Lumbar Spinal Stenosis

With current increase in life expectancy due to improvement in healthcare, lumbar spinal stenosis is becoming more frequently identified as the cause of low back and lower extremity pain, numbness, and/or weakness. Disc and/or facet degeneration are usually the earliest occurrence in aging. One disc anteriorly and two facet joints posterolaterally constitute the three-joint motion complex. As the disc bulges or protrudes and the facet joints hypertrophy, the volume of the spinal canal and neural foramina decrease. Abnormal motion as a result of the above also causes ligamentous hypertrophy and osteophyte formation, leading to further narrowing of the spinal canal and neural foramina. This is also aggravated by extension movements of the spine. Flexion of the lumbar spine, such as leaning forward on a walker, can produce symptomatic relief. Imaging studies should start with AP and lateral x-rays, preferable including flexion and extension lateral views to evaluate the presence of instability, such as spondylolisthesis. The best study at this time is MRI without contrast. T2-weighted images demonstrate the condition of the soft tissues such as the disc, ligamentum flavum, facet capsule, cysts, and neural structures. CT scan with or without myelogram is obtained if there are contraindications to MRI such as a pacemaker. Electrodiagnostic studies can be useful if peripheral neuropathy is suspected. Typically, symptoms are aggravated by walking and relieved with sitting. The aim of treatment is to provide relief of symptoms and to improve function. Nonsurgical treatment should be tried first, unless the patient is developing severe disabling pain, progressive neurological deficit, and/or bowel or bladder dysfunction. Patient education and physical therapy are important. Braces, such as lumbosacral corset, may provide relief by reducing loads. Pain medications and anti-inflammatory medications can be used. Epidural steroid injection may reduce the inflammatory component of nerve compression and often provides good relief of pain.

When conservative treatments have been exhausted and patients are developing disabling symptoms, surgery should be considered. For patients having progressive neurologic deficits such as significant motor weakness and/or bowel or bladder dysfunction (cauda equina syndrome), surgery should be performed as soon as possible. The goal of surgery is to decompress the stenotic levels to relieve the lower extremity pain, numbness, and/or weakness. If there is disc herniation responsible for part of the symptoms, this should also be addressed. If there is spondylolisthesis at the level of spinal stenosis, decompression and fusion with pedicle screw instrumentation have been shown to produce better results. If instability occurs due to more extensive decompression in which more than 50% of the facet joints are removed or the pars interarticularis is disrupted, then fusion should be performed. When there is degenerative scoliosis with rotational or lateral subluxation, or when there is significant loss of lumbar lordosis, alignment should be restored with fusion using posterior segmental instrumentation, preferably metal rods and pedicle screws.

There is minimally invasive surgery for relief of lower extremity pain. If there is no motor weakness and no bowel or bladder dysfunction, there are now various interspinous process spacers available for indirect decompression. When symptoms improve with forward flexion, the spinal canal and the neural foramina are found to be enlarged. The interspinous spacers are especially preferable if patients have significant medical problems that put them at higher risk for more extensive surgeries. Most of the spacers can be inserted under local anesthesia. It is contraindicated in patients with significant osteoporosis, severe scoliosis, or spondylolisthesis of more than grade I.

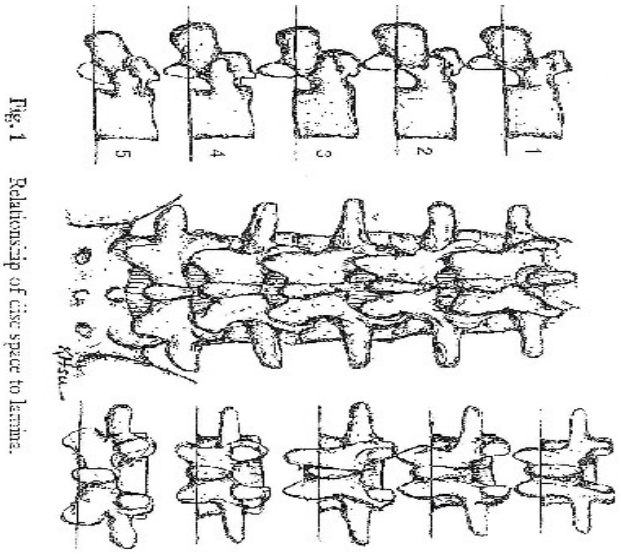

Fig. 1 Relationship of disc space to lamina.

