I was asked to see a man in the dysentery ward on account of an effusion into the knee-joint. I found the patient bright and cheerful but exceedingly emaciated. The right knee was flexed and contained a good deal of fluid. It was neither painful nor tender, there was no temperature and no haemorrhagic staining. I could not discover the cause, and thought that it might be an example of so-called dysenteric arthritis. The joint very soon improved and the man began to get about again, but two weeks later he suddenly developed a large subcutaneous haemorrhage down the inner side of the leg and extending into the instep and sole of the foot.

Another man recovering from a bad attack of enteric fever and who had been on milk diet for several weeks rapidly developed a large haematoma on the buttock, the tissues all round were also infiltrated with blood, and there were petechial spots on the legs. I drew off 30 c.cm. of broken-down blood clot, and a few days later a similar amount of haemorrhagic pus was evacuated by incision.

When well marked the characteristic appearances of the gums affect the whole mouth, but when only slight they may have to be looked for on the inner aspect and especially around some septic tooth or stump. The petechiae are nearly always confined to the lower limbs and the front of the chest, though they may be found elsewhere. The large haemorrhages occur either subcutaneously or into the muscles. The former are most common behind the knee or on the inner side of the leg and extending into the instep and sole of the foot, but they may be found in the palm of the hand and over the middle of the sternum. The deep haemorrhages are also commonest at the back of the knee, deep in the popliteal space, down the front of the leg, among the muscles on the dorsum of the foot, and on the back of the forearms.

In addition to these large intramuscular haemorrhages, there may be small haemorrhages among the muscles of the thigh or buttock. Quite often they are multiple and not infrequently suppuration takes place.

REFERENCE.

¹ Matthew D. O'Connell, *Lancet*, August 19th, 1916, p. 342. ² Turner, *Lancet*, May 26th, 1917.

ACUTE FEBRILE POLYNEURITIS.

BY

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Most cases of polyneuritis which are met with in practice can easily be traced to intoxication by an organic or inorganic poison, or are complications of an infective illness, but the etiology of others is less certain or is unknown. Many of these have been called "rheumatic" or "influenzal" neuritis, or have been attributed simply to exposure to cold.

The cases with which we are concerned here are characterized by such a uniform and constant combination of symptoms that it is advisable to describe them as a type, though nothing is known of their actual cause. As their onset is usually acute and almost always associated with a rise of temperature, they may be provisionally included under Sir W. Osler's title, "acute febrile polyneuritis." Similar conditions have been described in other textbooks under this same title, or as "infectious polyneuritis."

Such cases have often been observed in irregular epidemic form, generally during the winter, but they also occur sporadically. Several came under my observation in London during one winter some years ago, and the course and the symptoms of those I have seen in France have been identical, or at least very similar, in all particulars. I have examined or have obtained notes on about twelve cases during the last winter. They have occurred among men from all parts of our front as well as from the lines of communication, and consequently they cannot be with any probability attributed to local conditions. The relatively small number that have come under observation suggests that there is no reason to suppose that the disease has been more common than it is in civil life, or that it is directly due to the conditions of life of our forces in France.

EARLY SYMPTOMS.

The onset of the illness is usually rapid. Almost all patients have stated that it began with a general malaise or with fever, at first without any definite local manifesta-

tions; several cases were in fact diagnosed at this stage as "pyrexia of unknown origin." One case developed a short time after an attack of relapsing trench fever, and another had had within the previous few weeks an attack of vomiting and diarrhoea. It has rarely been possible to ascertain the degree or the type of fever at the onset; in some patients the temperature did not exceed 100° F., but in others it rose to 102° to 103° F.

The next symptom was generally pains in the legs and in the lower part of the back, which usually set in on the second or third day and persisted. A day or so later, though occasionally even from the commencement, the patient found his legs weak or experienced difficulty in walking any distance. This paresis increased rapidly, and the arms became similarly but less severely affected. About the same time, too, the patient generally noticed that his face was "drawn" or "stiff," and several complained that even in this early stage their speech had become unnatural, or that they had some difficulty in swallowing.

