TREATMENT IN GENERAL PRACTICE

This article is one of a series on the management of some diseases of the nervous system met with in general practice.

LUMBAR PUNCTURE IN DIAGNOSIS

BY

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The operation of lumbar puncture has become a routine diagnostic method in diseases such as meningitis and neurosyphilis, in which the experience of over thirty years has proved its value. And there are many other conditions in which it may be of great help in diagnosis when intelligently used. In this article an attempt is made to assess its probable value in cases showing different groups of symptoms, seeing that it is in this form that diseases of the nervous system present themselves to the clinician. In each case the diagnostic aid that may be expected has to be balanced against the discomfort of the operation and the possibility of unpleasant sequels. Actually, under local anaesthesia the operation is often almost painless, and the chief objection lies in the possibility of lumbar puncture headache. This may be guarded against to a large extent by using a fine needle (about 20 gauge) and by keeping the patient as flat in bed as possible for twenty-four hours after the puncture.

Lumbar puncture is robbed of much of its value unless use is made of a manometer. This is true of all types of case except proved neurosyphilis, and even here manometer readings are often helpful. It is important that the physician should become accustomed to the instrument by employing it at every opportunity, as only by this means will he gain confidence in interpreting his readings and in distinguishing abnormal from normal variations.

Meningeal Symptoms

In the presence of such symptoms as neck rigidity, head retraction, and Kernig's sign, with or without pyrexia, lumbar puncture should almost always be performed. Cases of tumour or abscess in relation to the cerebellum are exceptions to this rule, as in them the operation may be dangerous. The presence of papilloedema will in such cases give the clue to the diagnosis and act as a danger signal. When the fundi are normal, lumbar puncture carefully controlled with the manometer is not likely to be dangerous. Its value in diagnosis is here beyond question. Not only is it the only method of distinguishing the different forms of generalized meningitis from one another, and so of instituting the appropriate treatment, but it serves also to distinguish them from such conditions as "meningism," "benign lymphocytic meningitis," "post-infectious encephalitis," poliomyelitis, and subarachnoid haemorrhage.

In generalized meningitis the diagnosis is usually easy. The more or less purulent coagulum, the presence of organisms in the fluid, and the reduction of glucose and chlorides are here the most typical features. The cell count is also important, especially if attention is paid to the type of cell present, but the cells undergo alterations so rapidly after the fluid is withdrawn that their value in differential diagnosis is often less than might be expected. Examination by supravital staining, for example, is a method from which much is being learned, but which is only possible with fresh fluids. There are many causes for a high cell count apart from infection of the meninges, and polymorphonuclear cells, even in

sufficient numbers to cause turbidity of the fluid, may be found in rare cases of thrombotic hemiplegia and cerebral tumour. Therefore, useful as the cell count is, we cannot rely upon it as the sole evidence of meningitis.

DISEASE OF CRANIAL AIR SINUSES

Cases in which meningeal symptoms arise in the course of otitis media or infection of the cranial air sinuses present special difficulties, which are best solved by close co-operation between the pathologist and the clinician. In such cases the examination should always be made as soon as possible after the fluid is withdrawn, and, in addition to a careful cell count and culture on suitable media, the glucose and chlorides should be estimated quantitatively. In cases of this kind we often obtain turbid fluids which are sterile and show a normal percentage of chlorides with a varying reduction in glucose and generally an insignificant coagulum. These indicate a local infection either of the dura mater or of the brain, but are not necessarily of bad omen. On the other hand, clear fluids with fairly low cell counts may give on culture a few colonies of pneumococci or streptococci: in such instances recovery is less frequent. Between these extremes all types of fluid may be obtained, and it is a general rule in prognosis that so long as no organisms can be seen in films of the deposit, the chlorides remaining normal and glucose not being greatly reduced, there is still considerable hope for recovery, as the infection is still localized and may be attacked locally. When cocci appear in films of the deposit the prognosis becomes much worse, and is absolutely bad when they outnumber the cells in the fresh fluid.

