Lumbar Spinal Stenosis

Understanding the Causes, Symptoms & Surgical Treatment

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1. What Is Lumbar Spinal Stenosis?

Lumbar spinal stenosis is a narrowing of the spinal canal in the lower back that compresses the spinal cord and the nerve roots of the cauda equina — the bundle of nerves that supply the legs, bladder, and bowel. It is one of the most common reasons for spine surgery in adults over 60.

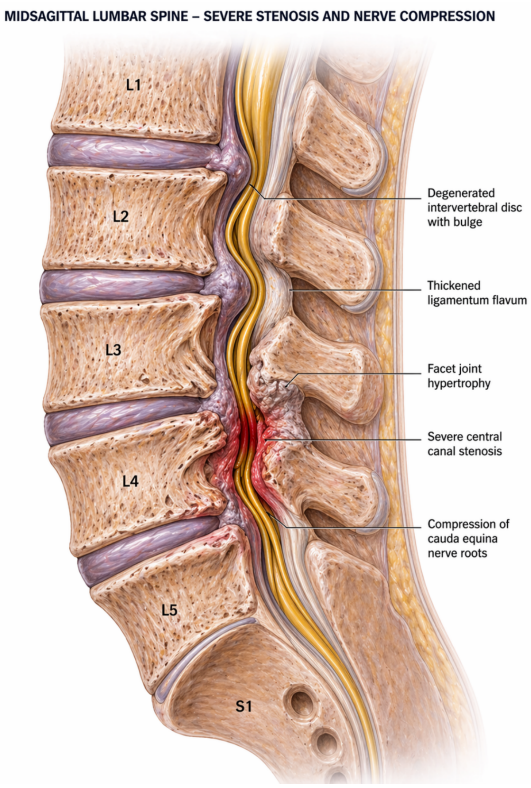
The word *stenosis* comes from the Greek for "narrowing." The spinal canal is the tunnel formed by the stacked vertebrae through which the spinal cord and nerve roots travel. When this space is reduced — by bone spurs, thickened ligaments, bulging discs, or a combination of all three — the nerves inside are compressed and their blood supply is compromised.

The condition develops gradually over years as part of the natural aging process and is typically seen in patients over 50. It is often described as "arthritis of the spine." In most cases it is manageable, and many patients do very well with conservative treatment. When symptoms are severe and disabling, however, surgery to decompress the nerves is highly effective.

The most commonly affected level is L4-5, followed by L3-4.

A patient with lumbar stenosis typically leans forward to relieve nerve pressure. Inset: narrowed spinal canal and nerve root compression at L4/5.

2. Anatomy & Causes of Stenosis



Midsagittal view: degenerated disc, thickened ligamentum flavum, facet hypertrophy, and severe central canal stenosis compressing the cauda equina.

The Structures That Narrow the Canal

As shown in the illustration, lumbar stenosis typically results from a combination of degenerative changes at the same spinal level:

- **Disc degeneration & bulge:** As discs lose height and hydration with age, they bulge posteriorly into the spinal canal, reducing space from the front.
- **Ligamentum flavum hypertrophy:** The ligament running along the back of the spinal canal thickens and buckles inward with disc space collapse — compressing the canal from behind. This is frequently the primary source of compression.
- **Facet joint hypertrophy:** The small joints at the back of each vertebra develop bone spurs (osteophytes) and enlarge with arthritis, narrowing the lateral recesses and foramina where nerve roots exit.
- **Spondylolisthesis:** A slippage of one vertebra forward over the next further narrows the canal and stretches the nerve roots. Degenerative spondylolisthesis is a common cause of stenosis at L4-5.

Types of Stenosis

- **Central stenosis:** Narrowing of the central spinal canal, compressing the cauda equina nerve bundle. Causes bilateral leg symptoms with walking (neurogenic claudication).
- **Lateral recess stenosis:** Narrowing of the side passages within the canal that individual nerve roots traverse before exiting. Causes single-nerve-root compression similar to a disc herniation.
- **Foraminal stenosis:** Narrowing of the exit foramen where individual nerve roots leave the spine. Causes sharp radicular pain down one leg (sciatica).

