

Spinal Stenosis

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SPINAL STENOSIS – anatomical narrowing of *spinal canal*, *root canals*, or *intervertebral foramina* with subsequent *neural and vascular compression*.

- PREVALENCE ≈ 0.5%.
- usually in *cervical* and *lumbar* spine; seldom in *thoracic* spine.

ETIOLOGY

1. **PRIMARY (CONGENITAL) stenosis** – relatively uncommon:
 - a) part of **skeletal dysplasias** (e.g. achondroplasia).
 - b) **isolated** - most common in lower lumbar spine: short pedicles, narrow interpediculate distance, coronal orientation of articular facets, interlaminar angle < 90°, shortening or thickening of lamina.
2. **ACQUIRED stenosis**:
 - 1) **degenerative spondylosis** (bulging disks with posterior osteophytes, facet hypertrophy, synovial cysts, ligamentum flavum infolding & hypertrophy, degenerative spondylolisthesis & scoliosis). see p. Spin13 >>
 - 2) **ossification of posterior longitudinal ligament** see p. Spin13 >>
 - 3) **trauma**
 - 4) **surgery** (laminectomy, fusion) complications
 - 5) **metabolic / endocrine disorders** (epidural lipomatosis, osteoporosis, acromegaly, renal osteodystrophy, hypoparathyroidism)
 - according to studies, 10-35% of lumbar stenosis patients have amyloid disease involving transthyretin (consider biopsy?)
 - 6) **Paget's disease**, diffuse idiopathic skeletal hyperostosis
 - 7) **ankylosing spondylitis**, RA

PATHOPHYSIOLOGY

- monosegmental or multisegmental.
- unilateral or bilateral.

CENTRAL CANAL STENOSIS can cause:

- a) **myelopathy** (cervical, thoracic)
- b) **cauda equina syndrome** (lumbar).

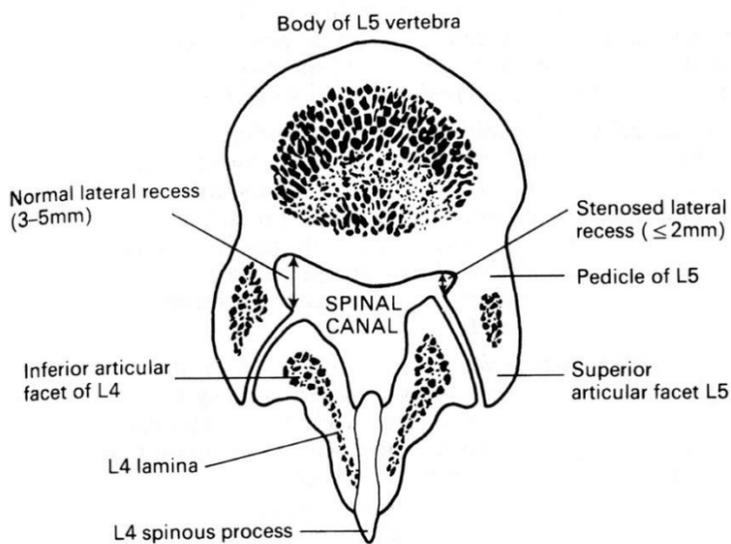
LATERAL RECESS STENOSIS can cause

radiculopathy.

NEUROFORAMINAL STENOSIS can cause

radiculopathy.

see p. PN1 >>, p. Spin13 >>



These frequently coexist - failure to recognize and correct one component at decompressive surgery is common cause for “failed back surgery syndrome”!

Disc degeneration → arthrosis of the uncovertebral joints, disc protrusion (**central stenosis**), ↓height of intervertebral space →:

- ↓intervertebral foramina (**foraminal stenosis**) → strain on facet joints → facet joint arthrosis, expanding joint cysts (**lateral stenosis**)
- ligamenta flava redundancy forms creases (**central stenosis**) - characteristic TREFOIL-SHAPED NARROWING of central canal.

- spondylosis leads to circumferential narrowing of the spinal canal and **static** compression of the spinal cord.
- movement of the cervical spine places the spinal cord at risk of injury secondary to **dynamic** forces, such as buckling of the ligamentum flavum in extension and impingement from a disc-osteophyte in flexion.
- *congenitally narrowed spinal canal* predisposes the degenerating spine to spondylotic myelopathy.

CLINICAL FEATURES

CERVICAL RADICULOPATHY

– see p. PN1 >>

CERVICAL SPONDYLOTIC MYELOPATHY

Slowly progressive **spastic gait disorder** + hand **numbness and loss of fine motor control** in **patient > 50 yrs** = CERVICAL SPONDYLOTIC MYELOPATHY until proven otherwise.

- hallmark symptoms are UMN signs in **legs** - **gait abnormalities** (stiff, spastic) and (**proximal***) **weakness / stiffness / proprioceptive loss**.
 - *distal strength is reduced less frequently
 - usually develop insidiously as subtle changes in gait or balance.
 - symptoms are commonly asymmetric.
 - loss of vibratory sense or proprioception can occur in the feet.

