THE DIFFERENTIAL DIAGNOSIS BETWEEN FUNCTIONAL AND ORGANIC PARAPLEGIA.

BY

R. T. WILLIAMSON, M.D.LOND., F.R.C.P.,
CONSULTING PHYSICIAN, ROYAL INFIRMARY, MANCHESTER.

THE differential diagnosis between functional and organic paraplegia or paraparesis is now of much interest on account of the large number of both affections in our military hospitals.

It is important that cases of malingering or of functional paraplegia should not occupy hospital beds for long periods or continue to receive pensions for months or years. It is equally important that men who have done their best to serve their country should not be regarded as cases of malingering or functional paraplegia when they are suffering from organic disease. The detection of indications of commencing organic affection in slight cases, and at an early period of the disease, is also most important.

It is desirable that malingerers should be at once recognized, and that cases of functional paraplegia should be very promptly treated and cured as early as possible by some means. But a definite differential diagnosis between functional and organic cases is necessary before this can be done.

In many cases the differential diagnosis is easy, in others extremely difficult and only possible after repeated careful examinations. Further, we have to bear in mind that functional symptoms may be associated with those of organic disease.

The most valuable indications in the differential diagnosis between functional and organic paraplegia are well known to those who are interested in nervous diseases and need only be briefly named. In this article I desire to draw attention to a few additional indications that I have found very useful in my own practice, and especially to the value of two signs—isolated loss of the vibrating sensation and loss of the tendo Achillis reflex.

The following are well known points in the differential diagnosis, and others might be mentioned:

Paralysis of the bladder, with incontinence of urine (overflow incontinence, or constant dribbling of urine), points to organic disease; it does not occur in functional paraplegia, though in this condition retention of urine occasionally occurs.

Reaction of degeneration on electrical examination of paralysed muscles is found in some cases of organic paraplegia; it does not occur in functional paraplegia.

Marked localized atrophy is not conclusive, but it would be in favour of organic paraplegia. Detection of bullets and foreign bodies, fractures of vertebrae, or of their laminae or processes, by x-ray examination, signs of aneurysm, caries, or growth, etc., are valuable indications in favour of organic disease of the spinal cord in certain cases.

History of a girdle pain, of root symptoms, or of severe pain in the back, for some time previous to the onset of paralysis are points in favour of organic disease, and especially if anaesthesia can be detected in the distribution of the spinal nerve roots at the level of the girdle pain.

Crossed paralysis—marked paralysis of the leg on one side and of the arm on the opposite side, whilst the other leg and arm are less affected, or paralysis of the leg on one side and anaesthesia of the opposite leg—would be in favour of organic disease.

Sensation.

If anaesthesia is detected, and its distribution and limits correspond exactly to those which have been established for *transverse* lesions at different levels of the spinal cord, then organic disease may be diagnosed. Thus, for example, transverse lesion of the lower end of the cord (third sacral segment) will produce anaesthesia in the gluteal region and scrotum. If higher (up to fifth lumbar segment) the lesion will cause anaesthesia down the back of the thighs, outer side of legs, and soles of the feet, in addition to the area of anaesthesia just mentioned, whilst the front and inner side of the thighs and the inner side of the legs will not be anaesthetic. Similar area of anaesthesia may be caused by lesion of the cauda equina. If

the lesion extends to the first lumbar segment the anaesthesia will extend to the groins, and the whole of the legs, the scrotum, and gluteal region will be anaesthetic.

In an organic spinal *transverse* lesion, if both feet are anaesthetic, the scrotum and gluteal region will be also anaesthetic. If the gluteal region and scrotum are not anaesthetic when the feet are anaesthetic, then the affection may be functional or due to peripheral neuritis, or a very limited spinal lesion, but we should require other signs to enable us to diagnose between the two. We may state this in another form—if the case is functional and the upper limit of anaesthesia is below the middle of the thigh, then the scrotum and gluteal region will probably *not* be anaesthetic.

If the anaesthesia extends up to the groin, the scrotum and the gluteal region will also be anaesthetic in organic disease due to a *transverse* lesion. If the scrotum and the gluteal region are not anaesthetic, in a case of paraplegia with anaesthesia extending up to the groins, *transverse* organic disease of the cord can be excluded and the case will probably, though not certainly, be functional or due to peripheral neuritis.