SYMPTOMS OF THE ESTABLISHED DISEASE.

Most of the cases came under my observation when the disease was fully developed, and its clinical symptoms are then extremely characteristic. The lower limbs, which are equally affected, are flabby, toneless, and extensively paralysed, but the paralysis is rarely complete in all groups of muscles, and often all are in fact more or less uniformly affected. Neither now nor later is muscular atrophy a pronounced feature, and contractures did not develop in any case under my observation. The feet are dropped, the toes pointed, and occasionally no movement of either toes or ankles is possible. The movements at the knee-joints, and especially extension of the legs, are usually less severely affected, though they, too, may be paralysed in the severer cases. Even in these, however, the patient can with effort flex, extend, adduct, abduct, and rotate his thighs, though the movements are of small range and feeble.

The affection of the arms is usually less severe, and it is rare to find any movement completely paralysed, though the distal segments are usually very weak; as a rule, the feebleness is remarkably uniform throughout the limbs. The muscles of the trunk are much less seriously involved, though the intercostal and abdominal muscles are weaker than normal. In the two cases which died from pulmonary complications the paresis of the respiratory movements was probably a contributory factor to the fatal termination. I have not observed palsy of the diaphragm.

Thus far the motor disturbances correspond closely to that of any type of generalized peripheral neuritis, the only striking feature being the relative uniformity of the paresis and the fact that the distal muscles of the limbs may not be much more severely involved than the proximal groups. But when we examine the muscles innervated by the cranial nerves we find that certain of them are particularly severely involved. The face is invariably much affected from the early days of the illness; the facial folds disappear, the cheeks are flat and smooth, the forehead devoid of wrinkles, the lips slightly everted, and when the patient is asleep or dozing the eyes are incompletely covered by the lids. The face has consequently an expressionless appearance, which, if once seen, cannot be again mistaken. On further examination it is found that all groups of muscles supplied by the facial nerves are severely paralysed; the patient is unable to wrinkle his forehead, frown, close his eyes firmly, blow out his cheeks, or whistle. Articulation is slurred and indistinct owing to the palsy of the lips, fluids often dribble from the corners of his mouth if he attempts to drink, and he complains that during mastication the food frequently collects between his teeth and cheeks.

The tongue has not been affected in any case I have seen, nor is the palate often involved, though a few men complained of occasional regurgitation of fluids through the nose on drinking. On the other hand, almost all experienced more or less difficulty in swallowing solid food, and in one case this attained a severe degree. Phonation was unaffected, and there were no symptoms to suggest laryngeal palsy, though the larynx was not examined directly in any of the cases. The muscles of mastication were occasionally weak.

The pupils are equal and circular and their reactions are normal, but diplopia, due to ocular palsies, was present in three cases at least, in two of which an external rectus was almost completely paralysed.

The deep reflexes, the arm-jerks, as well as the knee and ankle jerks, are usually absent from an early stage of the illness, though in one case I was able to elicit a feeble response on tapping the patellar tendons when the legs were already paretic. The superficial abdominal and cremasteric reflexes, on the other hand, can usually be obtained, but the plantar reflexes are absent when the lower limbs are severely affected.

Sensory symptoms are less prominent than the motor disturbances. Some men complained of dull aching pains in the feet and legs, but these were usually troublesome only when the limbs were moved or handled. I have not seen any man who suffered with pains comparable to those of a moderate case of alcoholic neuritis. The muscles of the legs, and less frequently those of the arms, are often slightly tender to compression, and in several the sciatic nerve was also painful when pressed upon or stretched.

When the various forms of sensation are tested surprisingly little disturbance is usually found, especially in superficial sensibility. Even the lightest contacts can, as a rule, be recognized everywhere and correctly localized, though this form of sensibility is occasionally dull on the feet. The appreciation of temperature and of pinprick is also unaffected, but heavy pressure on the muscles and tendons generally gives an unnatural amount of pain. On the other hand, the proprioceptive forms of sensation are frequently disturbed; the patients are unable to recognize passive movement within the normal range, especially in the distal segments of the limbs, and they have not an accurate knowledge of their positions in space. Further, the vibrations of a heavy tuning-fork are not properly felt, particularly in the feet and legs.

