THE NARROW LUMBAR CANAL
A Clinical and Radiological Review

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The importance of the size and shape of the spinal canal in relation to the occurrence of symptoms of cord or root compression, especially when spondylotic changes supervene, has been recognised for some time. Most of the earlier work concerned the cervical region (Pallis, Jones and Spillane 1954), but in more recent years a similar condition has been fully recognised in the lumbar region also (Verbiest 1954; Epstein, Epstein and Lavine 1962; Teng and Papatheodorou 1963; Highman 1965).

In the neck the antero-posterior measurement of the spinal canal is easily assessed on the lateral radiograph, and absolute values have been postulated for normal individuals (Wolf, Khilnani and Malis 1956; Payne and Spillane 1957; Burrows 1963), so that a small canal can readily be appreciated. In the lumbar region comparable antero-posterior measurements are not so widely used, partly at least because the posterior margin of the canal is more difficult to locate in the lateral radiograph. Verbiest (1954), in fact, stated that it was not possible to recognise the anomaly of a narrow lumbar canal on plain radiography and relied entirely on myelography. Huizinga, Heiden and Vinken (1952) made charts of the normal maximum and minimum antero-posterior measurements of the lumbar canal in human skeletons. Verbiest (1955) measured the diameter of the canal at operation in cases of developmental narrowness, and illustrated the instrument used. On the other hand, referring to the plain radiographs, Epstein and colleagues (1962) postulated that any antero-posterior diameter of less than 15 millimetres indicated narrowing of the canal. They also measured the interpedicular distance in the lumbar region by the method described by Elsberg and Dyke (1934) and found that the distance was at the lower limits of normal in a third of cases.

In an attempt to recognise the presence of narrowing of the lumbar spinal canal on the plain radiographs we have for some years been relating the antero-posterior diameter of the canal and the interpedicular distance to the size of the adjacent vertebral body. Although we do not claim any detailed accuracy for the method, we have found it of some value in assessing the size of a lumbar spinal canal. We wish therefore to describe the method, and also to present an analysis of thirteen patients found to have a narrow lumbar canal with spondylosis: ten of these patients came to operation.

METHOD

It should be understood that this method does not produce an accurate measurement of the size of the spinal canal, but only a rough guide as to its relative size in any particular individual. The main problem in any attempt at accurate measurement of the canal arises from the variation in its shape, which in most instances is pentagonal, but may be circular or even triangular in outline. To obtain definite information on the shape of a canal, were it required, it might be necessary to carry out special procedures, such as tomography from two directions or even in the transverse axial plane, but this would clearly be undesirable in most cases. Alternatively, by using plain films only, considerable information can be obtained from simply measuring the antero-posterior diameter and the interpedicular distance, although no account would be taken thereby of the patient's size or other magnification factors involved.
On the other hand, if these diameters were to be related to the size of the vertebral body adjacent to the canal, then variable factors such as these would cancel out.

In our investigations, therefore, we measure the antero-posterior diameter of the spinal canal in the lateral radiograph from the middle of the back of the vertebral body to the base of the opposing spinous process, which can be recognised by tracing forwards its inferior margin, a distance marked B in the radiograph (Fig. 1) and in the sketch (Fig. 2). We also measure the interpedicularr distance in the antero-posterior radiograph, marked A in Figures 1 and 2, and multiply these two values together to get a product AB. This product is then compared as a ratio with the product of the antero-posterior and transverse diameters of the middle of the adjacent vertebral body, marked D and C respectively in Figures 1 and 2, so that AB is related to CD.

If for example A = 2 centimetres, B = 2 centimetres, C = 4 centimetres and D = 4 centimetres, then AB = 4 and CD = 16 so that AB: CD = 4:16 = 1:4. We would thus refer to the "canal to body ratio" at that level as being 1:4.

Using this method, and in order to determine a base line in "normal" vertebrae, we analysed the films of fifty randomly selected patients who attended the fracture clinic for recent damage to the lumbar spine, but who were free from bone injury, and calculated the ratios for each lumbar level. Half of these patients were women, and, although it is possible that their canals may have been a little larger than those of men, the results were expressed together in a histogram (Fig. 3). Each dot represents the ratio for that particular level in the

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**FIG. 1**
Antero-posterior and lateral radiographs of a lumbar spine. A - interpedicularr distance. B - antero-posterior diameter of spinal canal. C - transverse diameter of vertebral body. D - antero-posterior diameter of vertebral body. The products AB and CD are compared.