- **neck stiffness / pain** because of the advanced spondylosis.
 - **Lhermitte's sign** may be present.
- stabbing **pain** in the preaxial or postaxial border of the **arms**, **loss of manual dexterity** (difficulty writing, difficulty with buttons or zippers) and **abnormal sensations** ("numb, clumsy hands").
 - **arm weakness** typically begins in triceps and/or hand intrinsic muscles (*wasting of the intrinsic hand musculature* is a classical finding in CSM).
 - have patient make a fist and release it 20 times in 10 seconds - impairment or clumsiness.
 - **finger escape sign** - patient holds his/her fingers extended and adducted; ulnar digits drift into abduction and flexion within 30 to 60 seconds.
 - sensory abnormalities start in the fingertips, are confined to the hand, and occur in a nonradicular distribution.
- positive **jaw jerk** may help distinguish upper cervical cord compression from lesions above the foramen magnum.
- loss of **sphincter control** and urinary incontinence are rare.
- patients may also present acutely with a **central cord syndrome** (after blow to the forehead → acute hyperextension injury with preexisting acquired stenosis or myelopathy, resulting in acute spinal cord compression): greater upper extremity weakness than lower extremity weakness.

QUANTIFICATION

1. **Hand dynamometry**
2. **Nine hole peg test**
3. **30-meter walk test** - measuring **time** and **number of steps** taken over 30 meters (objective, reproducible e.g. preop and postop)
4. **NURICK disability score**

Grade	Signs and symptoms
0	Signs or symptoms of root involvement but no evidence of spinal cord disease
1	Signs of spinal cord disease but no difficulty walking
2	Slight difficulty in walking that prevented full-time employment
3	Difficult in walking that prevented full-time employment or the ability to do all housework, but that was not so severe as to require someone else's help to walk
4	Able to walk only with someone else's help or with the aide of a frame
5	Chair-bound or bedridden

^a From, Nurick S: The natural history and the results of surgical treatment of the spinal cord disorder associated with cervical spondylosis. *Brain* 95:101-108, 1972 (48).

5. **Modified JAPANESE ORTHOPAEDIC ASSOCIATION functional score (mJOA)**

I. Motor dysfunction score of the upper extremities	Score
<i>Inability to move hands</i>	0
<i>Inability to eat with a spoon but able to move hands</i>	1
<i>Inability to button shirt but able to eat with a spoon</i>	2
<i>Able to button shirt with great difficulty</i>	3
<i>Able to button shirt with slight difficulty</i>	4
<i>No dysfunction</i>	5
II. Motor dysfunction score of the lower extremities	
<i>Complete loss of motor and sensory function</i>	0
<i>Sensory preservation without ability to move legs</i>	1
<i>Able to move legs but unable to walk</i>	2
<i>Able to walk on flat floor with a walking aid (i.e., cane or crutch)</i>	3
<i>Able to walk up and/or down stairs with hand rail</i>	4
<i>Moderate to significant lack of stability but able to walk up and/or down stairs without hand rail</i>	5
<i>Mild lack of stability but walk unaided with smooth reciprocation</i>	6
<i>No dysfunction</i>	7
III. Sensation	
<i>Complete loss of hand sensation</i>	0
<i>Severe sensory loss or pain</i>	1
<i>Mild sensory loss</i>	2
<i>No sensory loss</i>	3
IV. Sphincter dysfunction score	
<i>Inability to micturate voluntarily</i>	0
<i>Marked difficulty with micturition</i>	1
<i>Mild to moderate difficulty with micturition</i>	2
<i>Normal micturition</i>	3

^a From, Benzel EC, Lancon J, Kesterson L, Hadden T: Cervical laminectomy and dentate ligament section for cervical spondylotic myelopathy. *J Spinal Disord* 4:286-295, 1991 (8).

- ≥ 15 – **mild**
- 12-14 – **moderate**
- < 12 – **severe**

Category	Score	Description
Upper Extremity Motor Subscore (/5)	0	Unable to move hands
	1	Unable to eat with a spoon but able to move hands
	2	Unable to button a shirt but able to eat with a spoon
	3	Able to button a shirt with great difficulty
	4	Able to button a shirt with mild difficult OR other mild fine motor dysfunction (marked handwriting change, frequent dropping of objects, difficult clasping jewelry, etc.)
	5	Normal hand coordination
Lower Extremity Subscore (/7)	0	Complete loss of movement and sensation
	1	Complete loss of movement, some sensation present
	2	Inability to walk but some movement
	3	Able to walk on flat ground with walking aid
	4	Able to walk without walking aid, but must hold a handrail on stairs
	5	Moderate to severe walking imbalance but able to perform stairs without handrail
	6	Mild imbalance when standing OR walking
7	Normal walking	
Upper Extremity Sensory Subscore (/3)	0	Complete loss of hand sensation
	1	Severe loss of hand sensation OR pain
	2	Mild loss of hand sensation
	3	Normal hand sensation
Urinary Function Subscore (/3)	0	Inability to urinate voluntarily (requiring catheterization)
	1	Frequent urinary incontinence (more than once per month)
	2	Urinary urgency OR occasional stress incontinence (less than once per month)
	3	Normal urinary function

6. Neck Disability Index (NDI)

7. Berg Balance Scale (BBS)

8. Quality of life (nonspecific for CSM) - Medical Outcomes Study Short Form-36 (SF36v2)

Natural history is unclear

Natural course of CSM for any given individual is variable, and a precise prognostication is not possible! Current view is that myelopathy tends to progress

- some experts see it as a steadily progressive disease, others think it is episodic disease with periods of plateaus and worsenings.
- risk factors for progression: older age, motor deficits, long duration of deficits, more severe deficits.
- patients who present with cervical myelopathic findings: 75% demonstrate a slow progression of disease; in 1/3 of patients clinical course stabilizes.

