
The lumbar disc syndrome

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Clinical syndromes resulting from the protrusion of disc material into the spinal canal have been recognized since the original description of Dandy (1929) and the classical paper of Mixter & Barr in 1934. Despite intensive study, the precise aetiology of degeneration of the intervertebral discs remains obscure. Many factors of contributory importance have been identified. With progressive ageing, there is a gradual loss of water content of the nucleus pulposus, rendering this structure more friable and prone to degeneration. Similarly there is a progressive loss of elastic tissue and replacement fibrosis of the anulus fibrosus, and hence this structure will succumb more easily to any sudden rise of pressure in the nucleus pulposus. These changes commence after adolescence, but are undoubtedly aggravated by repeated minor trauma. Thus, lumbar disc lesions tend to be more common in heavy manual workers involved in repeated bending and lifting, and particularly are related to the repeated back injuries, so common in miners. Although trauma is often an important factor, lumbar disc protrusions are undoubtedly quite common in sedentary workers, and it is customary to blame faulty posture of the back, lack of exercise and unaccustomed domestic physical exertion in such patients. The frequent occurrence of disc lesions in pregnancy is probably attributable to the hydramia of pregnancy which indirectly weakens the ligamentous support of the intervertebral disc, and may lead to its expansion.

Pathology

Fig. 1 shows the normal intervertebral disc in sagittal and horizontal section and illustrates the proximity of the intervertebral foramen which contains the nerve root and artery, to the anulus fibrosus. Fig. 2 shows the stages in prolapse of an intervertebral disc. In the first stage the anulus is torn but there has been no extrusion of the nucleus pulposus. Shortly after this the nuclear material is
extruded through the tear and the posterior longitudinal ligament is stretched and produces severe and sudden back pain aggravated by movement. The next stage is for the protrusion to increase and it now encroaches upon the nerve root issuing from the spinal canal, leading to the occurrence of radicular compression and the familiar clinical syndrome of sciatica. This sequence of events is the most common one, and results from a postero-lateral disc protrusion. Much less commonly the tear in the annulus is central, and then the nuclear material may be extruded into the spinal canal and produce compression of the multiple roots which constitute the cauda equina. This is a dangerous situation which will be discussed later in this paper. There is no evidence that any form of conservative treatment will ever return prolapsed intervertebral disc material into its normal situation. The initial inflammatory reaction and the associated oedema determined by an acute protrusion will subside with conservative treatment in most cases. This, however, has certain sequelae, the most important of which are fibrosis and ankylosis of the extruded material to adjacent structures, and a progressive nerve root fibrosis.

Clinical features

In a recent series of 500 surgically verified lumbar disc protrusions (Robinson, 1965) it was found that 70% of acute disc lesions occurred in males. The initial episode occurred between the ages of 20 and 50 in 85% of cases. Severe back pain or sciatica certainly occurs below this age and may be due in these cases to a lumbar disc lesion, but other pathologies and particularly spinal tumours have to be considered in children or adolescence. Similarly in the older age group other causes have to be considered; in particular spinal metastases and pelvic tumours compressing the lumbo-sacral plexus are of importance. Mechanical factors related to the normal flexion-extension and lateral flexion of the spine determine the commonest sites of disc protrusion in the lumbar region: in 59% of cases it lies between L5 and S1 vertebrae. Next commonest is the L4/5 disc lesion, in 38% of cases. Combined lesions of these two spaces occur in 10% of patients and the remaining 3% at higher levels. Similar figures have been reported by Marshall & Schorstein (1968).

The sudden onset of severe back pain following immediately or within hours after sudden unaccustomed spinal flexion, lifting or trauma is well known.
The patient may feel a click in the back, and may find himself unable to rise after having bent down to lift a heavy object. Factors determining the acute back pain or lumbago are the tearing of the annulus, the pressure on the posterior longitudinal ligament, the strain imposed on the interarticular facets, and reflex muscle spasm in the erector spinae which induces the sciatic scoliosis so common in the acute stage of a lumbar disc protrusion.

