Neck</i>	42.0
<i>Back</i>	46.6
<i>Limbs</i>	20.0
<i>Chills and sweats</i>	75.5
<i>Vomiting</i>	46.8
<i>Visual disturbances</i>	14.7

finer to other regions was rare (temporal 7.5 per cent and occipital 4.8 per cent). The average duration was slightly over a week. It was commonly so severe for the first few days as to dominate the picture. Movement increased the pain, and lumbar puncture gave relief to some, though no definite association with spinal fluid pressure was discovered. In most cases headache was the one symptom that patients did not discount and it was for that reason alone that they sought medical care.

Disturbance of sleeping habits was, after headache, the most common symptom, 92 per cent having been affected. Abnormal drowsiness was found in 86 per cent. Included in this are some (14.7 per cent) in whom there was first insomnia and later somnolence; 6.2 per cent had insomnia alone. It was remarkable to observe how completely complacent most patients were about somnolence. It did not produce the slightest anxiety; commonly they passed it off with a smile or offered the excuse that they always slept when there was no particular work to do. The sleep as a rule appeared peaceful but some complained of terrifying dreams and some protested that they had been awake all night in spite of the nurses' conviction to the contrary.

Cerebral symptoms.—Various degrees of mental effects were noted in 73.7 per cent. These were much out of proportion to, and more persistent than, fever and other evidence of toxæmia. The commonest abnormality was general dullness, which sometimes was not detectable except by acquaintances or members of the family. In some cases this vague mental fogging could be appreciated only in retro-

spect, when the patient was recovering his normal alertness. As has been indicated, most were not disturbed about their condition; anxiety was entirely absent, and frequently they could not understand why they should be kept in hospital. This general torpor varied in degree up to complete stupor and even coma (10 per cent). Several patients lay in deep unconsciousness and were incontinent for three or four days, and finally recovered. Indeed, there is likely no brain condition in which unconsciousness persists for so long without being followed by death or gross disability. Confusion and disorientation were common. A few were hyperkinetic, especially at night, but wild delirium was rare. Amnesia covering the irrational period was the rule, and some had a complete memory blank for the whole febrile course. Convulsions at the onset were the rule in infants but observed in only one adult who had frequent right-sided Jacksonian attacks that recurred for two days and was followed by recovery.

Muscle pains of some sort occurred in 62.5 per cent, which was usually along the spine but sometimes in the limbs. On the average it persisted for only four days and was much less severe than the headache. It was described as a dull ache, and its site was often poorly defined though it seemed to be referred to deep muscles.

Chills and sweats occurred alone or in combination in 75.5 per cent of the cases. The chills rarely amounted to rigor but sweating was often profuse and prolonged. The odour was musty and, according to some observers, it had a distinctive and repulsive quality.

Vomiting occurred in 46.8 per cent of cases. It was early in the course of the disease and not frequent or persistent, usually lasting only one day and practically never more than three.

Visual disturbances.—Definite diplopia was found in 14.7 per cent of the whole group. About an equal number had indefinite disturbances which were recorded as "blurred vision". A few had mild photophobia.

PHYSICAL FINDINGS

Facial appearance.—There were four rather common signs to be noted about the face, *i.e.*, flushing, sweating, masking and bloating. The general impression often created in the acute stage was that the patient was a coarse, plethoric and perhaps a debauched person. The nose was red, the conjunctivæ blood-shot, and there was a

puffiness about the eyes and general congestion of the countenance; this, together with dysarthria, tremor and complaints of headache and diplopia created a convincing picture of the "morning after the week before". These striking facial changes could often be appreciated only when the patient recovered; the transformation was so profound that time and again we failed to recognize patients whom we had observed intently only a day or two before.

As a rule physical findings were surprisingly scanty and variable from day to day. In many severe cases abnormal neurological findings were almost completely absent. They indicated, when present, widespread but mild upper motor neurone and striate involvement. Common findings and their percentage incidence are listed below.

TABLE II.