3. Symptoms & Diagnosis

Symptoms

The classic symptom of lumbar stenosis is **neurogenic claudication** — pain, aching, heaviness, cramping, or weakness in the legs that comes on with walking or prolonged standing and is relieved by sitting down or leaning forward (such as over a shopping cart). This is caused by the dynamic narrowing of the canal: extension (standing upright) tightens the ligamentum flavum and worsens compression, while flexion (bending forward) opens the canal and relieves pressure.

Common Symptoms Include:

- **Low back pain** — aching, often worse with standing and walking
- **Leg pain, cramping, or heaviness** with walking a defined distance ("walking distance") that improves with rest — the hallmark of neurogenic claudication
- **Numbness or tingling** in the buttocks, thighs, calves, or feet
- **Leg weakness** — difficulty lifting the foot (foot drop) or climbing stairs
- **Relief with sitting or bending forward** — patients often lean on a shopping cart or prefer going uphill (flexed posture) over downhill (extended)
- **Bladder or bowel dysfunction** — urgency, frequency, or incontinence in severe cases; cauda equina syndrome is a surgical emergency

Neurogenic vs. Vascular Claudication: Leg pain with walking also occurs with arterial insufficiency (vascular claudication). The key difference: vascular claudication is relieved by standing still, while neurogenic claudication requires sitting or flexing forward.

Diagnosis

Diagnosis is made by combining the patient's history, physical examination findings, and imaging studies:

- **MRI of the lumbar spine** — the gold standard for diagnosing stenosis. Provides detailed images of the spinal canal, nerve roots, discs, and ligaments without radiation. Clearly demonstrates the degree and level(s) of compression.
- **CT scan / CT myelogram:** Used when MRI is contraindicated (pacemaker, ferromagnetic implants) or to better assess bony anatomy and osteophyte formation. CT myelogram involves contrast injection into the spinal sac and is very sensitive for nerve compression.
- **Standing X-rays (flexion/extension):** Assess spinal alignment, instability, spondylolisthesis, disc space collapse, and overall sagittal balance. Dynamic views detect motion at a segment that may indicate instability requiring fusion.
- **Electromyography (EMG) / nerve conduction studies:** Useful when symptoms are atypical to distinguish spinal nerve compression from peripheral neuropathy (e.g., diabetic neuropathy).
- **Walking/treadmill test:** Quantifies walking distance before symptom onset and helps gauge severity and surgical candidacy.

Grading Severity

MRI-based grading (Schizas or Ogikubo scale) classifies stenosis from mild to severe based on the proportion of the canal occupied by neural tissue versus cerebrospinal fluid. Symptoms, however — not imaging alone — drive treatment decisions.

4. Conservative Treatment

The majority of patients with lumbar stenosis can be managed successfully without surgery, at least initially. Conservative treatment is the appropriate first step for patients with mild to moderate symptoms who have no significant neurological deficits:

Physical Therapy

The most evidence-based conservative treatment. A lumbar stenosis PT program focuses on flexion-based exercises (which open the canal), core strengthening, hip flexibility, and aerobic conditioning. Aquatic therapy is particularly well-suited as the water's buoyancy reduces axial load on the spine.

Medications

NSAIDs (ibuprofen, naproxen, diclofenac) reduce pain and nerve inflammation. Neuropathic agents such as gabapentin or pregabalin can reduce leg burning and tingling. Muscle relaxants help with associated spasm. Short courses of oral steroids may provide temporary relief during flare-ups.

Epidural Steroid Injections (ESI)

Fluoroscopy-guided injections deliver corticosteroid directly to the site of nerve compression, reducing inflammation and providing significant symptom relief in many patients. Relief may last weeks to months. ESIs do not treat the underlying stenosis but can allow patients to participate in physical therapy and defer or avoid surgery.

Activity Modification

Avoid activities that extend the lumbar spine (prolonged standing, downhill walking, back-extension exercises). Favor flexion-based activities — stationary cycling, swimming, walking with a slight forward lean, or using a walker or shopping cart for support.