In addition to these spinal factors determining the pain, it is usual to find evidence of radicular irritation as evidenced by severe, sharp, shooting pain sometimes with a burning quality radiating from the back through one buttock into the posterolateral aspect of the leg. This usually radiates to the ankle and into the foot, and may be associated with pins and needles in the big toe and medial side of the foot, or on the lateral side of the foot, though rarely both at the same time. Evidence of root compression and irritation are found in the limitation of straight leg raising, which is an almost invariable accompaniment of the acute lumbar disc prolapse. Tenderness may be found on percussion over the sciatic nerve. In cases responding to conservative treatment these symptoms regress quickly in a matter of a few days after complete immobilization in bed on fracture boards. Physical signs due to compression of the nerve root and loss of neural function in sensory and motor fibres are usually present. The commonest signs are:

1. Reversible weakness of the extensor hallucis longus due to L5 compression; anterior tibial wasting and a dropped foot are occasional sequela.
2. A variable patch of anaesthesia over the lateral or medial aspect of the foot, and lower leg, corresponding to the L5 or S1 dermatomes.
3. The ankle jerk on the affected side usually becomes diminished or absent, and this is best elicited by having the patient kneel on a chair.
4. Quadriceps weakness and wasting, with a depressed knee jerk, are found in the uncommon L3/4 disc lesions.

These physical signs may be slight in degree and may partially regress with conservative treatment. It is rare however for an absent tendon jerk to return after an acute disc lesion. After the acute incident has settled, the patient is usually able to get up and be mobilized within 3 or 4 weeks, and will usually return to work within another month or so. He may then be subject to occasional feelings of instability in the spine, back pain and intermittent tenderness over the sciatic nerve, particularly brought on by sitting with the leg over the hard edge of a chair. Mild symptoms of this type are very common and tend to regress with the passage of time. Repeated episodes of acute disc protrusion may occur at unpredictable periods, and may or may not be related to further episodes of trauma.

The central disc protrusion requires further consideration (Jennett, 1956). This occurs in only 1% of all disc lesions admitted to hospital, and therefore its overall incidence must be extremely small. In these patients the onset is acute or subacute with sciatica, which often becomes bilateral. The important clue to the central position of the disc protrusion is the occurrence of progressive paraparesis of flaccid type and sphincter disturbance manifest as hesitancy, urgency and eventually retention of urine. These symptoms may evolve in a matter of a few hours from the onset, with pain or spreading sensory symptoms associated with bilateral paraparesis. Sometimes the paraparesis, retention and sacral anaesthesia (a critical sign) develop several days after an attack of usually severe bilateral sciatic pain.

The advent of these symptoms should lead to the immediate referral of the patient to a neurological centre, because a grave emergency has arisen. There is no hope whatever of such a lesion regressing spontaneously, and unless the compression of the cauda equina is relieved within a matter of hours, irreversible bilateral paralysis and sensory loss in the legs will inevitably occur. More important than this, however, is the fact that the paralysis of bladder and bowel function will almost certainly be permanent unless relieved promptly. In these circumstances an emergency myelogram must be performed. This helps to confirm the diagnosis and the site of the disc protrusion, and the patient should be moved immediately from the X-ray department to the operating theatre to relieve the compression of the cauda equina by means of a laminectomy and removal of sequestrated disc fragments.

Variations of the classical syndrome

Considerable differences from the typical picture are common.

1. High disc lesions (L2/3, 3/4) tend to produce anterior crural pain and loss of the knee jerk, but limitation of straight-leg raising may be absent.
2. For unexplained reasons an almost painless disc lesion can occur producing a dropped-foot with patchy distal anaesthesia. Diagnosis here presents obvious difficulties.
3. In juvenile cases, the onset may be gradual without history of trauma, but rigidity of the lumbar spine is striking. The development of sciatica is variable.
4. In the elderly, one must exclude a spinal tumour. The clinical syndrome is similar to that in younger patients except that there is often no restriction of straight-leg raising.
(5) In some patients, a curious syndrome of bilateral aching pain, cramp and paraesthesiae is related only to walking and relieved by rest. In this syndrome of ‘intermittent claudication of the cauda equina’, weakness of the extensor hallucis longus, segmental sensory loss and reflex changes are usually found; in contrast to the claudication of vascular insufficiency, the foot pulses are present. Examination of the patient after exercise may show accentuation of these signs. The syndrome is thought to be due to a relative ischaemia of the cauda equina induced by exercise, and related to mechanical compression of its blood supply (Blau & Logue, 1961; Evans, 1964). Most reported cases have had a central lumbar disc lesion, arachnoiditis or a congenital stenosis of the lumbar spinal canal (Joffe, Appleby & Arjona, 1966).