Clarke E, Robinson PK: Cervical myelopathy: A complication of cervical spondylosis. Brain 79:483-510, 1956

LUMBAR STENOSIS

History

Classic presentation of *lumbar stenosis* is **NEUROGENIC CLAUDICATION** see p. Spin13 >>

- patients usually have 4-5-year history of back pain* (lumbago) that becomes progressively worse;
 - pain starts in lower back and eventually begins to radiate to buttock(s), leg(s) or groin(s) because of nerve root compression (**radicular pain** is most common symptom of spinal stenosis!)
 - spinal stenosis pain is worse with **walking** and **backward extension*** and relieved by **flexing forward** (vs. mechanical back pain or disk herniation) and **recumbency**!
 - ***walking uphill** is usually worse because of associated hyperextension that narrows spinal canal.
 - pain exacerbated further by **vertical load** (epidural pressure is elevated while standing or walking, and lowered when **sitting** and in **flexion**).
 - pain is frequently accompanied by leg **hypesthesia** / **paresthesia** and characteristic **feeling of "heavy legs"** (progressing into leg **paresis**).
 - symptoms are absent at rest.

Patients whose pain is not made worse with walking have a low likelihood of stenosis

- **congenital stenosis** is usually asymptomatic; manifests earlier in course of acquired stenosis.
- spinal stenosis predisposes to neurologic dysfunction with superimposed minor disk disease!
- 20% patients exhibit symptoms of **depression** and 25% are dissatisfied with their life before surgery!

Objective examination

- physical findings (specific motor weakness, "stretch signs" by straight leg raising, abnormal Romberg test, abnormal Achilles tendon reflexes) are often absent!

Physical findings cannot confirm diagnosis of degenerative lumbar spinal stenosis

Natural History

- in **mild / moderately** symptomatic degenerative lumbar stenosis, **rapid or catastrophic neurologic decline is rare**
- natural history of clinically or radiographically **severe** degenerative lumbar stenosis is less clear (o patients agree to stay untreated).

DIAGNOSIS

Imaging is absolutely necessary to establish diagnosis! (no objective physical examination findings can confirm diagnosis)

N.B. **radiological** degree of stenosis does not necessarily correlate with **clinical** degree!

Normal spinal canal:

- widest and almost circular at C₁;
- narrows in mid cervical levels and slightly widens in lower, becoming more triangular in shape;
- in thoracic region canal is almost circular and becomes wider and more triangular, especially in lower lumbar spine.

Great individual and regional variation is rule - precise measurements are generally impracticable!

- **soft tissues contribution** (in addition to bone) is especially important in acquired stenosis:

theal sac cross-sectional area $< 1 \text{ cm}^2$ ($< 100 \text{ mm}^2$) represents stenosis.

CERVICAL STENOSIS

Dimensions suggesting stenosis:

sagittal dimension:
 $< 13 \text{ mm}$ – *relative* stenosis
 $< 10 \text{ mm}$ – *absolute* stenosis (absence of free CSF space)
transverse interfacet dimension $< 10 \text{ mm}$;
lateral recess AP dimension $\leq 2 \text{ mm}$ (norma 3-5 mm)

LATERAL RECESS is bounded: anteriorly by **vertebral body & disc**, laterally by **pedicles**, and posteriorly by **superior articular process** of adjacent facet joint.

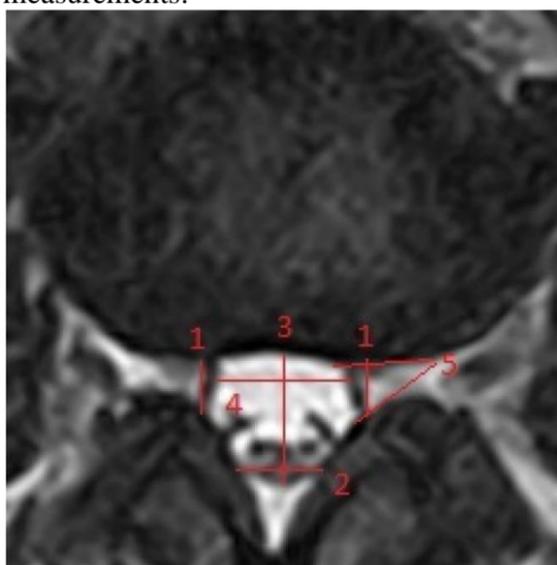
Cervical canal stenosis (best classified on T2-weighted sagittal images):

- grade 0** - absence of canal stenosis;
- grade 1** - subarachnoid space obliteration exceeding 50%;
- grade 2** - spinal cord deformity
- grade 3** - spinal cord signal change

Some radiologist do not use numbers to diagnose stenosis as many measurements are relative; regardless, it is known that cervical cord AP diameter is 10 mm, add 1 mm of dura on each side and 1 mm of CSF – anything $\leq 13 \text{ mm}$ is **stenosis** (present in 29% of population and most are asymptomatic; if canal is $\leq 7 \text{ mm}$, 50% chances the patient will have myelopathy in a lifetime)

LUMBAR STENOSIS

Most commonly used measurements:



1. Depth of the lateral recess; 2. Ligamentous interfacet distance; 3. AP diameter of dural sac; 4. Transverse diameter of dural sac; 5. Angle of the lateral recess.

STUDIES

- **currently** CT / MRI are performed in **supine position** (diminished gravity effect on alignment and stenosis); **future** imaging systems that scan patients in **upright weight-bearing position** would reveal more profound stenotic changes (criteria for stenosis may need to be refined).

