



Diagnosis and Management Approaches to Lumbar Spinal Stenosis

abstract

Lumbar spinal stenosis (LSS) is the leading cause of spinal surgery among older Americans, yet more than one-third do not gain significant relief from surgical treatment. The distinct pattern of lower back and leg pain induced by standing and walking associated with LSS is known as neurogenic intermittent claudication (NIC). Various treatment options for NIC include surgical interventions as well as pharmacological, biomechanical and conservative therapy (i.e., physical therapy). No specific treatment is associated with a guaranteed outcome, which underscores the need to further evaluate the diagnosis and symptoms associated with LSS.

***keywords:** lumbar spinal stenosis, neuropathic pain, treatment, treadmill testing, epidural steroid injection*

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Lumbar spinal stenosis (LSS) is defined as a narrowing of the spinal canal, nerve root canals, or vertebral foramina.¹ It is a common cause of low back pain and the leading indication for lumbar surgery in the United States for persons over 65 years of age.²⁻⁶ The condition typically manifests as moderate to severe pain in the lumbar region, buttocks, and legs provoked when standing or walking.⁵ This clinical pattern is referred

to as neurogenic intermittent claudication (NIC) and must be distinguished from peripheral vascular claudication. NIC often improves with postural change (i.e., stooped posture) whereas peripheral vascular claudication is not affected by posture. Associated with lumbar stenosis, NIC is considered to have a neurovascular mechanism that would account for concurrent sensory symptoms such as paresthesiae.⁷ Neuropathic pain is classically

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DEGENERATIVE LSS TYPICALLY AFFECTS INDIVIDUALS OLDER THAN 50 YEARS OF AGE AND ITS PREVALENCE INCREASES WITH ADVANCING AGE.⁹⁻¹¹

associated with conditions such as postherpetic neuralgia and diabetic neuropathy, but chronic low back pain syndromes are widely considered to be the most prevalent cause of pain associated with nerve injury.⁸

Epidemiology and Symptom Pattern

Degenerative LSS typically affects individuals older than 50 years of age and its prevalence increases with advancing age.⁹⁻¹¹ The pain intensity of LSS may range from mild to severe. Most commonly, the pain increases along with the duration of time spent standing or walking. Unilateral leg pain is associated with lateral recess and neuroforaminal stenosis whereas bilateral buttock and posterior thigh pain correlates with central canal narrowing.^{12,13} NIC is the most common reason patients with lumbar spinal stenosis seek care (Figure 1). Patients tend to present with positive sensory symptoms such as burning and tingling. More rarely they report the negative symptom of numbness. Fixed, focal neurological deficits such as motor

weakness in a specific dermatomal distribution are present in only a small subgroup, as most people with LSS only experience symptoms when upright.

The symptoms of NIC can significantly limit patient mobility, but pain typically fluctuates in intensity over the course of the syndrome rather than relentlessly progressing. It is this functional limitation imposed by lumbar stenosis that most adversely impacts quality of life. Patients' activities of daily living (ADL) are restricted as they may only tolerate the standing position for a brief period and be limited in how far they can ambulate before needing to sit or bend forward to attain relief.