Differential diagnosis

Fig. 3 shows diagrammatically a number of conditions which may simulate a prolapsed intervertebral disc in the lumbar region. **Tumours of the spinal cord or cauda equina** are relatively uncommon, but should be suspected when: (1) sphincter disturbance occurs early in the natural history of the syndrome, (2) there are signs of pyramidal tract involvement with brisk reflexes and extensor plantar responses, and (3) pain is intractable and does not respond to conservative management.

Tumours of the vertebral column are usually metastatic or due to lymphomas or myeloma, and may occur in someone known to suffer from a primary tumour or may be the presenting feature. Radiological evidence of vertebral collapse, osteolytic or osteosclerotic deposits will usually be present. Within a short time of the onset, metastatic tumours will usually lead to cord compression with retention of urine and paralysis of both lower limbs.

**Tuberculosis of the spine** is now less common than in former days, and radiological evidence of degeneration adjacent to the disc space with or without a soft tissue shadow over the psoas muscle will usually be present. Occasionally an **extradural abscess** secondary to skin sepsis will present with acute lumbago and sciatica, but invariably the patient is extremely ill and toxic with a high fever, marked local spinal tenderness, and the white blood cell count is elevated. In this situation immediate exploration is mandatory.

**Osteoarthritis** of the interarticular facets may produce intermittent or chronic low back pain, but does not usually enter into the differential diagnosis of acute lumbar disc protrusion.

**Spondylolisthesis** is due to a defect in the neural arch of the fourth or fifth lumbar vertebrae allowing displacement forwards or backwards of the vertebral body with its pedicles. This may be entirely symptomless, or may lead to chronic back pain worse on standing, with slight restriction of spinal movement; acute sciatica with signs of root compression are rarely seen.

**Ankylosing spondylitis** is most commonly seen in young men and is eventually associated with rigidity of the entire thoracic and lumbar spine. It usually presents with bilateral sacro-iliac pain. The sedimentation rate is usually elevated, there may be a normochromic anaemia, and the condition is sometimes related to chronic large bowel inflammatory lesions, and to rheumatoid disease.

**Sacro-iliac disease** may also be seen in Reiter’s syndrome, and sacro-iliac strain is not uncommon after pregnancy in young and especially obese women. In sacro-iliac disease the pain may radiate through the buttock to the thigh, but never extends below the knee. Neurological signs are absent. In older subjects, **vertebral metastases** or **tumours of the pelvis** which may be a malignant invasion from the cervix, rectum or ovaries may produce a syndrome identical with that produced by a prolapsed lumbar disc. A complete abdominal and pelvic examination through the rectum and the vagina will usually be sufficient to verify the diagnosis, but if there is doubt the patient should be examined by an expert in this field.
**Investigation**

Having considered some of the many causes of lumbago and sciatica, it must be pointed out that in the vast majority of instances the proper diagnosis can be made confidently on the basis of an adequate history and clinical examination. X-rays of the spine are usually unhelpful in younger subjects but should be always obtained if the clinical features are unusual or the response to treatment is unsatisfactory, or in elderly subjects where tumours of the pelvis and spine may be present. In the diagnosis of acute lumbar disc protrusions, straight X-rays of the spine can neither prove nor exclude a lesion, and more specialized ‘functional radiographs’ are only slightly more informative (de Martin & Figna, 1967).