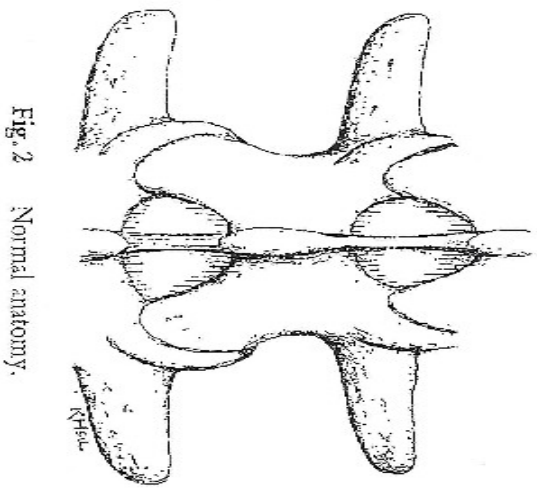

Fig. 2 Normal anatomy.

Key Points on the Surgical Anatomy of the Lumbar Spine

Anatomical landmarks are important in surgical approaches to the lumbar spine. The relationship of the disc to the interlaminar space must be understood. The disc level progresses cephalad faster than the interlaminar space (Figure 1). The fifth lumbar disc is at the L5-S1 interlaminar space level. The second lumbar disc is under the lamina of L2, more cephalad to the interlaminar space level. Therefore, the skin incision should be centered at the level of the disc. In the posterior approach, the bony landmarks include the spinous process in the center, progressing laterally to the lamina, facet joints, and transverse process (Figure 2). When the surgeon starts removing bone from the lamina, the least invasive is laminotomy (Figure 3).

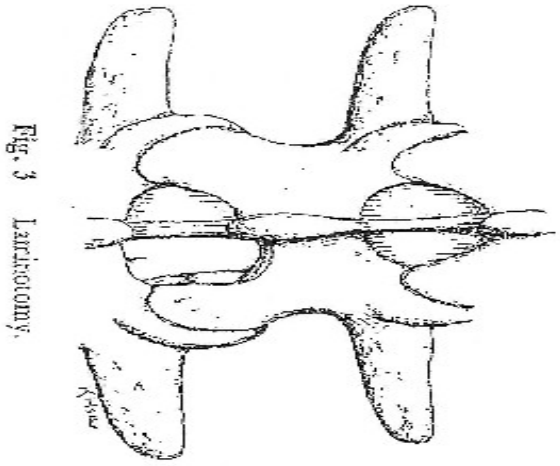

Fig. 3 Laminotomy.

Microdiscectomy can be performed this way. This is followed by laminotomy with partial facetectomy to expose more lateral structures (Figure 4).

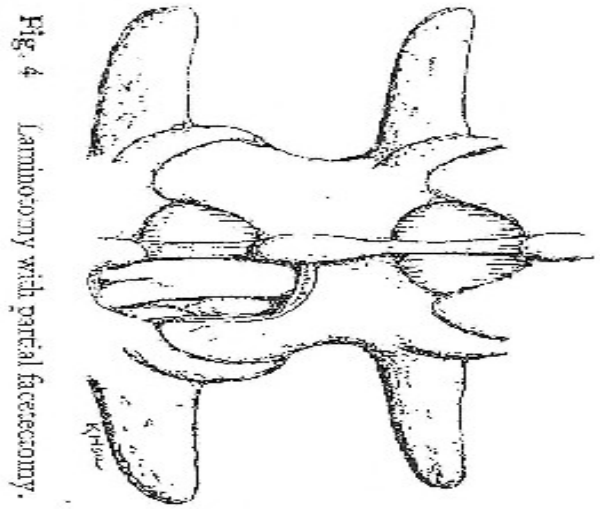

Fig. 4 Laminectomy with partial facetectomy.

