LUMBO-SACRAL ROOT PAIN

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It is now possible in most cases of "sciatica" to make a reasonably accurate diagnosis of the lesion responsible for the pain. A turning-point was the paper of Mixter and Barr (1934), reporting a series of cases in which protrusion of the intervertebral disks had caused pressure on the lumbar nerve roots and describing the diagnosis of disk protrusion by means of myelography. The occurrence of disk protrusion had been reported previously, but had not been regarded as sufficiently important or frequent to have much bearing on such a common condition as "sciatica."

Primary or idiopathic sciatica was for a long time accepted as a distinct clinical entity, and it was perhaps natural that clinicians should expect to find a common pathological basis in the majority of cases. Thus Dejerine thought that sciatic neuralgia was due to an inflammation of the lumbo-sacral nerve roots, which he called "radiculitis," and Sicard and Forestier suggested the term "funiculitis" for an inflammation of that part of the nerve traversing the intervertebral canal between the root and the plexus. With the increase in the use of *x* rays, the frequent occurrence of abnormalities of the lower lumbar vertebrae was noticed. Goldthwait of Boston postulated, more especially, the various degrees of sacralization of the fifth lumbar vertebra as the commonest cause of sciatica. Later Putti regarded arthritis of the intervertebral joints as the most common cause. Others have considered the condition to be a manifestation of myofascial "rheumatism" or "fibrositis." Since the recognition of the importance of disk prolapse it has been said that, except for an occasional cauda equina tumour, all cases of primary sciatica are due to disk lesions (Dandy, 1943).

In spite of these opinions we think there are a variety of lesions and these affect different parts of the nerve. Within the spinal canal pressure on nerve roots is almost certainly the commonest cause of symptoms, while arthritis of the intervertebral joints may be the most frequent lesion affecting the nerve roots in their course through the intervertebral foramen. Fibrositis and allied myofascial conditions are probably responsible for involvement of the nerves after they have emerged from the vertebral column. There is little evidence that inflammation of the main trunk of the nerve is a cause of sciatica, and Symonds (1943) is probably correct in saying that the sight of an inflamed and swollen sciatic nerve "trunk" "has never yet been granted to human eyes."

There is a tendency for each of the three main levels of nerve involvement to show a different clinical picture, but nevertheless differential diagnosis is no easy matter. Lesions of the nerve beyond the vertebral column are associated with chronic lumbar pain, and pain along the course of the sciatic nerve is seldom severe or early. The finding of "trigger points" of tenderness in the lumbar muscles is frequent in myofascial lesions, and is of considerable diagnostic significance. Lumbar pain alone also occurs for long periods before the onset of sciatica in arthritis of the intervertebral joints. The sciatic pain in this condition is not usually severe, and is often brought on by exercise and readily relieved by rest. On the other hand, muscle-wasting in the leg may be marked, and loss of power in dorsiflexion of the ankle, and even foot-drop, are seen more often than in either of the other types, with the exception of tumours of the cauda equina.

Where there is involvement of the nerve roots within the spinal canal lumbar pain may also be the first symptom; but this is not usual, and the sciatic pain soon becomes the dominant symptom. More often the sciatica is present from the onset, and may be very severe. In nearly every case there is exacerbation of the pain on coughing, sneezing, or other similar strain; this we regard as the most important single symptom pointing to a lesion involving the root within the spinal canal. Paraesthesiae in the dermatome supplied by the affected root are of great diagnostic value, but it is well known that all the symptoms may be intermittent, particularly in cases of disk prolapse. The neurological signs are also intermittent and variable. Their diagnostic value will be discussed later.

Classification of a Series of 50 Cases

Most of our present series of cases are those we considered to have some condition affecting a lower lumbar or first sacral nerve root within the spinal canal. We have included a few cases in which we decided to operate because of intractable or recurrent pain, although they did not fulfil all our diagnostic criteria. It is not surprising that our results in this latter group are unsatisfactory, but we were interested to find, on reviewing the cases, that, in all in which we had made a confident diagnosis of a lesion affecting the posterior roots, at least a considerable measure of relief followed operation—in spite of the fact that in some of them we had found no visible lesion.