Myelography is frequently employed, but there are no generally agreed indications. Some consider its use mandatory (Epstein et al., 1967) whereas others employ it infrequently (e.g. Marshall & Schorstein, 1968). Although serious complications of myelography are uncommon, it is my view that this procedure is indicated when there is diagnostic doubt as to whether the patient has a spinal tumour or a disc lesion. It may also be necessary when there are equivocal symptoms and signs, or where there is uncertainty about the organic nature of the clinical picture. In acute cauda equina compression a myelogram is indicated. False negative myelograms occur in about 10% of patients subsequently shown to have a disc lesion at surgery; false positives are less common, and depend to a large extent on the skill and experience of the radiologist. In England, iodophendylate (Myodil) is the contrast medium most frequently used, but on the Continent excellent and probably superior pictures are obtained by the injection of air (Chaouat et al., 1967) or the watersoluble Methiodal (Bianchi et al., 1967).

Examination of the cerebrospinal fluid (CSF) without introducing contrast medium, is of no diagnostic value, since normal protein levels are often found with disc protrusions, and very high levels (100–1000 mg/100 ml) may occur when the needle is placed above an acute protrusion.

**Treatment**

**Conservative**

In the management of patients with acute back pain, there are several different clinical problems. The mildest of these is the patient seized with what used to be called acute lumbago, that is back pain of sudden onset aggravated by twisting or flexion of the trunk, but with no radiation of the pain in sciatic distribution and with no signs of nerve-root irritation or compression. This condition is common in housewives lifting small babies from the ground, and in manual workers or sedentary workers who sustain minor trauma or adopt unaccustomed postures. These patients are the province of the family doctor, and should be treated with a limited period of strict bed-rest. A period of about 1 week will usually suffice, and during this time simple analgesics should be administered liberally. The causes of the syndrome are many and include ligamentous and muscle strains, transient subluxations of the intervertebral joints, and minor disc lesions. The patient does not need to be referred to hospital for treatment and should be allowed to return to work after a period of about a week. It is wise to avoid heavy lifting or stooping for a further week or two.

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<td>1. Bed rest</td>
<td>1. Laminctomy</td>
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<td>2. Traction</td>
<td>2. Spinal fusion</td>
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<td>3. Plaster jacket</td>
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<td>4. Spinal support</td>
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Table 1 illustrates some of the forms of treatment that have been used in acute disc lesions. All of these forms of therapy have their advocates, but a critical analysis of clinical material and of the relevant literature makes it quite clear that the only factor of importance is that of avoiding spinal movement by immobilization. Traction has no therapeutic merits other than keeping the patient immobilized in bed. A period of prolonged and absolute bed-rest on fracture boards, the patient being nursed on one pillow and his food being administered by a nurse, is essential. All patients of this type with genuine signs of root compression are best admitted to a hospital bed if one is available, and treated in this way for a period of not less than 2 weeks.

In the 3rd week the patient is allowed up for increasing periods of time, and in the 4th week, if mobilization is complete and pain-free, he should be allowed to return home. The use of a plaster of paris jacket or a spinal corset is based upon the prevention of spinal flexion, and is a useful measure for a few weeks after the patient has been mobilized. Addiction to these forms of spinal supports should be avoided if possible, but this is not always easy. It is not uncommon to see patients who have worn such appliances for many years, and in these instances there is no doubt that the appliance is supporting the psyche rather than the back. In this respect the prolonged use of a lumbar support is harmful and can only concentrate the patient’s attention to what he probably considers his fragile and vulnerable spine. In this way chronic neuroticism is engendered.
Pearce & Moll (1967) followed a series of about 100 patients treated conservatively by bed-rest, and re-examined them some years later. The mean follow-up period was 8 years, with a range of one to 13 years after the original incident. The results are shown in Table 2.

Chronic pain was moderate or severe in 32.4% and mild or absent in 67.6%. Believing that the amount of time lost from work was a good index of therapeutic efficacy, this was investigated and we found that 75% of patients lost either no work or less than 4 weeks/year from work after their acute disc lesion. Twenty-four per cent of patients were therapeutic failures as indicated by a loss of 4 or more weeks from work each year. The necessity to change the occupation because of back symptoms is another good index, and this had occurred in 29% of patients, 71% being able to continue with their previous occupation. The correspondence between these three parameters of recovery shows that about 30% of all patients have persistent chronic symptoms necessitating further treatment; 70% treated conservatively are in no way seriously disabled.