REDUCTION OF CHLORIDES

The reduction of the chlorides which is found in generalized meningitis is due to a reduction of the blood chlorides rather than to increase of meningeal permeability, although the latter undoubtedly takes place. It must therefore be interpreted according to the general condition of the patient, since, for example, vomiting or severe diarrhoea may deplete the system of chlorides, or hydration of the blood may occur if large quantities of water are drunk during a rise of temperature. In either case the chlorides in the cerebro-spinal fluid will fall as a result of the fall in the percentage of blood chlorides. And a fall in blood chlorides, when it takes place rapidly, may of itself cause "meningism," since the lowered osmotic tension of the blood leads to an increased formation of cerebro-spinal fluid. This is the explanation of many of the cases of meningeal symptoms in children associated with attacks of vomiting or sudden rises of temperature in which the only abnormalities in the cerebro-spinal fluid are an excess of pressure and a reduction in the chlorides.

CELL COUNT AND COAGULUM

Meningitis associated with a mononuclear cell count is most often caused by the tubercle bacillus, although rarer organisms such as blastomyces and streptothrix may also cause it. It is important to distinguish tuberculous meningitis from "benign lymphocytic meningitis" and poliomyelitis, in which a similar cell count is often obtained. Here great help is obtained from an examination of the glucose and chlorides, which are almost

constantly reduced in tuberculous meningitis but remain normal in the two latter conditions. The spider-web coagulum and the reduction of the glucose percentage from the normal 55 to 15 or 20 mg. per 100 c.cm. are the most constant changes in tuberculous meningitis, and when the chlorides also fall from the normal 725 to between 650 and 600 mg. or lower the diagnosis is almost certain, even if tubercle bacilli cannot be found in the coagulum or deposit. A coagulum of similar appearance may also sometimes occur in poliomyelitis and "benign lymphocytic meningitis," but its absence is a diagnostic point in favour of these diseases.

It might be thought that so characteristic a disease as poliomyelitis could never be confused with tuberculous meningitis, but experience shows that in some epidemics in which meningeal symptoms are prominent a clinical diagnosis of tuberculous meningitis is often made in the early stages. The term "benign lymphocytic meningitis" probably covers a number of conditions, some of which at least, like the meningo-encephalitis of mumps and human cases of "loup-ill," are mild virus infections of the nervous system. In some, as in mumps, the symptoms improve dramatically after lumbar puncture. In others, such as the cases of "post-infectious encephalitis," which are often included under this heading on clinical grounds, the outcome is less certainly favourable.

BLOOD IN THE CEREBRO-SPINAL FLUID

The symptoms of subarachnoid haemorrhage may resemble those of meningitis very closely. Usually, however, there is no pyrexia during the first few days after the bleeding has occurred. In the older textbooks such cases were included in the term "haemorrhagic meningitis," but it is now recognized that the great majority are due to rupture of small aneurysms on the circle of Willis or neighbouring arteries. These are at least as often due to a congenital defect in the structure of the vessel wall as to atheroma, and consequently the condition may arise at almost any period of adult life and even during childhood. The appearance of the fluid, with evenly admixed blood settling down to leave a yellow upper fluid without forming a coagulum, is sufficiently typical to suffice for the diagnosis even in the absence of a typical history. Opinion is divided as to the advisability of treating such cases by repeated lumbar puncture, but there is rarely danger in carefully withdrawing a small amount of fluid, and fairly free drainage often leads to a remarkable improvement in the symptoms.

The detailed examination of the fluid in such cases is of minor importance, but certain criteria are valuable in assessing the age of the haemorrhage and whether it has ceased. It appears that the life of red blood corpuscles within the subarachnoid space is rarely more than a week, and therefore the presence of red blood corpuscles after nine or ten days indicates a continuance of haemorrhage after the first attack. The leucocyte count is of little value. It is usually greatest at the end of the first week, at which time there is often also a rise of temperature, but as both phenomena seem to be due to the rapid breaking down of blood in the meningeal spaces which takes place at this time they have no prognostic significance. Free haemoglobin is rarely present in such fluids, and never before the sixth or seventh day from the onset of bleeding.

Subacute Cerebral Symptoms

In the presence of subacute cerebral symptoms, such as headache, coma in greater or less degree, mental confusion, and loss of memory, with or without more focal symptoms such as hemiplegia and aphasia, lumbar puncture is often of great value. In such cases the

diagnosis may lie between cerebral tumour or some other condition giving rise to increase of intracranial pressure (for example, hydrocephalus or subdural haematoma) on the one hand, and encephalitis in its various forms, cerebral syphilis, arteriosclerosis and uraemia, on the other. It is first of all important to exclude the possibility of cerebral tumour by estimating the pressure of the cerebro-spinal fluid.

