

Lumbar Spine: Common Pathology and Interventions

Andrea Strayer



Abstract: Lumbar herniated nucleus pulposus (HNP) and lumbar spinal stenosis (LSS) are common spine pathologies with different clinical presentations and interventions. HNP generally has an acute onset often without a precipitating event. Unless there is a significant or emergent neurologic deficit, nonsurgical medical management is warranted for 6 or more weeks after the onset of symptoms. If there is no improvement in 6 weeks, surgical intervention may be indicated. Microdiscectomy is the gold standard treatment for uncomplicated HNP. LSS has an insidious onset. Often, clinical presentation is a long history of intermittent back pain and gradual decrease in ambulation due to leg pain—which quickly subsides upon sitting. Medical management is the first treatment choice. If there is no improvement in the patient's condition, surgery may be necessary. As with any spine surgery, patient symptoms, clinical exam, and diagnostics must correlate. Postoperative care differs for microdiscectomy and decompressive laminectomy because the surgical pathology and interventions are different. The usual age variation of patients undergoing either of the two procedures will also change postoperative care needs. Neuroscience nurses provide ongoing patient education, and ensure a complete understanding of the proposed surgical intervention and outcome that may be expected by the patient and family. Congruent expectations between the patient and provider are vital. In addition, accurate assessment and evaluation of the patient's physical and functional progress by neuroscience nurses is of the utmost importance.

The radicular pain symptomatology associated with lumbar herniated nucleus pulposus (HNP) can be excruciating. For most, 4 weeks after symptom onset, pain control has been achieved and usual activities can be resumed. Approximately 16% of patients are still symptomatic 7 weeks after symptom onset (Rosomoff & Rosomoff, 1999).

Lumbar spinal stenosis (LSS) is the narrowing of the central canal and, often, the lateral recess due to facet joint hypertrophy, thickening and bulging of the ligamentum flavum, bulging of an intervertebral disc, osteophyte formation, or spondylolisthesis. Symptoms include leg

and buttock pain with activity that is alleviated by rest or maneuvers that increase spinal canal dimension, such as stooping forward to walk.

These common lumbar pathologies are quite different. Therefore, neuroscience nurses need a basic knowledge of HNP and LSS and the differences in clinical presentation and neurosurgical management of each to ensure they provide optimal care and counsel. This article describes HNP and LSS, presenting signs and symptoms, operative treatment, and nursing care. A brief overview of lumbar functional anatomy is presented.

An Overview of Functional Anatomy

Vertebrae

Posteriorly, the bony arch encircles the spinal canal (Fig 1). It is composed of transverse processes, facet joints, two pedicles, two laminae, and a spinous process. In the lumbar spine, the bony arch is quite bulky, providing the necessary support for upright posture. In the uncompromised spinal canal, there is ample room for the cauda equina and cerebrospinal fluid. Anterior to the spinal canal is the vertebral body.

Facet joints (bilateral) are composed of a superior articulating process and an inferior articulating process. These joints have a loose capsule and a synovial lining, thus they are apophyseal joints. The nerve root canal, also called the *lateral recess*, is adjacent to the pedicles and facet joints in the region of the foramina. The neural foramina are the actual far lateral exit openings (Benzel, 2001).

Intervertebral Disc

The intervertebral disc provides support and both allows and resists excessive movement. It consists of the nucleus pulposus and the annulus fibrosus. The nucleus pulposus in a younger individual is soft and similar to crab meat in texture. It is surrounded by the annulus fibrosus, which is tough and fibrous. Each disc is bonded to the vertebral body below and above by a thin cartilaginous plate, referred to as the *endplate*. The endplate resists herniation of the disc into the vertebral body and gives the disc its shape (Benzel, 2001).

Ligaments

Each disc is reinforced anteriorly by the anterior longitudinal ligament and posteriorly by the posterior longitudinal ligament (Figs 2, 3). The laminae are connected by an elastic yellow ligament called the *ligamentum flavum*. Each facet joint is connected to a capsular ligament.

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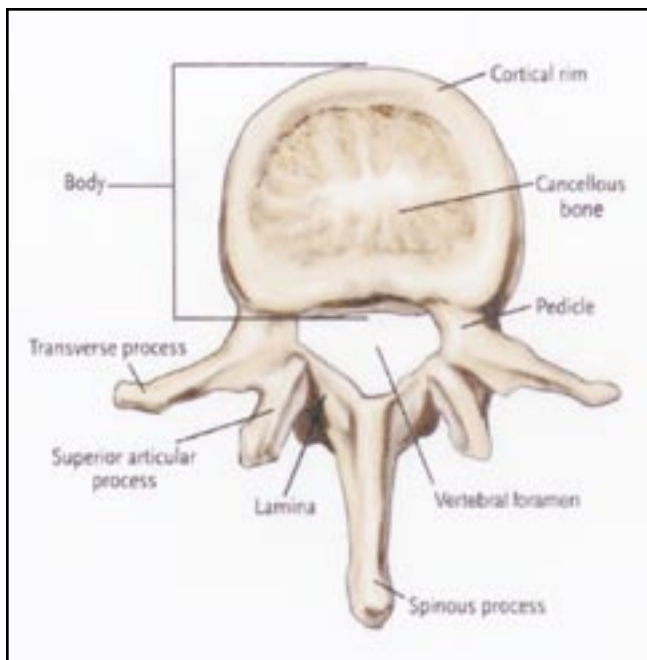


Fig 1. Lumbar vertebrae. (Illustration from Core Curriculum for Basic Spinal Training ©2003, Medtronic Sofamor-Danek. Reprinted with permission.)

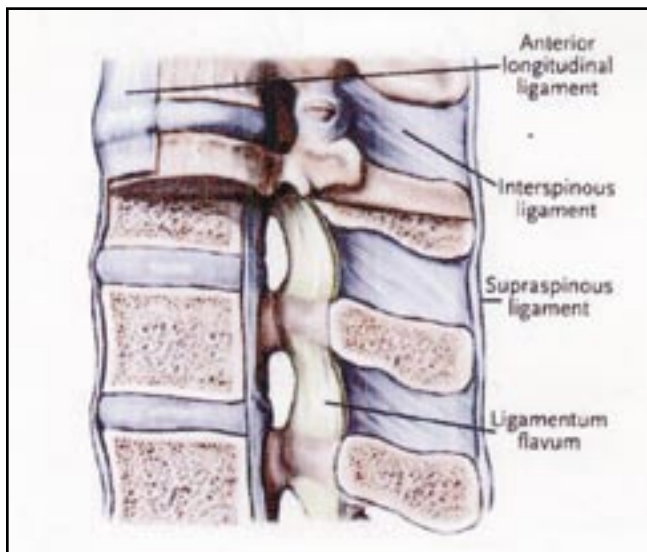


Fig 2. Lumbar vertebrae, lateral view with ligament examples. (Illustration from Core Curriculum for Basic Spinal Training ©2003, Medtronic Sofamor-Danek. Reprinted with permission.)