Plain radiograph - for excluding other causes (fracture, spondylolysis, neoplasm).

- **flexion-extension views** - to show spinal instability.

MRI - imaging study of choice.

Open MRI, conventional functional myelography - functional investigation of spinal flexion and extension during application of axial loading.

- **MRI or CT with axial loading** is suggested as a useful adjunct to routine imaging in patients who have clinical lumbar spinal stenosis and suspected but not verified central or lateral stenosis on routine unloaded MRI or CT.

CT myelogram – better (than MRI) delineates bony anatomy (esp. lateral recess stenosis) and specific nerve root's involvement; imaging study of choice when MRI is contraindicated.

- *theal sac often has characteristic "trefoil" shape* (in axial plane) - anterior indentation by bulging disc and posterolateral indentations by degenerated facet joints and/or hypertrophied ligamenta flava.
- in symptomatic stenosis, contrast medium is usually excluded from involved level.
- redundant **tortuosity of roots*** (above or below stenosis – “spaghetti” sign) is consequence of focal entrapment and stretching of these roots, which have long intradural course.
 *may be confused with large intradural veins

EMG detects neuromuscular diseases that may mimic stenosis.

Retrodental **epidural pannus** (T2-MRI):

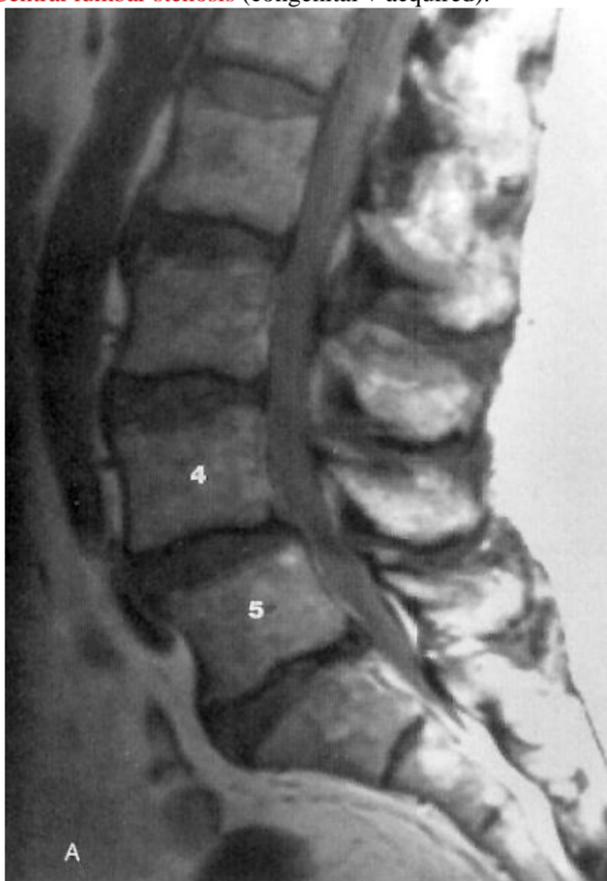


Source of pictures: Viktoras Palys, MD >>

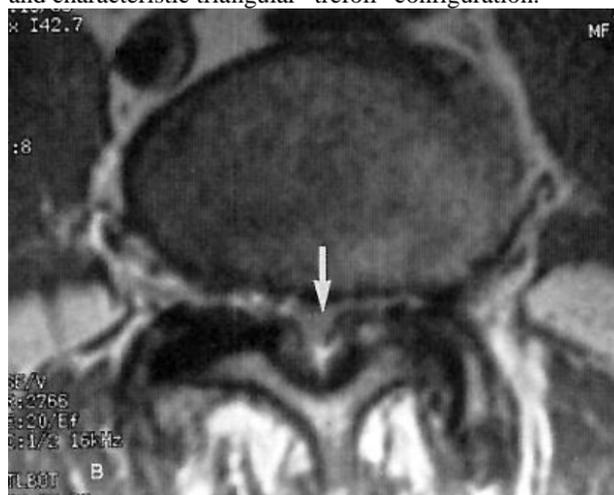
T2-MRI: normal (left) vs. stenotic (right) lumbar spine:



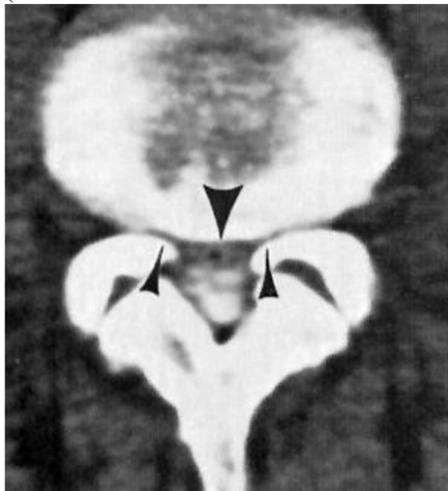
Central lumbar stenosis (congenital + acquired):



A) generalized narrowing of sagittal canal diameter (< 10 mm) caudal to L2-3 disc; more severe stenosis at L4-5 (associated with degenerative disc changes, including grade 1 spondylolisthesis).
 B) compression of thecal sac ventrally by bulging disc and posterolaterally by degenerated hypertrophied facet joints and ligamentum flavum; thecal sac (arrow) area < 1 cm² and characteristic triangular "trefoil" configuration.