	Percentage
<i>Stiffness of spine</i>	67.7
Back	65.8
Neck	58.7
Both	40.5
<i>Abnormal reflexes</i>	68.6
Absent knee jerks and/or ankle jerks .	45.6
Absent abdominals	51.0
Upgoing toe	30.0
Tremor	58.6
<i>Dysarthria</i>	31.5
<i>Nystagmus</i>	22.7
<i>Rigidity</i>	18.0
<i>Sphincter paresis</i>	18.1
<i>Kernig's sign</i>	8.5
<i>Dysphagia</i>	2.0
<i>Paresis</i>	14.0

Stiffness of the spine was not so significant as the figures suggest. It was commonly not noticed by the patient and persisted only during the acute period, that is, for four or five days. It impressed one as not being meningeal in origin largely, because attempted flexion of the head seemed not particularly painful and did not induce the Brudzinski response.

Abnormal reflexes.—Nearly 70 per cent had some abnormality of one or more of the four common reflexes. Briskness and sluggishness of the tendon jerks have been discarded as being of no special value. Absence of one or more tendon reflexes in the lower limbs was found at some time in half of the cases. Up-going toes were found by Babinski's, Oppenheim's or Chaddock's method in 30 per cent. Absent abdominal reflexes were present in more than half of the cases and was the most consistent and valuable of all the neurological signs.

Tremor was present in 58.6 per cent and was of value in differentiating from poliomyelitis. It was most common in the tongue, next in the lips, and then in the hands. It was of the "intention" variety; the tongue was tremulous on first being protruded, the lips on attempting to speak, and the hands only on voluntary movements.

In addition, there was in a few severe cases definite *cog-wheel* rigidity in the limbs. In infants general spasticity of all limbs was the rule; this was of the lead-pipe variety. Two boys (aged ten and twelve) had rigidity and flexion of all the limbs for several weeks. One of these died in the sixth week and post-mortem showed equine encephalitis. The other made a miraculous recovery; after being rigid, almost completely paralyzed and unable to speak for five weeks, he suddenly began to recover, and in the course of a month became apparently normal, except for slight difficulty in swallowing and paresis of one hand. Blood examination was positive for Western equine antibodies on the twenty-eighth day.

Dysarthria was present in 31.5 per cent, and appeared to be due to stiffness and tremor of the lips and tongue. That it was entirely secondary to this is suggested by the fact that over 90 per cent of those with dysarthria also had obvious tremor. Those with general rigidity were quite incapable of articulation and only made themselves heard by whining in a monotone.

Nystagmus was found in 22.7 per cent and was a dependable differential point. If definite nystagmus existed, we were much inclined to a diagnosis of encephalitis rather than poliomyelitis. It was variable in its appearance and as a rule was found only during the first half of the illness. In some cases it was observed only on a single occasion.

Kernig's sign (8.5 per cent), was surprisingly rare; this fact was useful in differentiation from various sorts of meningitis. One might infer from this that meningeal involvement is not great.

Dysphagia was found in five patients. This was evidently due to paralysis of the muscles of deglutition and was always associated with dysarthria. It only occurred in those who were desperately ill; of the five, four died.

Bladder and bowel symptoms were common, but probably not more prominent than in any other central nervous inflammation of equal

severity (*e.g.*, tuberculous meningitis). Incontinence of faeces or urine or both was found in 18.1 per cent. It was present only in stuporous or comatose patients and was likely due to that alone. A few had urinary retention and required to be catheterized. Constipation was almost always present and was sometimes associated with distension and discomfort; it was a persistent complaint in some. Our impression was that all these symptoms were due to general toxic effects rather than to specific neurological lesions. The chief evidence for this is that they invariably recovered as toxicity diminished.

Paralysis during the acute stage was not severe nor frequent; only thirty cases (14 per cent) were found and were classified as follows:

TABLE III.

Face	10
Limbs	12
Ophthalmoplegia	2
Ptosis	2
General weakness	4

The limb paresis was all upper motor neurone in type and was never severe enough to interfere with ordinary activity.

TEMPERATURE AND PULSE

Fig. 1 is a composite chart made from all the cases. Temperature reaches an average peak of 102° on the second day and gradually falls, to disappear on the tenth. The average pulse is relatively slow and does not go above 100. There were wide variations from this average course, but neither hyperpyrexia nor a completely afebrile course was encountered. The temperature was not a dependable indication of recovery. Very often confusion and delirium persisted for some days after fever had disappeared.