The limit of anaesthesia is of value in diagnosis. In a case of paraplegia, if sensation to touch is lost in both legs and the upper limit of the anaesthesia is a transverse line across the long axis of the leg (that is, at right angle to the long axis) at the knee, or just above or just below the knee, functional affection or peripheral neuritis is more probable than a spinal transverse lesion.

These are points of diagnostic value well known to those who are interested in nervous disease, and many others might be added.

Reflexes.

The diagnostic value of changes in the reflexes is well known. Loss of knee-jerks would of course indicate organic disease. Diminution of the knee-jerks cannot be considered of diagnostic value. When the knee-jerks are obtained in cases of paraplegia we have the various forms of spastic paraplegia to consider; we have often in such cases many points of diagnostic value in favour of organic disease—sustained ankle clonus, "clasp knife" rigidity, rectus clonus, and especially the Babinski and Oppenheim's reflexes. The Babinski or Oppenheim reflexes may be the only definite indications of organic disease in cases of early organic paresis of the legs. The other changes just named and other signs of organic disease may be absent at first. Also pseudo-ankle-clonus and pseudo-rectus-clonus are occasionally observed in functional paraplegia. The clonus, however, is not a sustained clonus. Usually the difference is easily detected, but in extremely rare cases it may very closely simulate a true clonus. A definite Babinski reflex does not occur in functional paraplegia.

The importance of these changes in the reflexes and of the other signs named is well known, but in certain cases the diagnosis is very difficult. The signs already named cannot be detected, or they are indefinite. In certain cases of paraplegia or paraparesis from tumour affecting the spinal cord—diagnosis verified by autopsy in some cases, in other cases clinical diagnosis of spinal meningeal tumour very probable—I have found the reflexes normal for a period at first; the knee-jerks have been normal, and ankle clonus and the Babinski reflexes have not been obtained. But usually in these cases we have a history of root pains or root symptoms for some time before the onset of paresis, and in course of time, often in a short time, the Babinski reflexes and ankle clonus are obtained.

In this article, however, I desire to draw attention especially to the value of two signs in differential diagnosis—(1) loss of the tendo Achillis reflex, and (2) loss of the vibrating sensation, when other forms of sensation are unaffected.

Value of the Tendo Achillis Reflex.

In many cases of functional paraplegia the plantar reflex is not obtained, and if all other reflexes are normal, loss of the plantar reflexes is a point which should lead to careful consideration of functional disease. The plantar reflex is lost in many cases of organic disease, but in such cases usually other reflexes are affected.

In some cases of paraplegia from organic disease we find the plantar reflexes lost, but the knee-jerks obtained and no ankle clonus. This condition of the reflexes may therefore be found both in functional paraplegia and in organic disease. Usually the testing of the tendo Achillis

reflex enables us to decide between the two conditions. The tendo Achillis reflex is *always* obtained in such cases if the disease is functional. When the Achillis reflex is lost the disease is always organic. But we cannot state the converse, that when the disease is organic the Achillis reflex is always lost. In some rare cases of organic disease the plantar reflex is lost and the Achillis reflex obtained.

The spinal reflex arc that must be intact if the plantar reflex is obtained is situated in the first and second sacral segments of the spinal cord. Just above this is the arc on which the tendo Achillis reflex depends (fourth and fifth lumbar segments). If the plantar reflexes are lost in organic disease, usually by extension of the lesion, the tendo Achillis reflexes are also lost; but in functional disease the tendo Achillis reflexes are always obtained. Hence the value of this tendo Achillis reflex in differential diagnosis. It is desirable to test the Achillis reflex in all cases whenever the plantar reflex is lost.

The tendo Achillis reflex is of special value also because it is very often lost in many cases of organic disease before the knee-jerk. Thus, in peripheral neuritis of various forms (alcoholic, diabetic, etc.), and in tabes at the onset often the Achillis reflex is lost before the knee-jerk. It may be lost when the knee-jerk has never been affected, as in some cases of poliomyelitis (chronic and acute); and it is lost on the affected side in many cases of sciatica. In testing this reflex the patient should turn on one side, if paralysed in bed, or he should kneel on a chair with the feet hanging down over the edge of the seat of the chair, and the calf muscles should be relaxed; or he should kneel with one knee on the chair and place the other foot on the floor at the side of the chair.*

The reflex is, of course, unexpected by the patient and not likely to be influenced by him voluntarily.