Lumbar lateral recess stenosis (CT myelogram): pronounced narrowing of space between vertebral body and facet joints (lateral recess) caused by degenerative hypertrophic changes at disc space (large arrow) and facet joints (small arrows); central canal is narrowed sagittally & transversely (some contrast is still visible within thecal sac):

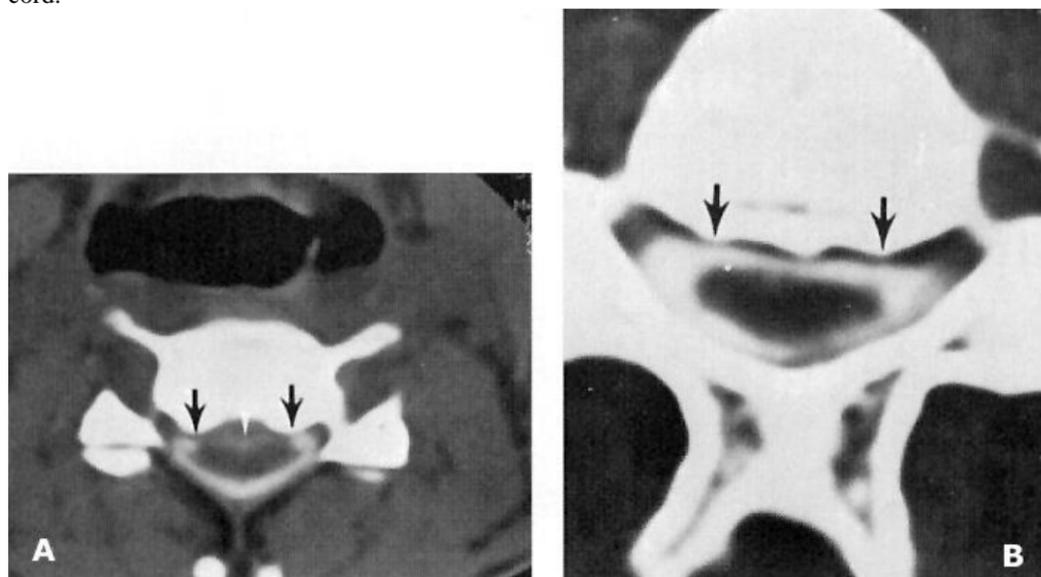


Congenital + superimposed acquired cervical central stenosis in 44-year-old woman with achondroplasia (T2-MRI); note punctate foci of increased signal within cord below narrowed foramen magnum and at level of C5 (arrows):

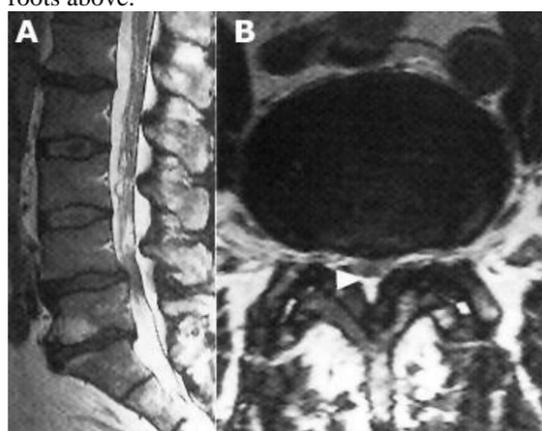


Cervical degenerative changes (CT myelography):

A) hypertrophic uncinate processes (*black arrows*) project into lateral spinal canal and entrance zone of neural foramina; midline disc herniation (*white arrow*); effacement of ventral CSF.
 B) posterior osteophytic ridge at C5-6 compromises sagittal diameter of canal, flattening ventral aspect of cervical spinal cord.

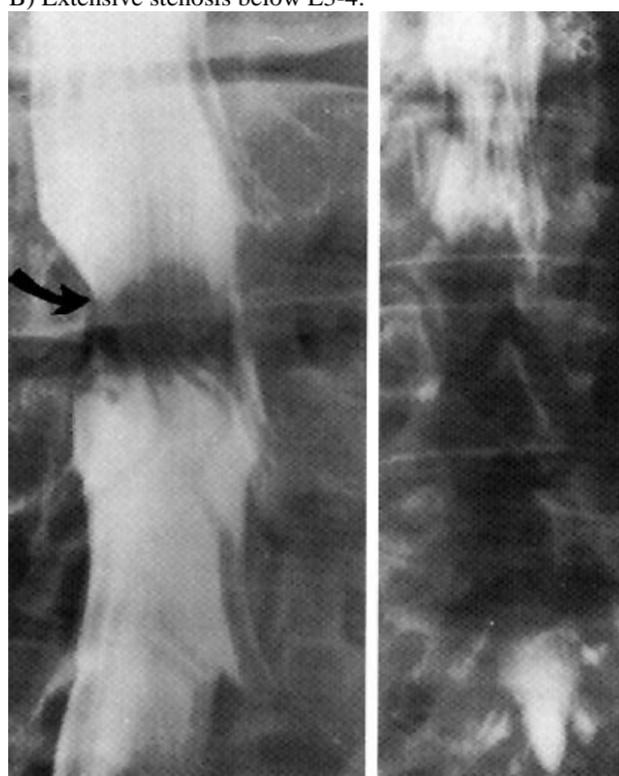


Degenerative **lumbar stenosis** (T2-MRI): severe stenosis at L4-5 with entrapment of cauda equina (obliteration of CSF signal from thecal sac at site of compression - *arrowhead*) and redundant coiling of intrathecal spinal roots above:



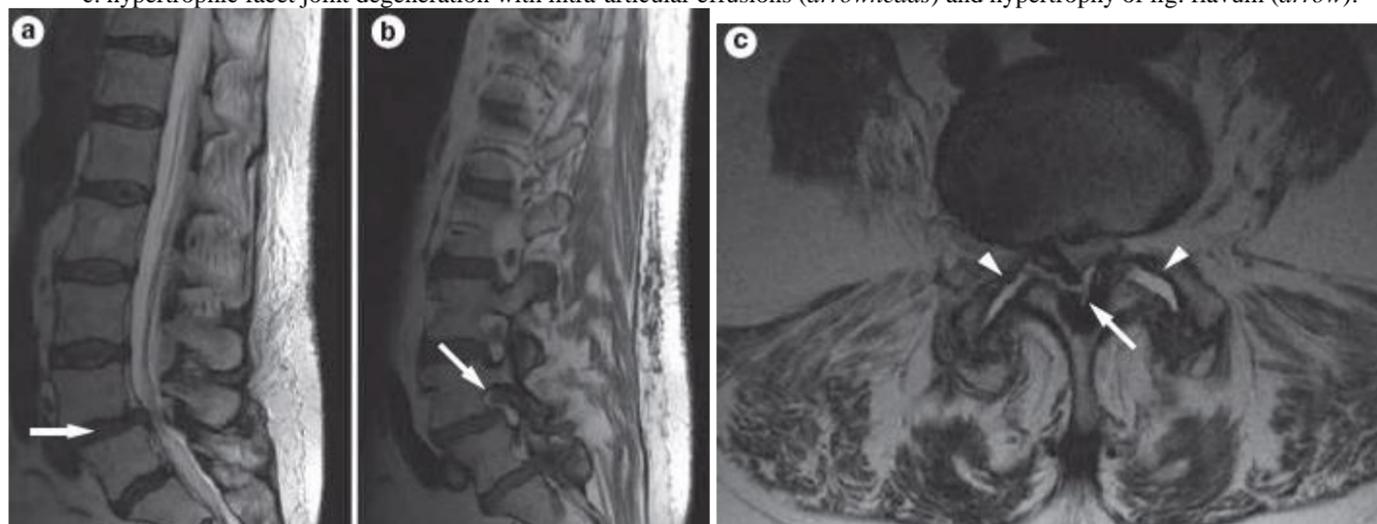
Lumbar stenosis (myelography) - two patients (note tortuosity of trapped roots):

A) Focal (*arrow*) posterolateral impression due to hypertrophic posterior joint.
 B) Extensive stenosis below L3-4.



Monosegmental lumbar stenosis at L4-5 (T2-MRI):

- reductions in disc signal and disc space height; disc bulging and slight ventral listhesis of L4 (*arrow*)
- narrowing of neuroforamen (*arrow*), which affects right L4 radix.
- hypertrophic facet joint degeneration with intra-articular effusions (*arrowheads*) and hypertrophy of lig. flavum (*arrow*):



Source of picture: Medscape Neurology from WebMD >>

MEDICAL THERAPY

CERVICAL STENOSIS

- after a cervical spondylosis patient became **symptomatic** (myelopathy), they **did not return to baseline***

Clarke E, Robinson PK: *Cervical myelopathy: A complication of cervical spondylosis. Brain* 79:483-510, 1956

*successful surgery may reverse some symptoms (esp. mild ones)

- anti-inflammatory drugs** – concern for side effects with chronic use
- analgesics** – Tylenol is agent of choice; opioids have no end organ toxicity, no dose ceiling effect.
- muscle relaxants** – only for acute episodes.
- antidepressants**
- anticonvulsants** (gabapentin, etc)
- steroids** – **systemic** (1-2 week courses) or **ESI** (axial neck pain is a poor indication for ESI)
- facet joint RF ablation** – for chronic axial neck pain.
- physical therapy** (adequate pain reduction is needed prior to PT to facilitate its utilization)
- cervical immobilization** with an external cervical orthosis have been recommended for symptomatic relief in myelopathy (esp. combined with isometric exercises), but no effect on long-term outcomes, including neurological progression, has been demonstrated.

N.B. **cervical collars may not prevent deterioration** in cervical spondylotic myelopathy (esp. if > 2 yrs duration).

Wilkinson M: *The clinical aspects of myelopathy due to cervical spondylosis. Acta Neurol Belg* 76:276-278, 1976

- manipulation and traction** show some efficacy for axial neck pain and radiculopathies; **contraindicated for myelopathy** because of the potential for aggravation of neurological injury!

LUMBAR STENOSIS

- for **mild to moderate** symptoms; also 3-6 months trial for **severe** symptoms (if no good response → surgery):

- Physical therapy**, exercise to reduce lumbar lordosis (delordosing physiotherapy).
- Anti-inflammatory drugs**
- Epidural steroid injections** with contrast-enhanced **fluoroscopy guidance**.
 - steroids are used in combination with local anesthetics in epidural, deep paravertebral, paravertebral and facet joint injections.
 - epidural injections have become prerequisite for many spinal surgery insurance authorizations.

- **LESS (Lumbar Epidural Steroid Injections for Spinal Stenosis) trial**- epidural steroids should be used sparingly or not at all as steroids give very little on top of local anesthetics and results are temporary.
- 4. Addition of **GABAPENTIN** to a PT can result in greater short-term improvement.
- 5. **PGE₁** IV shows promise in treating neurogenic intermittent claudication.

