CHAPTER 26

DISEASES OF THE CENTRAL NERVOUS SYSTEM

DURING the war little was added to organised knowledge of nervous diseases by the Australian medical services, but many clinical observations were made. The individual problems of diagnosis and aetiology were often difficult.

Nervous diseases appearing in service hospitals fall under many headings. These include such different groups as the following: system diseases as seen in civil practice; meningitis of non-suppurative type; encephalomyelitis of known or unknown cause, merging on the one hand into a purely cerebral and on the other into a peripheral affection; neuronitis and neuritis, single and multiple; nutritional states, such as spastic paraplegia as part of a deficiency syndrome; and symptomatic problems such as epileptoid seizures. It would be completely illusory to attempt to place clinical syndromes so diverse into aetiological categories. It is best therefore to refer to some of the clinical pictures seen and to suggest their possible basis.

THE FAMILIAR SYSTEM DISEASES

These need no extended reference. Occasionally men were seen with degenerative atrophic or dystrophic states, either non-existent in a recognisable form on enlistment, or else not detected. Occasionally, too, even medical boards, with the advantages of detachment and full-time work, as in the Middle East, had difficulty in deciding whether nervous signs and symptoms were of organic origin.

Though conversion hysteria was not commonly seen except in minor waves restricted both in time and place, it sometimes confusingly imitated organic lesions. Even more frequent was the combination of an organic basis and a large psychic element. (See section on psychiatry.) Now and then intracranial tumours occurred and even the rarities of neurological practice. One of the most unusual of the latter was an instance of *myasthenia gravis* associated with thymic enlargement, and relieved by surgical removal of the gland.

NON-SUPPURATIVE MENINGITIS AND MENINGO-ENCEPHALITIS

The most important varieties of these forms of meningitis and meningo-encephalitis seen on service were benign lymphocytic chorio-meningitis, and those associated with other virus diseases like mumps. These could as a rule be distinguished on clinical grounds, though this was not always easy in the early stages of mumps-meningitis when the characteristic glandular involvements were absent or inconspicuous. Differentiation by neutralisation tests was not possible with the facilities available at the time.

In most instances lymphocytic chorio-meningitis was also benign, and rarely affected any part of the nervous system but the membranes. Small outbreaks occurred during the warmer months of 1942. In Syria a series of thirteen cases was collected at the 2/3rd Casualty Clearing Station. No connection with animal vectors, such as mice, was observed. Headache was universal; onset was sudden, not infrequently with fainting. Neck stiffness occurred but not head retraction. Nausea and vomiting were common. The cell count in the cerebro-spinal fluid was usually 300 per cubic centimetre at the onset, and most of the cells were lymphocytes, even up to so high a percentage as 98. The acute illness usually lasted about a week; no focal signs were present in the nervous system, and recovery was satisfactory. Neutralisation tests were not carried out.

In men suffering from malnutrition, the disease was not always so benign. In Malaya, Harvey reported twelve cases occurring in 1942 among prisoners of war of the 8th Division. Three deaths took place in this series.

Lymphocytic meningitis was occasionally seen as a complication of mumps. There were usually some other features to be found on careful examination which settled the diagnosis. Fortunately serious involvement of the central nervous system was rare, so too were serious sequels. One of the most unfortunate occurred in a young Australian who on the fourth day of an attack of mumps had an ascending paralysis of the lower motor neuron type. Fortunately the staff of the 63rd British General Hospital in Cairo foresaw the risk of respiratory failure, and procured a respirator from the Anglo-American hospital in time to prevent his death from respiratory failure. Putting aside the question of aetiology this experience illustrated the need to have some form of mechanical respirator available; patients with threatened respiratory failure from a paralytic cause are fortunately very few in number, but their need is great.

Mention may be made here of torular meningitis, which was identified in several fatal cases in Palestine.

ENCEPHALOMYELITIS

Though no clear distinction can be drawn between viruses which chiefly attack the meninges and those preferring the central neural tissue, there are a number of conditions which can be roughly grouped under the heading of encephalomyelitis.

Certain tropical infectious diseases may produce confusing clinical pictures. Nervous complications are common in typhus and relapsing fever, and malaria and even dengue were occasionally misleading, but awareness and familiarity with the clinical pictures usually prevented diagnostic difficulties.

