



Lumbar Spinal Stenosis

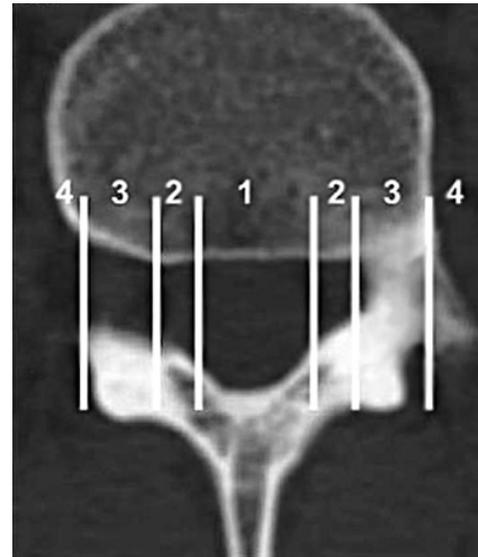
Lumbar spinal stenosis (LSS) is a condition of the spine, usually degenerative in nature, which results in a decrease in the cross sectional area of the spinal canal (see diagram opposite). Clinical LSS (CLSS) is a syndrome “of buttock or lower extremity pain, which may occur with or without back pain associated with diminished space available for the neural and vascular elements of the spine” (Watters 2008). It has been cited as the most common indication for spinal surgery in patients over 65 (Katz 2008).

Radiographic vs. Clinical LSS

It is useful to distinguish radiographic stenosis from the clinical syndrome of LSS. Articles and lectures about stenosis do not always make a clear distinction so caution must be exercised when trying to understand this condition.

Radiographic stenosis results from a cascade of degenerative changes. Some combination of symmetrical disc bulging, facet enlargement, and thickening of ligamentum flavum contribute to loss of canal space. Degenerative changes and a sagittal diameter less than 12mm (“relative stenosis”) or 10mm (“absolute stenosis”) on plain film x-rays suggests the presence of spinal canal stenosis, but an MRI (or CT) *is necessary to make a definitive diagnosis*.

Radiographic stenosis may be sub-divided into central, subarticular (in the area under the facet joints), or lateral (lateral recess, IVF) stenosis.



1 = central canal, 2 = subarticular,
3 = lateral recess, 4= IVF

👉 **Clinical tip:** The presence of radiographic stenosis may or may not result in a patient who is *symptomatic*.

The diagnosis of clinical LSS (CLSS) requires both radiologic evidence *and* signs/ symptoms of stenosis (i.e., neurogenic claudication, a radicular syndrome, or both) (Suri 2010).

Quick snapshot: Pattern Recognition

When should CLSS be considered? Suspect CLSS in an older patient with low back pain and leg symptoms (especially if the leg symptoms dominate). Two different leg presentations exist and may overlap:

- 1) *neurogenic claudication*
- 2) *radiculopathy* (Suri 2010)

1) Neurogenic claudication: This presentation has traditionally been associated with central canal stenosis. The symptoms are in one or both lower extremities, are usually non-dermatomal, radiate at least as far as the buttocks but more commonly into the thighs or as far as the feet, and may be aggravated by walking (intermittent claudication).¹ Patients may also complain of weakness, “heaviness,” abnormal sensations, or fatigue in the lower extremities. Leg symptoms may be aggravated by sustained or repetitive lumbar extension and relieved by lumbar flexion. Gait disturbances may also be present. Sensory, motor or DTR deficits are present only about ½ the time (Suri 2010). Nerve root tension tests are often negative, possibly due to associated lumbar flexion.

2) Radicular/polyradicular syndrome. This presentation has traditionally been associated with lateral recess or IVF stenosis. The dermatomal distribution of symptoms may or may not be associated with walking or standing.

Prevalence & pre-test probability

Reports of prevalence and pre-test probability vary depending on the patient pool: 1) radiographic stenosis in asymptomatic patients, 2) CLSS in mixed populations, and 3) CLSS in a higher risk group, specifically older patients presenting with low back and leg symptoms.

1. Radiographic stenosis in asymptomatic subjects. The prevalence of radiographic stenosis in a sample of patients 60-69 years old was 47% for relative stenosis and 19% for absolute stenosis. When radiographic stenosis was defined according to a different method (canal narrowing by 1/3 = mild stenosis; by 1/3 to 2/3 = moderate; > 2/3 = severe), prevalence in asymptomatic individuals over 55 was distributed as

¹ *Intermittent claudication* refers to unilateral or bilateral leg pain associated with walking. It can be neurogenic (thought to be caused by multiple nerve root ischemia associated with LSS) or vascular (associated with peripheral artery disease).

follows: 21-30% for moderate radiographic stenosis and 6-7% for severe (Luri 2008). Radiographic stenosis appears to be relatively common in these age groups so care must be taken to correlate with clinical signs and symptoms.

In another study conducted by Boden, the discrepancy between clinical symptoms and imaging findings was again demonstrated. This study reported that lumbar spinal stenosis was evident on MRI in 21% of asymptomatic individuals aged 60 years or older (Boden 1990).

2. CLSS in a mixed population of patients presenting with low back pain with or without leg pain. An estimated 13-14% of patients with low back pain seeking care from a specialist and 3-4% from a general practitioner are diagnosed with lumbar spinal stenosis (Whitman 2006).

3. CLSS in older patients with leg symptoms. Elderly patients with leg pain account for the population most likely to be affected by CLSS. Therefore they represent the most appropriate group for estimating pretest probability. One study of patients presenting with pain or numbness in the lower extremity (mean age of 65 years) reported a 47% prevalence of CLSS (Konno 2007). In this study, however, only approximately 1/3 of the patients were from a primary care setting. Two thirds came from specialty clinics where the prevalence is likely *much higher than in a purely primary care population or, presumably, in a chiropractic clinic.*

Prevalence of spinal canal stenosis

Patient pool	Setting	
Asymptomatic patients (60-69)		47% relative stenosis
radiographic evidence		19% absolute stenosis
Mix of LBP patients with and without leg pain	Primary care	3-4%
Mix of LBP patients with and without leg pain	Specialist	13-14%
>65 with LBP and leg symptoms	1/3 PCP, 2/3 specialists	47%
Older patient with LBP & leg pain	chiro	unknown

Clinical Presentation

Central canal stenosis may present differently from lateral recess stenosis. Theoretically, lateral recess stenosis is more likely to cause discrete radiculopathy that mimics a disc herniation. Central canal stenosis is more likely associated with non-dermatomal symptoms and can often affect both legs. Although these two clinical presentations exist, a consistent association of symptom pattern and imaging findings does not always hold up in practice (Suri 2010).