Nerve Roots

The cauda equina is a fanning bundle of lumbar and sacral nerve roots exiting the spinal cord. The cord typically terminates at the L1-L2 level (Fig 4). The nerves from the cauda equina provide communication to and from the lower extremities, bowel, bladder, and sexual organs. The cauda equina is relatively resistant to neurologic insults, as compared with the spinal cord (Benzel, 2001). The exiting nerve root in the lumbar spine is numbered according to the pedicle above it. For instance, the L5 nerve root passes below the L5 pedicle.

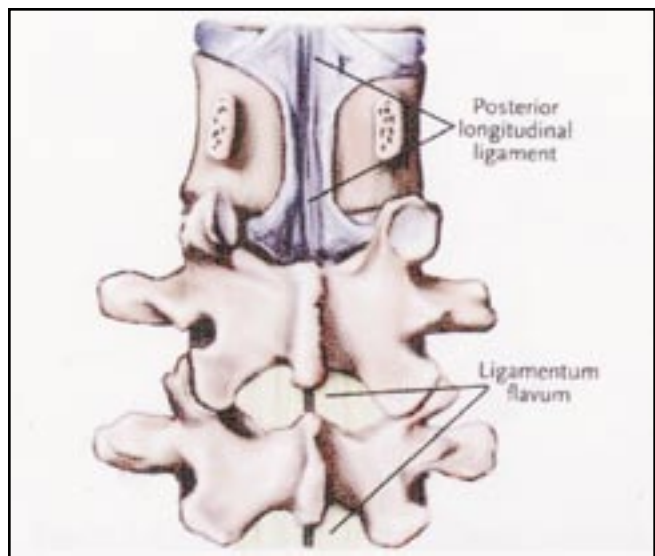


Fig 3. Lumbar vertebrae, posterior view, ligament examples. (Illustration from Core Curriculum for Basic Spinal Training ©2003, Medtronic Sofamor-Danek. Reprinted with permission.)

Herniated Nucleus Pulposus

Herniated nucleus pulposus (HNP), also referred to as a herniated disc, is a common spine pathology that occurs approximately 95% of the time at the L4-L5 or L5-S1 level (Fisher et al., 2004; Asch et al., 2002). Peak incidence of HNP is between 30 and 55 years of age (Atlas et al., 2000). The majority of herniated discs occur in a posterolateral direction, compressing the ipsilateral nerve root as it exits from the dural sac. Thus, a left L5-S1 disc herniation compresses the left S1 nerve root.

The nucleus pulposus is posterior in the annulus and the posterior longitudinal ligament (PLL) is midline, creating a somewhat weak point in the annulus on either side of the PLL (Fig 5). The nucleus pulposus first herniates into tears in the annulus fibrosus. It may eventually break through enough of the annulus to cause bulging. If the process continues, disc material may separate and migrate.

Radiculopathy is pain, paresthesias or both in the distribution of a nerve root (Fig 6). In this case, it is caused by nerve root irritation from an HNP. Each nerve root has a specific area of motor and sensory distribution. The radicular pain is often described as shooting or stabbing. There may be paresthesias in the same distribution. Sciatica is radicular pain in the L5 or S1 distribution. Patients typically describe deep buttock, posterior or posterolateral thigh pain that may or may not extend below the knee, into the lower leg and lateral foot. The pain is often aggravated by coughing, sneezing, or straining. It may also be aggravated by certain positions, such as sitting or standing. The pain usually subsides with rest.

Although most recover without surgery, patients with large midline lumbar HNPs may suffer significant neurological impairment. Cauda equina syndrome is caused

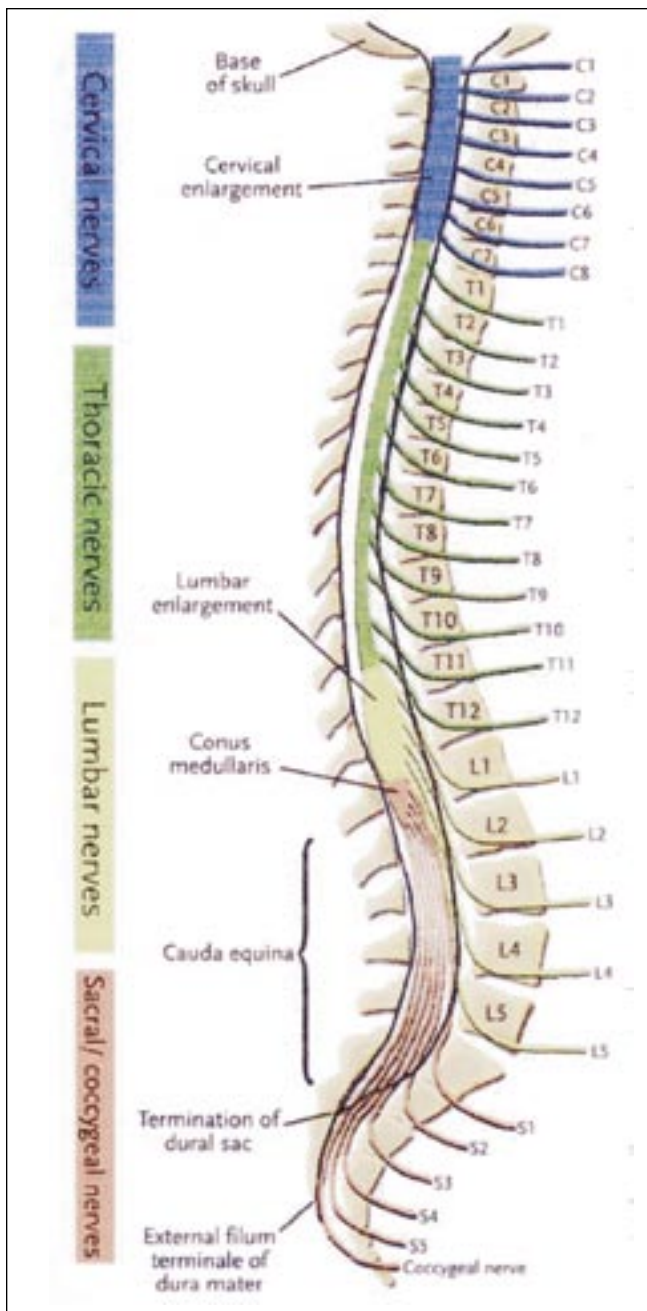


Fig 4. Relation of spinal nerve roots to vertebrae. (Illustration from *Core Curriculum for Basic Spinal Training* ©2003, Medtronic Sofamor-Danek. Reprinted with permission.)

by any large space-occupying mass, such as a large central HNP, located in the spinal canal at the level of the cauda equina. The cauda equina is the lumbar and sacral nerve roots extending from the lowest part of the spinal cord. It fills the thecal sac from approximately L2 to S1. Symptoms include urinary retention or incontinence, saddle anesthesia, progressive leg or foot weakness—often bilateral—or bowel incontinence. Although cauda equina syndrome is rare, neurologic compromise from this syndrome is severe and represents a surgical emer-

gency (Prendergast et al. 2004; Atlas & Deyo, 2001). It is important to note that a central HNP does not necessarily cause cauda equina syndrome. In fact, as with other HNPs, the patient can be totally asymptomatic with a central HNP, have back pain only, and have unilateral or bilateral radiculopathy without weakness or sphincter dysfunction. This situation is not a surgical emergency.

