Significance of the Small Lumbar Spinal Canal: Cauda Equina Compression Syndromes Due to Spondylosis

Part 2: Clinical and Surgical Significance*

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Normally, the intraspinal space in the lumbar spine increases the closer the vertebra is to the sacrum. Elsberg and Dyke reported the range of interpedicular measurements for the lumbar spinal canal. As their principal interest was tumors of the spine, their measurements dealt with the upper, not the lower, limits of normality. They did not concern themselves with the possibility of existence of an abnormally narrow canal. Schlesinger and Taveras have called attention to the radiographic appearance of a narrow canal.

A narrow lumbar canal (Fig. 1) is of congenital origin, but is asymptomatic until further encroachment of the space available for the nerve roots from some other process occurs. This, of course, is the situation in any size canal. With the presence of a congenitally small canal, any developing mass lesion tends to become symptomatic earlier and is likely to present more severe deficits than in a wider canal. Furthermore, a small lumbar canal makes surgery more difficult, with the requirement for a successful operation being more demanding. Usually, encroachment occurs as the patient develops lumbar spondylosis. Symptoms may be monoradicular; less commonly, compression of several roots, or even of the entire cauda equina may be present.

Physical examination will not disclose the presence of a small canal in patients where lumbar spine disease is aggravated by this condition. A narrow lumbar canal can be appreciated only by careful measurement of the interspinal volume by x-ray. Both anteroposterior and lateral films are necessary for this determination.

A patient with a narrow canal is, probably, no more or less likely to suffer a ruptured intervertebral disc. However, the presence of the narrow canal makes it likely that one of several conditions may occur with rupture of the disc. There may be symptoms from a much smaller extruded fragment, or the patient may prove refractory to nonoperative treatment. More commonly, there is a heightened symptom complex with involvement of more than one root and a denser neurological deficit than usually seen.

The usual problem in a patient with a narrow canal is spondylosis. In a normal-sized canal, very large osteophytic formations may produce no significant complaints, as lumbar spondylosis usually produces no symptoms and is found incidentally. Rarely, in a normal-sized canal it may produce symptoms identical to a ruptured intervertebral disc. Most commonly, if symptoms are present, they are usually confined to back ache. But when a congenitally narrow canal is present, the addition of spondylosis is much more

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likely to compress a nerve root, or even produce complete cauda equina compression.

The usual clinical symptom complex presented by patients with lumbar spondylolisthesis includes back pain and radicular pain, plus varying degrees of muscle weakness and reflex changes. Occasionally, pain is only a minor complaint, a rare patient presenting with predominantly motor weakness. The precise reason for this peculiar finding remains obscure. Such patients may be diagnosed as having a crossed leg palsy. A more thorough examination will disclose evidence of root involvement, indicating the need for a lumbar myelogram. Laminectomy and foraminotomy are required for relief of the foot drop.

The combination of spondylolisthesis and a narrow canal constitutes a serious neurosurgical disease. It should not be confused either in diagnosis or surgical management with simple disc extrusion. For, in the face of a narrow canal, management by traction and bedrest is not likely to result in gratifying relief of symptoms.

Surgery in patients with a narrow canal is difficult and should be carefully planned. The available room for manipulation of the nerve roots is greater at L5-S1 than at L4-L5, but the total interpedicular distance may be markedly reduced at all levels. Through a purely interlaminar approach, damage to the cauda equina may result by compression against the opposite pedicle as retraction is carried out to obtain exposure of the ventrally placed mass. The patient with a narrow lumbar canal has been made paraparetic during lumbar disc surgery through this mechanism. The operating surgeon must be prepared to remove enough bone for safe retraction, even if this means a full laminectomy for a soft extruded intervertebral disc fragment.

When spondylolisthesis and a narrow canal exist, laminectomy is required for relief of neurological deficit. Such patients need all the additional canal room the surgeon can provide. Laminectomy is therefore the operation of choice. The dura is often involved, becoming thin and attenuated. Often it is tightly stuck to the ligamentum flavum, and great care must be used to separate these two layers. If the dura is opened accidentally, the nerve roots may herniate, increasing the likelihood of damage to them during subsequent bone removal. Because of this thinning of the dura, plus the narrow space, the use of dural graft has been advocated by some surgeons. Perhaps its use is justified as it will provide a rapid enlargement of the space available to the cauda equina.

A narrow lumbar canal can coexist with a variety of other disease processes. This is particularly true in older patients, and the neurosurgeon should be wary of falling into the trap of explaining all the symptoms by the narrow canal. These diseases may be truly coexistent, as with vascular disease, or enhanced by the limited space available within a narrow canal, as in the case of tumors, infections, or certain congenital deformities. As vascular occlusive disease of the iliac arteries is common, it may prove particularly confusing. However, physical examination will disclose the decrease or absence of terminal aortic, femoral popliteal, and dorsalis pedis pulses. An aortogram should be done to confirm the diagnosis of arterial occlusive disease.

A congenital anomaly may become symptomatic at any age. Why this is so is not clear, but it probably relates to loss of compensatory abilities with aging. A rare cause of the narrow lumbar canal is the syndrome of spondylolisthesis without spondylolysis. This might be termed insufficiency of the superior sacral facets. The patient quite literally has a horizontal sacrum. Moiel and Ehni have reported two such cases. Two patients have been seen on the neurosurgical service of the University of Texas Southwestern Medical School (Fig. 2). In each case the dural sac has been found markedly compressed between the arch of L-5 and the body of S-1. This means that the narrowing of the canal occurs in the anteroposterior direction.

Intraspinal tumors may present monoradicular syndromes. Obviously, if the space within the lumbar canal is small, neurological loss will be more rapid and more severe. This is true of either extra- or intradural tumors.

Today in the United States, infection is a rare cause of neurological difficulty in the lumbar spine and usually is secondary to spinal surgery. However, tuberculosis and spinal arteries have not completely vanished from the scene. Again, if a narrow canal is