Lumbar Spine Stenosis

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Lumbar stenosis, the most common indication for spine surgery in older patients,[1] is the narrowing of the central spinal canal, lateral recesses, or neural foramina. Two broad types of lumbar stenosis are defined: congenital and acquired. *Acquired stenosis,* the far more common type, may result from spondylosis, trauma, postoperative change, tumor, or infection. Of these causes, spondylosis, or degenerative arthritis, is the most common. Degeneration of an intervertebral disk can result in bulging or herniation leading to a narrowing of the anterior aspect of the spinal canal, recess, or foramen. With loss of vertebral disc height, the ligamentum flavum buckles anteriorly, and undue stress is placed on the posterior spinal elements, causing facet joint arthropathy (hypertrophy, synovial cyst formation) and hypertrophy of the ligamentum flavum, all of which impinge on the posterior aspect of the spinal canal. Spondylolisthesis can further diminish the canal diameter. The decrease in canal diameter is not in itself a problem; rather, it is the compression of the thecal sac and nerve roots within that leads to symptoms. In addition to mechanical compression, nerve root ischemia is thought to have a role in the clinical signs and symptoms associated with stenosis.[2]

Classically, patients with lumbar stenosis report pain and/or paresthesias of the lower extremities when standing or walking, particularly over prolonged periods. Symptoms worsen with lumbar spine or hip extension, and symptoms subside over minutes when the patient leans forward, crouches, sits, or lies supine. This constellation of symptoms is termed *neurogenic claudication*. Less specific symptoms of radiculopathy (weakness, areflexia, paresthesias, dermatomal pain) can also occur secondary to lumbar stenosis. Even in patients with a clinical picture suggestive of lumbar stenosis, the diagnosis cannot be confirmed until spinal imaging demonstrates an anatomical abnormality corroborating the clinical findings.

Advances in neuroimaging have resulted in increased identification of this disease.[3] Magnetic resonance imaging (MRI) is the preferred modality, as it provides excellent soft-tissue delineation of the canal, the foramina, and their contents (Figure 1). When osseous pathology (eg, fracture deformity, postoperative osseous proliferation) is suspected, computed tomography (CT) may be useful, as this modality provides better evaluation of osseous structures than MRI does (Figure 2). CT myelography can also be used, and it is advocated by some, but this procedure

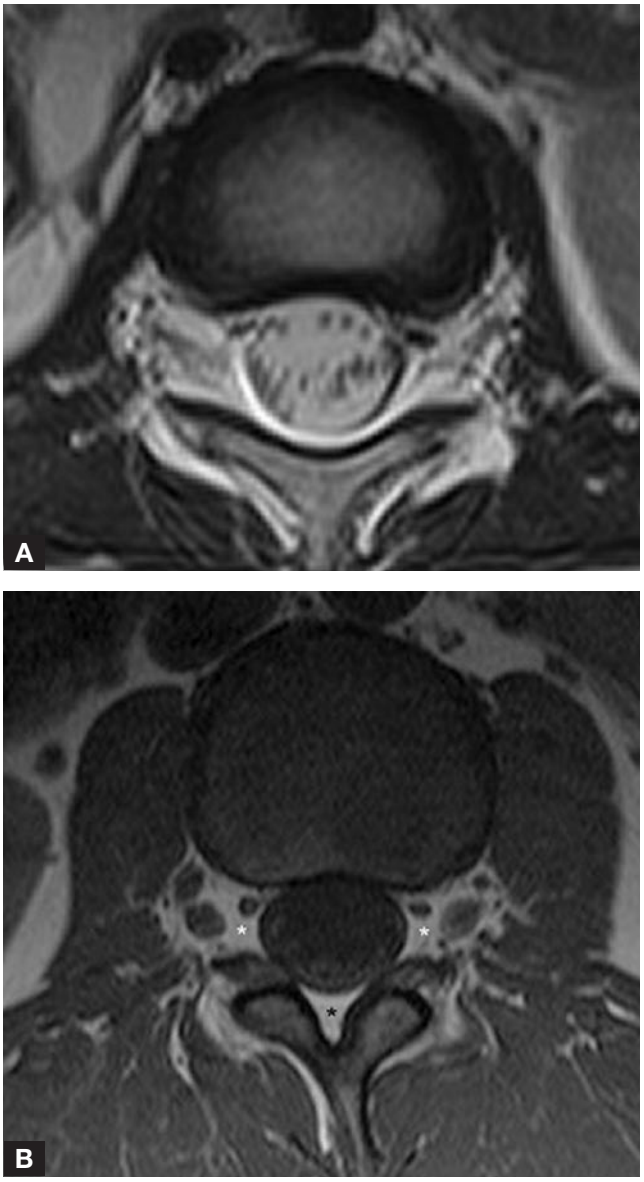

Figure 1. Normal lumbar spine in 2 patients: **(A)** patient 1, T_2-weighted axial image. Normal, round thecal sac, margins of which are delineated by bright cerebrospinal fluid within; **(B)** patient 2, T_1-weighted axial image. Normal fat around rounded thecal sac, in posterior epidural space (black asterisk) and neural foramina (white asterisks).