Clinical Presentation

History

A detailed clinical history is crucial. Obtain the following information:

- a description of the onset, including precipitating/alleviating factors
- quality, radiation, severity, and timing of the pain
- circumstances of the injury, (e.g., work-related)
- any weakness
- bowel or bladder difficulties
- any pain on the opposite leg.

A description of prior treatments, such as medication, injections (type and location), and physical therapy also are important to document. A patient with a typical L4-L5 HNP may describe a deep burning pain radiating from one buttock to the lateral thigh and leg and continuing over the dorsum of the foot, into the great toe. The patient also may experience hot, knifelike, shooting pain with a similar distribution.

Focused Neurologic Exam

A focused neurologic exam is performed to identify any neurologic deficit. Lower extremity strength, reflexes, and sensation are tested. Strength evaluation includes hip flexors, knee flexion and extension, dorsiflexion, plantarflexion, and great toe extension. Heel and toe walking also are tested to evaluate the strength of the tibialis anterior (foot dorsiflexion, L5) and gastrocnemius (foot plantarflexion, S1). Patellar and ankle deep tendon reflexes are evaluated. Sharp sensation is often tested with a pinprick in each of the dermatomal distributions. If the patient is describing any bowel or bladder incontinence, or impaired sensation, perianal sensation should be evaluated. At that time, anal reflexes can be tested. In the outpatient setting, evaluation of bladder function may not be possible, thus necessitating appropriate triage for bladder function. The straight-leg test, which may be performed with the patient either seated or laying down, is a fair screening test for nerve root irritation (Atlas & Deyo, 2001).

If an upper lumbar disc herniation is suspected, a femoral stretch test may be included in the evaluation. The patient is placed in a prone position, and the knee is maximally dorsiflexed. A positive test reproduces their typical pain. Impaired strength, reflexes, or sensation should directly correlate with specific nerve root involvement. Abnormal gait and posture should be noted. With severe pain, the patient may exhibit an antalgic gait,

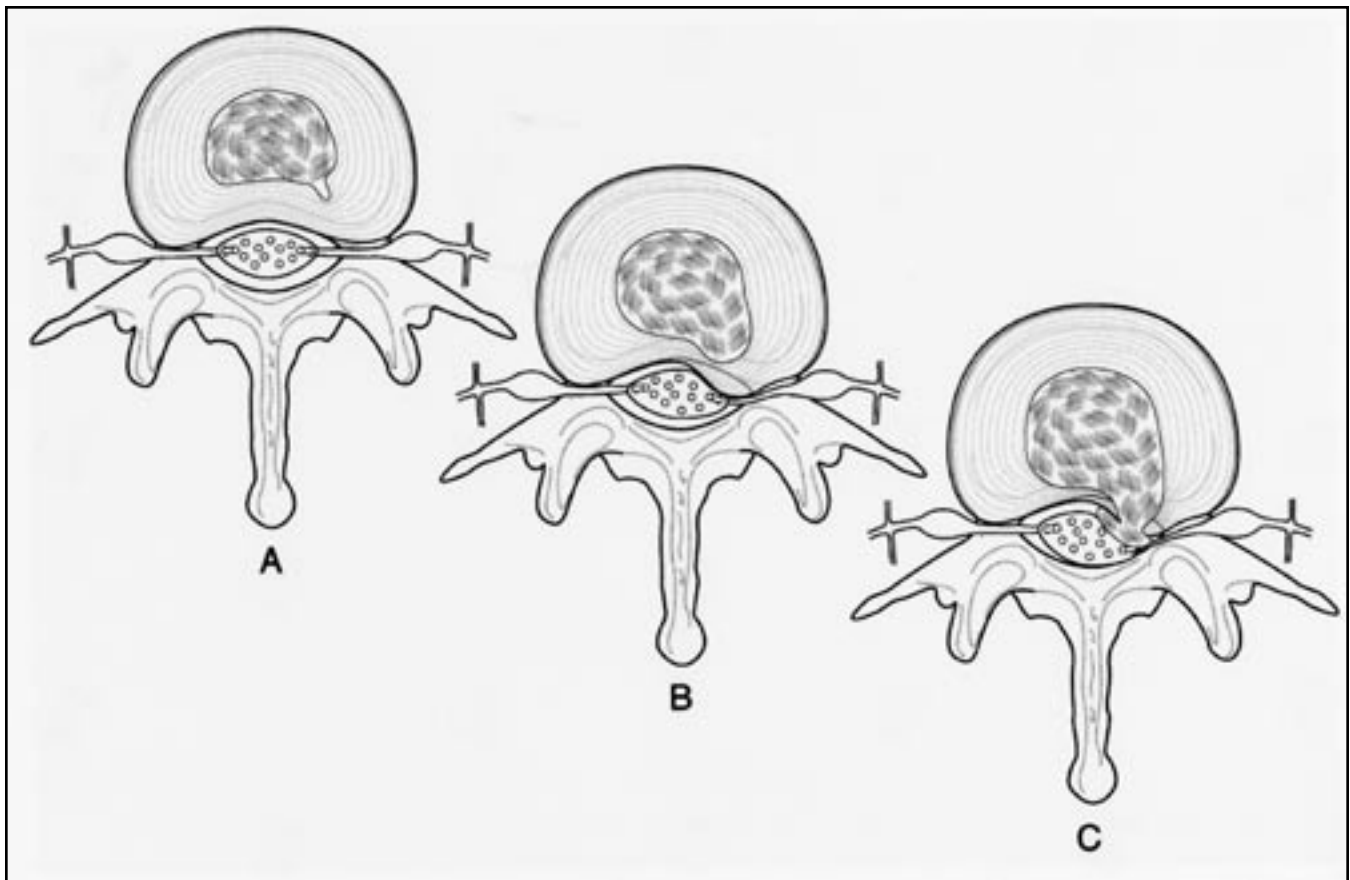


Fig 5. Progression of disc herniation.

A. Normal disc

B. Bulging disc placing pressure on exiting nerve root

C. Disc extrusion, disc material outside of annulus

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favoring the affected leg. The patient's sitting posture also may favor the affected side. The patient may change positions frequently, stating that staying in any one position too long increases the pain. Flexibility is tested with lumbar spine flexion and extension.

Medical Management

The primary emphasis of treatment for radicular complaints should be conservative care, reassurance, and education to allow patients time to improve without surgical intervention (Atlas & Deyo, 2001). The most frequently used nonsurgical treatments are back exercises, short-term rest, physical therapy, spinal manipulation, nonsteroidal anti-inflammatory medications, muscle relaxants, opioid analgesics, and epidural steroids (Atlas et al. 2000).