CEREBROSPINAL FLUID

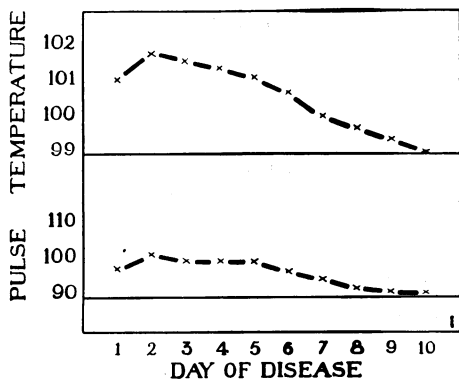
Lumbar puncture was done on every case and was occasionally repeated—249 punctures in all. Twenty-eight (14.0 per cent) were found to have a cell count under 10. Forty-one per cent gave counts between 10 and 99. Twenty-one (10.5 per cent) were over 400. The total cell counts on different days are shown in Fig. 2.

The highest counts are found on the first four days, averaging nearly 150 cells on each day. There is then a drop to 75 on the sixth day, followed by a secondary rise. Eleven cases,

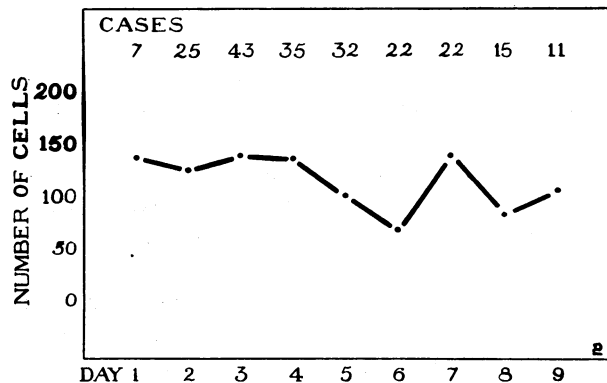
done on the ninth day, showed an average count of 113. It seems likely that the pleocytosis persists for several weeks in some cases. Two punctures done on the twenty-seventh and twenty-ninth days showed 30 and 12 lymphocytes, respectively. This finding may, on occasion, be of some value in diagnosis after the acute stage has past. Though 14 per cent of our cases gave a cell count of less than 10 on a single count, it is probable that very few cases run their whole course without some increase in cells.

fourth, fifth and sixth days. This also proved to be a differentiating point from poliomyelitis, in which monocytes were rarely found. One would judge from these figures that at the onset granulocytes and lymphocytes find their way into the spinal fluid in equal numbers. The granulocytes then disappear rapidly. Since the curve of their exit is quite similar to what happens in stored blood it seems likely that they are destroyed by simple lysis. The lymphocytes in contrast continue to increase in relative numbers right up to the end of the period

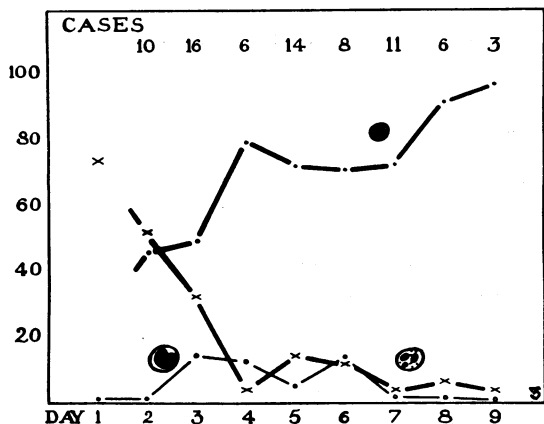
ENCEPHALITIS
COMPOSITE TEMPERATURE
AND
PULSE CHART



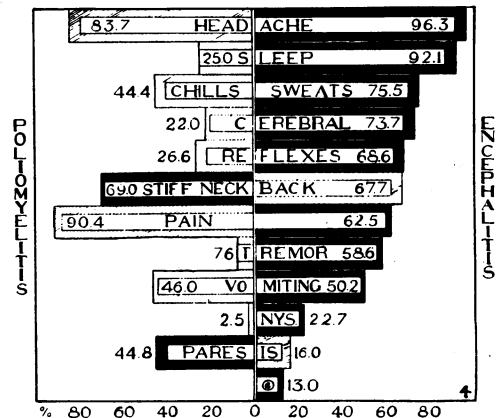
ENCEPHALITIS C.S.F. CELLS
ON DAYS OF DISEASE



