Stenosis in the Lumbar Spine: Diagnosis and Treatment

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Stenoses, or nerve entrapment, can occur at several sites. The focus here is on lumbar spine segments. Compression by stenosis can exist wherever nerve tissue is protectively covered by bone or where thick ligaments are located adjacent to nerve. Overgrowth of bone by spurs is the most common cause of compression producing disability and pain. Neurologic changes are rare. Diagnostic radiological imaging is needed, sometimes aided by selective injections of medications. Due to the limitations of non-surgical treatment, surgical decompression is common with generally good results.

Key words: *spinal stenosis, vertebral bone spurs, claudication, surgical decompression, nerve injections.*

Anatomy and Variations of Stenoses

In Greek, "stenosis" means an act of narrowing. Here we are discussing a compression or entrapment of nerve in the spine. Stenoses also are seen in other compressible and tubular structures, such as arteries, esophagus, trachea or bowel. The bony spine serves to protect the delicate spinal cord and nerves that are held inside a tubular membrane, the dura, that runs from the brain downward. However, an overgrowth of tissues around and in the spine can cause narrowing and entrapment of nerves and dura. In the lumbar region in humans, there is no spinal cord but only loose nerve rootlets inside the dural sac.

The various stenoses affecting the spine and spinal nerves at different levels are rather common. An accurate diagnosis is made with CT scanning or magnetic resonance imaging (MRI); sometimes both are needed. In the past, myelography (dye injection into the spinal fluid sac) was the diagnostic method employed, and it remains useful in central and subarticular stenosis but not in the lateral and other varieties lying further out than the dural sleeve.[1-7] The most common symptom in lumbar spine stenosis is called neurogenic claudication, a nerve-induced pain and limitation on walking usually expressed as disabling leg and often back pain. Rest usually fully relieves the problem. Since the problem is intermittent, neurological changes, numbness and weakness or reflex loss are quite unusual.[2]

In a review of 9,484 routine CT scans taken over a one-year period, 71% of which were of the lumbar spine,[7,8] some form of stenosis was found in 32% of the lumbar scans, and three-quarters of these stenoses were found at L5-S1, where the lumbar spine sits on its disc adjoining the sacrum bone. Of these, 73% were of the lateral type, caused by a nerve entrapment by a bone spur on the fifth lumbar vertebra where the nerve exits by way of a bony foramen (passage). Thus, 47% of patients with stenosis had L5-S1 entrapment by foraminal spurs, a common symptomatic lumbar spine problem, while 25% had central canal stenosis. Lateral stenoses also can arise from an overgrowth of the small stabilizing facet joints on the sides of the vertebra, squeezing the passing nerve against the back of the vertebral body.[9] Combined or pinhole stenosis also may occur (Figure 1). Generally, central stenosis is symptomatic only when it is "severe", whereas lateral stenosis is symptomatic when it is moderately severe.[7,8]

Diagnosis of Spinal Stenoses

In the majority of cases, patients seek medical attention for any problem because of pain, and less often due to disability. Spinal stenoses, however, usually cause more disability than pain.[6,10] Another type of claudication may result from poor circulation to the legs, which contributes to a similar pattern of progressive loss in walking even short distances but ordinarily without back pain, during which time the patient must stop to rest. The time needed to rest from vascular claudication may be only for several seconds, whereas neurogenic claudication usually requires several minutes' rest. Sudden neurogenic aggravation of the claudication may follow a back or leg injury by stretching the entrapped nerves or, if severe, from a sudden disc bulging or frank herniation of the involved disc. Although the physical examination is usually normal, true weakness usually indicates the need for early surgery.[2]

Thin slice CT scans within the spinal levels of L3 to S1 or a good MRI study with sagittal reconstructions (views parallel to the vertical midline) must be performed. Additionally, a momentarily painful nerve root injection using a mixture of a dilute local anesthetic, a cortisone compound and an X-ray contrast material administered by a radiologist, anesthesiologist or neurologist may be done under X-ray fluoroscopic control. This will stop the symptoms long enough to make the diagnosis, with the side effect of temporary, reversible leg weakness, and helps identify the specific entrapped nerve. The cortisone sometimes gives prolonged improvement over days, weeks or longer.