A 5-year prospective-outcome study evaluating the surgical and nonsurgical outcomes of sciatica caused by HNP found that the least symptomatic patients at baseline did well regardless of initial treatment. For patients with moderate-to-severe sciatica, surgical treatment was

associated with greater improvement at the end of the 5-year period (Atlas et al. 2000).

Surgical Indications

Clinical exam and history must correlate with radiographic studies. For example, a patient with right leg pain that radiates across the dorsum of the foot to the great toe should have radiographic confirmation that an L4-L5 HNP is compressing the right L5 nerve root. The symptoms should have persisted for at least 6 weeks without relief from conservative measures.

Surgical Treatment Options

Microdiscectomy

As previously mentioned, microdiscectomy is the gold standard for excision of a HNP. A microdiscectomy is performed with the assistance of an operating microscope. The microscope allows the surgeon and the assistant to view the same field, and it can be hooked up to a television monitor for teaching purposes. The presumed advantage of microdiscectomy to the patient is a

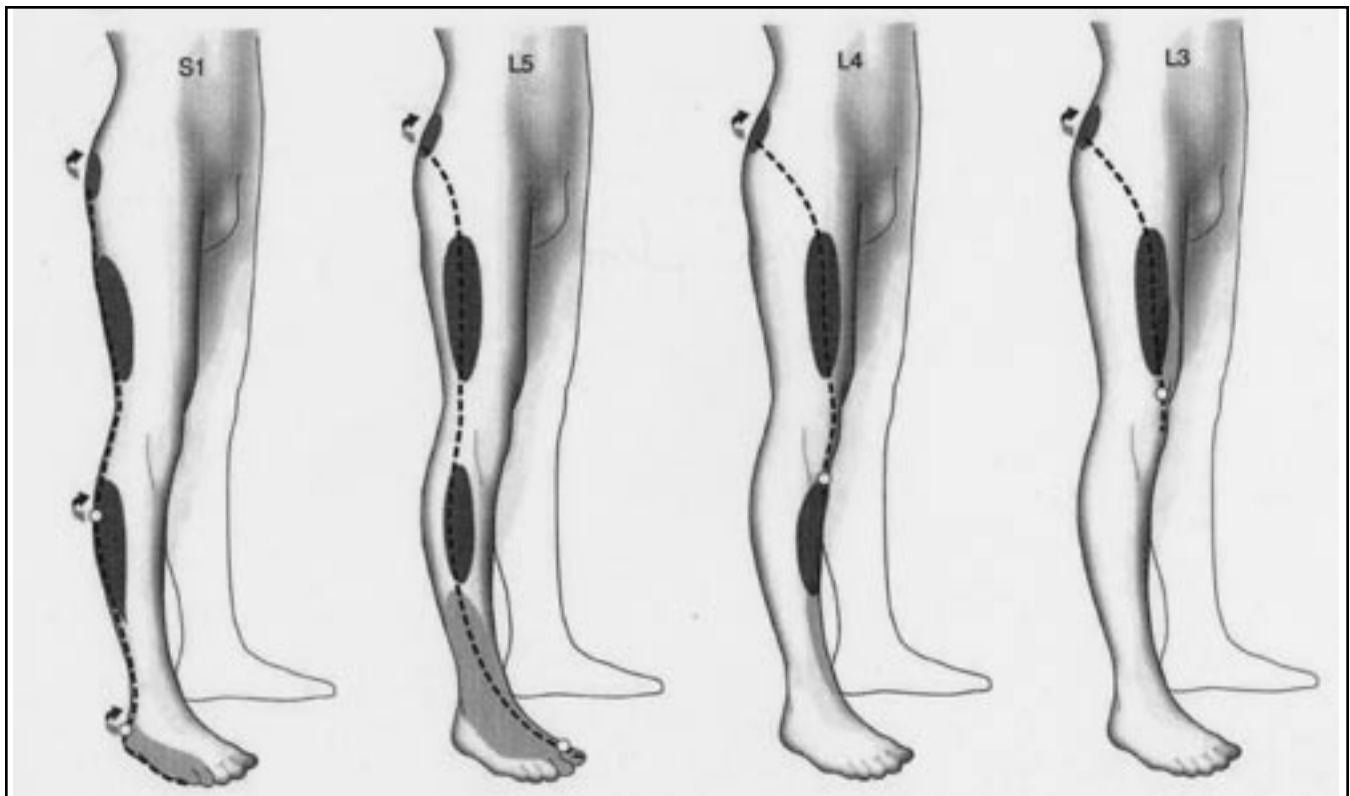


Fig 6. Lower extremity dermatomes with common pain and paresthesia distribution. The dashed line represents the sharp, radiating pain, which often has a dermatomal distribution. The open circles (o) indicate areas where pain may concentrate. The dark gray areas represent the poorly localized dull ache. The light gray areas indicate areas of paresthesias and sensory impairment. (Courtesy of University of Wisconsin Medical School.)

smaller incision and less postoperative pain. However, the incision has to be long enough to allow a sufficient view of the operative area. In larger individuals, the incision must be longer (Riew & McCulloch, 1999; Benzel, 2001). The procedure is described in detail in the operative technique section of this article. A recent prospective outcomes study conducted by Asch et al. (2002) found a 75%–80% success rate using the visual analog scale, Oswestry Low Back Disability Index, and self-reported patient satisfaction with surgery following microdiscectomy for herniated lumbar intervertebral disc.

Minimally Invasive Techniques

Tubular retractor systems are available for performing a minimal access discectomy (Fig 7). These systems are used in conjunction with Loupes magnification or an operating microscope. Proponents of this method report that patients require a smaller incision and have less postoperative pain than with microdiscectomy. The patient's postoperative healing period is essentially the same with either method.

Preoperative Preparation

In our practice, a neurosurgery nurse practitioner (NP) is responsible for preparing the patient for surgery. Preparation includes patient education, the preoperative history and physical, preoperative diagnostic testing,

follow-up of those diagnostic tests, and contact with local providers, as needed. The NP collaborates with the pre-anesthesia assessment center to ensure that the patient is medically prepared to undergo general anesthesia.

Preoperative patient education includes providing procedure-specific and general surgical information. The more prepared patients are for their procedure, the more they are able to participate actively in their care. Adequate preoperative instruction also prevents miscommunication and false expectations. Mutual expectations are crucial. Our patients are given patient educational handouts called, "Health Facts for You," "Microdiscectomy," "Avoiding Constipation," and "Advanced Directives." They also are given an educational book regarding undergoing surgery at this institution.