Cerebral tumours which do not produce an increase in pressure of cerebro-spinal fluid are not likely to lead to other than focal symptoms. Hydrocephalus is always associated with an increased pressure of cerebro-spinal fluid. But in a certain number of cases of subdural haematoma no rise of pressure is found. In the latter cases there will usually be a history of an injury to the head, usually a blow or fall on the forehead or occiput. A slight yellow coloration of the fluid is found during the first few weeks after such an injury, and the protein is, as a rule, raised from the normal 30 to the neighbourhood of 100 mg., without a corresponding excess of cells. In hydrocephalus the fluid itself shows no abnormality, and the same is true of a certain proportion of cases of cerebral tumour, but in others a varying degree of excess of protein, with or without yellow coloration and raised cell count, is observed. An excess of protein is constantly present in cases of neurofibroma of the acoustic nerve. Gliomas near the ventricular wall are generally associated with a rise of protein, and often, also, with an excess of cells. Definite yellow coloration is perhaps only seen with tumours in these situations. Cerebral arteriosclerosis does not as a rule cause either a raised intracranial pressure or anything more than a slight excess of protein. In malignant hypertension, however, the pressure of cerebro-spinal fluid is usually abnormally high. Sometimes a small haemorrhage or softening associated with surrounding oedema of the brain while raising the pressure may also increase the protein to the neighbourhood of 200 mg. A similar rise of protein may also occur in uraemia, although here also it is not constant. An excess of cells may also be found after a cerebral thrombosis, or in the course of uraemia, and in both conditions polymorphonuclear leucocytes may form a considerable proportion of the cell count. The diagnosis of such cases rests, perhaps, most definitely on the variation in the fluid from one week to another, since this is much greater in cases of cerebral arteriosclerosis and uraemia than in those of cerebral tumour.

That coma may be due to overdose of hypnotic drugs, such as bromides or the barbiturates, is not likely to be forgotten at the present time. Either type of drug may be found in the cerebro-spinal fluid when taken in large quantity. Free drainage of cerebro-spinal fluid is recommended in the treatment of such cases.

When there is a history of syphilis, and especially when the Wassermann reaction of the blood is positive, it is important to distinguish between cerebral syphilis, general paralysis, and non-syphilitic disease of the brain. General paralysis is almost always associated with strong colloidal reactions (gold, benzoin, mastic, etc.) of the paretic type and a very strong Wassermann reaction in the fluid. The cell count varies from 10 to 200 cells, but always includes a considerable proportion of mononuclear cells with very large nucleus. In cerebral syphilis the fluid may be very similar, although the colloidal reaction inclines to the luetic type of curve and the cell count is more purely lymphocytic. It is a point of some importance that when colloidal reactions of paretic type occur in cerebral syphilis they are always associated with a great excess of cells, whereas in general paralysis they may accompany any type of cell count. Still more important is the examination of the fluid after two months of intensive anti-syphilitic treatment, when the Lange and

Wassermann reactions will be found to have become weak or negative if the case is one of cerebral syphilis, whereas in general paralysis they will remain almost unaltered.

The cases of acute syphilitic meningitis which come on during the first two years after infection are easily mistaken for other forms of meningitis or encephalitis unless the Wassermann reaction is examined. Finally, it must be remembered that tumours of the brain and other non-syphilitic diseases may afflict a patient who has a positive Wassermann reaction in the blood. In such cases the Wassermann reaction is usually negative in the fluid.

Paraplegia

Lumbar puncture may give valuable aid in the diagnosis of the cause of paraplegic symptoms, and is rarely contraindicated in such cases. Attention is here directed, first, to the possibility of compression of the spinal cord or of blockage of the spinal subarachnoid space, and, secondly, to the presence of inflammatory changes in the fluid. Careful manometric examination, using Queckenstedt's test, is therefore essential in such cases. A complete spinal block is shown when there is no change in the manometric reading on deep bilateral jugular compression or on the inhalation of amyl nitrite, though coughing or abdominal compression may bring about a temporary rise of pressure. Lesser degrees of spinal block are more clearly indicated by failure or delay in the return of the pressure to normal when jugular compression is stopped than by a delay in the initial rise, seeing that the latter may be due to an obstruction, as by a nerve root, at the point of the needle. Associated with spinal block there is always an excess of protein in the fluid, but this of itself is insufficient evidence of spinal compression, as it may appear in other conditions. Spinal block usually indicates the presence of a tumour or granuloma within the spinal canal, although it may more rarely be caused by adhesive meningitis of an acute or more chronic type.