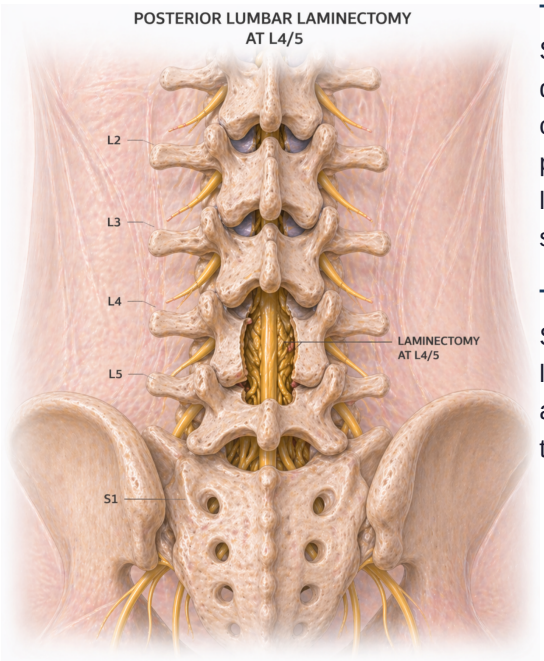
Assistive Devices

A cane or rollator walker reduces axial load and allows a flexed posture, often meaningfully increasing walking distance. A lumbar support brace may help some patients during flare-ups, though it should not be worn continuously as it promotes muscle weakness.

When Conservative Treatment Is No Longer Sufficient

Surgery becomes appropriate when: symptoms significantly limit quality of life despite 3–6 months of conservative care; neurological deficits are present (foot weakness, leg weakness); walking distance is severely limited; or cauda equina syndrome develops (bladder/bowel dysfunction) — which requires **emergency surgical decompression**.

5. Surgical Treatment — Lumbar Laminectomy



Posterior lumbar laminectomy at L4/5. Removal of the lamina and ligamentum flavum provides direct decompression of the cauda equina and individual nerve roots.

The Goal of Surgery

Surgery for lumbar stenosis does not "cure" the underlying degeneration — it removes the structures that are physically compressing the nerves, creating more space in the canal. The procedure is called a **lumbar laminectomy** (or decompressive laminectomy), and it is one of the most commonly performed and successful operations in all of spine surgery.

The Procedure

Surgery is performed under general anesthesia with the patient lying face-down. A posterior midline incision is made over the affected levels. The muscles are retracted to expose the back of the spine:

- **Laminectomy:** The lamina (the bony arch forming the roof of the spinal canal) is removed, along with the thickened ligamentum flavum. This immediately opens the canal and takes pressure off the compressed nerve roots.
- **Foraminotomy:** If individual nerve roots are trapped in their exit foramina, bone and soft tissue are trimmed to enlarge the opening and free the root.
- **Facetectomy / undercutting:** Overgrown facet joint bone is carefully removed from the lateral recesses to decompress nerve roots traveling through them.

When Is Fusion Added?

A laminectomy alone is sufficient when the spine is stable. Spinal fusion is added when: there is degenerative spondylolisthesis (vertebral slippage); significant instability is present on flexion-extension X-rays; or multiple levels require extensive decompression that may destabilize the spine. Fusion uses interbody cages, pedicle screws, and rods to lock the unstable segment in proper alignment while bone grows across it.

Minimally Invasive Options

Microendoscopic or tubular retractor approaches allow decompression through smaller incisions with less muscle disruption, reduced blood loss, shorter hospital stay, and faster recovery — while achieving equivalent nerve decompression to open techniques.

6. Preparing for Surgery

Good preparation improves outcomes and reduces complication risk. Please follow all instructions given by Dr. Caridi's office:

- **Pre-operative testing:** Blood work, EKG, chest X-ray, and medical clearance are obtained 2–4 weeks before surgery.
- **Medications:** Stop blood thinners (aspirin, warfarin, Plavix, Xarelto, Eliquis) as instructed — typically 5–7 days before. Continue blood pressure and cardiac medications with a sip of water the morning of surgery unless told otherwise.
- **NSAIDs:** Stop ibuprofen, naproxen, and similar medications 7 days before surgery to reduce bleeding risk.
- **Diabetes:** Hold metformin 48 hours before surgery. Adjust insulin dosing as directed by your primary care physician.
- **Fasting:** Nothing to eat or drink after midnight the night before surgery. Clear liquids (water, black coffee) may be permitted until 2 hours before — confirm with your surgical team.
- **Smoking:** Stop smoking at least 2–4 weeks before surgery. Nicotine impairs wound healing, increases infection risk, and worsens anesthesia outcomes.
- **Home preparation:** Arrange for a driver and a caregiver for the first few days. Set up a recovery area on the ground floor if possible. Place frequently needed items at waist height to avoid bending.
- **Shower** with antiseptic wash (Hibiclens) the night before and morning of surgery as instructed to reduce skin bacteria and infection risk.