Unilateral laminectomy includes complete removal of the lamina on one side (Figure 5).

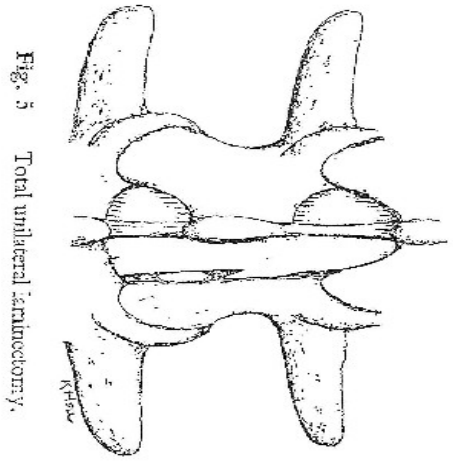

Fig. 5 Total unilateral laminectomy.

The names for surgery on a disc can be confusing. Discectomy may imply total removal of a disc. A complete disc removal can be performed only anteriorly—for example, during an anterior interbody fusion or total disc replacement. From a posterior approach, only 1/5 to 1/3 of the disc can be removed. "Trimming" a disc or sequestrectomy may mean removal of only the extruded or sequestered part of the herniated disc. Bilateral laminectomy includes complete removal of the spinous process and lamina on both sides (Figure 6).

Severe central spinal stenosis often

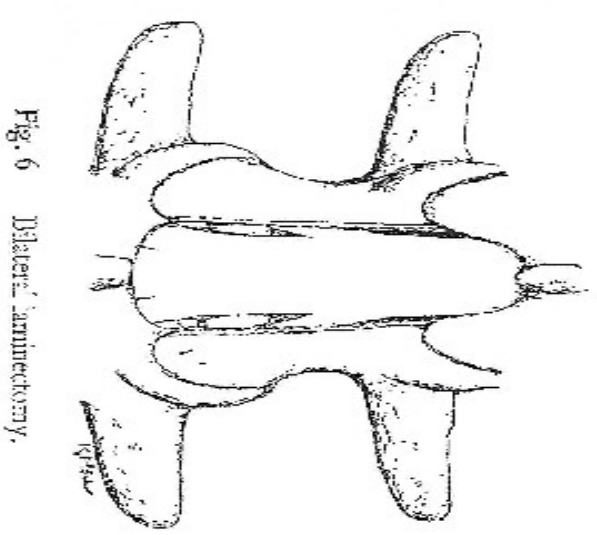

Fig. 6 Bilateral laminectomy.

requires bilateral laminectomy. Lumbar facet cyst can be visualized by laminotomy or partial laminectomy with partial facetectomy (Figure 7).

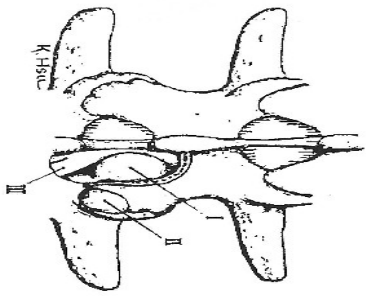

Figure 7. Illustration of lumbar facet cyst visualized at the time of surgery. This cyst is bilobed with the ventral portion (II) compressing the thecal sac and nerve root (III). The smaller dorsal portion (II) is emerging from the same facet joint.

The surgical approaches for doing fusions—posterior, posterolateral, lateral, transforaminal (TLIF), anterior, anterior-posterior, etc.—will be discussed separately in other sections of this website.