Central canal stenosis can cause cauda equina syndrome (CES). The estimate is that CES occurs only in approximately 6% of stenosis cases (Suri 2010). In these cases, the symptoms of CES are *in addition* to the usual stenosis symptoms. The presence of CES warrants an urgent referral to an emergency room for advanced imaging and possible surgical decompression. (See CSPE protocol, [Cauda Equina Syndrome](#).)

The following section lists the best clues from the history and physical exam for making a diagnosis of suspected CLSS (Suri 2010). Note that test performance (expressed as likelihood ratios) was derived primarily from specialty clinics and may differ when applied in a chiropractic setting.

👉 Clinical tip: How to interpret positive and negative likelihood ratios...		
Likelihood ratios	Change in pre- to post-test probability	Estimated change in post-test probability
Positive >10 Negative < 0.1	Large and often conclusive	45% for + LR 10
Positive 5-10 Negative 0.1-0.2	Moderate shifts	30% for + LR 5
Positive 2-5 Negative 0.5-0.2	Small (but sometimes important) shift	15% for +LR 2

HISTORY

The typical patient has low back pain, is over 55, but more likely over 65 (+LR 2.5, -LR 0.3) or 70 (+LR 2.0 95% CI, 1.6-2.5) and has unilateral or bilateral lower extremity

symptoms (reported in 90% of cases) (Suri 2010).

Best clues to RULE IN CLSS

Although a number of the LRs listed below are moderately good, note that some of the estimates are less precise, with wide confidence intervals. This may reflect that they are based on relatively small patient samples.

Finding	+LR	95% CI
No pain when sitting	7.4	1.9-30
Cauda equina* symptoms including burning sensation around the buttocks or priapism when walking	7.2	1.6-32
Unexplained urinary problems	6.9	2.7-17
Bending over improves symptoms	6.4	4.1-9.9
Bilateral Buttock or leg pain	6.3	4.1-9.9
Neurogenic claudication	3.7	2.9-4.8

* Note: Cauda equina syndrome is not common and is present in only about 6% of LSS cases.

📌 **EXAMPLE:** *If we estimate the prevalence of LSS in a 65 year old patient with low back and leg pain at 20% (presuming the 47% prevalence quoted earlier is too high for a chiropractic clinic), the historical finding of no leg pain when sitting (LR 7.4) would result in a post-test probability of 65% (a jump of 45%).*

Best clues to RULE OUT CLSS

Finding	LR	95% CI
Absence of neurogenic claudication	0.23	0.17-0.31

PHYSICAL EXAMINATION

In general, physical examination findings in isolation are not as useful as symptoms from the history.

Best exam clues to RULE IN CLSS

Finding	+LR	95% CI
Wide-based gait	13.0	1.9-95
Abnormal Romberg test	4.2	1.4-13

EXAMPLE: One physical exam finding does have a high LR: wide-based gait. If we estimate the prevalence of CLSS in a 65 year old patient with low back and leg pain at 20%, observing the patient walk with a wide stance (+LR 13) would result in a post-test probability of 76% (a jump of 56%).

odds. Its greatest strength, therefore, is as a tool to help rule out CLSS.

Clinical tip: Inquiring about diabetes is useful because of the potential for diabetic neuropathy.

Best exam clues to RULE OUT CLSS

Finding	LR	95% CI
Forward flexion provokes/exacerbates symptoms	0.48	0.24-0.96

ADDITIONAL CLUES

The following clues, if present, have a smaller effect increasing the probability of CLSS. These findings, however, carry *no power to rule out* CLSS when they are negative (Suri 2010):

Finding	+LR	95% CI
Lower extremity weakness	2.1	1.0-4.4
Absent Achilles reflex	2.1	1.0-4.4
Lower extremity loss of vibration	2.8	1.3-6.2
Lower extremity loss of pinprick sensation	2.5	1.1-5.5
Severe lower extremity pain	2.0	
Sustained extension increases thigh pain (e.g., 30 seconds)	1.6	

COMBINATION OF FINDINGS

In one study looking at overall expert physician “confidence” in a diagnosis of suspected CLSS, the combination of findings that yielded the highest degree of confidence was an **older patient with lower extremity symptoms, having no pain when seated, a wide based gait, and thigh pain with 30 seconds of sustained extensions** (Katz 1995).

DIAGNOSIS PREDICTION RULE

The following score card is based on a clinical prediction rule designed to aid in the diagnosis of CLSS (Konno 2007). Although a score of 7 or above results in only a small increase in the odds of having the condition, *a score below 7 significantly decreases the*

CLSS SCORE CARD Characteristic	Risk score ≥ 7
History	
Age (years)	
60-70	1
>70	2
Absence of diabetes	1
Symptoms	
Intermittent claudication (+)	3
Exacerbation of symptoms when standing up	2
Symptom improvement when bending forward	3
Physical examination	
Symptoms induced by having patients bend forward	-1
Symptoms induced by having patients bend backward	1
Good peripheral artery circulation	3
Abnormal Achilles tendon reflex	1
SLR test positive	-2
TOTAL	

Interpreting the CLSS Scores (Konno 2007)

Index	Estimates
Sensitivity (score ≥ 7)	0.928
Specificity (score ≥ 7)	0.720
Likelihood ratio	
Positive test result (score ≥ 7)	3.31
Negative test result (score < 7)	0.1

EXAMPLE: If we estimate the prevalence of LSS in a 65 year old patient with low back and leg pain at 20%, a score below 7 using this prediction rule (-LR 0.1) would result in a post-test probability of 2% (a drop of 18%).

DIFFERENTIAL DIAGNOSIS

Before arriving at a provisional diagnosis of CLSS, a number of competing diagnoses and causes must also be considered.