Informed Consent

No neurosurgical procedure is without risk. The patient must have a clear understanding of the risks, benefits, and alternatives available. Although the risks from disc repair procedures are low, they include nerve root damage, infection, blood loss, cerebrospinal fluid leak, potential worsening of symptoms, chance of disc reherniation, anesthesia complications, or even death. The benefit of the procedure is symptomatic relief, but there is a chance that symptoms will not improve. In the case of muscle weakness, it is not known how much function

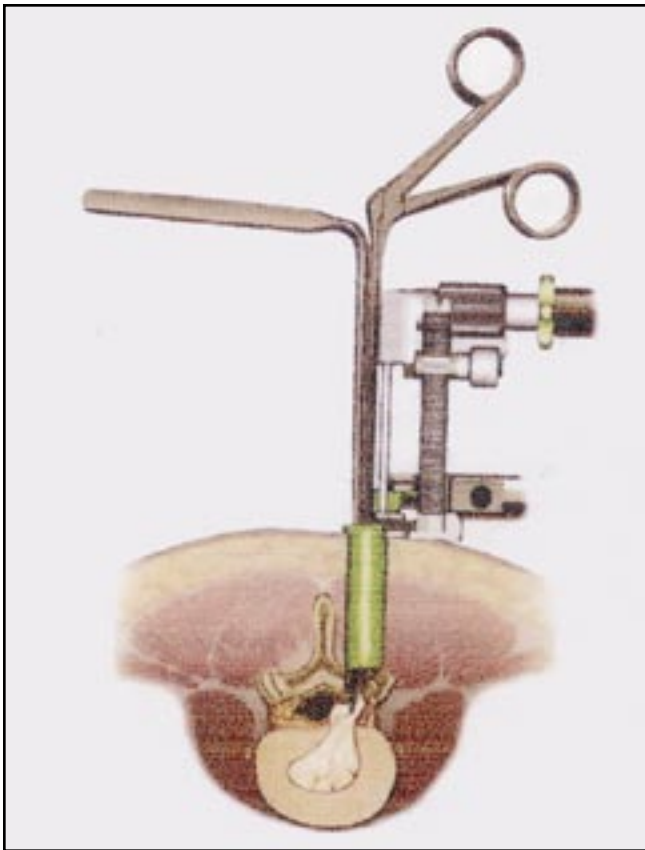


Fig 7. Tubular retractor system example. (Illustration from *Core Curriculum for Basic Spinal Training* ©2003, Medtronic Sofamor-Danek. Reprinted with permission.)

may be restored. Generally, the alternative to surgery is to continue medical management. In our practice, the neurosurgeon discusses the procedure, risks, benefits, potential complications, and alternatives with the patient. The NP then reinforces the discussion, answers all remaining questions, and ensures that informed consent is obtained. This reinforcement may be done the same day as the initial consultation, or at a later date.

Surgical Treatment

Microdiscectomy

A microdiscectomy can be performed under general or regional anesthesia. After anesthesia induction, the patient is gently turned prone to a knee-chest position. At this institution an Andrews frame is used for nonobese patients. Bony landmarks are palpated, and the patient's skin is prepared. The correct disc space is confirmed radiographically following deep dissection. Once confirmed, the ligamentum flavum and lamina are dissected, exposing the nerve root. The opening in the lamina is termed a *semihemilaminectomy*. After the nerve root is identified, all ligaments obstructing the view are cleared away. A nerve root retractor is placed gently to move the nerve root structures out of the way. The disc is often excised using a combination of Epstein curettage

and pituitary ronguers. The disc pieces, which vary in size, are carefully removed. A Woodson instrument and a dural separator are used to ensure all needed disc material is removed. Then the area is irrigated, hemostasis is achieved, and the wound is closed.

Postoperative Care

Patients who have undergone a microdiscectomy typically require an outpatient or 23-hour stay. In addition to general postsurgical nursing care, their nursing care plan should include the following:

Neurologic Assessment

Assessment of lower extremity strength and sensation is a priority. It is imperative to evaluate whether the patient's function is better, the same, worse, or in some way different than their preoperative baseline. Nurses providing postoperative care often have not examined the patient preoperatively and must refer to the preoperative evaluation documented in the medical record. The patient's description of pre- versus postoperative symptoms also is valuable information to ascertain.

Mobilization

Patients will be able to mobilize with assistance shortly after returning from the postanesthesia care unit. Instruct the patient to roll onto his or her side, bring the legs down the side of the bed while simultaneously raising the torso up using the arms. This method will decrease pain by limiting the amount of twisting/bending the patient must do. In addition, a demonstration of rising from a sitting position using the legs and keeping the back straight will assist a patient's efforts to regain mobility.

Pain Control

Postoperative pain varies considerably between patients. Generally, pain is well managed with oral hydrocodone or oxycodone with acetaminophen. In addition, a nonsteroidal anti-inflammatory drug (NSAID) is beneficial for muscular discomfort. If not medically contraindicated, this medication can be initiated soon after surgery. If muscle spasms are painful, antispasmodics can be beneficial. In some cases, patient-controlled anesthesia provides optimal pain relief.

Nonpharmaceutical measures for muscle discomfort and nerve root irritation can be very helpful. Heat is beneficial for muscle spasms and tension. Ice often helps decrease radicular pain, if used no more than 20 min/hr for up to 4 consecutive hours. Gentle massage—away from the incision—over the low back also may help to reduce muscle discomfort.

Constipation Avoidance

Constipation induced by opioid use can be a problem that requires specific prevention counseling. At this institution, a constipation prevention program has been

instituted that includes the use of a bulk fiber supplement and a stool softener 2 days before surgery. The stool softener is resumed immediately after surgery. The fiber supplement is started when the patient resumes adequate fluid intake. Patients can become very ill if constipated, and it increases their back pain.

Urination

Bladder function is assessed with a bladder scanner to be sure there is adequate emptying. Postoperative urinary dysfunction warrants further evaluation by a physician.

Discharge Planning

Discharge planning begins during the preoperative clinic visit. The patient's resources for home care after discharge need to be in place before undergoing surgery. It is important to stress limitations. For example, patients with small children will not be able to lift them. Activities, such as loading the dishwasher and dryer which require considerable bending, and vacuuming, which requires twisting, will not be possible. It is recommended that a patient have a caregiver attending to them for a minimum of 24–36 hours after discharge.

Activities

Activities such as bending, twisting, or lifting more than 10 lbs are restricted. It is especially important to limit activity to walking and adhere to restrictions during the first 2 weeks after surgery, to lessen the risk of reherniation and promote muscle healing. In this practice, activity is limited for the first 6 weeks. In the subsequent 6 weeks, we ask patients to increase their activity gradually. Twelve weeks after surgery, most patients have resumed their usual activity level. These instructions may be altered if a patient's work or usual activities are especially strenuous.

Incision Care

Incisions can be closed with staples, sutures, steri strips, or skin glue. Incision instructions vary with the type of closure. Be aware that the incision is likely to be directly at the waist, where underwear and pants may rub. A light dressing will protect the wound from rubbing on clothing.

Work

Return to work can be difficult. Employment requirements are extremely varied and a patient's return to work needs to be tailored to meet his or her individual needs. Work-hardening programs are often beneficial for those in jobs that require lifting and other physical exertion. Occupational medicine centers often offer work hardening programs.