**FIG. 2**
Superior aspect and median sagittal view of a fifth lumbar vertebra to show the four diameters.
lumbar spine, and it can be seen that most lie in the range 1:2 to 1:4.5. The former ratio indicates a large canal, and the latter ratio a small canal.

In patients suspected clinically of having small spinal canals these ratios have been calculated, sometimes in anticipation of myelography and sometimes after. Over the course of the last seven years thirteen patients have attended the South-West Neurosurgical Department with a clinical syndrome believed to be related to a small lumbar spinal canal and associated spondylosis.

**CLINICAL MATERIAL**

The records of thirteen patients were analysed with reference to symptomatology, objective findings on neurological examination, radiological appearances of the lumbar canal on plain radiography and myelography, and operative findings. There were twelve men and one woman. The age range was from forty-nine to sixty-nine years, with an average of fifty-seven years.

The neurological syndromes with which these patients presented can be divided into two groups. 1) Those with a history of backache, unilateral or bilateral root pain, with objective signs of root compression or paraparesis. There were eight patients in this group. 2) Those patients in whom intermittent claudication was the only, or major symptom. These patients presented with a history of pain or paraesthesiae in the legs provoked by exercise and subsiding with rest. There were five cases in this group, and none of them showed evidence of peripheral vascular disease.

All the patients were assessed neurologically and had plain radiographs of the lumbar spine, and all were subjected to myelography, lumbar or cisternal. Ten patients were operated upon (one patient had two operations, separated by an interval of two years). In these patients the late results of operation have been classified in three groups: Good—complete resolution of symptoms, even when residual neurological signs were still detectable; Fair—improvement compared with the state before operation, particularly as regards symptoms, but residual disability; and Poor—no improvement.

Table 1 summarises the neurological presentation, myelographic features, findings at operation and results in the thirteen patients. The term "minimal loss" denotes the finding of minor defects, such as absent or altered tendon reflexes; while "moderate" or "marked"

<table>
<thead>
<tr>
<th>CANAL TO BODY RATIO</th>
<th>L.1</th>
<th>L.2</th>
<th>L.3</th>
<th>L.4</th>
<th>L.5</th>
</tr>
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<tbody>
<tr>
<td>1:5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1:4.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1:4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:3.5</td>
<td></td>
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<tr>
<td>1:3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1:2.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*FIG. 3*

Analysis of fifty "normal" lumbar spines. The ratios of AB:CD have been plotted at the first to fifth lumbar levels inclusive. The ratio 1:2 represents a large normal canal. The ratio 1:4.5 represents a small normal canal.
loss denotes neurological deficit gross enough, usually by virtue of motor loss, to result in significant functional incapacity. The myelographic findings are summarised. The findings on plain radiography and "canal to body" ratios have been omitted at this stage for the sake of brevity, and will be referred to in the discussion.

ILLUSTRATIVE CASE REPORTS

Case 1—A sixty-five-year-old man, a taxi proprietor, was admitted in October 1961. Two years before he had begun to have low back pain after a fall on to the buttocks. Pain later radiated down the back of both legs, and he had begun stubbing his toes when walking. Examination showed peripheral weakness in both legs, more marked on the left. The knee jerks were sluggish, the ankle jerks absent. There was no sensory loss. The protein content of the cerebrospinal fluid was 95 milligrams per cent.

Radiological examination showed an exceptionally narrow canal at the third and fourth lumbar levels, with ratios of 1:5.5. Moderate degenerative changes were present around the disc margins and the apophyseal joints, with adjacent sclerosis. Lumbar myelography showed an incomplete block between the third and fourth lumbar vertebrae, with compression from the sides and dorsally. Disc space well preserved.

Fig. 4
Case 1—Myelography to show incomplete block between the third and fourth lumbar vertebrae, with compression from the sides and dorsally. Disc space well preserved.
examination showed that the ratio of the canal at the third and fourth lumbar levels was small, with a ratio of 1:4. Moderately severe degenerative changes were present both around the disc margins and in the apophysial joints. The exit foramina were flat. Cisternal myelography showed a narrow lumbar canal with partial obstruction lower down, and prominent roots of the cauda equina (Fig. 5).