Assessment

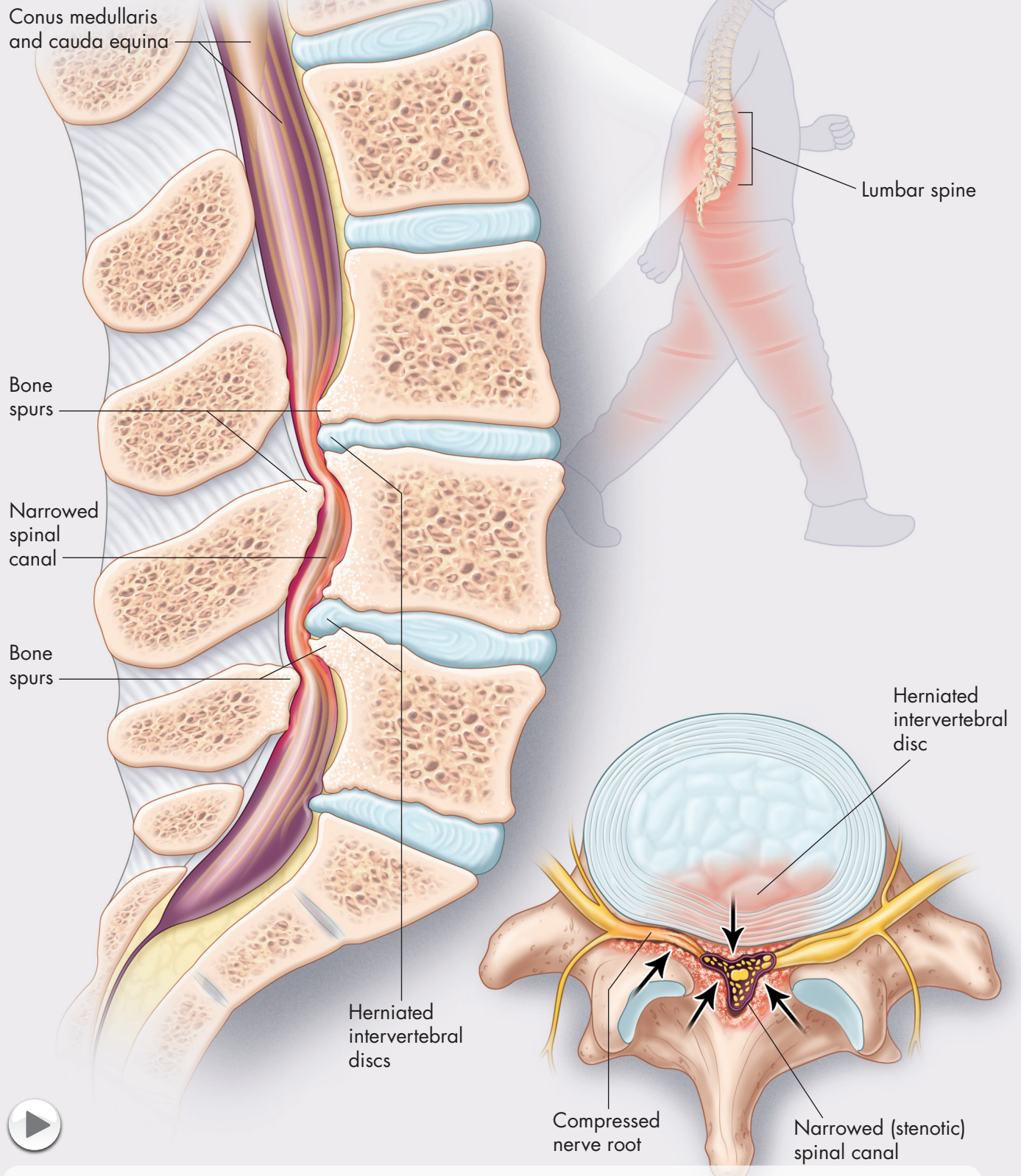
Many older patients with imaging evidence of lumbar stenosis have no symptoms associated with narrowing so it is essential to question the patient about their experience of pain. A history of pain alleviated with forward flexion, which increases the dimensions of the canal, is often a critical detail. Assessing the lateralization of the



Key Point

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Figure 1: Lumbar Spinal Stenosis (LSS)



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GENERALLY, RADIOGRAPHIC INTERPRETATION APPEARS TO OVERESTIMATE THE CORRELATION BETWEEN CROSS-SECTIONAL IMAGING AND PAIN SYMPTOMS.¹⁶

pain and associated neurological deficits such as weakness or numbness are useful for distinguishing the syndrome from common conditions such as diabetic polyneuropathy and postherpetic neuralgia. The decision to surgically decompress the spine is largely based on the assessment of functional limitation, the patient's history, and direct patient examination.¹⁴ Assessment should include a thorough psychosocial evaluation for other factors that may acutely modulate pain intensity.