Case Study

MD is a 26-year-old female with an 8-week history of low back and right posterior leg pain, subjective leg

weakness, and numbness of the posterior thigh, calf, and lateral foot. Upon presentation, her back pain had nearly resolved, and her weakness had markedly improved. Her pain was aggravated by activity and alleviated by periods of rest. She described her pain as a nagging, aching, burning pain that radiated from her right buttock into her posterior thigh and calf, and extended to her lateral right foot. She had undergone epidural steroid injections, participated in a regular regime of low back stabilization exercises, and taken NSAIDs daily.

History and Review of Systems

- *Social history:* Graduate student, new to the city and the university. Single, previously very active, non-smoker, social alcohol use.
- *Past medical history:* No past medical problems.
- *Past surgical history:* Left knee surgery, remote.
- *Medications:* Naproxen.
- *Allergies:* No known drug allergies.
- *Review of systems:* Unremarkable.

Focused Neurologic Examination and Diagnostics

The neurological examination indicated a decreased sensation to pin prick and light touch in the posterior thigh, calf, and lateral foot on the right lower extremity. Left lower extremity sensation was intact. Bilateral lower extremity strength was intact. She was able to walk heel and toe without difficulty. Knee and ankle jerk reflexes also were normal bilaterally. Her right lower extremity exhibited positive straight leg testing at 45 degrees. A review of her MRI scan revealed a large herniated disc at the L5-S1 level on the right, compressing the right S1 nerve root (Figs 8, 9).

Operative Intervention

MD underwent an L5-S1 right microdiscectomy for excision of a large herniated nucleus pulposus. Four weeks after surgery she had complete resolution of her symptoms. At 6 weeks after surgery she was instructed to begin a muscle strengthening program.

Lumbar Spinal Stenosis

Lumbar spinal stenosis (LSS) is any narrowing in the lumbar spinal canal or lateral recess. It can be developmental, congenital, or acquired. This article discusses acquired degenerative lumbar spinal stenosis. Lumbar spondylosis refers to degenerative changes of the lumbar spine. Facet joint hypertrophy, thickening and bulging of the ligamentum flavum, outward bulging of the intervertebral disc, and disc degeneration, or degenerative spondylolisthesis, are all manifestations of lumbar spondylosis. These degenerative changes may cause a reduction in the sagittal diameter of the spinal canal, commonly referred to as *central canal stenosis*. The normal horseshoe-shaped spinal canal becomes a flattened triangular shape (Fig 10). Lateral recess stenosis also is a result of hypertrophy of the facet joints, loss of disc space



Fig 8. Sagittal T2 weighted magnetic resonance image of L5-S1 herniated nucleus pulposus.

height, posterolateral bulging of the disc, or degenerative spondylolisthesis. There can be central canal stenosis in the absence of lateral recess stenosis (Fritz et al. 1998; Best, 2002; Gunzburg & Szpalski, 2003).

Spine extension (bending backward) causes posterior disc bulging and bulging of the ligamentum flava, which results in further narrowing of the central and lateral canals. To compensate, a forward-flexed posture alleviates some of the narrowing caused by the hypertrophied ligamentum flavum and facets.

Clinical Presentation

History

Individuals with lumbar spinal stenosis are generally older and have a long history of intermittent low back pain. Leg pain, which can be unilateral or bilateral, is a more recent complaint. In addition, there is a progressive loss of the capacity to ambulate because of leg pain or paresthesias (Katz et al., 1995). Patients may describe that in the past, they were able to walk a considerable distance, but now they must sit down to rest after walking from the parking lot to the clinic. If questioned, they may indicate that they find walking easier at the store when using a grocery cart. This walking ease results from the forward flexion position assumed while pushing a grocery cart.

Focused Neurologic Examination

On examination, strength, reflexes, and sensation in the lower extremities often are normal. When observing ambulation, there may be a stooped or “simian” stance, with associated gait. It is common to elicit diminished or absent patellar and ankle jerk reflexes due to nerve root compression (Best, 2002; Davenport, 1994; Porter, 1996).

Neurogenic claudication can occur and is described as lower extremity pain, paresthesias, and heaviness or weakness that spreads from the legs into the buttocks and low back while walking. Sitting down relieves the symptoms. Usually affecting men older than 50 years, claudication symptoms are thought to be caused by multilevel compression on the cauda equina and surrounding vasculature (Porter, 1996). A back flexion posture may gradually be assumed to help alleviate symptoms (Best, 2002; Katz, 1996).

Vascular claudication also may be present and may confuse the clinical picture. In contrast with neurogenic claudication, vascular claudication clinical presentation includes a normal posture, diminished lower extremities pulse, stocking glove sensory loss, preserved leg strength, and trophic skin changes. Cessation of ambulation and maintenance of a standing position alleviates vascular claudication symptoms.

Medical Management

A detailed description of the medical management of LSS is beyond the scope of this article. Briefly, medical management includes rest (but not bed rest), NSAIDs, opioid analgesics (if no relief from NSAIDs), and anti-spasmodics. A steroid boost may be helpful. Physical therapy for back stabilization exercises is warranted. Epidural steroid injections (ESIs) and nerve root blocks are often beneficial. Delpont et al. (2004) retrospectively evaluated the outcome of 140 patients with lumbar spinal stenosis who had undergone an ESI. They found that 32% reported more than 2 months of pain relief, 29% had less than 2 months of pain relief, and 29% had no pain relief. Interestingly, 74% were at least somewhat satisfied with ESI as a form of treatment.



Fig 9. Axial T2 weighted MRI of L5-S1 herniated nucleus pulposus.

Surgical Indications

The most common indication is back and leg pain that restricts or prevents activities of daily living. The patient feels a diminished quality of life such that they are willing to undergo operative intervention. Clinical history, exam, and radiographic studies must correlate. All other potential differential diagnoses must have been ruled out.

Surgical Treatment

Decompressive Laminectomy

The goal of decompressive laminectomy is to relieve pressure on the thecal sac and exiting nerve roots, while preventing instability. It is a technically demanding operation because of hypertrophic bone and osteophyte formation. The laminectomy can be unilateral, bilateral, or multilevel. The standard operation is a wide laminectomy with bilateral foraminotomies. The degree of bony excision is dependent on the degree of surgical pathology. The surgeon takes great care to prevent puncture of the thecal sac and any nerve root damage. Although minimally invasive techniques are employed in sev-

eral specialty centers, they have not received widespread acceptance or use. A lumbar fusion may be required.

Preoperative Preparation and Informed Consent

Preoperative preparation and informed consent is the same as discussed earlier in this article. However, since this population is older and subject to more comorbidities, preoperative assessment and planning may be more challenging. Patients need to be medically ready to undergo general anesthesia. In addition, the recovery process is more prolonged than after a microdiscectomy. Adequate assistance in the home should be planned before the surgery.