Peripheral Artery Disease (PAD)

If leg symptoms are brought on by walking, then neurogenic claudication due to stenosis must be distinguished from vascular claudication associated with blockage of the main arteries to the leg.

Symptoms due to PAD are more commonly felt in the calves than the thighs and will usually subside within 2-5 minutes of rest. The presence of strong peripheral pulses also makes PAD less likely. Finally, the symptoms of PAD are not affected by the positioning of the lumbar spine.

A treadmill test can be used to help differentiate CLSS from PAD. The patient walks on a level treadmill until leg symptoms are aggravated and then attempts to continue walking with the treadmill inclined. If the patient can continue to walk further (now with the incline promoting lumbar flexion), neurogenic claudication is suggested. If the patient cannot continue, vascular claudication is more likely.

Differentiating neurogenic and vascular claudication (Yuan 2009)		
Factors	Neurogenic	Vascular
Low back pain	More likely	Less likely
Leg symptoms	More common in thighs	More common in calves
Evaluation after walking	Increased muscle weakness	Unchanged
Palliative factors	Bending over, sitting	Stopping
Provocative factors	Walking downhill (due to increased lordosis)	Walking uphill (due to increased metabolic demand)
Pulses	Present	Absent
“Shopping cart” sign ²	Present	Absent
van Gelderen bicycle test ³	No leg pain	Leg pain

² The “shopping cart” sign is detected when a patient reports that s/he can walk longer and further in a store setting if leaning over a shopping cart or anything that results in lumbar flexion.

³ The patient with neurogenic claudication should tolerate riding a stationary bike, performed in a forward flexed position with little axial load applied. Patients with vascular claudication, however, will become symptomatic due to tissue hypoxia.

Herniated Lumbar Disc

The radicular presentation of CLSS must be differentiated from a lumbar disc herniation.

If the patient’s leg symptoms are relieved by bed rest, worsened by sitting or lumbar flexion, or worsened by a Valsalva maneuver, a disc herniation is more likely. If the leg symptoms are relieved by sitting and/or unrelieved by bed rest, stenosis is the more likely of the two. A positive SLR test is much more commonly associated with a disc herniation (sensitivity is reported to be 90%) (Deville 2000), but is less commonly positive in CLSS.

Other considerations

Many other conditions can mimic CLSS and must be considered. See table.

DDX for Lower Extremity Pain (with or without back pain) (Suri 2010)	
Other causes of radicular pain	disc herniation, tumor/facetral synovial cysts, infection (disc/vertebrae), instability (with or without spondylolisthesis), vertebral osteophytosis, compression fractures, nerve root adhesions
Deep referred pain from the spine	deranged discs, facets, sacroiliac joints
Deep referred pain from other structures	hip lesions, trochanteric bursitis, muscle strains, myofascial pain syndromes
Peripheral nerve lesions	diabetic neuropathy, piriformis syndrome
Other diagnoses	PAD (vascular intermittent claudication), compartment syndrome, peripheral neuropathy, visceral referred pain

Ancillary studies

Because of the patient's age, leg presentation, and potential neurological involvement, plain film radiographs are recommended in the initial assessment. Films are particularly recommended if neurological deficits are also present because deficits increase the concern for a space occupying lesion.

!! Clinical warning: *Follow up MRI is often indicated in these cases even in the presence of negative plain films because MRI is more sensitive and specific in the diagnosis of a space occupying lesion.*

Advanced imaging may be ordered to confirm the initial LSS diagnosis or may be ordered later if treatment is not effective. A 3 month trial of conservative therapy could be reasonable as long as the patient appears to be improving or at least remains stable. If at any time during this period red flags appear suggesting a more serious condition, then an MRI would be indicated.

When stenosis is suspected, CT and MRI (more than one sequence) are the best advanced imaging tests to order.

Myelography, an invasive imaging modality, has not been shown to be more accurate and should be avoided (deGraff 2006). Although MRI is generally recommended as the imaging technique of choice (ACR Appropriateness Criteria, 2011), neither a 2006 systematic review (McGraff 2006) nor a 1992 meta-analysis (Kent 1992) could demonstrate the superiority of MRI or CT. Due to poor overall quality of the studies reviewed, reasonable estimates of test sensitivity and specificity cannot be made either.

NEW RESEARCH. In 2010 a new MRI radiological sign was reported, the nerve root sedimentation sign, which had a sensitivity of 94% (95% CI 90-99%) with a perfect specificity of 1.00. If confirmed by other research, this sign would be more useful than cross sectional area measures. The positive sign represents a lack of the normal settling of the nerve roots to the dorsal portion of the thecal sac in the supine patient. Correlation with clinical signs and symptoms is still obligatory (Barz 2010).

Although common practice, it must be borne in mind that the assumption that radiologic measures confirm the diagnosis of CLSS has not been firmly established.

Other ancillary studies for suspected neurogenic claudication include bicycle or treadmill testing, and occasionally electrodiagnostic testing (e.g., EMG and nerve conduction studies).

Ancillary studies for vascular claudication include ankle brachial indices⁴, duplex ultrasound or magnetic resonance angiography. Duplex ultrasound⁵ is a good initial assessment tool if a vascular cause is suspected.

When to Suspect Spinal Canal Stenosis as a Cofactor to Other Diagnoses

Sometimes radiographic stenosis is present and, although not the primary pain generator, exacerbates the symptoms from some other cause. A classic example would be a lumbar disc herniation that occurs in a stenotic canal. In this case, the stenosis can be a key cofactor exacerbating the pain and neurological findings. It can also down grade the prognosis from a successful outcome for conservative care (Saal 1996).

⁴ The ABI number is obtained by dividing the blood pressure in the ankle by the blood pressure in the arm. A value of 0.9 or greater is normal.

⁵ Duplex ultrasound combines Doppler flow with diagnostic ultrasound. It measures the speed of blood flow and can be used to estimate the diameter of a blood vessel as well as the amount of any obstruction.

TREATMENT IMPLICATIONS

In general, conservative treatment is given *despite* stenosis rather than because of it and is appropriate for those with mild to moderate symptoms. Symptoms may be associated with increased inflammation, circulatory compromise to the nerve roots (as can happen when the lumbar spine is in extension), and associated instability.