TABLE I.—*Types of Lesion found at Operation (50 cases)*

	Cases
1. Ruptured intervertebral disks	27
2. Tumours of the cauda equina	3
3. Hypertrophy of ligamentum flavum following lumbar puncture	2
4. Ruptured ligamentum flavum	1
5. "Radiculitis"	5
6. Transverse defect in myelograms. "Disk projection"	2
7. No lesion found:	
With signs of root lesion	6
Without signs of root lesion	4

This classification of our cases is based upon the findings at operation, although we are well aware that a surgeon's findings may not be completely reliable, since he is likely to find only lesions which are obvious or with which he is familiar.

Of our cases 54% were *lesions of the disk*, comprising three main types. The commonest is one in which a portion of fibrocartilage is avulsed from the posterior margin of the disk and is often lying free in the spinal canal. It may, however, be in front of the posterior common ligament—if that is intact—and be found only after incising the ligament, although its presence is often obvious from the backward displacement of the latter. In other cases the disk appears to have undergone degeneration, forming a softened material which extrudes through an incision into the posterior common ligament. Extrusion of the nucleus pulposus is the third type, and this may be difficult to distinguish from the previous one because the extruded material is soft and gelatinous. Characteristically this follows injuries to the disk by lumbar puncture.

Hypertrophy of the ligamentum flavum was found in two of our cases, although it has been denied by Dandy (1943) that it is ever the cause of root pain. In both our patients the hypertrophy followed trauma by a lumbar-puncture needle. In the first, a young woman, lumbar puncture had been carried out for spinal analgesia; and in the second, a young man, 18 lumbar punctures had been done 10 years before for the treatment of cerebrospinal meningitis. Symptoms—mainly of low backache, but with some occasional posterior crural pain—had come on gradually until he was almost crippled. Lumbar puncture in the fourth space gave a "dry tap." Injection of iodized oil higher up, and myelography, showed a complete block at the level of the lower border of the third lumbar vertebra. The diagnosis of thickening of the ligamentum flavum was confirmed at operation, when the ligament was seen to be enormously thickened, forming an "hour-glass" constriction of the theca. Excision of the thickened ligament was followed by filling of the lower theca with cerebrospinal fluid. Subsequently his pain slowly subsided.

There were five cases of what we have called "*radiculitis*." We have previously reported three of these under the title "sciatic neuritis" (Holmes and Sworn, 1945). The lesions found were of two types. There were three cases with gross swelling of the affected root but without any discoverable mechanical cause. It is true that oedema and swelling of the root may be associated with a ruptured disk, but we have never seen them to anything like the same degree. In one of our patients—following the suggestion of Burns and Young (1945) that in the lower lumbar region a nerve root may be affected by the disk above—we explored the fourth lumbar disk imme-

diately above. No lesion was found; but the contrast between the normal and the enlarged roots was considerable. In two patients the root was normal in size, but there were adhesions between it and surrounding structures, particularly anteriorly, and nothing else abnormal was found. It seems possible that these two cases may represent a later stage of the first type. The pathology in this group of five cases is obscure. The gross oedema and adhesions suggest inflammation; but against this are the history of trauma in all but one case and no changes in the cerebrospinal fluid suggestive of inflammation.

The occurrence of almost complete *transverse filling defects in the myelogram*, with no lesion discovered at operation, has previously been noted. Hyndman, Steindler, and Wolkin (1943) regard these as false defects, but say that "the results [of operation] have been as favourable as when a herniated disk has been found and removed." They also remark that from such cases "one might deduce that causes other than herniated disk may be responsible for root pain at the fourth and fifth lumbar vertebrae." We have had two such cases, both relieved by operation, one of which seems worth describing in detail.

A woman aged 50 was referred to us by Mr. D. Wainwright from the Orthopaedic Hospital, Stoke-on-Trent. She had suffered from low back pain for 25 years and intermittent left sciatica for the past five years. There was severe left-sided sciatic pain on coughing and sneezing. She had occasional "pins and needles" sensations on the outer border of the left foot. On examination Lasègue's sign was positive on the left side at 45°. There was no motor weakness or muscle-wasting. Slight impairment of sensation to pin-prick and light touch was present on the outer border of the left foot and external malleolus. The ankle- and knee-jerks were present and equal. Lumbar puncture revealed no subarachnoid block and a normal fluid with a protein content of 40 mg. per 100 ml. W.R. negative. Straight skiagrams of the lumbar spine showed no abnormality, but myelograms at intervals of two days revealed a constant transverse filling defect opposite the disk between L 4 and 5. At operation the fourth and fifth lumbar laminae were removed. The fourth and fifth disks appeared normal and no definite protrusion could be seen or felt. The nerve roots also appeared normal. There was some relief from pain immediately after the operation, and then gradual improvement until three months later, when the patient said she was completely free from pain.