There was, however, a possible fallacy in assuming that nervous lesions found in a patient convalescing from typhus were due to this disease. This was well shown in a man in a base hospital who had peripheral palsies at first attributed to the typhus from which he was recovering, until it was found that he had been given one injection of diphtheria antitoxin for a membranous pharyngitis three weeks earlier. The probable reason for a

facial palsy was sometimes revealed by a history of several bouts of tick-borne relapsing fever. Double facial palsy in an endemic area was practically diagnostic of this disease. Further consideration of diphtheria as a cause of peripheral palsies will be given later. Fuller accounts of the nervous complications of typhus and relapsing fevers will be found in the appropriate sections.

The so-called infantile paralysis, acute anterior poliomyelitis, only needs passing reference here. Occasional infections were seen in the forces. Several cases occurred in a cavalry regiment in Cyprus in 1941: the men affected had fever with rapid onset of paralysis. In view of the greater number of young adults attacked during the more recent epidemics it is fortunate that more trouble was not experienced with this disease.

The so-called "diffuse encephalomyelitis" of indeterminate origin was occasionally seen. More clearly differentiated varieties such as the St. Louis or equine types apparently did not occur, though it is notoriously unsafe to dogmatise about the clinical types associated with different viruses. Therefore no attempt will be made to suggest that a presumed virus infection attacking the brain is necessarily different from one attacking the lower neuron. With this reservation neuronitis will later be described as an entity.

Diffuse encephalomyelitis produced varied pictures. A man died after drowsiness, muscular spasms, meningeal irritation, pleocytosis and increase in protein of the spinal fluid. Little but cerebral congestion was found at autopsy. Another soldier recovered with only slight sequels from paraplegia of unknown cause, with slight pleocytosis (200 cells) and excess of protein (80 mgm. per cent) in the spinal fluid. These two were included in a series of seven seen in six months by C. B. Sangster in a hospital in New Guinea. This series also included a hemiplegia of upper neuron type, with 65 cells and 85 mgm. protein in the spinal fluid, which gave a goldsol reaction of 3332211000. Another, clinically encephalitis, showed fever, lethargy and affective change, tremor, rigidity, drooping eyelids, and restlessness: cells in the fluid were high, 720, and the protein 160 milligrammes. One patient was under treatment for malignant malaria, but neither malaria nor typhus was considered to have any bearing on the condition. The remaining patients in this series had peripheral lesions, shortly to be discussed.

Other types of cerebral illness were seen, and ascribed to encephalitis. At the 106th Casualty Clearing Station, for example, at Finschhafen, within a short time a man died of acute ascending polyneuritis and another died after a brief, febrile illness in which acute mania was the predominant feature. No lesions except some evidences of diffuse encephalitis were found at autopsy. A third man three days after a febrile illness lasting ten days had a convulsion, followed by delirium and loss of consciousness. No abnormality was found in the cerebro-spinal fluid, and there was no evidence of malaria. Recognising the limited opportunities for investigation in the field, this small series may correctly illustrate

how acute disseminated encephalomyelitis may cause symptoms ranging from delirium to paralyses, central or peripheral.

Other patients were observed in whom cranial nerve palsies occurred; usually such lesions were not simply or singly focal, they were found on careful examination to be part of other changes in different portions of the nervous system. A distinctive type of encephalomyelitis was described in troops in the Northern Territory. Two men died from encephalomyelitis; the histological picture was identical and distinctive. Its chief features were focal necrosis of nervous tissues with accumulated polymorph or microglial cells, necrosis of the walls of the small and medium veins, which were infiltrated with inflammatory cells, and cellular infiltration with perivascular cuffing of adjacent nerve tracts. There was negligible meningeal reaction, and no evidence of any bacterial infection. The interesting feature of the condition was that in one patient the illness began with tenderness running from a small unhealed cut on one little finger which spread with pain up the ulnar nerve, and affected the whole arm. Later a rigor occurred and rapid spread of neural lesions was apparent. In the other patient cerebral symptoms occurred fourteen days after tonsillectomy; he had headaches, vomiting, and diplopia, and shortly before death, external rectus palsy. It would appear that the infective agent, which was not bacterial, reached the brain by peripheral channels. No virus was isolated.

Japanese summer or "B" encephalitis was the subject of a special instruction to the occupation force in Japan. This is outside the scope of this history, but a few features may be mentioned because the possibility of its occurrence in the Changi area on Singapore Island has been raised. In general it resembles the St. Louis type, and is believed to be transmitted by mosquitoes. Fever, clouding of cerebration, and various paralyses occur, and respiratory paralysis is common. Parkinsonian symptoms sometimes appear. Occasional encephalitic illnesses were reported from Changi in which the diagnosis of "B" encephalitis was suggested. The symptoms were in general similar: slight meningeal irritation was manifest, the usual headache and hebetude occurred, rigidity and tremor were sometimes noted, and also occasional epileptiform seizures. Most but not all the patients made a good recovery. The evidence is of course insufficient to allow an exact diagnosis to be made, but the suggestion is interesting.