Imaging

Axial imaging, such as magnetic resonance imaging (MRI) and computed axial tomography (CAT scanning), offer precise anatomical detail and are routinely used to identify and define the presence and severity of lumbar spinal stenosis.¹⁵ However, overreliance on anatomic imaging is an important driver of the wide geographic variation in rates and types of treatment for the symptoms associated with lumbar spinal stenosis.¹⁶ Generally, radiographic interpretation appears to overestimate the correlation between cross-sectional

imaging and pain symptoms.¹⁶

The widespread adoption of CAT and MR imaging have led to a sharp increase in the diagnosis of this condition over the past three decades. The degree of stenosis and the number of levels are relevant factors to correlate with symptoms. High grades of stenosis and the presence of stenosis at multiple levels are more refractory to surgical as well as interventional treatments such as epidural steroid injection.

Treadmill Testing

Investigators have used functional tests of walking tolerance to assess treatment response following surgery in patients with neurogenic claudication.^{17–19} Formal treadmill testing has several advantages in addition to reducing patients' recall bias: it precipitates the symptoms for which patients seek medical attention, provides a well-studied, quantifiable assessment of functional status, possesses an excellent safety record, and is easy to administer.¹⁴ Treadmill testing has the distinct advantage of directly assessing neurogenic claudication, the predominant symptom for which the patient has sought

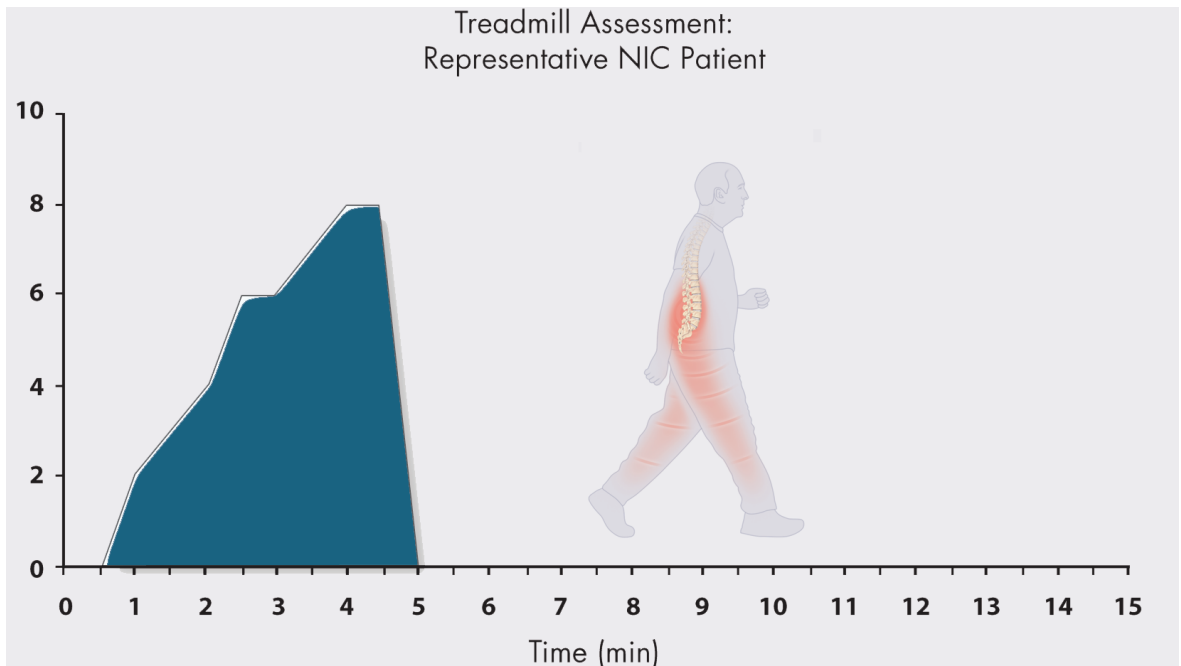


Key Point

Pain with standing and walking, also known as neurogenic intermittent claudication (NIC), is the most common reason people with lumbar spinal stenosis seek care.