ENCEPHALITIS
DIFFERENTIAL C.S.F. CELL COUNT
ON DAYS OF DISEASE



COMPARISON OF INCIDENCE OF SIGNS AND SYMPTOMS



Differential cells counts were done on seventy-five cases, Fig. 3. The single case examined on the first day showed a 75 per cent preponderance of granulocytes. On the second day granulocytes and lymphocytes were evenly divided. The granulocytes then rapidly dropped to 4 per cent on the fourth day, but rose to 15 per cent on the fifth and sixth, after which they disappeared. Monocytes appeared in considerable numbers (about 15 per cent) on the third,

of observation (9 days). This increase must also be absolute since during this period the average total cell count falls but slightly.

BLOOD EXAMINATION

Leucocyte counts were done on only 25 cases during the first ten days. Sixteen of these were over 10,000 per cubic millimetre and none was over 16,000. We can say from this that mild leucocytosis seems to be the rule, but many

more cases should be tested to confirm this impression.

DIFFERENTIAL DIAGNOSIS

In an epidemic there is a tendency to over-diagnosis; cases with symptoms remotely resembling the disease in question are liable to be labelled without thorough scrutiny. In the case of an epidemic of encephalitis such over-diagnosis is not great, because diseases resembling encephalitis are rare in any community. The conditions, other than poliomyelitis, that were admitted to hospital, wrongly diagnosed, were: sub-arachnoid hæmorrhage (2), typhoid fever (3), uræmia (1), brain tumour (1), chorea (1), pneumonia (3), influenza (6), malingering (1), disseminated sclerosis (2), cerebellar abscess (1), meningitis (2), Menière's syndrome (2) and mumps encephalitis (1). The diagnosis in most of these became evident on further examination; the cerebellar abscess was recognized only on autopsy. On the other hand, several cases coming into the general hospitals with a diagnosis of cerebral vascular disease proved to be encephalitis. The spinal puncture in these latter cases usually made the diagnosis, but some were discovered only post mortem.

On the other hand, definite cases may have a negative serum reaction during the first three weeks or longer. The only sure method of diagnosis is to observe a change in serological reaction during the course of the illness. We have had only two such opportunities. One patient gave a negative complement-fixation test on the eighteenth day and a positive neutralization test on the ninety-third day; the other had a negative neutralization test on the eighth day, which was reported positive on the sixty-ninth. Both were typical clinically.

The complement-fixation tests were done in the laboratory of Dr. L. T. Webster, Rockefeller Institute, New York. They were tested for Eastern and Western equine, St. Louis encephalitis, and for chorio-meningitis. None was positive for any virus except Western equine. The neutralization tests were done in the Rocky Mountain Laboratories, (Dr. H. R. Cox), Hamilton, Montana, and were for Western equine virus only.

Our experience with these tests is summarized in the table below. The figures in brackets represent the cases that were negative twenty-one days or more after the onset, and in each instance are included in the figure which precedes them.

TABLE IV.
RESULTS OF COMPLEMENT-FIXATION AND NEUTRALIZATION TESTS

Clinical diagnosis	No.	Complement-fixation		Neutralization		Total	
		Positive	Negative	Positive	Negative	Positive	Negative
Definite encephalitis	49	25	3 (2)	14	7 (2)	39	10 (4)
Probable encephalitis	20	6	1 (0)	4	9 (6)	10	10 (6)
Doubtful encephalitis	15	1	6 (1)	1	7 (6)	2	13 (7)
Definite poliomyelitis	30	1	27 (25)	0	2 (1)	1	29 (27)
Probable poliomyelitis	9	1	4 (4)	2	2 (2)	3	6 (5)
Doubtful poliomyelitis	2	0	0	0	2	0	2 (2)
	125	34	41	21	29	55	70

The most convincing single evidence of this disease is a positive complement-fixation or neutralization test. Even this, if found positive or negative on a single occasion, is not absolute proof. Since there has been encephalitis in horses in Manitoba during the past three years a certain unknown proportion of the population may have positive blood even though they have had no acute illness. Such persons may have erroneous serological diagnoses made when they suffer from any illness with nervous symptoms, but this would be at most a rare event and false positives are probably uncommon.