NEURONITIS

From the early days in Palestine scattered cases of peripheral neuritis or neuronitis were seen among the A.I.F. Some of these showed affection of a number of neurons; others were strictly localised. Of the focal lesions facial, peroneal, radial and *serratus magnus* palsy were the most frequent. Some of these were no doubt due to trauma, but many were not. These lesions were observed both on home and oversea fronts throughout the war. Sometimes there was a clear history of injury, such as the familiar stretcher compression of the radial nerve. Sometimes injury seemed to be the probable cause though proof was lacking, as in some of the instances of involvement of the long thoracic nerve. *Serratus magnus* paralysis was

not uncommon, causing winged scapula, and in a few instances was bilateral. Carrying stretchers or ammunition seemed to bear a causal relation in some cases. Facial palsy often seemed to be in the same category as the other focal forms, but relapsing fever was always to be thought of in the Middle East, as mentioned above. Lieut-Colonel M. L. Powell reported from the 2/5th Australian General Hospital his observations of these lesions, and pointed out that fatigued men may more easily sleep in constrained and unusual positions, and that the loss of subcutaneous fat may increase vulnerability of certain nerves to injury. He mentioned specially the radial, ulnar, external popliteal, musculocutaneous and long thoracic nerves as vulnerable. The significance of this factor in debilitating illness has been mentioned in the section on typhus fever.

No doubt a presumed virus was sometimes blamed for a lesion due to pressure or other form of damage, but where trauma may reasonably be excluded, it seems justifiable to attribute the lesion to a toxic, or perhaps infective agent. Sensory involvement was sometimes found, but sometimes a pure motor palsy was the only finding.

In numbers of the focal types of palsy, a brief febrile disturbance prefaced the loss of power, and pain in the appropriate region was common also. For example, pain in the shoulder girdle often preceded paralysis of the *serratus magnus, spinati,* deltoid or *trapezius.* Increase in the protein content of the cerebro-spinal fluid was found in some of these focal palsies.

Some of these types of neuronitis resembled the Guillain-Barré variety, but conformity with the original description was much closer where the distribution of the lesions was anatomically wider. The "classic" type was seen in which after an initial febrile attack and a variable latent period, a sudden and widespread flaccid paralysis of muscles appeared. It is in this type that rapid deterioration and death may occur, apparently from cardiac failure. Dissociation of cellular and protein reactions of the cerebro-spinal fluid was sometimes found, but this finding appearing as it does in diverse conditions, is not *per se* of diagnostic value. As a rule, too, the affection was benign, though recovery was usually slow and sometimes interrupted by relapses, especially if strain was applied too early. Of course it does not follow that the nature of polyneuronitis is known because it may or may not conform to a pattern familiarised by one symptomatic description in the literature. Whether there are several infective agents concerned or not cannot be stated from the information available.

Polyneuritis sometimes seemed to bear some time-relation at least to other infections, but in countries where service carries a considerable risk of infective illness no conclusions can be drawn from this. For instance a member of the W.R.A.N.S. had a double foot and wrist drop following a *Salmonella* infection; this and similar observations may cause speculation, but the aetiology remains obscure.

Throughout the war peripheral palsies of all kinds were attributed by one or another to complications of known infectious disease. This was sometimes justified. Mumps, relapsing fever and typhus were good ex-

amples, but there was no warrant to incriminate a disease like malaria simply because it was frequent. A sequential relationship with, say, a diarrhoeal disease such as in the example above quoted is also insufficient for proof. Again, a familiar disease such as anterior poliomyelitis of known cause may simply explain all symptoms, without the need of invoking another cause. There still remain other varieties of polyneuritis or neuronitis of varying degrees of severity and distribution. Of these, apart from poliomyelitis, the most worrying were those which advanced rapidly from the periphery to involve the central nervous system. Respiratory failure might occur either from direct involvement of the muscles of respiration or from affection of bulbar centres. The latter, of course, had a very grave prognosis. The onset was not necessarily alarming. Motor weakness was first apparent in the lower limbs, with some loss of reflexes and perhaps some sensory symptoms. After a variable number of days rapid progression occurred and respiratory failure was threatened. Some of these patients died. Those with signs of bulbar palsy did not as a rule respond to treatment in a mechanical respirator. Others recovered even after a threat of circulatory and respiratory failure. For example, one man had pain in the limbs and double vision, soon followed by motor weakness in the face and all limbs, with slight loss of sensation. No abnormality was found in the cerebro-spinal fluid. Weakness in the external muscles of respiration followed, with palatal and laryngeal palsies, loss of deep reflexes and disturbance of the bladder reflexes. The diaphragm became partly paralysed, but despite this and the complication of pneumonia, the patient completely recovered.