NASS Clinical Guidelines for Lumbar Stenosis (2011):

There is insufficient evidence to make a recommendation for or against the use of **pharmacological treatment**.

Medical/interventional treatment may be considered to provide **long-term (2-10 years) improvement** and has been shown to improve outcomes in a large percentage of patients*.

There is insufficient evidence to make a recommendation for or against the use of **physical therapy or exercise** as stand-alone treatments. But a limited course of active PT is an option.

Epidural steroid injections: **INTERLAMINAR** injections are suggested to provide **short-term (2 weeks to 6 months) symptom relief**. Multiple **TRANSFORAMINAL** injections or **CAUDAL** injections are suggested to produce **medium-term (3-36 months) relief of pain**. There is, however, conflicting evidence concerning long-term (21.5-24 months) efficacy.

Lumbosacral corset is suggested to **increase walking distance and decrease pain**; no evidence that results are sustained once the brace is removed (grade B recommendation).

*20-40% of patients with mild / moderate lumbar stenosis receiving medical/interventional treatment will require surgical intervention within 10 years; of the patients who do not require surgical intervention, 50-70% will have improvement in their pain.

SURGICAL THERAPY, OUTCOMES

INDICATIONS

1. **Myelopathy**, esp. with demonstrated progression and age > 60 yrs (Nurick's criteria), mJOA ≤ 14 points
 - treatment of **mJOA ≥ 15** patients remains controversial; experts lean towards surgery for patients with predominance of **neck pain, motor symptoms** (gait dysfunction and hand weakness), and female gender – surgical intervention results in greater gains.
2. **Cauda equina syndrome** → **urgent surgery**
3. **Severe radiculopathy**:
 - 1) significant muscle weakness.
 - 2) pain affecting patient's quality of life.
4. Prevention of SCI in **cervical stenosis**
 - asymptomatic and mildly symptomatic cervical stenosis patients are commonly recommended to undergo surgery due to risk of SCI after a minor trauma.
Chang, Victor "The Risk of Acute Spinal Cord Injury After Minor Trauma in Patients With Preexisting Cervical Stenosis" Neurosurgery: October 2015 - Volume 77 - Issue 4 - p 561-565
10 patients (18%) experienced a traumatic event during the follow-up, with none sustaining an SCI - it seems that occurrence of SCI in this patient population after minor trauma is likely smaller than many physicians surmise

Extent of radiological findings is generally of little help for identification of surgery indication!

CERVICAL STENOSIS

Indications – see above >>

Decompression through:

- A) **posterior approach** - **laminectomy (CLAM)** – for ¹multilevel compression, ²hypertrophied ligamentum flavum.
N.B. wide decompression (pancervical laminectomy) with removal of much of facet joints may result in **swan-neck deformity** (esp. if patient already has loss of lordosis preoperatively) - spinal cord becomes draped over the dorsal aspect of ventral compressing structures with worsening static cord compression; to avoid this, use **PCF** or alternative techniques:
 - a) **expansive laminoplasty**.
 - b) **suspension laminotomy** - laminae are divided and separated from lateral elements by fragments of bone held in place by sutures.
- B) **anterior approach** - **ACDF** – for anterior compression at few* disc levels.
 - *some authors report that disease involving > 2 vertebral body levels may be better addressed by a dorsal approach
 - if stenosis is also behind vertebral bodies (incl. OPLL*) – need **corpectomy** (or at least ACDF with **Cloward technique**).
*OPLL tends to progress after surgery, so need to decompress also levels above and below stenosis

Moderate and Severe Degenerative Cervical Myelopathy

Rafael De la Garza Ramos et al. Predictors of Return to Normal Neurological Function After Surgery for Moderate and Severe Degenerative Cervical Myelopathy: An Analysis of A Global AOSpine Cohort of Patients. Neurosurgery 85:E917-E923, 2019

- although the main goal of surgery is symptom stabilization, a subset of patients achieves remarkable improvements.
- 20.3% (51 out of 251) with moderate or severe baseline myelopathy achieved an mJOA score of 18 (no signs of myelopathy) at 2 yr.
- **T1W-hypointensity** on MRI and **longer walking time** (on 30-m walking test) predict a less likelihood of achieving return to normal neurological function after surgery for moderate or severe DCM.
- 9.7% deteriorated within 2 yr after surgery!
 - on univariate analysis, **male gender** (P = .01) was associated with higher odds of deterioration, whereas **severe baseline myelopathy** was associated with lower odds of deterioration (P = .05); on multivariate analysis, male gender was found to significantly increase the odds of deterioration at 2 yr of follow-up (OR 3.23; 95% CI, 1.29-8.07; P = .01). Crude deterioration rates between males and females were 13.5 vs 4.4% (P = .01).

LUMBAR STENOSIS

Indications – see above >>

LAMINECTOMY ± FORAMINOTOMY at involved levels.

- for lateral recess decompression – **facetectomy** (removal of medial part of hypertrophic facet joint).
N.B. wide decompression with removal of much (> 50%) of facet joints may result in **spondylolisthesis**.
- patients should be aware that benefits of surgery decrease with time but still remain significant till 4 (and possibly 10) years later. However, obtaining improvement for such a period is worthwhile even if it were to fade thereafter.
- **"failed back syndrome"** (scar, residual stenosis); H: reoperation or spinal cord stimulator.
- **dynamic stabilizing device** (Coflex) is an adjunct to flavectomy; offloads facet joints and affords spine stabilization without traditional instrumentation; flattens lordosis → worsened sagittal balance.