Making a working diagnosis of CLSS (even without advanced imaging to confirm the diagnosis) can affect the management plan in a variety of ways:

1. Overall treatment strategy
2. PARQ and charting
3. Symptom monitoring
4. Patient education
5. Length of care & decision making

1. Overall treatment strategy

Management can be divided into 3 main treatment strategies:

- 1) **Control symptoms** by normalizing joint function through manipulation/mobilization and eradicating sources of soft tissue pain such as trigger points.

Treatment options

- Flexion distraction therapy (See Appendix I).
- HVLA manipulation (avoiding peripheralization maneuvers)
- MFTP treatment (ischemic compression, PIR, etc.)

- 2) **Prescribe a physical rehab program** (usually in the range of 10-12 weeks) to minimize any accompanying functional or structural instability.

Treatment options

- Stabilization exercises, including balance tracks. (See CSPE protocol, [Low Back Rehabilitation](#)).

- Addressing muscle imbalances as needed (e.g., stretching iliopsoas, hamstrings; activating gluteus maximus, abdominal muscles)
- Cardiovascular exercises, including a walking program perhaps with a rolling walker on level ground. The patient should stop just short of what reproduces symptoms. If this is not well tolerated, the practitioner can encourage flexion based exercises like bicycling. If swimming is recommended, avoiding the breast stroke is best.
- Neuromobilization techniques. (See Appendix II)
- Perform single and double knee to chest exercises to promote lumbar flexion (Williams exercises).

- 3) **Teach activity modification strategies and ergonomic changes.** Activities and exercises that promote extension are avoided at least in the acute stages. Flexion postures are encouraged.

Treatment options

- Avoid working with arms elevated.
- Avoid standing for long periods or modify standing posture by leaning over on a supported surface, placing one foot on a foot rest (to create flexion in the lumbar spine) and/or occasionally holding a posterior pelvic tilt.
- Modify home setting if necessary to prevent falls. (See Appendix III)

Patients with CLSS often display a wide stance and gait, positive Romberg test, and evidence of altered proprioception. No studies have reported the incidence of falls specifically in a CLSS population. A small 2011 study did demonstrate that patients with severe CLSS failed functional mobility tests (e.g., sit to stand, six meter walk test etc.) at a rate similar to patients with severe knee osteoarthritis - a population known for an increased risk for falls (Kim 2011).

2. PARQ and charting

If there is a strong probability of CLSS, the patient should be informed of this and the role of surgery briefly discussed. A more detailed discussion can be reserved for a time when and if a surgical consultation is required. In cases where the LSS remains on the differential diagnosis list behind a more likely working diagnosis, this discussion can be delayed at the practitioner's discretion.

Charting can reflect CLSS as a "suspected" or "probable" diagnosis or tagged on to another diagnosis as a "rule out" depending on the practitioner's index of suspicion. A confirmed diagnosis cannot be made without evidence from advanced imaging.

3. Symptom monitoring

Symptom monitoring will fall into four broad categories.

Cauda equina red flags: Patients should learn the red flags signaling a cauda equina syndrome. This is especially important because of the small (6%) but long term risk of developing CES. Even after patients have completed or withdrawn from care they will need to remain vigilant.

Neurological symptoms. Motor status and girth should be monitored periodically. Progressive motor weakness or atrophy should trigger further evaluation and a potential surgical consult.

Function. Progressive disturbance in gait, decreased ability to get around home or community, or significant effects on work or activities of daily living may trigger the need for a surgical consultation.

Symptom severity. Back pain and leg symptom severity can be monitored by oral pain scale.

Clinical tip: Monitoring *worst* pain besides current or usual pain may be useful. In one study, it was the only pain measure that reflected clinically significant improvement (Murphy 2006).

4. Length of care and decision making

Patients should be aware that conservative management will be generally of a longer duration compared to uncomplicated mechanical low back pain. They also may require ongoing palliative or supportive care. Physical rehabilitation programs are often 10-12 weeks in length. A 2006 case series which combined several approaches to manual therapy reported success with a shorter program (average 13 visits, with 90% of patients who responded favorably being discharged within 7-18 treatments) (Murphy 2006).

Although there is insufficient evidence to make strong recommendations, it is the consensus of the CSPE committee that a reasonable therapeutic trial would consist of initially seeing the patient 2-3 times a week. Minimal clinically important improvement (e.g., improved function, walking distance, standing time, pain intensity or decreased pain medication) should be expected within 3-4 weeks.⁶ This improvement should be maintained or exceeded by the 6th week of care. In some cases, a therapeutic trial of 3-4 months may be necessary to achieve maximum therapeutic impact. Patients' status at 3 months may provide insight to their longer term prognosis (Amundsen 2000). At that time, further supportive or palliative care, or a surgical consultation, may be indicated.

5. Patient education

Patient education should emphasize a number of key points (most of which have been alluded to above):

- Prognosis and natural history of LSS
- The potential need for ongoing palliative or supportive care
- Surgical vs. conservative outcomes
- Red flags for cauda equina syndrome
- The need for active participation in an exercise program
- Specific activity modifications

⁶ Minimal clinically important improvement is best judged by the practitioner, but examples include a 2 point improvement in PSFS or 2 point drop in pain on OPS.

Research and Rationale

There has been little research relative to manual therapy. A 2009 review identified only 4 single case studies, a case series, and an observational study. The studies which included diversified style adjusting, mobilization, and flexion distraction therapy generally showed positive results with no significant side effects (Stuber 2009).

One 2006 study compared a 6-week combination program of manual therapy, flexion exercises, strengthening exercises and walking to a simpler flexion exercise and walking program. The combination program had superior outcomes in disability and in patient self-rated improvement at 1 year follow up. The NNT was 2.6⁷ (Whitman 2006).

In a 2006 prospective case series (cohort study), Murphy et al. treated 57 patients with a combination of flexion distraction therapy, neuromobilization, and stabilization exercises. Patients were seen 2-3X/week for 3 weeks; then based on re-exam, 1-2X/week. Those fully resolved were released for 3 week follow up. Mean visits = 13.3. Forty-four patients were followed up (mean 16.5 months, range 3-48 months). At follow up, Roland Morris had decreased 5.2 points (from baseline).⁸ No serious or lasting side effects were reported.