The Vibrating Sensation.†

The vibrating sensation is often of much service in the diagnosis of organic from functional affections. In cases with marked affection of sensation, organic and functional, the vibrating sensation is, of course, often lost, along with sensation for touch, pain, and temperature. Also, in cases of organic disease limited to the motor parts of the spinal cord and in many functional affections, the vibrating sensation and all other forms of sensation are normal at all stages. But with respect to diagnosis, the important point is that loss of the vibrating sensation is frequently one of the earliest signs of sensory affection in certain organic diseases of the spinal cord. At a later date other forms of sensation may be affected; but for a period—in some cases short, in others long—loss of the vibrating sensation may be the only objective sign of sensory affection in many organic diseases. This may occur in compression of the spinal cord from meningeal or vertebral tumour or caries, in some cases of disseminated sclerosis, in cases of combined postero-lateral degeneration of the spinal cord, and in early multiple peripheral neuritis. This isolated loss of the vibrating sensation is of diagnostic value; and from the examination of a large number of cases of organic and functional affections I think we may conclude that in any cases of paresis or paralysis of the legs, if the vibrating sensation is lost whilst other forms of sensation (to touch, pain, and temperature) are felt, and if the patient persists in this statement in spite of suggestions to the contrary, functional affections (hysteria and malingering) are extremely improbable and may be excluded.

In functional cases, if sensation is affected at all, sensation to touch or other forms of sensation are lost along with the loss of the vibrating sensation, or by suggestion, through the wording of the question, the patient will state that they are affected. He will not persist that the vibrating sensation is *alone* affected and that other forms of sensation are felt normally.

In testing the forms of sensation I think it advisable

to test touch sensation first and the vibrating sensation last. Also a part where the sensation is expected to be normal should be tested first and the examiner should see that the patient recognizes clearly the difference between touch sensation and the vibrating sensation at this part.

In cases of localized lesions of single peripheral nerves or nerve trunks often sensations to touch, etc., are not affected; in other cases lost; but the vibrating sensation is recognized. In these cases the vibrating sensation is often felt normally; it is sometimes diminished, but I have never found it lost entirely. In this respect such cases differ markedly from *multiple* peripheral neuritis.

The following brief references to cases I have met with in my own practice will indicate the value of certain signs, and especially of the tendo Achillis reflex and of the vibrating sensation, in the early recognition of organic diseases, and in the differential diagnosis from functional affections.

In early cases that at a later period can be clearly diagnosed as the spinal form of disseminated sclerosis, or compression myelitis from vertebral caries, or various forms of spastic paraplegia, for some time paresis of both legs with a Babinski or Oppenheim reflex may be the chief signs and the reflexes just named are the only definite indications that the disease is organic. Occasionally the Babinski reflex is obtained on one side only. If the Babinski reflex cannot be obtained, occasionally the Oppenheim reflex can be detected. Both these reflexes are diagnostic of organic disease. In some of these cases also the vibrating sensation is not felt, whilst other forms of sensation are recognized. This change, if detected, would be an additional definite sign in favour of organic disease.

Cases of peripheral neuritis from alcohol, diabètes, or other causes are occasionally seen at a very early stage, when the knee-jerks are still obtained. The patient complains of weakness and pains in the legs. In such cases the tendo Achillis reflexes are usually lost, and very frequently the vibrating sensation is lost whilst other forms of sensation are felt. Thus we have two definite signs that the affection is not functional.

In chronic anterior poliomyelitis commencing in the legs the Achillis reflex may be lost, though at first the knee-jerk is obtained. In a case of this affection following a very slight injury to one foot the loss of the tendo Achillis reflex enabled me to exclude functional disease or malingering as the cause of the paresis. The knee-jerks were normal in this case and the vibrating sensation and other forms of sensation were felt quite well. The bladder was unaffected, and at first paresis of the muscles of the legs below the knee and loss of the tendo Achillis reflex and feeble or indefinite plantar reflexes were the only signs of the disease. Later the plantar reflexes were lost. In acute anterior poliomyelitis limited to the lower lumbar region we often find the tendo Achillis reflex lost, though the knee-jerks are obtained, and we have thus an important indication in favour of organic disease in the differential diagnosis from functional affections.