At exploratory laminectomy the prominent ridges between the fourth and fifth lumbar vertebrae and the fifth vertebra and the sacrum formed by the contiguous margins of the vertebral bodies, were removed, and the respective disc spaces were found to be very narrow. During the patient's convalescence the ureteric calculus was removed. Six months after operation she had no symptoms and showed no abnormal neurological signs.

Case 3—A fifty-five-year-old farmer had had occasional backache and pain in both legs for four years. Three days before admission he developed severe low back pain with pain radiating to the outer aspect of the right leg. The day before admission he developed weakness and numbness of both legs and urinary retention. Examination showed severe peripheral weakness in both legs, with absence of the right knee jerk and diminution of both ankle jerks. There was sensory impairment in the fourth lumbar and distal dermatomes. Plain radiographs showed the ratio of the canal at the second and third lumbar levels to be very small—1:4.5 and 1:5 respectively. Moderate degenerative changes were present around the disc margins and in the apophysial joints. The exit foramina were flat. Cisternal myelography showed a complete block between the second and third lumbar vertebrae with compression from all sides, and prominent cauda equina roots (Fig. 6). At operation the vertebral canal was found to be markedly narrowed in its transverse diameter, and a large protrusion of disc material between the second and third lumbar vertebrae was removed. After operation recovery of bladder function was slow but complete, and there was residual weakness in both legs.

Case 4—A forty-nine-year-old postman presented with a six-year history of paraesthesiae in both legs on exertion. Paraesthesiae appeared in the feet and spread to involve both legs as he walked, the claudication distance shortening progressively to twenty-five yards. These symptoms disappeared quickly on rest. Latterly paraesthesiae had been accompanied by calf pain. Examination showed no vascular deficiency in the legs, and the only neurological deficit was absence of the ankle jerks. Radiographs showed the ratio of the canal at the third and fourth lumbar levels to be average at 1:3. The apophysial joints were arthritic and the facets noticeably sclerotic. Lumbar and cisternal myelography showed a block between the fourth and fifth lumbar vertebrae, with compression from the dorsal and ventral aspects. The cauda equina roots were prominent (Fig. 7). At exploratory laminectomy marked narrowing of the vertebral canal was found, but there was no extra dural or intradural mass to account for the myelographic block. The dural tube was remarkably constricted, and when the dura was opened the roots of the cauda were seen to be congested, and tended to prolapse through the dural incision. Decompression was carried out, the dura being left unsutured. After operation there was no return of symptoms and he was able to walk an unlimited distance on discharge.

Case 5—A fifty-one-year-old lorry driver had suffered a first attack of severe low back pain and bilateral sciatica nine years before admission. This attack subsided spontaneously, as did frequent subsequent attacks, and he was able to work intermittently with the help of a lumbo-sacral corset. For five years pain in both legs had been more prominent than back pain and had been provoked by walking, subsiding on rest. He had been impotent for two years. At the time of admission in November 1963 examination showed wasting of both quadriceps muscles and of the left anterior tibial muscles. There was weakness at both hips and of dorsiflexion of both ankles. Knee and ankle jerks were absent on the left and sluggish on the right. There was sensory blunting in the fifth lumbar and first
Case 3—Cisternal myelography with the patient erect to show a complete block between the second and third lumbar vertebrae. Compression apparently from all aspects. Prominent cauda equina root shadows.

Case 4—Lumbar and cisternal myelography with the patient erect to show a complete block between the fourth and fifth lumbar vertebrae. Compression from the dorsal and ventral aspects. Disc space well preserved. Prominent cauda equina root shadows.
sacral distribution on both sides. Radiographs showed the ratio of the canal from the third to the fifth lumbar vertebrae to be small—from 1:4 to 1:4·5. Sclerotic changes were particularly evident around the apophysial joints, and the exit foramina were flat. There was slight loss of alignment between the fourth and fifth vertebrae. Cisternal myelography showed a block between the fourth and fifth vertebrae with dorsal compression (Fig. 8). Exploration showed the fourth lumbar lamina to be markedly thickened, and the vertebral canal greatly narrowed. Decompression by laminectomy was done. After operation the patient became pain-free but had residual weakness, particularly of the left leg.