Lumbar flexion-distraction therapy is thought to increase vascular and CSF flow and decrease venous congestion by increasing the dimensions of the spinal canal (Cox 1999, Dougherty 2010). This or similar techniques are commonly chosen for manual treatment of spinal stenosis (Stuber 2009, Cox 1999, Dougherty 2010). Related approaches include "drop-table", lumbar flexion mobilization, long axis (axial) traction, etc.

⁷ This means that for every 2.6 patients in the complex program, an average of 1 patient got superior results over the comparison program.

⁸ The minimal clinically important difference (MCID) for the Roland Morris Questionnaire has been reported variously from 2-5 point drop in score (Liebensen 2007).

Physical therapy programs are commonly the first approach to treating CLSS. An RCT comparing physical therapy to epidural steroid injection in 29 patients showed improved VAS and Roland Morris Disability Index (RMDI) scores in both groups (Koc 2009).

Referral for Medical Interventions

Medical interventions include epidural injections and surgical decompression.

Epidural steroid injection is a non-surgical treatment option for symptomatic relief (Briggs 2010, Lee 2010). In a retrospective case series, 87% of 216 patients undergoing fluoroscopically guided epidural steroid injection showed improvement (Joon 2010).

As part of the PARQ, patients should be advised of the possibility of a surgical option. The lack of reliable, evidenced-based predictors of symptom progression can make a surgical decision more difficult. Bowel or bladder dysfunction, significant effect on ambulation, progressive neurological loss, or failure of a conservative treatment plan are all indications for surgical consultation.

A 2007 study of 174 patients treated surgically reflected greater improvement in leg symptoms in those patients with unilateral leg pain compared to those with bilateral leg pain (Yamashita 2007). An RCT in 2008 of stenosis patients with symptoms for at least 12 weeks suggested that surgery produced greater improvement in terms of pain and disability at 3 months and at 2 years over non-surgical care (Weinstein 2008). In an earlier 2000 study, 100 patients with symptomatic lumbar spinal stenosis were given surgical or conservative treatment and followed for 10 years. The treatment results after 3 months generally heralded the longtime results, which were largely in favor of surgery. However, more than half of the conservatively treated patients had a satisfactory outcome. A delay of surgery for 3 years did not worsen the prognosis. Therefore, a primarily

conservative approach (e.g., a treatment trial of up to 3 months) is still a viable option (Amundsen 2000).

Natural History and Prognosis

A small 2006 study (Haig 2006) followed 82 subjects with MRI evidence of lumbar spinal canal stenosis for 18 months. Of the 61 patients who were symptomatic, most of them improved in both signs and symptoms. While the symptoms of spinal canal stenosis appear to fluctuate, they tend to generally improve over time. Other studies (albeit of limited quality with relatively short term follow up) estimate that approximately ½ to ⅔ of patients treated nonsurgically will either improve or maintain status quo at the time of follow up (Whitman 2007).

♣ **Clinical tip:** *Neither the anatomical state of the canal nor the presence of neurological deficits seems to be able to predict future pain or disability.*

Copyright © 2011 University of Western States

Primary Author: Ronald LeFebvre, DC

Reviewed and Adopted by CSPE Committee

- J. Michael Burce, DC, DABCO
- Daniel DeLapp, DC, DABCO, LAc, ND
- Lorraine Ginter, DC
- Ronald LeFebvre, DC
- Owen T. Lynch, DC
- Ryan Ondick, DC
- Jeremiah Patton, DC
- Anita Roberts, DC
- James Strange, DC
- Michael Tarnasky, DC
- Devin Williams, DC
- Laurel Yancey, DC

Other reviewers and contributors

- Beverly Harger, DC, DACBR
- Lisa Hoffman, DC, DACBR
- Sara Mathov, DC, DACBR
- Dave Panzer, DC, DABCO
- Dave Peterson, DC

REFERENCES

- American College of Radiology. ACR Appropriateness Criteria®: low back pain, acute chest pain. Available at: http://www.acr.org/secondarymainmenucategories/quality_safety/app_criteria.aspx Accessed 5/2011, last reviewed 2008.
- Amundsen T, Weber H, Nordal HJ, Magnaes B, Abdelnoor M, Lilleås F. Lumbar spinal stenosis: Conservative or surgical management? *Spine* 2000;25(11):1434-6.
- Barz T, Melloh M, Staub LP, et al. Nerve root sedimentation sign: Evaluation of a new radiological sign in lumbar spinal stenosis. *Spine (Phila Pa 1976)* 2010;35(8):892-7.
- Black ER. Validity numbers reported in Mazanec DJ, Low back pain syndromes in diagnostic strategies for common medical problems, 2nd edition, 1999 and in Fritz JM, DeLitto A., et al. Lumbar spinal stenosis: a review of current concepts in evaluation, management, and outcome measures. *Arch Phys Med Rehabil* 1998;79:700-70.
- Boden DS, Davis DO, Dina TS, et al. Abnormal magnetic -resonance scans of the lumbar spine in asymptomatic subjects: a prospective investigation. *J Bone Joint Surg Am* 1990;72:403-8.
- Briggs VG, Wenjun Li, Kaplan MS, Eskander MS, Franklin PD. Injection treatment and back pain associated with degenerative spinal stenosis in older adults. *Pain Physician* 2010;13:E347-E355.
- Cox JM. Low back pain: mechanism, diagnosis, and treatment. 6th Ed. Williams & Wilkins, 1999 p.173, 175-176, 179, 198-204.
- de Graff L, Prak A, Bierma-Zeinstra S, et al. Diagnosis of lumbar spinal stenosis: a systematic review of the accuracy of diagnostic tests. *Spine* 2006;31(10):1168-76.
- Devillé W, van der Windt D, Dzaferagić A, Bezemer PD, Bouter LM. The test of Lasègue: Systematic review of the accuracy in diagnosing herniated discs. *Spine* 2000;25(9):1140-7.
- Dougherty P, Salsbury Lyons S, Everett C, Weiner D. Chronic lower back pain with stenosis in an older adult male. *Topics in Integrative Health Care* 2010;1(2) ID:1.2003 [ISSN 2158-4222].
- Haig AJ, Tong HC, Yamakawa KSJ, et al. Predictors of pain and function in persons with spinal stenosis, low back pain, and no back pain. *Spine* 2006;31:2950-7.