A certain amount of hyperaesthesia to moving contacts is occasionally present, more especially in the legs; rubbing with a wisp of cotton-wool or with the finger-tips, as well as gentle scraping with the finger-nails or any sharp object, gives pain or more discomfort than normal.

Another interesting feature was the almost constant disturbance of the functions of the sphincters; the majority of the patients complained that they had had for some days more or less difficulty and delay in starting and completing micturition, though the use of a catheter was never necessary, and a few had occasional vesical incontinence. Temporary incontinence of faeces occurred in one man.

Vasomotor, trophic, and secretory disturbances are absent, or are at least not prominent.

The mental state of these patients was never affected, and showed no peculiarity; their general intelligence, memory, and power of attention remained intact.

In none of the cases in which it was examined did the urine contain albumin or sugar, nor did any other complication or disease that could be connected with this illness develop in any patient.

COURSE OF THE ILLNESS.

Two patients died, one from bronchitis the other from bronchopneumonia. Most of the others remained under observation for only short periods, though in a few instances the course of the illness could be followed for some weeks.

Most of the patients were first seen within a few days of its onset, but others only later. All the symptoms, and especially the paresis, reach their maximal development quickly, generally within a week or so, and in those who survived the progress of the illness was characterized by steady and rapid improvement which usually set in within two to three weeks of the onset. The pains and hyperaesthesia diminish quickly after the first fortnight or so, and somewhat later the power of the paretic muscles begins to return gradually, that of the arms usually before the legs. Some weakness of the facial muscles generally persists for a considerable time.

I have seen no patient in whom recovery had become complete, though one man whose legs had been much affected was able to stand alone about three or four weeks after the onset of the neuritis. Probably all do not recover so quickly, but in those who could be observed for some time the rapidity of the return of power in the affected muscles was striking.

The difficulty in swallowing and the sphincter troubles are among the first symptoms to disappear.

PATHOLOGY.

From two of the fatal cases I obtained for microscopical examination portions of the spinal cord and cerebral cortex, and from one of them pieces of one sciatic nerve and some lumbar and sacral roots.

The peripheral nerves and the spinal roots were fixed in osmic acid and were later carefully teased out. The sciatic nerve contained some fibres in the early stage of degeneration, their myelin sheaths being broken up into chains of spherical or oval globules, while the calibre of other fibres was irregular and their staining unequal; or there was a tendency to segmentation. The proportion of affected fibres was, however, small, and it was chiefly in the finer fibres that the change was most obvious. In the spinal roots, on the other hand, I could find no evidence of degeneration or other change.

The spinal cord and the cerebral cortex were stained only by Nissl's method. No evidence of inflammation, congestion, or infiltration by any type of cells could be found in either, or in the meninges covering them, but in the ventral horn cells alterations similar to those seen in other forms of peripheral neuritis were visible. Some cells were slightly swollen: there was a partial disintegration of the tigroid masses especially around their nuclei, and in a few instances the latter were swollen and more rarely eccentric in the cells. The only recognizable alteration in the cortex was a similar slight chromatolysis in some of the larger cells and especially in the Betz cells of the motor area.

Unavoidable circumstances made a more complete examination of the nervous system impossible, but these changes are sufficient to confirm the diagnosis of peripheral neuritis, and to exclude any other widespread affection of the nervous system.

In three cases the blood and cerebro-spinal fluid were examined, but no culture could be obtained from either, and the latter did not contain an excess of cells or present any other abnormal feature.

Finally, there was no evidence of previous abuse of alcohol, or of poisoning by any of the organic or metallic substances that commonly produce peripheral neuritis; nor did the disease develop after diphtheria, scarlet fever, or any other common infectious illness.

DIAGNOSIS.

The differential diagnosis of this condition does not present any great difficulties if its special clinical features are recognized. These are a rapidly developing and widespread flaccid motor paralysis, which involves to an exceptional degree the facial muscles, those concerned in deglutition, occasionally the ocular muscles, and the sphincters. Sensory disturbances, on the other hand, are relatively insignificant, and the amount of pain and paraesthesia is slight in relation to the severity of the motor affection.