Blood samples of 125 patients were submitted for examination: (ten of these had two samples tested). Before sending the blood, we had already classified the patients according to our clinical judgment as indicated above. There were 49 in whom we felt that the diagnosis was unequivocal, and whose blood was sent largely to identify the type of encephalitis; of these, 39 were confirmed and 10 were not. Of the 10 negative cases, 6 had been ill for less than 21 days, *i.e.*, 14, 3, 18, 18, 17 and 13 days respectively. These were typical in all respects and we feel sure that they were

suffering from encephalitis of some sort. The other 4 had had their initial symptoms more than 21 days before the test. Each one had convincing evidence of encephalitis. No other cause for their illness was found and all recovered. Two were negative to complement-fixation and two to the neutralization test. From these negative results, we must assume that some cases do not develop antibodies in sufficient quantities, or that a virus other than those tested for was involved in the epidemic.

There were 20 cases considered "probable" encephalitis, whose blood was examined; 7 had a complement-fixation test, 6 were positive and one was negative, but had been ill for only nine days. Thirteen had neutralization tests; 4 were positive and 9 were negative, and 6 of these were more than 21 days past the onset.

Fifteen cases considered clinically "doubtful" were submitted. Of 7 who had complement-fixation test, one was positive and 6 negative, but only one of these latter had been ill for three weeks. Eight "doubtful" cases had neutralization tests; one was positive and 7 were negative, and 6 of these had been ill for more than 21 days.

It will be seen that the complement-fixation test agreed much more closely with our clinical findings than the neutralization test. If we consider only the clinically "definite" and "probable" cases, and ignore the negatives who had been ill less than three weeks, we find that complement-fixation was positive in 31 out of 33 cases, *i.e.*, 93.9 per cent. Applying the same analysis to the neutralization test, we get 18 positives in 26 cases, or 69.2 per cent. If we bring "doubtful" cases also into the reckoning, the positivity for the two tests is 91.4 and 57.5 per cent, respectively. This difference in the two tests may be largely accounted for by the fact that the neutralization test is slower in becoming positive.

DIFFERENTIATION FROM POLIOMYELITIS

The principal difficulty arose in distinguishing encephalitis from poliomyelitis. The points of contrast are reviewed below.

1. *Age and sex incidence* have been compared in the article on epidemiology by Donovan and Bowman.

2. *Comparison of signs and symptoms.*

Twelve common clinical manifestations are contrasted in Fig 4. It will be seen that the two diseases have the same signs and symp-

toms and are contrasted only in the frequency and intensity of these. In the figure the frequency of each feature is indicated by horizontal lengths (and the figures they bear), intensity is shown by shading.

Poliomyelitis is on the average and in most respects a faint imitation of encephalitis. For this reason very mild cases of encephalitis and very severe cases of poliomyelitis are often hard to diagnose. The five common findings in encephalitis (*i.e.*, headache, somnolence, sweating, cerebral changes, and abnormal reflexes) may all occur in poliomyelitis, but they are less common and very much less pronounced. Poliomyelitis overshadows encephalitis in two respects only, *i.e.*, stiffness of the neck and production of paralysis. There are no absolutely differential points though the presence of nystagmus or tremor, or the discovery of monocytes in the spinal fluid are very strong evidence against poliomyelitis and much in favour of encephalitis. Flaccid segmental paresis is almost always due to poliomyelitis.

3. *Temperature and constitutional symptoms.*—The acute stage of poliomyelitis occupied about half a week, encephalitis usually produced acute symptoms for a week. In both diseases there are many cases milder and less prolonged, in fact it seems likely that a large proportion of cases were "abortive" and undiscovered.