Assessing the patient's understanding of the procedure is important. Asking open-ended questions such as, "tell me about your surgery" or "tell me what you and the doctor have discussed" will give insight into their level of understanding. Risks are

similar to microdiscectomy and include dural tear, infection, blood loss, nerve root damage, spinal instability, lack of symptom improvement, general anesthesia complications, or death. Specific counseling regarding dural tear and cerebrospinal fluid leak must take place. The benefit of the surgery is a decrease in pain that will lead to improvement in function. The alternative is to continue with medical management. The patient's general medical health—and how it may influence the surgical procedure and recovery—is taken into consideration. Mutual expectations between the surgeon and patient are crucial.

Operative Technique

Decompressive Laminectomy

Following general anesthesia induction, indwelling catheter placement, and placement of sequential compression stockings, the patient is carefully turned prone. Following deep tissue dissection, localization is confirmed with X ray. Removal of bone begins with the spinous process. The amount of bone removed depends on the amount of stenosis. For instance, if the patient has lumbar

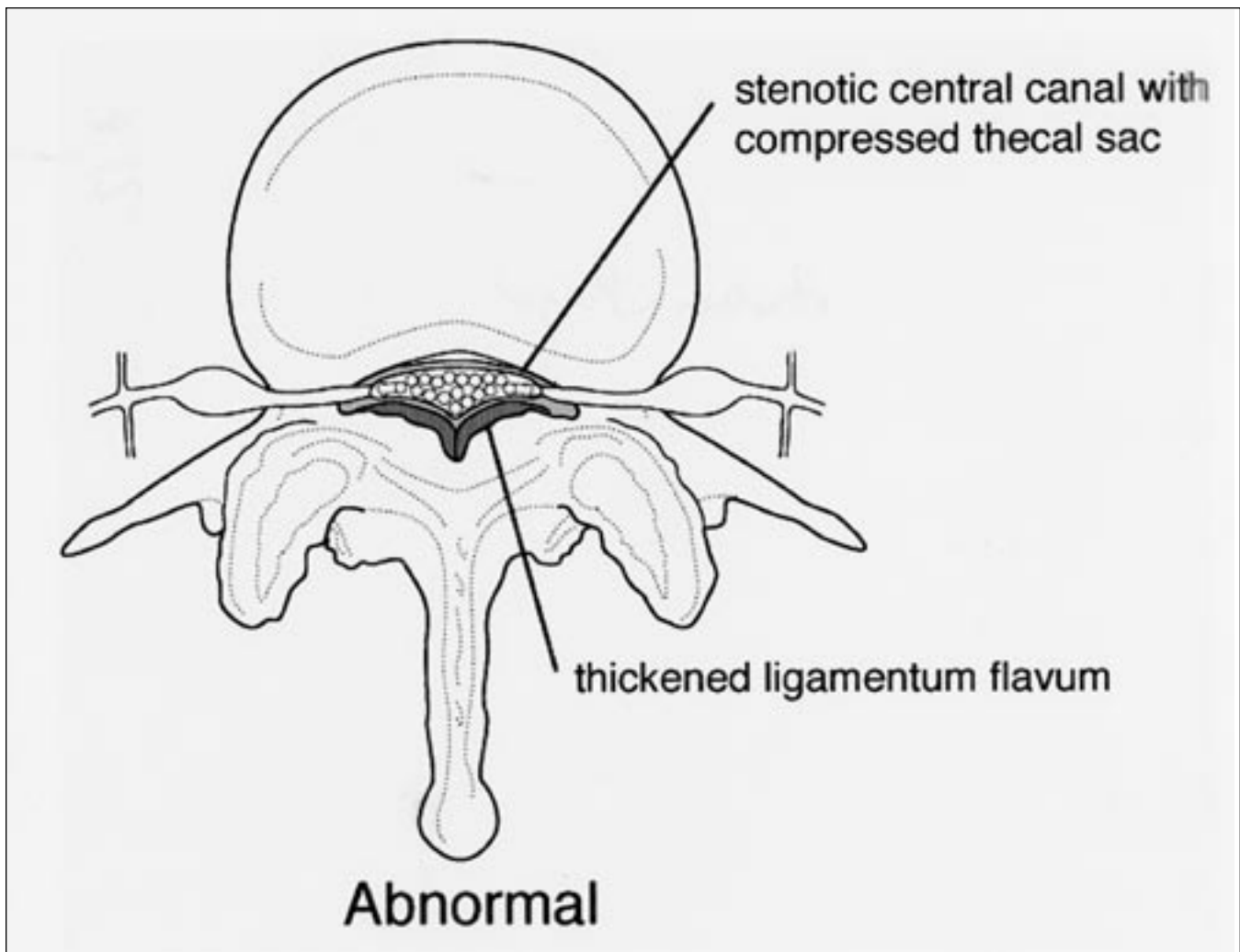


Fig 10. Stenotic lumbar spinal canal. (Reprinted from *AANN Core Curriculum for Neuroscience Nursing, 4th ed.* ©2004 with permission from Saunders.)

stenosis from the L3 to L5 levels, the L4 spinous process is removed first. Then the spinous process of L3 and L5 are partially removed. The lamina are thinned with a high-speed drill. A Kerrison rongeur is used to remove the thinned lamina, carefully decompressing the spinal canal. The ligamentum flavum lies between the lamina and the thecal sac. Often with spinal stenosis, the ligamentum flavum is thickened. Cottonoids are used to protect the dura to complete the ligamentous and bony dissection. The lateral recesses then are checked and ligamentous or bony material is removed to ensure good nerve root decompression. The wound is then irrigated and closed.

Postoperative Care

Length of stay is dependent on pre-morbid medical health and number of levels decompressed. Pre-morbid medical conditions, such as diabetes and hypertension, require close observation. Patients with multilevel laminectomies have lengthier surgeries, larger incisions, concomitant increased pain levels, and slower mobilization.

Neurologic Assessment

As noted previously, assessment and evaluation of the lower extremity function is imperative. Because of the chronicity of the symptomatology before surgery, the patient's preoperative symptoms usually continue.

Mobilization

Patients are mobilized, even if only to sit at the bedside, the same day of the surgery. In some cases, a physical therapist is consulted to evaluate the need for a walker and gait retraining. No muscle stretching or strengthening exercises are recommended for the first 6 weeks, to allow for muscle healing.