Figure 2
Treadmill Assessment
for Neurogenic
Intermittent
Claudication

Representative
example of a
neurogenic
intermittent
claudication patient.
Pain level is elicited
by walking on a
treadmill at 1.2 mph
for a maximum of
15 minutes at zero
elevation.



medical attention.¹⁵

Typical NIC patients start with minimal rest pain and after a few minutes experience moderate to severe pain. Many do not complete the maximum time allotted. See Figure 2 for a representative NIC treadmill test.

Treatment

Figure 3 illustrates treatment options for NIC. The mainstay of treatment for NIC symptoms is surgical decompression, but for older patients at risk for perioperative complications, for those with moderate symptom severity, and for the growing population of older adult patients with late recurrence of NIC after decompressive laminectomy, there is a surging unmet need for mechanism-based diagnostic strategies and new oral pain treatments.⁷ Decompressive laminectomy, involving resection of the bone and

ligaments around the stenosis, is typically recommended for patients with severe, persistent symptoms in whom conservative treatments have not provided pain relief.^{12,13,20} Patients with multilevel tight stenosis, which is common among older adults, are less likely to have a favorable outcome than patients with single level stenosis. Despite a robust evidence base demonstrating efficacy for up to several years, there remains significant uncertainty as to which patients benefit from surgery, as suggested by the wide geographic variation in the rates and types of surgery.¹⁵ In 1996, Atlas and colleagues compared the outcomes of 81 patients who were treated surgically and 67 patients who were treated conservatively after 12 months.¹² Surgically treated patients had worse symptoms when enrolled and were markedly less symptomatic than the non-surgically treated patients



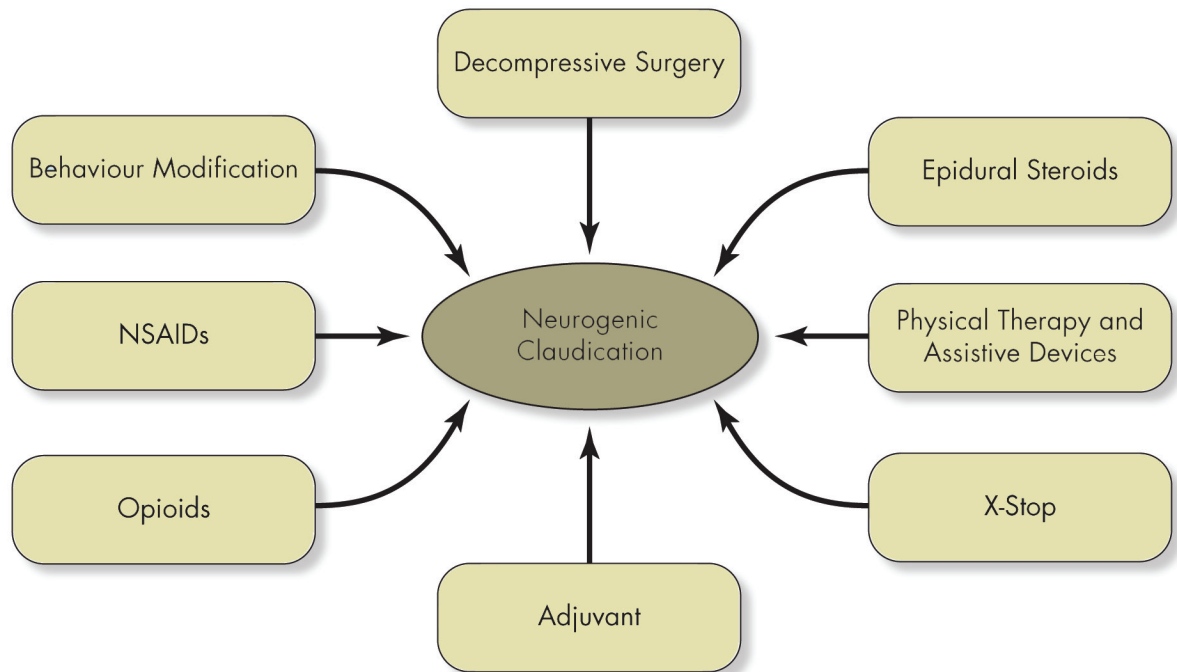
Key Point

Treadmill testing of walking tolerance aids in identifying individuals with neurogenic claudication.