4. *Spinal fluid.*—The total counts from day to day were not different. The differential in encephalitis was sometimes distinguished by the presence of a moderate number of monocytes (5 to 15 per cent). Polymorphonuclear leucocytes tend to persist in the spinal fluid of unparalyzed poliomyelitis cases; this is in contrast to the paralyzed cases and also to the usual case of encephalitis.

5. *Serological tests* are the most convincing evidence of encephalitis; only by these were some mild cases of encephalitis diagnosed.

TREATMENT

The great majority presented no difficulty so far as treatment was concerned. The only problem presented by the average case was one of keeping up nourishment, because of stupor and anorexia. Most patients could swallow quite adequate quantities when aroused and intravenous fluid was but rarely necessary. For the few hyperkinetic cases bromides and chloral per rectum were given with benefit

Enemas were very frequently required because of stubborn constipation, distension, and abdominal discomfort. A small number required catheterization on a few occasions.

No particular effect from the sulfonamides was detected. Many patients were given moderate doses as a prophylaxis against secondary pulmonary infection.

We were much impressed with the necessity for prolonged rest. After the febrile period the patients themselves could see no reason for remaining in bed and invariably over-estimated the extent of their recovery. This sanguine outlook is characteristic of the disease. Several who insisted on going about soon after the acute stage had a definite recurrence of severe cerebral symptoms. We have come to feel that every definite case should remain in bed for at least four weeks, and be kept on limited mental and physical activity for some months.

RESIDUAL EFFECTS

The great majority of patients make a complete spontaneous recovery. Since 16 per cent are over 60 it is sometimes difficult to distinguish between post-encephalitis symptoms and those due to cerebral vascular changes. We feel that senile changes are likely to be induced or increased by acute encephalitis. Among younger people complete recovery usually occurs but subjective symptoms may persist for some months. Dr. Elka Graf examined 120 patients from one to three months after the acute attack. The subjective symptoms with percentage incidence is shown in the following table.

TABLE V.
SUBJECTIVE SYMPTOMS

	<i>Percentage</i>
Headache	28.0
General weakness	33.0
Localized weakness	3.3
Muscle pain	7.5
Insomnia	6.6
Nervousness	19.1
Amnesia	26.5
Blurred vision	8.3
Diplopia	1.6
Confusion	4.1

In the same group objective findings were few; 13 per cent showed some tremor of the hands, tongue or lips and 2.5 per cent showed nystagmus. Only one that we know of had definite paresis.

After personally following a small number of patients with subjective symptoms ever since the original attack we feel that nearly all will recover, except for arteriosclerotic symptoms referred to above. There have been a few cases who appear normal and protest that they are well who, according to their families, have slight character changes. This sometimes is shown by irritability, but in not a few the consort believes that the patient has become more amiable and "easier to live with". Such a mellowing effect on the disposition is unique as a pathological effect.

SUMMARY

Encephalitis (Western equine) infection produces a fairly constant clinical picture. Subjectively the dominant features are headache (96.3 per cent), disturbance of sleep (71.3 per cent) and spinal pain (62.3 per cent). The characteristic constitutional effects are not unlike those of fairly deep alcoholic intoxication. The patient is drowsy and indifferent, and, when aroused, is confused or quite disoriented, but protests that he is well except for headache. He is usually quite complacent and not inclined to be quarrelsome or violent. In delirium he is amiable and easily controlled. The thick speech, the staggering gait, and the appearance of the face complete the picture.

The usual neurological signs are curiously like those in disseminated sclerosis. Nystagmus, intention tremor, absent abdominals and an up-going toe are common, and the speech, though not "scanning", is inclined to be jerky. The great difference from case to case is not in the variation in the symptoms present but in the great difference in the intensity of all signs and symptoms. There are many very mild cases, and some that are extremely severe.

No matter how severe poliomyelitis may be it never presents this picture; the general effect is in complete contrast to what is usually found in encephalitis. The child appears more alert than normal, is querulous with vague discomfort. Headache and neck ache are commonly the only symptoms volunteered, and during the first few days rigidity of the neck and spine are the only physical signs. Very mild encephalitis may produce a picture almost identical with this, and unless there is tremor, nystagmus or monocytic spinal fluid, or unless flaccid paralysis supervenes differentiation cannot be made without a serological test.