7. Risks & Complications

Lumbar laminectomy is a safe and well-established procedure with a high success rate. As with any surgery, however, risks exist and should be clearly understood:

- **Dural tear (CSF leak):** The thin membrane surrounding the spinal cord may be inadvertently nicked during surgery, causing cerebrospinal fluid leakage. Most are repaired immediately and heal without long-term consequences, though they may prolong hospital stay. Occurs in 1–5% of cases.
- **Nerve root injury:** Manipulation of compressed nerve roots during decompression can cause temporary or, rarely, permanent weakness or sensory change. The risk is higher when nerves are severely and chronically compressed.
- **Infection:** Surgical site infections occur in 1–3% of cases. Treated with antibiotics; deep infections may require surgical debridement.
- **Epidural hematoma:** Bleeding into the spinal canal after surgery can compress nerves and requires emergency re-operation. Rare but serious.
- **Failed decompression / recurrent stenosis:** Incomplete decompression or regrowth of scar tissue or bone over time may cause recurrence of symptoms — particularly at adjacent levels.
- **Spinal instability:** Extensive bone removal can occasionally destabilize the spine, leading to spondylolisthesis and requiring fusion at a later stage.
- **Thromboembolism (DVT/PE):** Blood clots in the leg or lungs are prevented with early ambulation and sequential compression devices during surgery.
- **Anesthetic risks:** Cardiac, pulmonary, and allergic complications related to general anesthesia are rare but possible, particularly in elderly patients with medical comorbidities.

8. Recovery After Lumbar Laminectomy

Hospital Stay 1–2 days	Most patients are walking the same day as surgery. Pain is managed with oral medications. Physical therapy ensures safe mobility before discharge. A home exercise program is given.
Week 1–2 Home Recovery	Rest and short, frequent walks. Avoid bending, lifting more than 5–10 lbs, or twisting. Keep the incision clean and dry. Wound check at 10–14 days. Many patients notice leg pain improvement almost immediately.
Weeks 2–6 Early Mobilization	Outpatient physical therapy typically begins at 2–4 weeks. Gradually increase walking distance daily. Driving is usually permitted at 2–3 weeks once off narcotic pain medication. Return to desk work is often possible at 2–4 weeks.
Weeks 6–12 Full Recovery	Most patients achieve full functional recovery by 6–12 weeks. Return to light physical work at 6 weeks; manual labor at 10–12 weeks as cleared by Dr. Caridi. Follow-up X-rays at 6 weeks confirm stability.
Long-Term Outcome	Studies show 85–90% of patients experience significant improvement in leg pain and walking ability after laminectomy. Maintaining core strength and a healthy weight protects the spine and reduces the risk of symptom recurrence at the same or adjacent levels.

9. Post-Operative Instructions

Activity

- Walk multiple short distances each day — increase gradually
- No bending, lifting >10 lbs, or twisting for 6 weeks
- No driving while taking narcotic pain medication
- No swimming or soaking in a tub until the wound is fully healed (4–6 weeks)
- Sleep on your side with a pillow between your knees

Wound Care

- Keep the incision clean and dry for 48–72 hours
- You may shower after 48–72 hours — pat dry, do not scrub
- Do not apply creams, ointments, or tape to the incision unless instructed
- Staples or sutures are removed at your 2-week follow-up visit

Medications

- Take pain medications as prescribed; do not exceed recommended doses
- Take a stool softener (Colace) while on narcotics to prevent constipation
- Resume blood thinners only when instructed by Dr. Caridi
- Resume NSAIDs only after your follow-up visit

Diet & Hydration

- Stay well hydrated — drink 6–8 glasses of water daily
- Eat a high-protein, high-fiber diet to support healing and prevent constipation
- Avoid alcohol while taking prescription pain medications

Call Dr. Caridi's Office or Go to the Emergency Room Immediately If You Develop:

- New or worsening weakness or numbness in either leg
- Loss of bladder or bowel control — cauda equina syndrome is a surgical emergency
- Fever above 101.5°F, chills, or redness/warmth/discharge at the incision site
- Severe headache that is worse when upright and relieved by lying flat (may indicate CSF leak)
- Severe sudden increase in back or leg pain
- Calf pain, swelling, redness, or warmth (possible deep vein thrombosis)
- Chest pain or shortness of breath (possible pulmonary embolism)