Non-operative Treatment of Spinal Stenoses

Treatment should begin early. Sometimes the problem is relieved by a change in

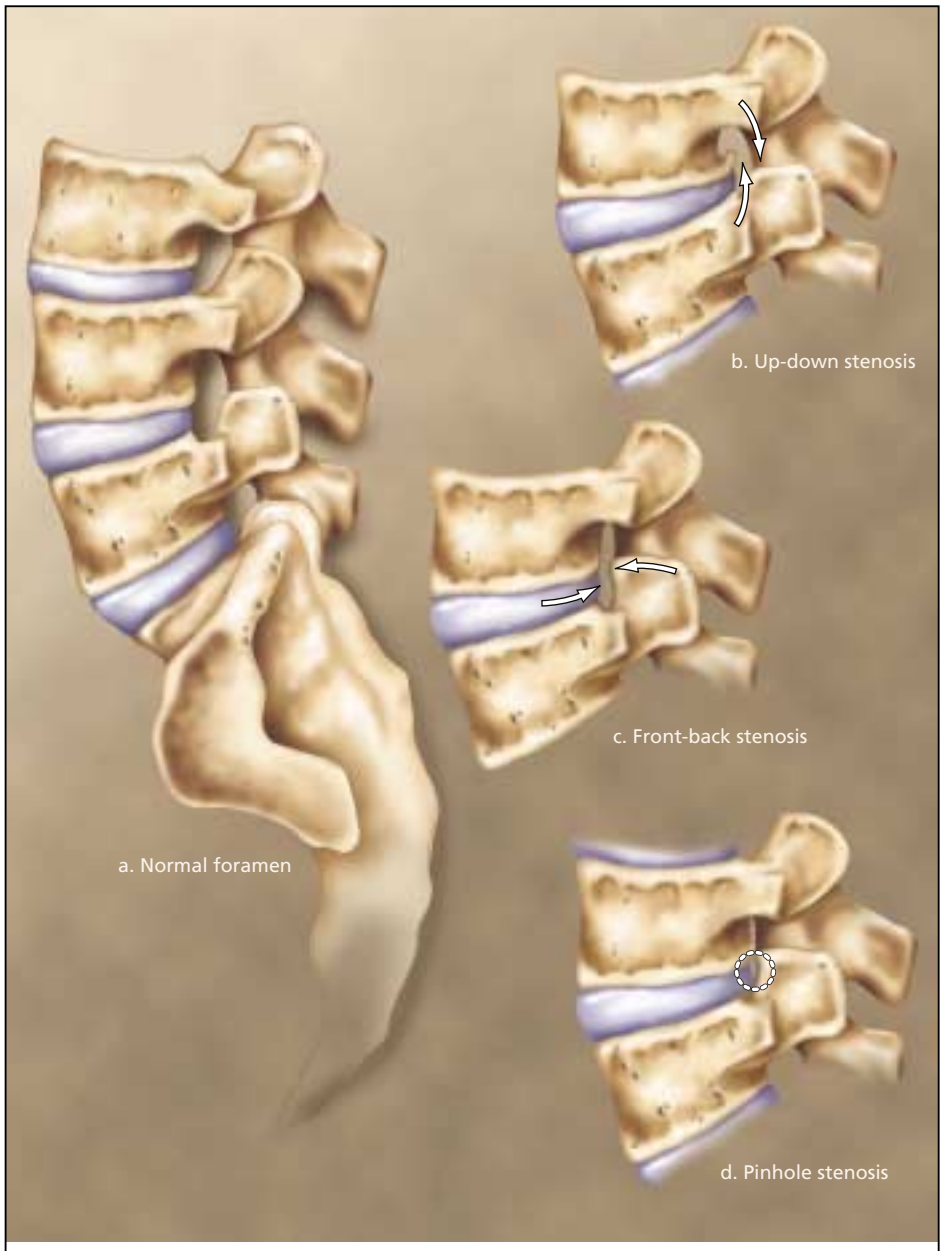

Figure 1. Various types of foraminal stenoses. Note the widely open normal foramen (a), through which the ganglion and its nerve emerge. The different small anatomical changes each require specific techniques for decompression with minimal bone removal and without nerve injury. Clinical improvement from each type of stenotic decompression generally falls in the 75% good to excellent range, depending on location and extent of the lesion, age and condition of the patient, degree of motor loss and experience of the surgeon.

lifestyle, such as a reduction in the aggravating outdoor or occupational activity. Physical therapy or chiropractic up to the point of tolerance can help unless the symptoms progress; these methods are not curative, however. Spinal epidural long-acting cortisone injections alone, administered by a specialist, is a valid treatment that sometimes results in lasting benefits.[11] Such cortisone injections should be at least two to three weeks apart and limited to only three within six months, as needed.