The early date at which improvement sets in is another striking feature; as a rule, no recovery can be expected in alcoholic, lead, or arsenical neuritis of similar severity till a much later period.

This condition can easily be distinguished from the various forms of rapidly developing paralysis of spinal origin, though its confusion with acute ascending myelitis is possible. This, however, produces a true paraplegia with a more or less definite though variable upper level, severe disturbances of all forms of sensation in the legs and trunk, sphincter paralysis with retention of urine, and extensor plantar responses, even though the knee-jerks may be absent. Further, the cranial nerves are not involved, though visual disturbances, due to the presence of foci in the optic nerves or in the chiasma, are not uncommon.

From acute poliomyelitis it may be distinguished by the more rapid evolution and the more irregular distribution of the palsy, the frequent paralysis of the trunk muscles, and the usual absence of objective sensory symptoms in this disease.

Certain of the cases I have seen had been diagnosed as Landry's paralysis, and the separation of polyneuritis from this is less easy, owing chiefly to the vague and indefinite conception of this disease that characterizes its description in many textbooks; almost all forms of both peripheral

and spinal paralysis which show a tendency to an ascending course have been in fact included in Landry's paralysis, but it is now generally accepted that this term should be restricted to a condition which begins with a progressive paralysis of the lower limbs that rapidly ascends and involves the trunk muscles, later those of the arms, and as a rule leads to a fatal termination from respiratory palsy before the cranial nerves are affected. Objective sensory disturbances are also very slight or absent, and the sphincters are rarely involved.

The clinical symptoms of acute febrile polyneuritis are also sufficiently distinct to permit its differential diagnosis from other forms of peripheral neuritis, though none of the individual symptoms are peculiar to any one of them. The more usual causes of neuritis, namely, alcohol, lead, arsenic, and various organic poisons, as well as the recent occurrence of diphtheria, scarlet fever and of other infectious illnesses, should be in the first place excluded. From alcoholic neuritis it is distinguished by the relative uniformity of the paresis in the limbs, the early and marked involvement of the facial and deglutition muscles, the slight degree of the sensory loss and of pain, the absence of mental symptoms, and finally by the relatively early date at which recovery sets in and its favourable progress.

In neuritis due to lead the palsy almost always picks out at first certain groups of muscles, such as the extensors of the wrists, and if it becomes general it is usually associated with that group of cerebral symptoms which have been described as lead encephalopathy. Arsenical neuritis is easily recognizable by the prominence of gastrointestinal symptoms, pigmentation and trophic disturbances, serious sensory loss, early muscular atrophy, and its very slow convalescence; while beri-beri may be excluded by the absence of oedema, and vasomotor and cardiac symptoms.

TREATMENT.

The treatment in the present state of our knowledge can be only symptomatic. The patients should be kept warm and comfortable, the danger of respiratory complications should be guarded against, and care should be taken even from the beginning of the illness that the paralysed muscles are not unduly stretched. Certain of the cases seemed to benefit from diaphoresis and the employment of diuretics.

The Chadwick Lecture

ON

MENTAL HYGIENE AND SHELL SHOCK DURING AND AFTER THE WAR.

BY

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MAJOR R.A.M.C.(T.F.).

MR. PRESIDENT, LADIES AND GENTLEMEN,—A new epoch in military and medical science, has arisen in consequence of the employment of high explosives, combined with prolonged trench warfare, in this terrible war.

The term "shell shock" is applied to a group of varying signs and symptoms, indicative of loss of functions and disorder of functions of the central nervous system, arising from sudden or prolonged exposure to forces generated by high explosives. In a large number of cases, although exhibiting no visible injury, shell shock is accompanied by burial. Again, cerebral or spinal concussion may be caused by sand-bags, hurled from the parapet or paradose of the trench, striking the individual on the head or spine. The soldier may be concussed by the roof or wall of the dug-out being blown in, or he may be driven violently against the wall of the trench or dug-out, or blown a long distance simply by the strength of the explosion.