In many cases of functional paraplegia, in some cases of hysteria, shell shock, and neurasthenia, the plantar reflexes are lost but all other reflexes normal. This isolated loss of plantar reflex is always in favour of functional disease, and, though not diagnostic, should lead to careful examination for other signs. In any case of paraplegia (or paresis of the legs), if the plantar reflexes are lost and the knee-jerks obtained and ankle clonus not obtained, the tendo Achillis reflex should be carefully examined. The tendo Achillis reflex is always present in functional disease; if lost, organic disease can be diagnosed; if obtained, the case is probably functional though not certainly. The plantar reflexes are normal or increased in other cases of functional paresis or paraplegia, and the other reflexes normal or increased.

In some cases of compression of the spinal cord by a tumour, meningeal or vertebral, or by tumour within the cord, for a period at the onset of the paraplegia (for a few days or longer) the legs may be partially or completely paralysed and yet the reflexes may be all normal and sensation to touch, pain, and temperature normal. Soon changes in the reflexes occur in these cases—Babinski reflex, or ankle clonus, or loss of all the reflexes. But if the case is seen at the early period, when all the reflexes are normal, the diagnosis from functional disease will require very careful consideration. A history of girdle or

* For more detailed description see writer's book, *Diseases of the Spinal Cord*, p. 66. London: 1911.

† The vibrating sensation may be tested by a large vibrating tuning-fork, the foot of which is placed on a subcutaneous bony prominence or bony surface, such as the malleoli, the inner surface of the tibia in the leg, the anterior superior iliac spine, the styloid process of the ulna at the wrist, the sternum, etc. I have found a tuning-fork which is supplied by Messrs. Woolley and Sons, chemists, Victoria Bridge, Manchester, very useful. It is 7½ inches long, and marked A 1440. An oval metal foot-piece is attached to the tuning-fork. A few control observations are desirable to see if the patient clearly recognizes the nature of the sensation before a routine examination is made.

root pains or root symptoms for some time, weeks or months, before the onset of the paraplegia would be in favour of compression by growth and against functional disease. After a time in other cases I have found that though sensation to touch, pain, and temperature have been felt quite well the vibrating sensation has been lost, and if, in spite of suggestions to the contrary, the patient persists in these statements, we have a valuable indication against the diagnosis of functional disease. Later a definite Babinski reflex may be obtained and incontinence of urine may occur; these would be symptoms indicating organic disease.

In a number of cases where the symptoms later have indicated combined postero-lateral degeneration or sclerosis, at the earliest stage the symptoms may be only slight weakness or heaviness in the legs and indefinite and slight unsteadiness in walking, and functional disease has to be considered. In such cases I have found the vibrating sensation lost whilst other forms of sensation are felt. At this stage also only an indefinite and occasional Babinski reflex may be obtained. From the loss of the vibrating sensation without loss of other forms of sensation in these cases I have excluded functional affections and later definite Babinski reflexes, ankle clonus, paresis, ataxia, and the symptoms of postero-lateral degeneration have developed.

Difficulty in differential diagnosis occasionally occurs in cases of paralysis or paresis of the muscles below the knee, of the muscles which dorsiflex the foot (anterior tibial muscles), and of those which plantar-flex the foot. The symptom may be bilateral or unilateral. Various lesions of the cord or peripheral nerves may produce this form of paralysis. Sensation and the bladder and rectum may be unaffected, or sensation may be only slightly affected. The knee-jerks may be obtained; ankle clonus is not obtained, and the plantar reflexes are lost or feeble or indefinite. But usually the tendo Achillis reflex is of diagnostic service. If the tendo Achillis reflex is *lost* the disease is organic. If the disease is functional the tendo Achillis reflex will always be obtained (it might also be obtained in very localized organic lesions). If the anterior tibial muscles only are affected the tendo Achillis reflex may be obtained in organic cases, but in these cases the patient would be able to stand on his toes (with his heels raised from the ground) but not on the heels with toes raised off the ground.

We meet with many cases of functional paresis among soldiers sent home from active service, presenting three pronounced symptoms—rigidity, paresis, and tremor of the legs. Sensation is normal, the reflexes are normal or merely increased, and the bladder and rectum are unaffected. In some of the cases the symptoms have followed an injury and the cases are often incorrectly diagnosed as "spastic paraplegia." Injury and bullet wounds of the cord, pachymeningitis and other organic lesions may cause somewhat similar symptoms. Sustained and marked ankle clonus and rectus clonus would be in favour of organic disease. But they are often absent in the slighter cases of organic disease, and a pseudo-ankle-clonus or pseudo-rectus-clonus may be occasionally obtained in these functional cases, though the clonus is usually less sustained and less marked than in organic disease. Often the "clasp knife" rigidity is of diagnostic service. The rigidity of legs in the extended position at the knee is marked and we have much difficulty in bending the knee at first, but when once it is *very slightly* bent further flexion is easy (as in bending a clasp knife). This form of rigidity would indicate organic disease. Also a Babinski reflex would be definite indication of organic disease.