Operative Treatment of Spinal Stenoses

Central Stenosis

Central stenoses account for about 25% of lumbar stenoses and are commonly due to an overgrowth of ligaments behind the dura usually accompanied by a degenerative overgrowth of ancillary stabilizing facet joints at the same level.[12] Together, the bulging of the disc in front—often the trigger for sudden aggravation of symptoms—and the redundant ligaments and degenerated facets behind reduce the diameter of the central canal to that of a pencil, excessively small for the descending nerves (Figure 2). Surgery removes appropriate portions of this narrowing, opening it to about the diameter of one's finger without damaging nerves or the tough membrane dura containing them.[13,14]

Subarticular Stenosis

This type, also called recess stenosis, accounts for 23% of spinal stenoses. Its point of narrowing is beneath the facet joints and occurs at the upper margins of the bony spinal arch beneath which the nerve rootlets and dura pass.[3] The entrapment is particularly aggravated during standing and bearing weight, making the disc bulge. The diagnosis is aided by a careful injection of the involved nerve with a small volume of the anesthetic-contrast-steroid mixture described above, temporarily removing all pain even on standing. Surgery involves the simple removal of the overlying bone that is nerve entrapping.[13]

Lateral Stenosis

This common disorder accounts for 47% of spinal stenoses and is caused by small specific bone spurs along the lateral lips of the vertebral body. Vertebral spurs generally result from a tearing of outer ligament margins of annulus attachments followed by new bone formation. The entrapping, symptom-causing spurs are well seen on scans and occur at the foramen (bony exiting nerve passage); although small (about the size of two rice grains), they can be potentially devastating (Figure 3). Again, direct injection of the entrapped nerve, as described above, will confirm this to be the problem. The rather tricky surgery consists of removing the offending spurs but without major removal of bone. A

number of successful surgical approaches can be used, including the removal of a part of the side of the lamina, an approach from far lateral, or crossing over beneath the spinous process from the opposite side—a procedure not easily understood but remarkably simple after good training.[13,15] These procedures can be performed with the patient lightly sedated, using an epidural block. I have employed one or more of these methods in over 500 cases over a period of eight years. About 75% of these cases received more than 50% lasting improvement in their disability and pain, indicating that surgery may not alleviate all of the symptoms in all patients.

Figure 2 A & B. Central spinal stenosis shown with its characteristic overgrowth of the posterior ligament and overgrowth (arthritis) of the facet joint. These are mid-sagittal (side view of front-back) slice parallel MRI scans, 5mm apart, side by side. Decompression is principally directed towards removing the ligamentous hump.

Far-out Stenosis

This rather rare problem occurs in only about 5% of lumbar spinal stenoses. It occurs exclusively at the L5-S1 level where the already emerged leg nerve (outside the foramen) is caught between far lateral vertebral bone spurs or part of the normal bony transverse process, pressing the nerve against the wing (ala) of the sacral bone.[16] Surgery requires removal of the offending way-out bone spur on the L5-S1 vertebral lip or a small part of the transverse process.

Clinical Results

An accurate diagnosis is tantamount to proper treatment. When the patient does not respond to a change in lifestyle that might be causing the symptoms, and conservative measures do not provide prolonged relief, surgery may be indicated. In the hands of a well-trained spinal surgeon, the needed decompressions—literally taking the burden off the problem—are usually quite successful. In general, about 75% of cases receive good to excellent results, largely with a return to prior activities. Such good results simply mean that the entrapped nerve now has a reasonable chance to recover. It should be noted that acute pressure on a nerve (as when awakening with a numb hand in the morning from sleeping in an improper position) is generally not painful in the absence of an inflammation of that nerve. Instead, tingling and numbness, usually temporary, occur. Indeed, a nerve that hurts is still "working". Signs of potential irreversibility of the nerve compression occur when true persistent loss of sensation and weakness begin—this may well indicate a pressing need for intervention and perhaps surgery.

Summary and Conclusions

Stenosis at some part of the spine may particularly cause major disabling problems for the older patient. Older nerve tissue appears more vulnerable to pressure, bone spurs are more common with age and symptomatic stenoses are rather common after age 60, when, unfortunately, postoperative complications also are more frequent. Each type of stenosis causes a limited variation in symptoms, usually progressive difficulty in walking accompanied by leg and often back pain with little true weakness or loss of nerve function. Diagnosis is based on history more than the examination, as well as good scanning images (CT or MRI) of the spine (Figure 4). Nerve root injections with local anesthetic also may help to identify the exact nerve(s) entrapped. Patient selection involves a specific anatomical diagnosis of the stenosis and a general review of the health and preparedness for surgery in each case. Several variations in surgery are used successfully for each type of stenosis in the spine. As little bone as possible is removed in the approach to assure against postoperative instability with possible additional surgery.[17] Clinical success varies, with more success for the central spinal variety, most likely because it can be a simpler surgical decompression. ◆