Figure 3

Potential Treatment Options for Individuals Diagnosed with Lumbar Spinal Stenosis.

Treatment is dependent on a per patient basis. A physician will suggest which treatment options are recommended according to the patient's status.



at the 1-year follow-up. The predominant symptom (either leg or back pain) was much better or completely resolved for 55% of surgically treated patients, compared with 28% of non-surgically treated patients.¹²

X STOP

The X STOP, an interspinous spacer, is a new technology that simulates the canal opening of forward flexion and thereby reduces symptoms of neurogenic intermittent claudication secondary to lumbar spinal stenosis. The X STOP is implanted between the spinous processes and reduces pathologic extension at the symptomatic level(s), while allowing flexion and unrestricted axial rotation and lateral bending. The first X STOP study using neurogenic claudication as a primary measure of treatment success in a multicentre,

prospective, randomized study was done by Zucherman et al.²¹ The role of this new technology in the hierarchy of treatment options is not yet clear, but for some patients best served by a nondestructive, reversible intervention, who do not improve with conservative management, the X STOP is a reasonable option.²¹

Deferring surgery has not been associated with irreversible neurological injury in trials comparing surgical and nonsurgical treatments. Nonoperative treatment for spinal stenosis includes bed rest, nonsteroidal anti-inflammatory drugs (NSAIDs), opioid analgesics, oral corticosteroids, and physical therapy.

Pharmacological Therapies

NSAIDs are often prescribed to minimize the presumed inflammatory response of compressed



Key Point

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PATIENTS WHO HAD POSTOPERATIVE LAMINECTOMY SHOWED THAT A 6-WEEK EXERCISE PROGRAM REDUCED PAIN IN ABOUT 80%.²⁷

nerve roots. To date there is only one positive pharmacological treatment of neurogenic claudication.²² In this study, gabapentin treatment resulted in an increase in the walking distance, a decrease in the intensity of the low back and leg pain on movement, and an improvement in the sensory and motor deficit in patients with LSS.²² According to the Spine Patient Outcomes Research Trial (SPORT) observational study, medication treatment prescribed for spinal stenosis patients ranged across multiple medication classes: anti-inflammatory agents (most commonly utilized), opioid analgesics, over-the-counter remedies, tricyclic anti-depressants, and muscle relaxants.²³ There is little clinical evidence, other than anecdote, to support the use of these medications for neurogenic intermittent claudication. There may be reduction in the intensity of mechanical pain with an inflammatory mechanism commonly associated with lumbar stenosis.

Nonpharmacological Therapies

Although medications are commonly required to manage pain

and maintain function in older patients, nonpharmacologic therapy remains an important treatment option. Nonpharmacologic interventions involve minimal risk and may provide substantial pain relief. A rolling walker that prompts anteflexion at the lumbar spine reduces pain intensity, improves walking tolerance, and enhances gait stability.

Patients with LSS often benefit from conservative treatment and participation in a physical therapy (PT) program. Lumbar extension exercises should be avoided in this population, as spinal extension and increased lumbar lordosis are known to worsen LSS. Flexion exercises for the lumbar spine should be emphasized, as they reduce lumbar lordosis and decrease stress on the spine.²⁴ Results from a 2006 study by Whitman suggest that patients treated with nonsurgical physical therapy programs may achieve clinically important improvements at 6 weeks and 1 year.²⁵ It remains unclear precisely which rehabilitation techniques are most effective. For example, patients receiving a program of manual physical