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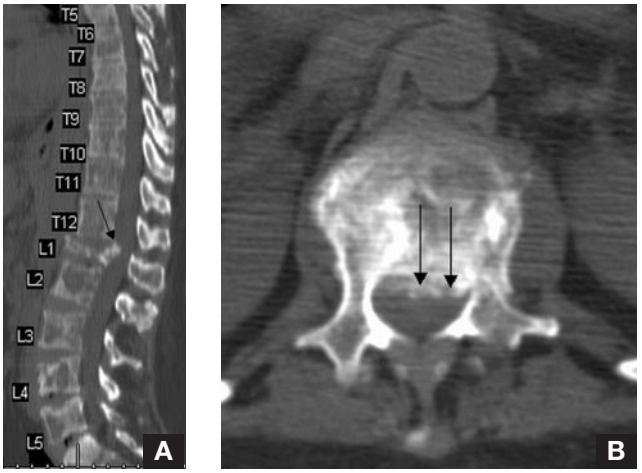

Figure 2. Computed tomography (CT) and stenosis. (A) Sagittal reformatted CT image of patient with multiple myeloma shows multiple lytic lesions involving all vertebral levels. There is a pathologic fracture at L1 with retropulsion of bone leading to central canal stenosis (arrow). (B) Axial CT cut through L1, the area of pathologic fracture. Bone encroaches on central canal (arrows). (C) Sagittal short TI inversion recovery (STIR) magnetic resonance imaging of same patient shows pathologic L1 fracture (arrow) and central stenosis and provides excellent display of diffuse marrow involvement (bright areas) and encroachment on intrathecal contents at this level.

carries associated risks of lumbar puncture, radiation exposure, and contrast reaction.

Imaging of the normal lumbar spine reveals a round thecal sac surrounded by epidural fat. The fat extends laterally into the lateral recess and neural foramina and posteriorly between the thecal sac and the posterior arch. In mildly stenotic canals, the thecal sac is flattened, and there is less epidural fat (Figure 3). In severe central canal stenosis, the thecal sac has a characteristic "trefoil" appearance, and posterior epidural fat is obliterated or markedly attenuated (Figure 4). Nerve root edema can also be detected. Similarly, stenosis of the lateral recess or neural foramina distorts the shape of these regions, and fat is either decreased or absent within the area and around the exiting nerve.

Lumbar stenosis is a common incidental radiologic finding in 6% to 7% of asymptomatic adults and in up to 20% of adults over age 60.[4] A poor correlation has been found between severity of imaging findings of stenosis and patient symptomatology—reinforcing the idea that the clinical history, physical examination, and imaging findings should be correlated to correctly diagnose lumbar stenosis.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

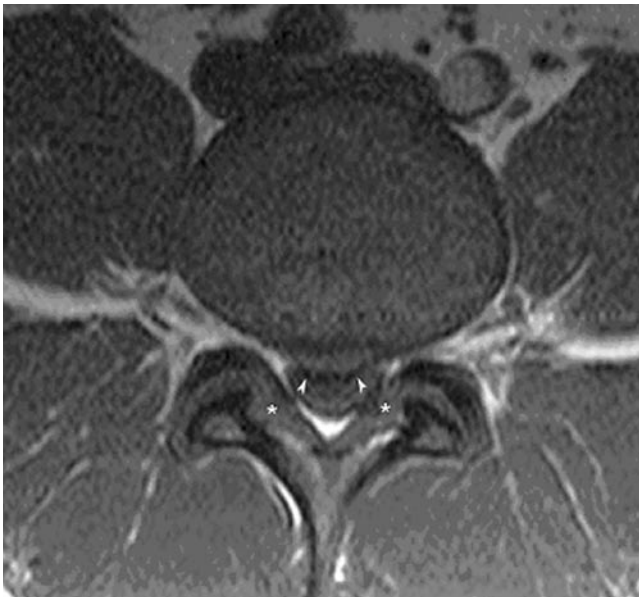

Figure 3. Mild central canal stenosis T_1-weighted axial image. A central disc protrusion (white arrowheads) abuts and flattens the adjacent thecal sac. Both neural foramina are narrowed, as signified by decreased (bright) fat within. Facet joints and ligamentum flavum (white asterisks) show mild hypertrophy bilaterally, further encroaching on the canal diameter.

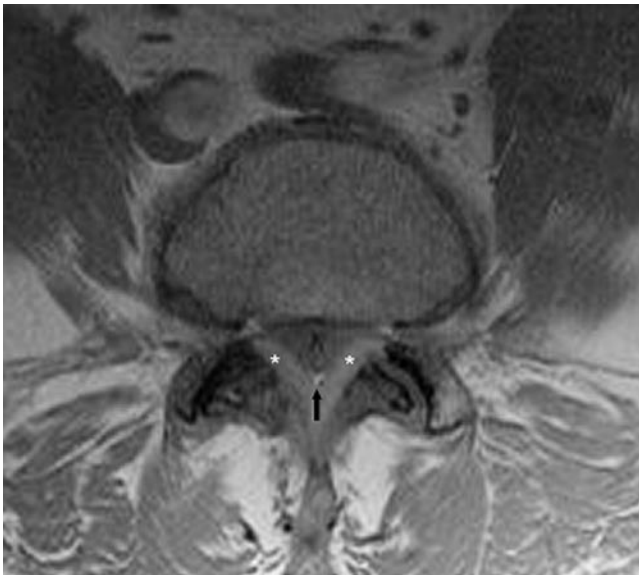

Figure 4. Severe central canal stenosis T_1-weighted axial image. Thecal sac has triangular or trefoil shape compressed between hypertrophied ligamentum flavum (white asterisks) and vertebral body. Posterior epidural fat is obliterated, with only small focus of bright T_1 signal (fat) remaining (black arrow).

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