![Figure 8](image_url)

**FIG. 8**

Case 5—Slight scoliosis. Sclerotic apophysial joints in the antero-posterior plain radiograph. Cisternal myelography with the patient erect to show a complete block between the fourth and fifth lumbar vertebrae with mainly dorsal compression. Slight loss of alignment at this level.

**Comment**—Two striking features of the group as a whole are, firstly, the heavy male preponderance (a ratio of 12:1), and secondly the length of history before presentation at the Neurosurgical Unit. As to sex distribution, this group is weighted considerably more in favour of males than the series of Epstein, Epstein and Lavine (1962) or of Teng and Papatheodorou (1963). As to the length of history, only three patients had had symptoms for less than six months, and nine patients had had symptoms for over two years, the longest duration (Case 6) being twenty-five years. Often the early symptoms had been mild and not particularly disabling—usually intermittent backache or root pain, for which the patient did not seek advice until more serious signs appeared. The onset of symptoms was usually insidious, injury being the provoking factor in only three cases; in two of these (Cases 1 and 10) a fall on the buttocks initiated back pain leading to root compression symptoms, and in both of these cases operation confirmed the narrow canal.

Of the eight patients in the group presenting with symptoms and signs of severe nerve root compression, low back pain was present in five and unilateral pain in two. There was sphincter disturbance in two. Neurological examination showed bilateral lower motor neurone disturbance in six cases (with associated sensory disturbance in three); in two cases there was unilateral motor and sensory loss.
TABLE 1

CLINICAL AND OTHER FEATURES IN THIRTEEN PATIENTS

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age in years</th>
<th>Sex</th>
<th>Presenting symptoms</th>
<th>Neurological signs</th>
<th>Myelographic findings</th>
<th>Operation findings</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>Male</td>
<td>Bilateral sciatica</td>
<td>Moderate peripheral weakness</td>
<td>Incomplete block at L.3 4</td>
<td>Narrow canal congested roots</td>
<td>Fair</td>
</tr>
<tr>
<td>2</td>
<td>57</td>
<td>Female</td>
<td>Right groin pain</td>
<td>Proximal weakness and wasting of legs</td>
<td>Narrow canal</td>
<td>Ridges at L.4,5 and L.5 S.1</td>
<td>Good</td>
</tr>
<tr>
<td>3</td>
<td>55</td>
<td>Male</td>
<td>Paraparesis rapid onset</td>
<td>Severe motor loss</td>
<td>Block at L.2 3</td>
<td>Narrow canal; L.2 3 disc prolapse</td>
<td>Fair</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>Male</td>
<td>Intermittent claudication</td>
<td>Minimal loss</td>
<td>Block at L.4 5</td>
<td>Narrow canal congested cauda</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
<td>Male</td>
<td>Sciatica and claudication pain</td>
<td>Moderate motor loss</td>
<td>Block at L.4</td>
<td>Narrow canal thick L.4 lamina</td>
<td>Fair</td>
</tr>
<tr>
<td>6</td>
<td>51</td>
<td>Male</td>
<td>Intermittent sciatica</td>
<td>Marked deficit</td>
<td>Block at L.3 4 and prolapsed L.4 5 disc</td>
<td>Two operations; multiple disc removal; Narrow canal</td>
<td>Poor</td>
</tr>
<tr>
<td>7</td>
<td>49</td>
<td>Male</td>
<td>Intermittent claudication</td>
<td>Minimal loss</td>
<td>Narrow canal; partial block</td>
<td>Multiple disc prolapse; congested cauda</td>
<td>Fair</td>
</tr>
<tr>
<td>8</td>
<td>64</td>
<td>Male</td>
<td>Pain and weak left leg</td>
<td>Marked loss</td>
<td>Block at L.3/4</td>
<td>Narrow canal, thick lamina</td>
<td>Fair</td>
</tr>
<tr>
<td>9</td>
<td>69</td>
<td>Male</td>
<td>Intermittent claudication</td>
<td>Minimal loss</td>
<td>Narrow canal</td>
<td>No operation</td>
<td>Unchanged</td>
</tr>
<tr>
<td>10</td>
<td>52</td>
<td>Male</td>
<td>Paraparesis</td>
<td>Severe loss</td>
<td>Block at L.2 3</td>
<td>Narrow canal; L.2 3 disc prolapse</td>
<td>Fair</td>
</tr>
<tr>
<td>11</td>
<td>58</td>
<td>Male</td>
<td>Sciatica</td>
<td>Moderate loss</td>
<td>Multiple disc protrusion</td>
<td>No operation</td>
<td>Improved</td>
</tr>
<tr>
<td>12</td>
<td>57</td>
<td>Male</td>
<td>Paraparesis</td>
<td>Severe loss</td>
<td>Multiple ridges block at L.4 5</td>
<td>L.4 5 disc prolapse</td>
<td>Fair</td>
</tr>
<tr>
<td>13</td>
<td>66</td>
<td>Male</td>
<td>Intermittent claudication</td>
<td>Minimal loss</td>
<td>Narrow canal</td>
<td>No operation</td>
<td>No follow-up</td>
</tr>
</tbody>
</table>