Spine Patient Outcomes Research Trial (SPORT)

- surgical versus nonoperative treatment for lumbar spinal stenosis; class II evidence.
- exclusions: spondylolisthesis, instability (defined on lateral X-ray).
- surgical patients maintain substantially greater **improvement in pain and function** through 4 years!!!

Weinstein JN et al. for the SPORT Investigators. Surgical versus nonsurgical therapy for lumbar spinal stenosis. *N Engl J Med* 2008; 358 : 794 – 810

NASS Clinical Guidelines for Lumbar Stenosis (2011):

Decompressive surgery is suggested to improve outcomes* in moderate to severe lumbar stenosis (grade B recommendation), incl > 75 yo.

Decompression alone** is suggested for **leg predominant symptoms without instability***** (grade B recommendation).

There is insufficient evidence for or against an **interspinous process spacing device** in lumbar stenosis.

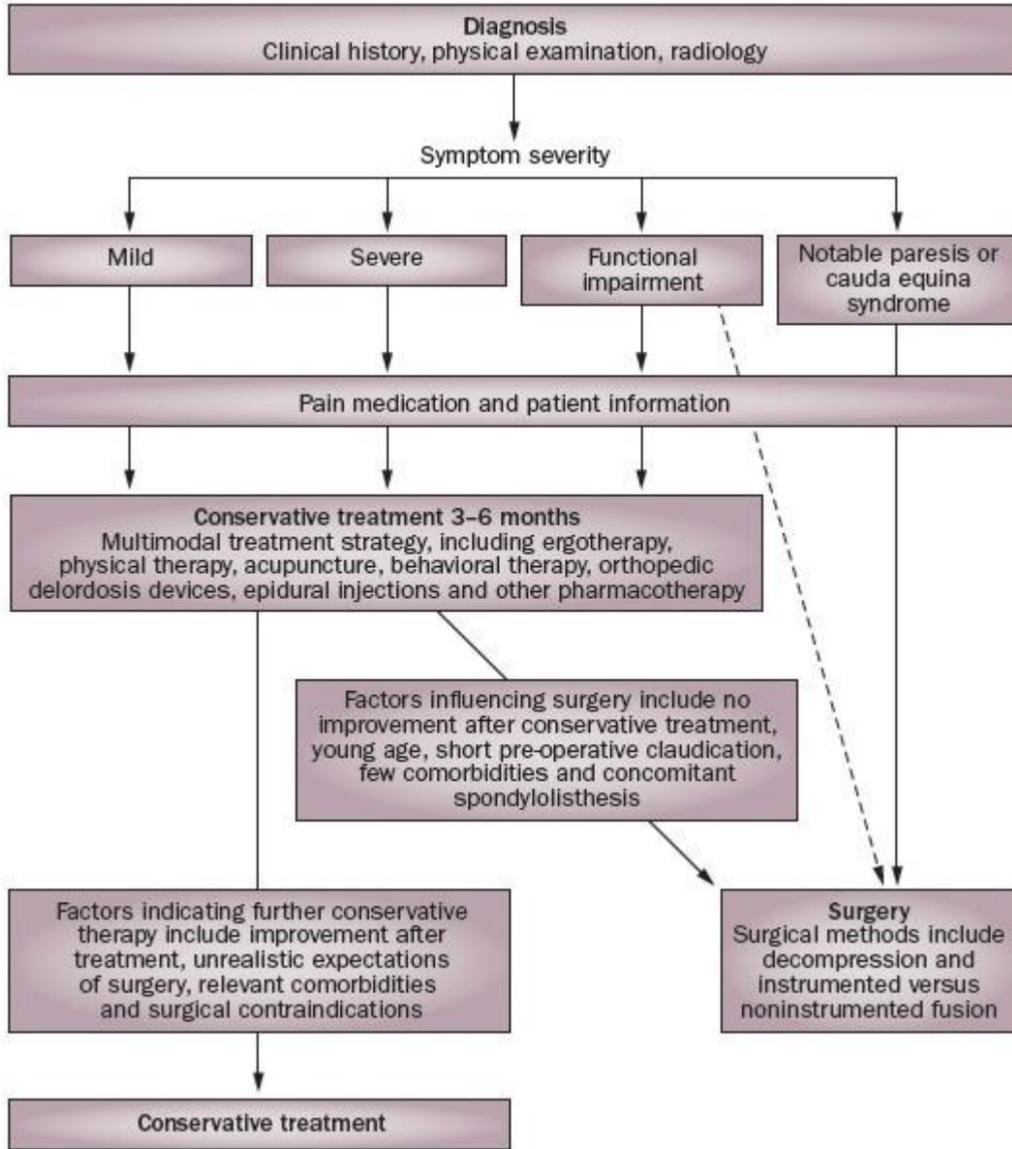
*good or excellent results in 80% of patients at 4-year and 70% at 10 years follow-up.

**i.e. without fusion

***i.e. < 5 mm intervertebral translation

N.B. patients who have medical/interventional therapy first but then cross over to surgery will not harm their chances of success with surgery.

Treatment algorithm for symptomatic lumbar spinal stenosis:



BIBLIOGRAPHY for ch. “Spinal Disorders” → follow this [LINK >>](#)