CONCLUSION.

Certain reflexes are of the greatest service in the differential diagnosis and early recognition of organic disease, and especially valuable in early cases are the Babinski or Oppenheim reflex, and in many cases the loss of the tendo Achillis reflex, since these signs may be detected when other definite changes have not yet occurred.

The chief difficulty occurs when the knee-jerks are not lost, and when ankle clonus, rectus clonus, and clasp knife rigidity are not obtained. In one group of cases the Babinski or Oppenheim reflex is obtained, and this is diagnostic of organic disease. In other cases the plantar

reflex is not of the Babinski type, and it may be lost or feeble. In these the loss of the tendo Achillis reflex would be diagnostic of organic disease.

The following are combinations of diagnostic importance, especially at the onset of a number of organic affections.

Paresis with loss of the tendo Achillis reflex, as in early anterior poliomyelitis—chronic, subacute or acute.

Paresis with loss of the plantar reflex and loss of the tendo Achillis reflex (in many organic diseases).

Paresis with double sciatica and loss of the tendo Achillis reflexes, as in early cauda equina lesions.

Paresis with loss of the tendo Achillis reflex, loss of the vibrating sensation, and pains in the legs, as in early peripheral neuritis.

Loss of the vibrating sensation with very slight incoordination and very slight paresis, with or without a Babinski reflex, as in early combined postero-lateral degeneration of the cord.

Paresis, with Babinski reflex (in many organic affections).

Paresis with loss of the vibrating sensation and Babinski reflex (in the early stages of several organic diseases of the cord).

Root pains, or root symptoms, followed after a period of weeks or months by paresis, as in meningeal spinal tumour.

(In all these early combinations the knee-jerks may be obtained.)

When the diagnosis has been especially difficult, or the symptoms slight and indefinite, the three indications of organic disease which I have found of the greatest service in my own practice have been the Babinski or Oppenheim reflex, the loss of the tendo Achillis reflex, and the loss of the vibrating sensation, whilst other forms of sensation are unaffected.

The value of the Babinski reflex is well known, but the cases briefly mentioned and the points emphasized in this article are, I think, sufficient to indicate that in addition to the well known signs in favour of organic affections we have in the loss of the tendo Achillis reflex, or of the vibrating sensation (whilst other forms of sensation are unaffected), two further signs of much service, and deserving of more frequent consideration in the differential diagnosis and early recognition of certain forms of organic nervous disease.

In certain specially difficult cases, when other usual and well known signs are indefinite or cannot be detected, these two signs are often of great diagnostic value.

AN "IN VITRO" METHOD OF DEMONSTRATING THE "RETURN IMMIGRATION" OF LEUCOCYTES IN BLOOD CLOTS AND IN WOUND TISSUES.

By C. J. BOND, C.M.G., F.R.C.S., COLONEL A.M.S.,

HONORARY CONSULTING SURGEON, NORTHERN COMMAND; HONORARY CONSULTING SURGEON TO THE LEICESTER ROYAL INFIRMARY; MEMBER OF THE MEDICAL RESEARCH COMMITTEE.

In articles published in the BRITISH MEDICAL JOURNAL during the last three years¹ I have drawn attention to the phenomenon of the "return immigration" of phagocytes. The main facts established have been: (a) The transportation of pigment particles, previously applied to the surface of granulating wounds, by wandering cells to deeper layers of the granulation tissue. In some cases these pigment-laden cells were recovered from the medullary cavity of exposed bone at some distance from the granulating surface of the wound. (b) These results in the human subject were confirmed by experiments on animals, which also showed in some cases the paths in the tissues traversed by the wandering phagocytes.

Since, however, the question of the possible transference of the pigment granules by the blood or lymph stream arose in all these cases it became important to control these results in the living subject by experiments on excised portions of living tissue, where the circulatory factors could be excluded. In other words, it became necessary to devise some experimental method whereby the only