It has been shown that the force generated by 17-inch shells is equal to 10,000 kilograms per square metre, or 10 tons to the square yard. This supports the contention that even death may occur as the result of aerial concussion, generated by high explosives, without visible injury. I think probably the cause of death in such a case would be sudden arrest of the vital centres. The stem of the brain, surrounded by the cerebro-spinal fluid, is prevented

from oscillating by the anterior and posterior roots and the ligamentum dentatum. The cerebro-spinal fluid therefore acts as a water jacket to the spinal cord and water cushion to the base of the brain. A sudden shock of great intensity would be transmitted through this incompressible fluid, and seeing that it not only surrounds the central nervous system, but fills up the hollow spaces, ventricles, and central canal, and all the interstices of the nervous tissues, it follows that a shock of sufficient intensity communicated to the fluid would occasion commotion of the delicate colloidal structures of the living tissues of the brain and spinal cord. Such commotion would certainly lead to disordered function, and, if severe, to loss of function. The higher centres are the most likely to be affected; therefore consciousness, memory, sensory perception, and speech suffer. If the commotion is sufficient to arrest the functions of the vital centres in the medulla instant death would ensue, but it is difficult to determine in many cases whether the force was delivered by the hurling of a sand-bag against the head or spine or simply by aerial concussion in a confined space.

This leads me to call your attention to another important factor which may complicate the condition termed "shell shock." The soldier, while lying partially buried and unconscious, or at any rate helpless, may be exposed to various noxious gases, generated by shells or mines, especially carbon monoxide, or oxides of nitrogen, both of which are poisonous by reason of the deoxygenating effects upon the blood. Other poisonous gases from shells may produce most injurious and even fatal results; for example, cyanogen compounds, phosgene, which is chloride of carbonyl, etc. Both these gases are very deadly in their effects.

Malingering as shell shock is, I am informed by Captain William Brown, quite common at the front, and the detection of conscious fraud is not easy in many of these cases, owing to the fact that a functional neurosis due to a fixed idea or obsession, inhibiting will power, may be mistaken for malingering. Again, the notion of never recovering tends to become a fixed idea, and this fact is of considerable importance in respect to discharge from the army "permanently unfit," and the subsequent payment of pension and compensation. It is essential to be sure of your diagnosis that the disease is altogether functional, and being satisfied thereof, to avoid all forms of suggestion of non-recovery.

Mental and Bodily Condition at the Time of Receiving the Shock.

In considering the effects of shell shock on the nervous system, it is necessary to call attention to a complex of factors of extrinsic and intrinsic origin, apart altogether from the effects produced by direct material injury to the central nervous system by commotion and concussion. I will now consider the extrinsic conditions in modern trench warfare which lead in a neuro-potentially sound individual to nervous exhaustion, predisposing to shell shock. It must be obvious that through all the sensory avenues exciting and terrifying impressions are continually streaming to the perceptual centres in the brain, arousing the primitive emotions and passions, and their instinctive reactions. The whole nervous system, excited and dominated by feelings of anger, disgust, and especially fear, is in a condition of continuous tension; sleep, the sweet unconscious quiet of the mind, is impossible or unrefreshing, because broken or disturbed by terrifying dreams.

Living in trenches or dug-outs, exposed to wet, cold, and often (owing to shelling of the communication trenches) to hunger and thirst, dazed or almost stunned by the unceasing din of the guns, disgusted by foul stench, by the rats and by insect tortures of flies, fleas, bugs, and lice, the minor horrors of war, when combined with frequent grim and gruesome spectacles of comrades suddenly struck down, mangled, wounded, or dead, the memories of which are constantly recurring and exciting a dread of impending death or of being blown up by a mine and buried alive, together constitute experiences so depressing to the vital resistance of the nervous system, that a time must come when even the strongest man will succumb, and a shell bursting near may produce a sudden loss of consciousness, not by concussion or commotion, but by acting as the "last straw" on an utterly exhausted nervous system,