We believe that this type of case is due to "*disk projection.*" Normally the disk projects a little further into the spinal canal than the vertebral body, and a slight exaggeration of this, especially in association with a rather short nerve root, might well account for the symptoms and also for the myelogram. Occasionally a similar myelogram is found with a wide herniation of a disk, and, although the filling defect is seldom so symmetrical, it may only be at operation that the two can be differentiated with certainty. We found no softening of the disks in these two cases. The important feature is that operation gives good results; though whether this is due to displacement of the root or to decompression is not clear.

Though in six cases with definite signs and symptoms of root irritation we found no lesion at operation, we are inclined to think that some lesion must have been present but overlooked. Two cases had what we thought was some thickening of the ligamentum flavum, but this may have been within normal limits.

Diagnosis

We are in agreement with Munro (1945), who sums up one of his articles by saying: "Clinical examinations lay the groundwork for suspecting the presence of a posterior herniation of a lumbar disk. Contrast myelography proves or disproves this suspicion, determines the level of the herniation, and leads to a minimal amount of surgery, should this be indicated." We might add to this that myelography is the only satisfactory procedure, except operation, for revealing the various causes of root compression. The need for it will of course depend upon the relative frequency of disk rupture and other lesions, but since we have a high proportion of the latter in our series we regard myelography as of the first importance. We have used it in every case in which operation has been seriously considered, and we do not think that it has affected any of our patients adversely. In most cases the iodized oil (neohydriol, fluid) has been removed by needling at the end of operation, and in some patients who did not come to operation we have removed the oil by the method of Kubik and Hampton (1941), although it is not always easy to obtain complete removal.

Table II gives the frequency of the clinical signs and symptoms in our series of 50 cases and illustrates our finding that the signs and symptoms in cases of "sciatica" cannot be relied upon to determine the type or exact level of the lesion. Increase in pain in the back of the leg on coughing or sneezing is the most valuable symptom indicating that a nerve root is affected within the spinal canal, but is of course not conclusive. It is true that in many patients a diagnosis of disk protrusion may be made from the history and clinical signs alone. Definite neurological signs, such as sensory loss in the fifth lumbar or first sacral dermatome, loss of ankle-jerk, motor weakness, and muscular wasting, are extremely valuable when present, but are very variable in their incidence even in cases of long standing. We are of the opinion that much greater accuracy is obtained from myelography.

TABLE II.—*Clinical Data in Groups of Cases with Disk Protrusion, with Other Lesions, and with No Discoverable Lesion*

Clinical Data	Disk Protrusion	Other Intraspinal Lesions	No Lesion Found
Males	24 (89%)	10 (77%)	7 (70%)
Females	3 (11%)	3 (23%)	3 (30%)
History of injury or strain	14 (51%)	9 (69%)	5 (50%)
Posterior crural pain	27 (100%)	12 (92%)	8 (80%)
Sensory impairment in dermatome	15 (55%)	9 (69%)	3 (30%)
Absence or diminution of ankle-jerk	16 (59%)	5 (38%)	4 (40%)
Deep tenderness in back of thigh	3 (11%)	6 (46%)	5 (50%)
Spinal tenderness	4 (15%)	4 (31%)	7 (70%)
Lasègue's sign	26 (96%)	12 (92%)	9 (90%)
Unilateral	23 (85%)	5 (38%)	9 (90%)
Bilateral	3 (11%)	7 (53%)	—
Increase of posterior crural pain on coughing	26 (96%)	12 (92%)	6 (60%)
Scoliosis	8 (30%)	7 (53%)	3 (30%)
Muscular wasting in leg	8 (30%)	4 (31%)	1 (10%)
Spinal subarachnoid block	1 (4%)	4 (31%)	—
Positive myelogram	25 (92%)	12 (92%)	2 (20%)

Percentages are given to the nearest whole number.
Of the disk protrusions 20 were of the disk between L 5 and S 1; 6 were of the disk between L 4 and L 5; and in one case there were three protrusions—at L 3 to 4, L 4 to 5, and L 5 to S 1, with spinal subarachnoid block.