- Joon WL, Jae SM, Kun WP, et al. Fluoroscopically guided canal epidural injection for management of degenerative lumbar spinal stenosis. *Skeletal Radiol* 2010;39:691-9.
- Katz JN, Harris MB. Lumbar spinal stenosis. *N Engl J Med* 2008;358:818-25.
- Kent DL, Haynor DR, Larson EB, Deyo RA. Diagnosis of lumbar spinal stenosis in adults: a metaanalysis of the accuracy of CT, MR, and myelography. *AJR Am J Roentgenol* 1992;158(5):1135-44.
- Koc Z, Ozcakir S, Sivrioglu K, et al. Effectiveness of physical therapy and epidural steroid injections in lumbar spinal stenosis. *Spine* 2009;34(10):985-9.
- Konno S, Hayashino Y, Fukuhara S, et al. Development of a clinical diagnosis support tool to identify with lumbar spinal stenosis. *Eur Spine J* 2007;16:1951-7.
- Kim H-J, Chun H-J, Han C-D, et al. The risk assessment of a fall in patients with lumbar spinal stenosis. *Spine*;36(9):E588-E592.
- Lee JW, Myung JS, Park KW, Yeom JS, Kim KJ, Kim HJ, Kang HS. Fluoroscopically guided caudal epidural steroid injection for management of degenerative lumbar spinal stenosis: short and long-term results. *Skeletal Radiol* 2010;39:691-9.
- Liebensen C. *Rehabilitation of the Spine*, 2nd edition. Philadelphia PA: Lippincott Williams & Wilkins 2007.
- Murphy DR, Hurwitz E, Gregory AA, Clary R. A non-surgical approach to the management of lumbar spinal stenosis: a prospective observational cohort study. *BMC Musculoskeletal Disorders* 2006;7:16.
- Saal J. Natural history and nonoperative treatment of lumbar disc herniation. *Spine* 1996;21(45):2S-9S.
- Stuber K, Sajko S, Kristmanson K. Chiropractic treatment of lumbar spinal stenosis: a review of the literature. *J Chiropr Med* 2009;8:77-85.
- Suri P, Rainville J, Kalichman L, Katz JN. Does this older adult with lower extremity pain have the clinical syndrome of lumbar spinal stenosis? *JAMA* 2010;304(23):2628-36.
- Vo AN, Kamen LB, Shih VC, Bitar AA, Stitik TP, Kaplan RJ. Rehabilitation of orthopedic and rheumatologic disorders. 5. Lumbar spinal stenosis. *Arch Phys Med Rehabil* 2005;86(3 Suppl 1):S69-76.
- Watters WC, Baisden J, Gilbert TJ, et al. Degenerative lumbar spinal stenosis: an evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spinal stenosis. *Spine* 2008;8:305-10.
- Weinstein JN, Tosteson TD, Lurie JD, et al. Surgical versus nonsurgical therapy for lumbar spinal stenosis. *N Engl J Medicine* 2008;358:794-810.
- Whitman JM, Flynn TW, Childs JD, et al. A comparison between two physical therapy treatment programs for patients with lumbar spinal stenosis. *Spine* 2006;31:2541-9.
- Yamashita K, Aono H, Yamasaki R. Clinic classification of patients with lumbar spinal stenosis based on their leg pain syndrome. *Spine* 2007;32:980-5.
- Yuan PS, Albert TJ. Managing degenerative lumbar spinal stenosis. *J Musculoskeletal Med* 2009;26:222-31.

APPENDIX I: Flexion-distraction Protocol for Suspected Spinal Canal Stenosis

The following protocol for clinical spinal canal stenosis is essentially the same as for lumbar disc herniation. The procedure primarily applies both long axis distraction and decompression in slight non-weight-bearing flexion.

Since the practitioner cannot always tell how an individual patient is going to respond to repeated distraction/decompression until it is actually applied, a cautious, methodical approach is used and tolerance testing is performed before each treatment.

Anytime the patient indicates that the distraction/decompression applied is making him/her worse, the practitioner must stop and reevaluate his/her status (especially leg symptoms) and determine whether this particular therapy is appropriate at this time.

CLINICAL WARNING! Because there is the potential risk of over distracting and flexing the patient, it is safer if the practitioner under treats rather than over treats during a visit, especially when starting with a new patient. The most common reason for causing a flare up is dropping the table into too much flexion.

CONTRAINDICATIONS

The following are contraindications to flexion-distraction therapy: Recent fracture, infection, surgical indications (i.e., cauda equina syndrome, progressive neurological deficits, positive image findings such as presence of a tumor), severe adhesions, displaced fragments, significant symptoms at rest, hypermobility at the segment to be treated, and cognitive difficulties in communication of symptoms.

STEP 1: Positioning the patient and adjusting the table

1. Check the table for safety. Be sure that all sections of the table are locked and the flexion tension is adequate to support the patient's lower extremities. Approximate the length of the table to accommodate the height of the patient.
2. Usually the acute patient is more comfortable at first lying in some degree of prone flexion.
3. If lying prone is not well tolerated, configure the table to reproduce the patient's antalgic posture.
4. If the need for a post-treatment lumbar support belt is anticipated, the belt can be placed on the table underneath the patient before he or she lies down.
5. The practitioner should physically demonstrate to the patient how to get on and off table.
6. The patient should use his/her arms to lower the abdomen onto the table, standing on the asymptomatic leg and lifting the symptomatic leg onto the lower section. The patient maintains a neutral pelvis, performs an abdominal brace, squeezes the buttocks together, and hip hinges while going through the transition movements.
7. The patient's ASIS's should be 2" cephalad on the thoracic piece. It is better to have them too high (cephalad) on the table than too low (caudad) because the higher ASIS position, the less danger there is of over-flexing the lumbar spine.
8. Inform the patient that the table is going to be unlocked, the pelvic piece is going to be lowered, and s/he may feel a "stretch" in the back.
9. Stabilize the pelvic piece by holding it steady with one hand as you release the locking mechanism with the other. This helps protect the patient from any abrupt movement either in flexion or

extension as the pelvic piece is unlocked.