In the section on diphtheria, mention has been made of the possible importance of diphtheria in causing polyneuritis. Instances can be quoted of apparently obscure attacks of polyneuritis which were found to be due to a previous attack of diphtheria, but the frequency of this can only be guessed. However, it is probable that diphtheria has really been overlooked in numbers of instances, although in Australian hospitals care was taken to investigate patients with neuritic signs to exclude this possibility. There has been a tendency too, in some quarters, to regard an increase of protein in the spinal fluid without increase of cells as a diagnostic feature of a neurological disease. It is important to realise that the Guillain-Barré syndrome is not necessarily due to one constant aetiological factor, and that certain of its features may be found in patients recovering from poliomyelitis and in the subjects of post-diphtheritic palsies. Experiences in the forces have shown that a throat swabbing may give a surprising result at times, and that a cutaneous lesion in a patient with neuritic signs should arouse suspicion, especially if sensory disturbances or deep pigmentation are found in its neighbourhood. With all these reservations, neuronitis may be regarded as forming a distinct category of nervous disease. Certain clinical neurological pictures were repeated on all fronts, despite differences in climate, location and endemic disease. When trauma, malnutrition, endemic infectious disease, diphtheria and known nervous diseases were excluded, there still remained a series of clinical states which

regularly produced and reproduced certain symptomatic pictures. In the present state of knowledge and recognising the possibility of multiple aetiology, these may be attributed with reasonable confidence to a toxic cause, possibly a neurotropic virus.

NERVOUS LESIONS DUE TO NUTRITIONAL STATES

The clearly-cut neural syndromes due to nutritional causes are described in the section dealing with malnutrition. The exact aetiological diagnosis could not always be made. When clinical syndromes of consistent type appeared in sequence with other evidence of malnutrition the relationship was reasonably clear. Encephalopathy, peripheral neuritis and spastic paraplegia appearing in a definite time-symptom pattern were clearly of nutritional origin. Sometimes the position was less clear. At Changi persistent foot drop lasting for months was classed as certainly due to neuritic beriberi, and lesser grades of weakness of the leg muscles with unsteady gait were included without hesitation. Men were seen, however, with ataxia and bilateral paresis of the muscles supplied by the circumflex nerve: they recovered, but the nature of the condition was uncertain. Beriberi could not be excluded, but was there in addition some other toxic or infective cause? This question cannot be answered at present.

OTHER NEUROLOGICAL PROBLEMS

One of the most difficult problems to settle was that of epileptoid or convulsive attacks. These were of two varieties, those believed to be due to epilepsy, and those occurring as an isolated incident, sometimes thought to be associated with intercurrent disease.

Epilepsy is incompatible with capacity for service with an armed force in time of war. A special question was inserted in the list to be answered by each enlisted man or woman. Even this often failed to elicit a history of epilepsy either due to suppression of facts, or lack of knowledge. The practical difficulty often arose of determining whether a given man had really had an epileptic attack, as such alleged attacks were not always seen by trained observers. Occasionally the patient's story was intrinsically convincing, as in an unusual case published by Noad in which a subject of uncinate fits gave a striking description of his symptoms. Narcolepsy was seen on a few occasions. The admission of four men with narcoplepsy into Concord Military Hospital in one quarter of 1945 is rather striking. It seems a remarkable coincidence for these to be sequels of previous encephalitic attacks, and one is reminded of recent well-authenticated instances of narcolepsy in which no association with organic disease was found.

A more difficult problem was that of men with unexplained convulsive attacks. Certain features were common to these incidents. They nearly all occurred in New Guinea or the neighbouring islands. They were unique, that is, consisted of a single episode only, and there seemed no evidence of their being truly epileptic. They were not always associated with endemic

tropical disease. Under the conditions prevailing in the more forward areas full investigation was difficult. Occasionally the death occurred unexpectedly of a man who had just had an unexplained convulsion, but even then autopsy did not always reveal the cause.