Accurate diagnosis at as early a date as possible is essential in such cases, and although lumbar puncture of itself will rarely indicate the cause of the spinal compression, it may, when combined with radiological examination, clinch the diagnosis. In addition to the primary tumours of the meninges, and benign and malignant tumours of the bones, the possibility of invasion of the spinal canal by granulomatous masses (tuberculous, staphylococcal, or lymphadenomatous) must be borne in mind, especially in the more acute cases.

Poliomyelitis is characterized in its early stages by a high cell count, in which polymorphonuclears are often abundant, along with a comparatively slight excess of protein, usually below 0.1 per cent. This may serve to distinguish it from Landry's paralysis and polyneuritis, in which the fluid either is normal or contains a considerable increase of protein with a low cell count. In rare cases of polyneuritis a higher cell count may be found in the fluid, along with a great excess of protein and often a yellow colour.

In the acute inflammatory or demyelinating diseases of the spinal cord (acute disseminated myelitis, disseminated sclerosis, and diffuse myelitis) the cell count is rarely above 20 per c.mm., and the protein excess is also moderate. Acute syphilitic myelitis is usually associated with a high cell count in the fluid and with a positive Wassermann reaction in the fluid and blood. In this condition, and in disseminated sclerosis, the Lange reaction is often strong, and, especially in the latter disease, may be of the "paretic" type. Thrombotic lesions of the spinal cord are not usually associated with any increase in the cells or with any great excess of protein.

In more chronic types of paraplegia the chief value of lumbar puncture is to eliminate the possibility of spinal tumour or compression. The diagnosis of disseminated sclerosis may sometimes be indicated by a moderate increase in the cells along with a strong Lange reaction, but, except in these conditions and in syphilitic myelitis, no characteristic changes in the fluid are to be expected.

Pain in the Distribution of the Spinal Nerves

When the chief, or the only, symptom is pain along the distribution of one or more of the spinal nerves, lumbar puncture is often of great help in diagnosis. Many such cases are due to a small tumour on a nerve root or to compression of a nerve root by disease of the vertebrae, and it is important to eliminate these possibilities by testing for spinal block. Inflammatory disease of the lumbo-sacral roots or of the sciatic nerves may be associated with a considerable excess of protein and occasionally with a rise in the cell count in the lumbar fluid; but in these cases no spinal block will be present. A similar excess of protein without spinal block may be found when a spinal tumour lies in the lumbo-sacral canal below the level of puncture. Radiological investigation with or without the help of lipiodol is often useful in cases of the latter type.

Finally, in cases of neuralgic pain the possibility of tabes should be borne in mind. It is true that a considerable proportion of the cases of tabes in which pain is the chief symptom have a perfectly normal spinal fluid, but some excess of lymphocytes, a positive Lange reaction of the "luetetic" type, and a positive Wassermann reaction, are usually found.

OBSERVATIONS ON FIJIAN FIRE-WALKING

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On Thursday, August 29th, 1935, the ceremony of fire-walking was performed at Suva by native Fijians from a neighbouring island (Mbengha) for the benefit of members of the British Medical Association who were visiting the island of Fiji on their way to Australia.

We were invited to make an examination of the fire-walkers that we desired, in order to learn, if possible, how a performance which might be expected to cause severe pain is carried out without obvious painful reactions. It is not necessary to describe here the full details of the performance, which have been recounted by other observers, beyond stating that the one that we witnessed conformed fully to the traditional routine.

On arrival we found that, in preparation for the ceremony, a pit, some twelve to fifteen feet in diameter, had been scooped out in the ground to a depth of several (four or five) feet. The floor of this hollow had been covered with stones of irregular shape, each about the size of a football. On them a fire of logs had been burning for nine or ten hours. The stones were of a whitish-grey colour, possibly owing to the action of the fire, mostly rounded or water-worn, and of a granular surface. They had been specially brought from Mbengha by the performers. When we arrived, the logs, still glowing, had been mostly burnt up or reduced to charcoal. Before the ceremony began, a few unburnt logs on the surface were carefully removed by native assistants by means of loops of twisted green bark attached to long poles. Some stones were turned over by these men and roughly arranged so as to afford a fairly steady and secure foothold.