10. Adjust the flexion tension as needed to allow the weight of the patient's lower extremities to be supported by the table without it moving up or down when you let go.

STEP 2: Tolerance testing

The purpose of this part of the protocol is to determine if the patient will tolerate the flexion-distraction procedure by applying various distractive forces to the spine and the legs. The depth is always 2" (2 inches) or less from the starting/taut position.

The patient is a candidate for this therapy if:

- the severity of the back or leg pain is reduced or at least not increased,
- leg pain centralizes or remains the same and,
- the quality of the leg or back pain remains the same or becomes more dull or diffuse.

If the patient cannot tolerate this testing, the doctor should proceed with other therapies. It may be useful to reevaluate at a later time to see if there is a change in their tolerance to the procedure.

1. **Central Distraction Testing:** With the patient not in the ankle cuffs.
 - a. Without contacting (securing) the spine, slowly lower the table from the starting (taut) position into 2" of flexion and hold for four seconds. Repeat by moving down from L2-L5, one segment at a time.
 - b. If there is no negative response, proceed to the next step.
2. **Single Leg Distraction Testing:** With the patient not in the ankle cuffs.
 - a. Without contacting (securing) the spine, hold the ankle of the uninvolved side, push the table into 2" of flexion (from the starting [taut] position), and hold for four

seconds. Repeat by moving down from L2-L5, one segment at a time.

- b. Repeat this process on the involved leg side.
- c. If there is no negative response, proceed to the next step.

3. Foot Cuffs Testing:

- a. Do not test or treat with foot cuffs on the first visit.
- b. If the patient tolerated the first treatment, test using the foot cuffs on the subsequent visit. Without contacting (securing) the spine, hold the ankle of the uninvolved side, push the table into two inches (2") of flexion from the starting (taut) position, and hold for four seconds. Repeat by moving down from L2-L5, one segment at a time.
- c. Repeat on the involved side.

You may find that a patient can tolerate one of these testing procedures but not the others. In that case you would treat using only the procedural step that the patient *can* tolerate.

STEP 3: Treatment

1. Select the spinal level for treatment based on your diagnosis of the location of the herniation. Contact the spinous process of the upper vertebra of the involved motor unit. If unsure of the involved disc, distract one level higher and work down rather than starting below the problem and working up.
2. If appropriate for the patient (as determined by Step 2 Tolerance Testing), apply the ankle cuffs, and configure the table into slightly increased axial distraction by separating the pelvic section from the lumbar section of the table (by crank or automatic).
3. Cautiously flex the table to get a sense of the starting point of joint distraction with the hand contacting the spine. This is the point when you first feel tension (tautness) across the spinal levels you

wish to distract (e.g., the inter-spinous space between L4-L5). At the same time gauge the amount of flexion (equal to or less than 2" or 15 degrees) by sensing where the distal end of the pelvic piece is relative to your thigh/leg.

4. Be sure that the table does not swing lower than 2" or about 15 degrees below that spot where you first feel the starting point (tautness) across the desired spinal joint.
5. As a general guideline, 2" of flexion or the patient's head starting to move into extension is an indicator that there is probably enough distraction being applied.
6. From the starting/taut point:
 - a. Slowly (4 seconds) pump the table into flexion. Repeat 5 times.
 - b. Maintain a constant comfortable P-A and I-S pressure on the spinous process during the distraction.
 - c. Let up the pressure slightly when the table is coming back up.
 - d. Apply three sets.
 - e. Between sets soft tissue goading (1-2 minutes) can be done (e.g., along the spine from T12-L5, the iliolumbar ligaments, gluteus medius and down the posterior/lateral thigh to the knee. The break between sets offers a chance to see if the patient will have a delayed reaction to the flexion distraction.

This protocol is continued over subsequent visits until the patient demonstrates at least 50% improvement and the centralization of radicular symptom is now cephalad to the knee. At this point other tractional loads are explored in the following order: lateral flexion, circumduction, rotation, and then extension.

NOTE: *If distraction worsens symptoms anytime during therapy, stop and re-evaluate.*

STEP 4: Terminating the treatment session

1. Return the table to the original starting position and lock it in place.
2. If a support belt was placed on the table, secure it to the patient in the backwards position, before they get off the table. When they are up, loosen the belt and turn it around so it is on correctly.
3. Get the patient off the table using the same precautions used when getting them on: instruct the patient to maintain a neutral pelvis, abdominal bracing, hip hinging and have the patient "helicopter" spin off the table onto the asymptomatic leg.

Based on the patient's reaction to the treatment, re-evaluate if distraction is appropriate at this stage of care. Remember you may need to start out doing less than the full protocol depending on the patient's reaction to Step 2 Tolerance Testing.

APPENDIX II: Neuromobilization

Patients with CLSS may benefit from procedures and home care exercises that create an alternating tensile load at each end of the nerve-cord complex. This “flossing” technique referred to as a “slider” may not be appropriate for patients with acute sciatica.

Rationale

Theoretically, these procedures produces a “gliding” motion or load on the nerve helping to release any impingements and reduce possible adhesions at the nerve root or along its course. This theory has never been validated. The rationale for applying this procedure is based on biomechanical plausibility, expert opinion (Butler 1999, McGill 2007, Murphy 2006) and inclusion as part of a management plan in a small pragmatic trial (Murphy 2006).