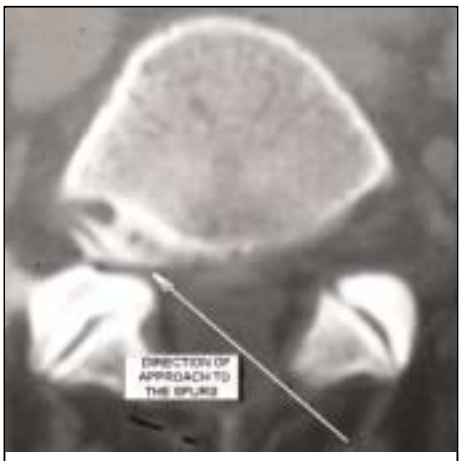

Figure 3. Lateral spinal stenosis due to small bone spurs in the foramen, just where the exiting ganglion or post-ganglionic nerve passes. The ganglion is caught between these parallel "tramtrack" spurs and the bony pedicle just above. The transverse surgical approach is indicated by the long arrow.

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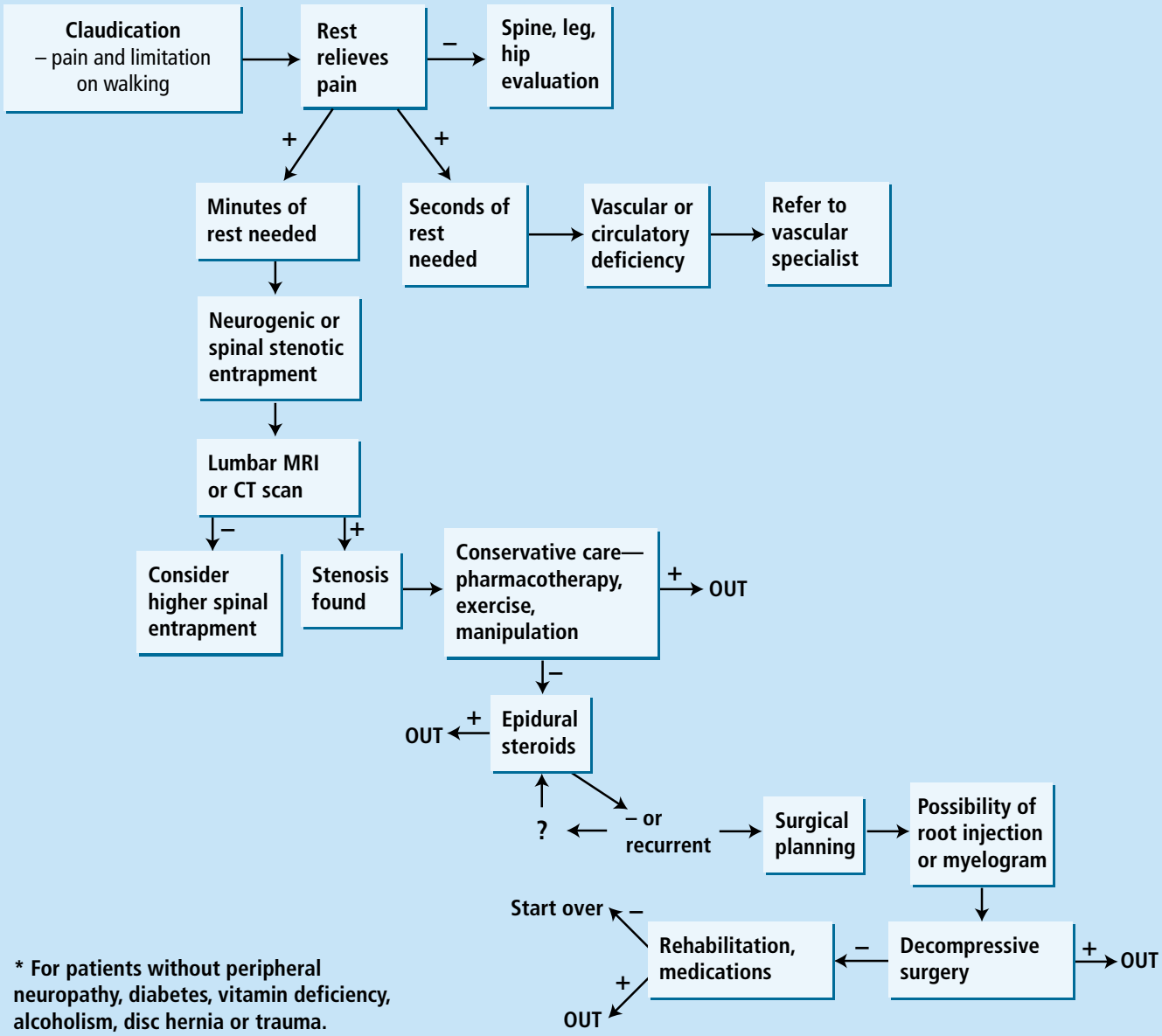
Figure 4: Recommended Management of Lumbar Spinal Stenosis*



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