Of the five patients in the group in which intermittent claudication was a prominent symptom, the subjective discomfort, either pain or paraesthesiae, was always bilateral. Pain in the back and legs was present in three cases, and two patients described tinglings without pain, affecting both legs and spreading proximally from the feet with exercise. The only patient to show any marked neurological deficit on examination was in Case 5. In the other patients no deficit was detected beyond absence of ankle jerks.

The spinal fluid protein was elevated on the seven occasions it was recorded; the highest level was 600 milligrams per 100 millilitres. That the level of the protein would depend on the level of spinal puncture in relation to the block was pointed out by Blau and Logue (1961). However, in Case 2 the cisternal protein was 76 milligrams per 100 millilitres, though there was no evidence of pathology higher than the lumbar canal.

DISCUSSION

The neurological complications of cauda equina compression within a narrowed lumbar canal are of recent recognition (Verbiest 1954, Epstein and colleagues 1962, Teng and Papatheodorou 1963). There is no doubt that such compression, whether the main factor be
disc protrusion, spondylotic bar or laminar hypertrophy, acting as it does in a vertebral canal already narrowed, can produce embarrassment of the cauda equina or emergent nerve roots. Compression may produce, at one extreme, progressive paraparesis with sphincter disturbance, or so-called intermittent claudication of the cauda equina at the other. The present series illustrates the various types of presentation, but all cases had in common a narrow lumbar canal.

Intermittent claudication has been described previously in relation to the narrow canal (Brish, Lerner and Braham 1964; Joffe, Appleby and Arjona 1966) and as a feature of central lumbar disc prolapse (Blau and Logue 1961, Evans 1964) and of lateral disc protrusion (Spanos and Andrew 1966). The mechanism by which claudication pain may be produced was discussed by Blau and Logue (1961), who thought that pain and sensory disturbance were ischaemic in nature, compression of nerve roots preventing the hyperaemia of cauda equina roots that normally follows exercise. Similarly Evans (1964), measuring the claudication times under varying tensions of inspired oxygen, suggested that pain or paraesthesia was due to relative ischaemia of active cauda equina roots during exercise. The striking feature in four of our cases of intermittent claudication was the paucity of physical signs, even though abnormalities demonstrated by plain radiography and myelography, and at operation, were marked. In any patient, therefore, with a history of claudication pain and only minimal physical signs, difficulty may arise in differentiating between aorto-iliac arterial disease and lumbar spinal canal compression, as has been pointed out by Blau and Logue (1961). Both conditions tend to affect the older male patient in particular, and clinical examination may not always provide a clear distinction between the two. In some patients, indeed, it is possible that a degree of overlap occurs. In such circumstances, therefore, the demonstration of a narrow lumbar canal, possibly with additional spondylotic features, on plain radiographs, may help to indicate the origin of the lesion, and lead to myelography rather than aortography in the first instance. Although not all authors are agreed, we feel that plain radiographs are of considerable value in the recognition of a narrow canal, and that in most cases the additional information of the "canal to body" ratio is most helpful. In all our cases abnormality was evident in plain films. Slight scoliosis was present in most of them, and slight loss of alignment between the fourth and fifth lumbar vertebrae was noted in three cases. In all, the apophysial joints were arthritic, with narrowing of the joint space and sclerosis of the articular facets. The sagittal plane of the apophysial joint was noticeably close to the midline in several cases. The exit foramina were generally shallow with short pedicles seen in the lateral view. By contrast, the intervertebral disc spaces were often quite well preserved with only minimal marginal osteophytosis.