SLR Slider

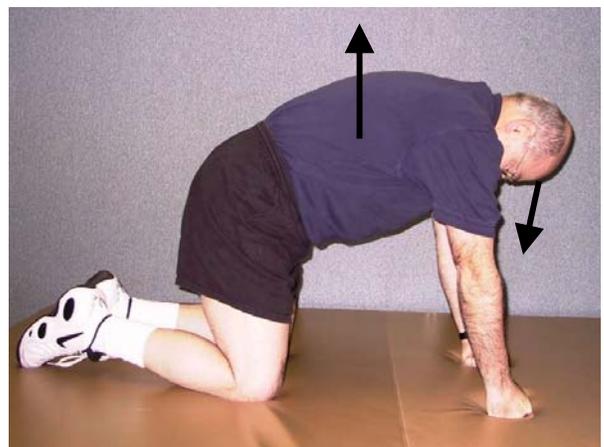
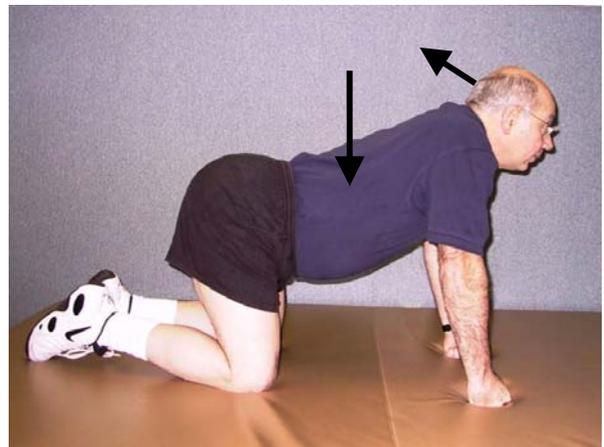
This is an in-office procedure. The leg is raised until the practitioner feels tissue resistance. It is then lowered a few degrees and the ankle is slowly dorsi- and plantar flexed for 10-25 repetitions.



SLR Slider

Cat Camel Flossing

This maneuver is thought to both mobilize lumbar joints and create alternating tension and relaxation tension the nerve roots. The patient gets on hands and knees in a quadruped position and simultaneously flexes the cervical and lumbar spine (posterior pelvic tilt) and then extends the cervical and the lumbar spine (anterior pelvic tilt). This can be done 10 to 15 repetitions 2-3 times a day.



Cat Camel

Seated Slider

The patient sits at end of a chair or bench and flexes his/her neck forward with the legs relaxed and the ankle plantar flexed (creating a cephalad load on the nervous system). The symptomatic leg is then extended straight out and the ankle dorsiflexed as the neck is extended backwards (creating a caudad load). This motion is repeated 10 times in a smooth coordinated fashion. (See photos to right.)

If the leg pain is mildly aggravated by the neck flexion or leg extension, the motion should be limited to just within a pain-free range.

McGill (2007) has the following recommendations:

- If any exercise has already been identified that centralizes the symptoms, it should be performed first.
- During the nerve mobilization, there are two options regarding how the patient's thoracolumbar spine is pre-positioned. The patient can hold the spine in a "safe" neutral pelvis pose or can adopt a position

that has been previously found to be beneficial. For example, the patient's patellar reflex can be tested with the patient sitting in extension, then in forward flexion. If one position improves the stretch reflex, the thoracolumbar spine can be held in that position during the neuro-mobilization exercise.

- The motion should be performed at a slow, coordinated pace (about 5 seconds for one cycle).
- The practitioner should first carefully monitor the patient in the office. The patient should monitor his/her response to the treatment throughout the following day. If there is no adverse reaction, the patient can perform 10 repetitions 3-4 times a day. If symptoms are exacerbated between sets, the exercise should be discontinued.
- Some patients may be made worse by this exercise so patient response needs to be cautiously monitored.

Those who respond with symptom improvement are reported to do so within a few days to 2 weeks.



Seated Slider

APPENDIX III: Fall Prevention Safety Tips

Indoor Safety Tips

- ✓ Keep floors free of clutter. Remove all loose wires and cords that are in a traffic area.
- ✓ Be sure all carpets, including those on stairs, and area rugs have skid-proof backing or are tacked to the floor. Do not use slippery wax on bare floors.
- ✓ Use non-skid mats or rugs on the floor near the stove and sink. Clean up spills immediately.
- ✓ Keep stairwells well lit with light switches both at the top and the bottom, and install sturdy handrails on *both* sides. Mark the top and bottom steps with bright or fluorescent tape.
- ✓ Install grab bars on the bathroom walls beside the tub, shower, and toilet. Use a non-skid rubber mat in the shower or tub. If you are unsteady on your feet, use a plastic chair with a back and non-skid legs in the shower or tub and use a hand-held shower head to bathe.
- ✓ Place light switches within reach of your bed and a night light between the bedroom and bathroom. Get up slowly from sitting or lying since a drop in blood pressure may cause dizziness at these times. Keep a flashlight with fresh batteries beside your bed.
- ✓ If you live alone, you should consider wearing a personal emergency response system (PERS). Also consider purchasing a portable telephone to take from room to room so you can call for help immediately if you fall.
- ✓ Place frequently used items within easy reach to avoid frequent bending or stooping. Minimize the use of step-stools. If a stool is necessary, use a sturdy one with a handrail and wide steps.
- ✓ Learn to rely on assistive devices to help you avoid strain or injury. For example, use a long-handled grasping device to pick up items without bending or reaching. Use a pushcart to transfer heavy or hot items from

the stove or counter top to the table.

- ✓ If you have had a fracture or some other problem that makes you unsteady on your feet, do not hesitate to use a cane or a walker.

Outdoor Safety Tips

- ✓ Cover porch steps with gritty, weatherproof paint.
- ✓ Use caution when walking on floors that are slippery or have visually confusing floor patterns. You may find these in the lobby of a hotel or bank, a hospital, or the grocery store. Do not hesitate to ask for assistance or use a cane or a walker on unfamiliar or uneven ground.
- ✓ Slow down. Accidents are more likely to happen when you do things in haste.
- ✓ Remember that more fractures occur when it is wet or icy, so be extra careful in those conditions. During the winter, carry a small bag of sand in your car. If the ground is icy where you park, sprinkle the sand by your car door.

Preventing Trauma While in Transit

- ✓ Remain alert and brace yourself when riding a bus that is slowing down or turning.
- ✓ Watch for slippery pavement and other hazards when entering or leaving a vehicle.
- ✓ Have fare ready to prevent losing balance while looking for change.
- ✓ Do not carry too many packages. You should always have one hand free to grasp railings.
- ✓ Allow extra time to cross the street, especially in bad weather.
- ✓ At night, wear light-colored or fluorescent clothing and carry a flashlight.
- ✓ Reduce the time spent driving your own car if possible; try to avoid driving at night, during rush hour, or in bad weather.