Results of Myelography

In the following summary a "positive" myelogram means that a filling defect was present in the iodized-oil column. The abnormalities of filling varied from small defects in the region of the "axillary pouches" of the nerve roots to large notched or transverse defects in the main column of oil.

1. *Disk Protrusions.*—Myelogram positive in 25 cases; doubtful in two cases.

2. *Tumours of the Cauda Equina.*—Myelogram positive in all three cases, but diagnosis had previously been made from the presence of subarachnoid block and increased protein content of the C.S.F. Myelograms defined the limits of the tumours.

3. *Hypertrophy of the Ligamentum Flavum following Lumbar Puncture.*—Myelogram positive in both cases. "Hour-glass" defects were present, with complete subarachnoid block in one case.

4. *Ruptured Ligamentum Flavum.*—A small notched defect was seen in the one case.

5. "*Radiculitis.*"—Positive in four cases, negative in one.

6. "*Disk Protrusion.*"—Transverse defects in both cases.

7. *No Lesion Found.*—(*a*) In the two cases of doubtful thickening of the ligamentum flavum one myelogram was positive. (*b*) In the other four cases with signs of root irritation one was positive, two doubtful, and one unsatisfactory owing to the patient being in severe pain and unable to be manipulated. (*c*) The four cases without signs of root irritation all had negative myelograms.

Treatment

There is no doubt that most cases of "sciatica" will clear up spontaneously, or can be cured or relieved by relatively simple measures without resort to surgery. Rest in bed, splinting, physiotherapy (particularly the application of heat), injection of "trigger points" with local analgesic, and epidural injections of saline or local analgesic, all give successful results. There is also no doubt that a small number of cases are unaffected by such measures or suffer from recurrence of pain at intervals. It is not always satisfactory to temporize and attempt simple treatment in every case. The condition may be progressive, as in spinal tumour. Even in cases of disk protrusion a sudden increase in the protrusion may sometimes cause an irrecoverable paraplegia. It is, moreover, important to most patients that

they should return to work and be free from disability as quickly as possible.

We have therefore made a complete clinical and radiological examination of all our patients with sciatica, including lumbar puncture with manometry and examination of the cerebrospinal fluid. If the presence of root irritation has been suggested, or if pain has been severe or of long duration, we have discussed the possibility of operation. If operation has seemed necessary, and has been agreed to by the patient, myelography with iodized oil has been carried out. If the myelography has been positive operation has been performed, but in a few cases we have operated, in spite of negative myelograms, because of severe and intractable pain.

Laminectomy may be necessary for extensive lesions, but in most cases of disk rupture we have used the interlaminar approach, usually combined with removal of the lower border of the upper lamina. This gives better access to the anterior part of the ligamentum flavum and to its lateral extension, the interpeduncular ligament. It is easy to remove the rest of the lamina if necessary, and this gives a good exposure of two roots. We find that our patients are little affected by this limited operation, and we usually allow them up after 12 days.

All of the 27 patients with disk protrusion were immediately relieved of pain. There has been one recurrence of protrusion 18 months after operation, and a second operation was done for this, with complete relief. Of the other conditions described, it is interesting to note that in all cases with a positive myelogram improvement followed operation. One case of spinal tumour showed signs of recurrence six months after operation. In the cases with negative myelograms no appreciable relief followed operation, but no patient was worse.

Summary

Fifty cases of lumbo-sacral root pain have been studied clinically, radiologically, and at operation, and the findings are described. In 54% of the cases the symptoms were due to protrusion of the fourth or fifth lumbar intervertebral disk, but we have described several other lesions which were found at operation.

Apart from operation, myelography is the only satisfactory diagnostic method for revealing and locating the lesion.