Concerning direct measurement of the canal, Highman (1965) considered it unreliable unless correction were made for the patient's position and the geometric magnification factors. An advantage of the ratio method, described above, is that these corrections are unnecessary. The ratios of twelve of the thirteen cases indicated small or very small spinal canals, ranging from 1:4 to 1:6, there being eight cases beyond the normal limit of 1:4·5. Only one case had an average ratio of 1:3.

Plain radiographs, it is true, do not indicate the cross-sectional shape of the canal, nor do they demonstrate the degree of soft-tissue thickening around the articular facets and in the ligaments, which, together with a bulging annulus, may cause severe root compression in a basically small canal. Myelography provides essential information on the size of the remaining subarachnoid space. Verbiest (1954) relied for diagnosis partly on the myelographic appearances and partly on the findings of a shallow canal at operation. Daum, Smith, Walker, Chapman and Eversman (1959) measured the antero-posterior depth of the contrast material and postulated that anything less than 15 millimetres was suggestive of a narrowed canal. Epstein and his colleagues (1962) found that the antero-posterior depth of the column of opaque oil varied from 0·8 to 1·5 centimetres and related the dorsal compression of the column to the inward protrusion of the ligamentum flavum and the thickened laminae. On a
point of technique, Teng and Papatheodorou (1963) used a full column of contrast material with the patient erect. They emphasised the presence of multiple ridges in the upper lumbar and mid-lumbar region, and compared spondylosis with nucleus pulposus herniation. Blau and Logue (1961), and Lewtas and Dimant (1957) mentioned the thickened cauda equina roots evident in the myodil, although the latter did not refer specifically to a small canal in their cases.

At myelography, in nine of our thirteen cases a complete obstruction to the flow of myodil was demonstrated, the fringed margin indicating extrathecal compression. In the other four cases obstruction was incomplete. Compression of the myodil appeared to be mainly from the dorsal aspect rather than from in front, and the obstructions were evident at or close to the disc spaces. Partial obstruction at several levels was present in five cases, the levels tending to be in the upper lumbar and mid-lumbar region.

Cisternal myelography was carried out in five cases, on two occasions in addition to lumbar myelography, and on three occasions because of failure of lumbar puncture. That lumbar puncture is often difficult in the presence of a narrow lumbar canal was noted by Epstein and his colleagues (1962), and it may be preferable, if a narrow canal is noted in plain radiographs, to proceed to cisternal myelography without initial lumbar puncture.

All the ten patients undergoing exploration were submitted to laminectomy. When radiological evidence of canal narrowing was present three neural arches were usually removed, whether or not localised disc protrusion was found. The spinal canal was noted to be significantly narrowed on seven occasions. Local disc protrusions were removed in seven operations (in six patients), and narrowing of the canal and disc protrusion coincided in six cases. Multiple disc protrusions were removed in two operations. In three cases the roots of the cauda equina were seen to be swollen, congested and adherent, though in no case was there dense arachnoiditis. At operation, unusual thickening of the laminae, as noted by Epstein and his colleagues (1962), was not a prominent finding; on two occasions hypertrophy of the lamina at the level of myelographic block was noted, and once the ligamentum flavum was seen to be unusually thick. However, considerable difficulty may be encountered in carrying out laminectomy, not because of thickening of the laminae and ligaments, but because the reduced capacity of the canal makes the introduction of rongeurs difficult. When myelographic block has been demonstrated, the exploration is centred on the level of obstruction, but if generalised narrowing is suspected, or if ridges are present above or below the main block, it is advisable to plan the exploration so that adequate decompression can be carried out. The dura should be opened over sufficient length to decompress the cauda equina roots, until there is adequate flow of cerebrospinal fluid and no hindrance to the intrathecal passage of a soft rubber catheter cranially and caudally. The dura is best left unsutured.

It will be seen from the Table that, of ten patients submitted to operation, two were completely relieved of symptoms and could be considered good results, seven were improved but remained disabled, whilst one patient was not improved.

**SUMMARY**

The syndromes associated with a narrow lumbar spinal canal are described and discussed. In thirteen cases two main groups were evident, the larger group having mainly backache and root pain, the smaller group having intermittent claudication. A method of recognising the narrow spinal canal on plain radiographs is described, and a comparison made with normal controls. The findings at operation are reported and the importance is emphasised of making a wide laminectomy for decompression.

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REFERENCES


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