Cerebral malaria seemed the most likely organic cause, as these episodes occurred in men who had been exposed to malignant malaria. Post-mortem examination should have unfailingly revealed this cause had it been present, but it was not always possible for a skilled morbid anatomist to carry out the examination. Further, it was not always realised that brain smears made on slides as well as blood smears from cerebral vessels could be sent on for fuller examination. However, the clinical history of these men did not always fit into the picture of cerebral malaria.

It was, of course, possible that a convulsion might occur as an initial episode of a malarial attack. Against this must be set the observation that a number of these men were not proved to have a malarial attack, either on clinical or haematological grounds. Also, convulsions were very uncommon in severe malarial attacks, even among prisoners of war who were seriously malnourished, and who were often forced for lack of drugs, to make the best or worst of their attacks without alleviation. Scrub typhus was also suggested as a cause, since the onset was often rapid, and nervous complications were common. Here again, the after history of these men usually disproved this hypothesis. The possibility of some of these attacks being due to tetany merits fuller attention. Dehydration with significant depletion of body fluid and with hypochloraemia could easily occur in New Guinea and similar climates. Hyperventilation is possible, too, on exertion or in association with nervous causes. Alkalosis having been produced it is not difficult to precipitate tetany, particularly in susceptible subjects. The occurrence of epileptoid attacks in a state of hypocalcaemia has been recognised, and calcium imbalance may exist in an undernourished person or may be more easily produced.

J. E. G. Pearson recently described epileptic attacks in an officer of the R.A.F. due to tetany. Malaise, anorexia and vomiting associated with prepyloric ulcer induced dehydration, and later biochemical investigation showed that the fits were due to acute tetany. The tetanic threshold is more easily passed in some persons than in others: the same applies to convulsive attacks. No further evidence can be offered, but the suggestion is worth remembering.

A further suggestion has been made that an adverse calcium balance might arise from the use of wholemeal bread. The addition of a calcium salt to wholemeal has been practised to counteract this, and tetany has even been attributed to phytic acid poisoning. Stanton Hicks has, however, pointed out that within the last century wholemeal was consumed by all races in Europe, apparently without their suffering from any obvious ill effects of adverse calcium balance. In any case, Australian troops in New Guinea never received the equivalent of wholemeal. They may have received wheat germ, but not phytic acid, which is in the bran. Therefore, this nutritional factor as a possible precipitant of some of the evil effects

of diminished intake of calcium, is of no importance in this particular problem.

It may be remarked in conclusion that tetany as a medical emergency may easily be overlooked.

In addition to biochemical causes, the possibility of malnutrition must also be considered. This would seem unlikely except under conditions of dietetic insufficiency of severe grade, such as prevailed in some Japanese prison camps, where deficiency states like Wernicke's encephalopathy were observed. Though epileptoid seizures were rare, it is of interest that they appeared in sequences in some areas, but the explanation is obscure.

The problem of diagnosis of pains of sciatic type and distribution arose not infrequently, and at base hospitals lesions of the intervertebral discs were recognised and treated. Treatment was usually carried out by surgeons interested in neurosurgical or orthopaedic work; it is dealt with in the section on orthopaedics.

PERSISTENT HEADACHE

Headache was a frequent complaint at sick parades and in patients coming before medical boards. The occurrence of headache after meningitis has been mentioned. Many men who complained of headaches in the early stages of the war gave a history of previous head injury and due care was taken not to enlist men with such a history. Some men complained that the glare of strong light caused headache—the same symptom is met after head injury. Others complained that drill or exertion had the same effect. Large numbers of refraction tests were made in all the Services, and a considerable number of corrective glasses ordered, but the effect on the headache was not striking. There is little doubt that in men who gave no relevant history or presented no evident stigma of disease or injury, the headache was chiefly, if not entirely psychoneurotic in origin. Sometimes it was possible to discover a factor in the soldier's background or domestic life. More often reassurance and return to work was the best treatment, at least it often eliminated the unfit.

The complaint of headache was often linked with "black-out". This was for a time one of the most popular complaints made at sick parades. Few men knew what was really meant by the term; the commonest meaning assigned was temporary faintness or giddiness. It was seldom that any special action was necessary for this vague symptom. Even when based on a distinct degree of discomfort, which was often doubtful, it assumed a much more prominent position in the field of consciousness than its importance warranted.

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