Key Point

A surging unmet need for oral pain medication is essential to treat pain associated with lumbar spinal stenosis.

therapy, exercise, and body-weight supported treadmill walking reported greater rates of perceived recovery following treatment than those receiving a program of flexion exercises, walking, and sub-therapeutic ultrasound.²⁵

Exercise, weight reduction, orthotic devices, and drug therapy may also be part of a conservative approach.²⁶ Patients who had post-operative laminectomy showed that a 6-week exercise program reduced pain in about 80%.²⁷ Orthotic devices, including those designed to flatten the lordotic curve of the lumbar spine, are of uncertain benefit. Some patients find the braces temporarily beneficial, but many find them uncomfortable and cumbersome, particularly after the strength of abdominal muscles improves.²⁷

Lumbar Epidural Steroid Injections

If conservative therapy is not beneficial or well tolerated, the primary

care physician may consider a course of lumbar epidural steroid injections (LESI) as a local complement to medical and nonpharmacologic approaches (Figure 4).

Epidural steroid injections are among the most common interventions performed for neurogenic intermittent claudication. A single LESI has been shown to delay the onset of moderate to severe pain when walking and improve the tolerability of walking overall as measured by a 15-minute treadmill assessment.²⁸ Studies have shown a decline in pain associated with LSS and an increase in functional status and relief in overall satisfaction with LESI.²⁹ Lumbar epidural steroid injections provided approximately one-third of this patient population with more than two months of relief, and more than one half with improvement in function.²⁹ The majority of patients were satisfied with LESIs as a form of treatment in assisting them through the more painful periods of their condition, although many required reinjection for periodic flare-ups over the 3-year period.²⁹

One study has found that LESIs are most useful in treating a radicular distribution of symptoms with pain most severe in the extremities.³⁰ They may improve function and reduce pain intensity but in patients with severe multilevel stenosis, their benefit may be too short-lived to warrant the

Figure 4

Image of a Lumbar Epidural Steroid Injection

Anterior to posterior fluoroscopic image of right L5 transforaminal epidural steroid injection post contrast washout following medication infusion.



SUMMARY OF KEY POINTS

Degenerative lumbar spinal stenosis typically affects individuals older than 50 years of age and its prevalence increases with advancing age.

Pain with standing and walking, also known as neurogenic intermittent claudication (NIC), is the most common reason people with lumbar spinal stenosis seek care.

Treadmill testing of walking tolerance aids in identifying individuals with neurogenic claudication.

Various treatment options for NIC include surgical interventions as well as pharmacological, biomechanical and conservative therapy (i.e., epidural steroid injections and physical therapy).

A surging unmet need for oral pain medication is essential to treat pain associated with lumbar spinal stenosis.



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long-term side effects of repeated corticosteroid exposure and cost. Lumbar epidural steroid injections are commonly used before considering surgery for alleviating pain associated with LSS and NIC, as the underlying syndrome varies in intensity over time. Several months of marked relief may obviate the need for surgical decompression indefinitely in some patients.³¹

Conclusion

Lumbar spinal stenosis remains a leading cause of impaired mobility among older adults. Neurogenic intermittent claudication is the predominant painful symptom pattern for which patients seek treatment. Laminectomy remains a mainstay of therapy, but there is wide variation in rates of surgery and outcomes that may reflect an overemphasis on pathoanatomy driven by over-reliance on imaging technology. Recent advances in the understanding of the pathophysiology of this

distinctive neuropathic syndrome localizing to the cauda equina will provide the foundation for non-surgical therapies for which there is a surging unmet need. A new generation of nonsurgical therapies for treating lumbar spinal stenosis and neurogenic intermittent claudication will provide the possibility of improved mobility and independence throughout the lifespan.

Clinical Pearls

Vascular claudication should not improve with postural change (bending forward) in patients who have lower extremity pain induced by exertion.

It is the exception that untreated symptoms of LSS lead to progressive neurological deficits. In the majority of patients the course is one of waxing and waning pain intensity.

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