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MEDICAL RESEARCH IN EIRE

The Medical Research Council of Ireland has issued its report for the year 1945 from 85, Merrion Square, Dublin. The grant from the Hospitals Trust Board, guaranteed by the Minister for Local Government and Public Health for three years from January, 1944, was £5,000. As the period of this allocation of money will expire at the end of 1946 the Council has approached the Minister to make a substantial increase in the annual grant and to guarantee it for a much longer period. A big increase in applications for fellowships and studentships is anticipated now that more workers are becoming available to devote themselves to research, and it will be possible to send students abroad for training. The Council has decided to continue the goitre prophylactic scheme in the Clonmel and Kilsheelan areas in County Tipperary, where goitre is endemic, and it is hoped by the end of 1946 to have enough information to allow it to make definite proposals to the Public Health authorities for keeping this disease under control in the area. An investigation into the typhoid carrier condition was continued until the end of July, and the investigation into the chemotherapy of tuberculosis is progressing. By June of last year the Council had relinquished all control over the distribution and use of penicillin, the supply position to Eire having by that time become adequate for all requirements. The Committee appointed by the Council to advise the Minister for Local Government and Public Health on the establishment of dietary standards suitable to the Irish population held five meetings and submitted a detailed memorandum. Arrangements have been made for training field workers in methods necessary for carrying out the survey. During the year two studentships, five whole-time fellowships, and one part-time fellowship were awarded, and a number of grants-in-aid were authorized. The report concludes with a summary of work done by grant-holders during 1945.

TREATMENT OF SONNE III BACILLARY DYSENTERY AND BACILLARY DYSENTERY ("CLINICAL") WITH PHTHALYL SULPHATHIAZOLE

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In a previous publication (Jamieson, Brodie, and Stiven, 1944) the clinical and bacteriological results obtained in 200 confirmed cases of bacillary dysentery of mixed type in Dundee were given. Although sulphaguanidine was found to produce results slightly superior, both clinically and bacteriologically, to those obtained with aperients and chalk, 30% of the cases treated with this drug were still bacteriologically positive in convalescence.

The present paper gives the results obtained by the treatment of 48 cases of Sonne III bacillary dysentery and 40 cases of "clinical" bacillary dysentery (i.e., cases showing blood and mucus in stools but from which no pathogenic organism was isolated) with phthalyl sulphathiazole. A note is also included on the possible prophylactic effect of the drug in a case which was cross-infected with Sonne III dysentery while convalescing from paratyphoid B fever.

Selection of Cases.—A specimen of faeces from each case admitted to King's Cross Hospital, Dundee, during the period August, 1944, to June, 1945, with a diagnosis of bacillary dysentery was examined bacteriologically on each of three successive days. Four days after cessation of treatment with phthalyl sulphathiazole, and provided clinical cure (see below) had been established, specimens of faeces were examined bi-weekly until three successive negative results were obtained. Cases yielding one or more positive results for the Sonne III bacillus either initially or during convalescence were placed in the bacteriologically confirmed group of cases: those yielding consistently negative results were placed in the clinical group.

Clinical Features.—Thirty-two of the 48 Sonne III cases and 28 of the 40 clinical cases were under 10 years of age. As in the previously reported cases, pyrexia was not a feature of the illness. Eight of the 48 Sonne III cases and one of the 40 clinical cases had a temperature greater than 100° F. (37.8° C.). In the Sonne III cases the stools showed blood and mucus in 30 and mucus in 18. Blood and mucus were present in the faeces of each case in the clinical group.

Method of Treatment.—Tablets of phthalyl sulphathiazole were crushed and given 4 times daily in water. Abundant fluids were administered by mouth, and a light diet was given during the first few days. The dosage used (see Table I) was one-half that employed for sulphaguanidine, on account of the lower solubility of phthalyl sulphathiazole. No toxic effects were observed in the 88 cases treated.

TABLE I.—*Dosage of Phthalyl Sulphathiazole*

Age in Years	Grammes per Day					Total in Grammes
	1st	2nd	3rd	4th	5th	
0–2	3	1	1	1	1	7
2–5	5	2	2	2	2	13
5–12	10	3	3	3	3	22
Over 12	15	4	4	4	4	31

Clinical Results of Treatment

Clinical cure was accepted as established on the disappearance of mucus and/or blood from the stool and return to normal consistence, maintained for a minimum period of 72 hours. The average periods required for clinical cure, after