Pain Control

Patients may suffer from a significant amount of low back muscle pain and spasm due to the degree of surgical manipulation. Pain medications, whether they are opioids or NSAIDs, need to be evaluated carefully to ensure appropriateness and screen for potential interactions with other medications. Generally, oxycodone or

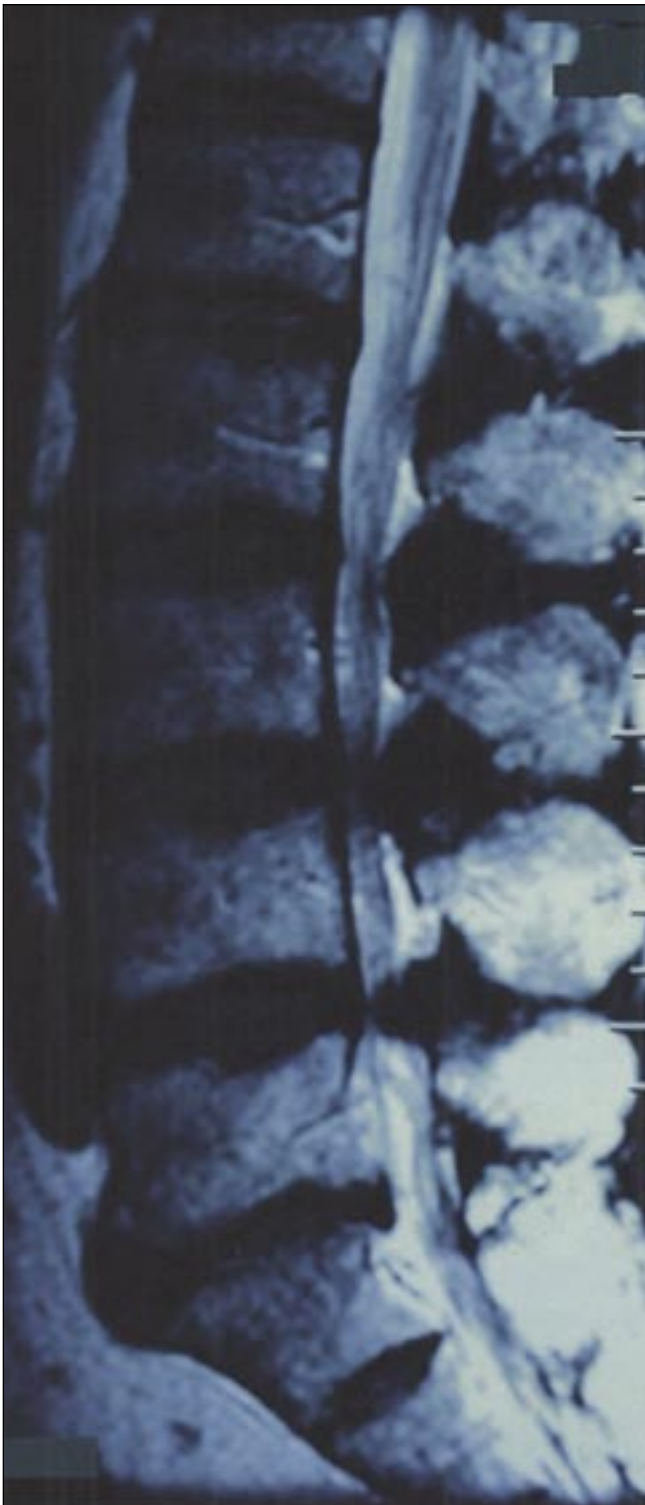


Fig 11. Sagittal T2 weighted MRI of multilevel lumbar stenosis.

hydrocodone with acetaminophen provide adequate pain control for a few days after surgery. When choosing and dosing medications, geriatric considerations should be taken into account. Constipation avoidance measures previously mentioned should be instituted.



Fig 12. Axial T2 weighted MRI illustrating severe lumbar spinal canal stenosis.

Urination

Bladder function is assessed with a bladder scanner to be sure that there is adequate emptying. Urinary dysfunction postoperatively warrants further medical evaluation.

Discharge Planning

Again, discharge planning begins during the preoperative clinic visit. The patient's resources for home care after discharge need to be in place prior to surgery. This is especially important because patients generally are older and will have a more prolonged recovery. For the first 24–36 hours after discharge, it is not recommended that a patient be left alone.

Activities

Activity restrictions include no bending, twisting, or lifting more than 10 lb. This limits activity for the first 6 weeks. Then we ask patients to increase their activity gradually over the subsequent 6 weeks so that 12 weeks after surgery, they are at their usual activity level. These instructions may be altered if their usual activities are especially strenuous.

Incision Care

Incisions can be closed with staples, sutures, steri strips, or skin glue. If the incision is especially long, or if there are concerns regarding a cerebrospinal fluid leak, staples or sutures generally are used. Incision instructions vary with the type of closure. Be aware that this incision is likely to be directly at the waist, where underwear and pants rub. A light dressing will protect the wound from rubbing on clothing.

Work

Return to work can be difficult. Employment requirements are extremely varied and return to work must be tailored to individual circumstances.

Case Study

DC is a 64-year-old male with a 20-year history of low back pain. He stated that for approximately the past year he had been experiencing bilateral lower extremity numbness from his knees to his feet. In addition, he complained of increasing right leg pain that improved following an epidural steroid injection. His symptoms increased when walking and lifting. He experienced few symptoms while pushing a grocery cart. Over time, he noted a gradual decrease in his usual activities. He denied any leg weakness or falling episodes.

History and Review of Systems

- **Social history:** Married, self-employed insurance agent. Travels extensively by car in a local area. Rare alcohol consumption, nonsmoker. Sedentary, can walk only about 2 blocks before experiencing pain.
- **Past medical history:** Ulcerative colitis and gout.
- **Past surgical history:** Chemonucleolysis L4-L5 and right knee surgery, remote.
- **Medications:** Rofecoxib, mesalamine, enteric coated aspirin, daily vitamin, vitamin E.
- **Allergies:** No known drug allergies.
- **Review of systems:** Sedentary, no chest pain, palpitation, dyspnea on exertion; ulcerative colitis and gout in good control.

On neurological examination, his right foot dorsiflexion was weak—rated at a strength of 4/5. The remainder of his strength was intact. He was bilaterally areflexic at the knees and ankles. His sensation to pin prick was diminished in the bilateral lateral calf and his whole foot, bilaterally. An MRI scan revealed severe spinal canal stenosis at L3-L4 and L4-L5, as well as a herniated nucleus pulposus on the right at L5-S1 (Figs 11, 12).

DC underwent a L3-L5 decompressive laminectomy, and L5-S1 right microdiscectomy. Postoperatively, he had significant lumbar muscle spasm. Two days postoperatively he developed atrial flutter and was emergently cardioverted. His cardiac status prevented him from ambulating, which added to his back pain. Eight days after surgery, he was stable and discharged to home. Three months after surgery, DC was working full time and had resumed his usual activities, though some bilateral leg numbness and dorsiflexion weakness persisted. Physical therapy was ordered for low back stabilization exercise. At 6 months, DC experienced no weakness, and only minor toe numbness. Overall, he was very pleased with his surgical outcome.

Summary

Patients with HNP or LSS commonly are seen in various practice settings; therefore, an understanding of the underlying disease process and interventions is beneficial. The symptomatology patients experience with HNP or LSS can significantly affect their lifestyle and quality of life. Neuroscience nurses are pivotal to assess, intervene,

educate, reassure, and advocate for patients with common lumbar spine pathology.

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