Manipulation is occasionally dramatic in relieving pain, but it is equally important to remember the occasional and equally dramatic catastrophes that can follow manipulation. On a number of occasions, patients have been rendered paraplegic, or have developed signs of total root destruction. Manipulation is one of the most controversial issues in medicine, since techniques vary from one manipulator to the next, and results are proportional to the enthusiasm of the operator. The cost of manipulation to the patient can also not easily be dismissed as a factor determining recovery. There is no evidence that manipulation returns the protruded disc material to its normal situation in the spinal column. Pennybacker (1968) has recently stated that manipulation has no place in the treatment of lumbar disc lesions.

Surgical

Surgical treatment is needed in a small proportion of patients with lumbar disc lesions. Two procedures are used. The first is a laminectomy with removal of disc material from the intervertebral foramen and the spinal canal. The second is often used with the first and consists of spinal fusion which attempts to improve the mechanical stability of the spine. Operation is indicated under the following circumstances.

(1) Pain unrelieved by conservative treatment.
(2) Recurrent episodes of severe pain, incapacitating in degree.
(3) Progressing physical signs such as wasting of the anterior tibial muscles with consequent foot-drop. Total foot-drop and dense sensory loss will not be relieved by surgery, and at this stage are often painless.
(4) As an urgent procedure for a central disc prolapse.
(5) If there is serious diagnostic doubt as to whether the patient suffers a spinal tumour or a disc lesion. This issue can often be settled by means of a myelogram, but occasionally the myelographic appearances are equivocal and laminectomy is necessary to clarify and remedy the underlying pathology.

The operation consists of an extradural decompression of one or more nerve roots with extirpation of the interior of the disc to lessen the risk of recurrence. There are good arguments for the exploration of both the L4/5 and L5/S1 spaces in all cases, since multiple lesions occur in at least 10% of operated cases (Semmes, 1964; Marshall & Schorstein, 1968). Surgery is successful in relieving pain in about 80% of carefully selected cases (O'Connell, 1951; Barr et al., 1967; Pennybacker, 1968). In a large series, Barr et al. (1967) found that results were the same after simple excision as after combined excision and spinal fusion. Age, sex, the level of the lesion and the duration of symptoms likewise did not affect the results of surgery. The operative mortality rate was 0.3%, and transient post-operative complications occurred in 12%. In contrast, Marshall & Schorstein (1968) found that the outcome after surgery was adversely affected by increasing age, heavy manual work, symptoms present for longer than 6 months and by pending litigation. Cases requiring re-operation had a poor prognosis in general, although 25% were rendered symptom-free.

Finally we must consider the common problem of the patient with chronic backache. This is
especially frequent in women, and also occurs in men following minor back injuries, particularly at work when a compensation issue remains unsettled. Obesity and poor spinal posture may perpetuate minor ligamentous strains, but more important than these factors I believe, are depression and neurosis. These are extremely common in patients who have genuine organic pain of spinal origin, and are then secondary to the unrelieved pain. In such cases appropriate medical or surgical treatment is indicated. Some patients with chronic pain deny the association with emotional factors, insisting that pain is the only problem and depression of minor importance. In these patients it is well worth trying a 2 months’ course of anti-depressant drugs; often the results are gratifying. Addiction to spinal corsets should be avoided, by not permitting these for longer than 3 months at a time. Low back pain may be a manifestation of a pure psychogenic disorder without any underlying mechanical factors, and this should be suspected in patients with no physical signs, no history of acute episodes, and in whom there are many other symptoms of an anxiety neurosis or personality disorder. In these patients mechanical investigation and treatment should be avoided since it only perpetuates the psychological problem and directs further attention to their backs. It is always difficult to try to persuade a patient to learn to live with and compensate for an intermittent or chronic pain, but in the ultimate analysis this is the last resort in patients who plague a multitude of different doctors with chronic backache.

References