

Spinal Stenosis

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SPINAL STENOSIS - narrowing of *spinal canal*, *root canals*, or *intervertebral foramina*.

- 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) **spondylosis** (bulging disks, 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)
 - 6) **Paget's disease**, diffuse idiopathic skeletal hyperostosis
 - 7) **ankylosing spondylitis**, RA

CLINICAL FEATURES

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

CENTRAL CANAL STENOSIS can cause:

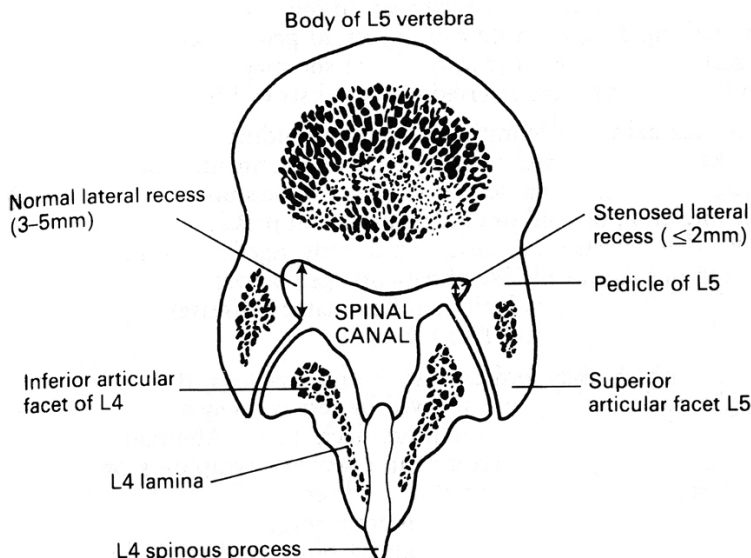
- a) **myelopathy** (cervical)
- b) **cauda equina syndrome** (lumbar).

LATERAL RECESS STENOSIS can cause

radiculopathy.

NEUROFORAMINAL STENOSIS can cause

radiculopathy.



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

- patients usually have 4-5-year history of back pain that becomes progressively worse
 - pain starts in lower back and eventually begins to radiate 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)
 - ***walking uphill** is usually worse because of associated hyperextension that narrows spinal canal.
- **congenital stenosis** is usually asymptomatic; manifests earlier in course of acquired stenosis.
- spinal stenosis predisposes to neurologic dysfunction with superimposed minor disk disease!
- physical findings (specific motor weakness, "stretch signs" by straight leg raising) are often absent!

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

DIAGNOSIS

Imaging is absolutely necessary to establish diagnosis!

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.

Dimensions suggesting stenosis:

sagittal dimension < 12 mm (< 13 mm in lumbar spine);
transverse interfacet dimension < 10 mm;
lateral recess AP dimension ≤ 3 mm.

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

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 cm² (< 100 mm²) represents stenosis.

- *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.

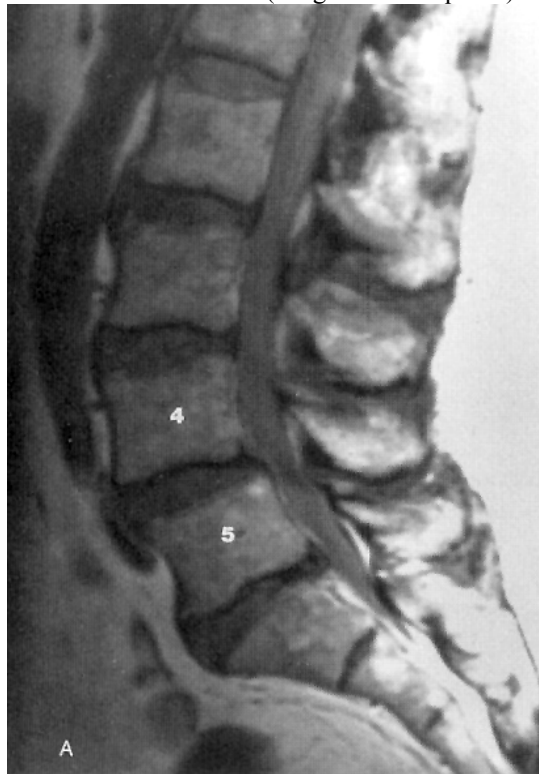
CT myelogram – better (than MRI) delineates bony anatomy (esp. lateral recess stenosis) and specific nerve root's involvement.

- *thecal 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) is consequence of focal entrapment and stretching of these roots, which have long intradural course.
*may be confused with large intradural veins

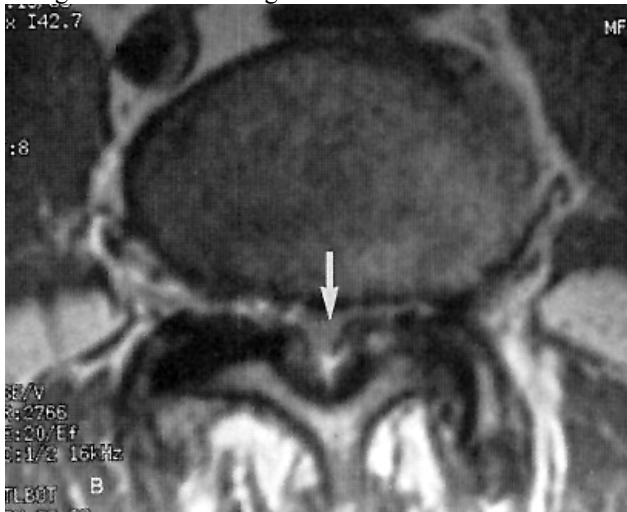
T2-MRI: normal (*left*) vs. stenotic (*right*) lumbar spine:



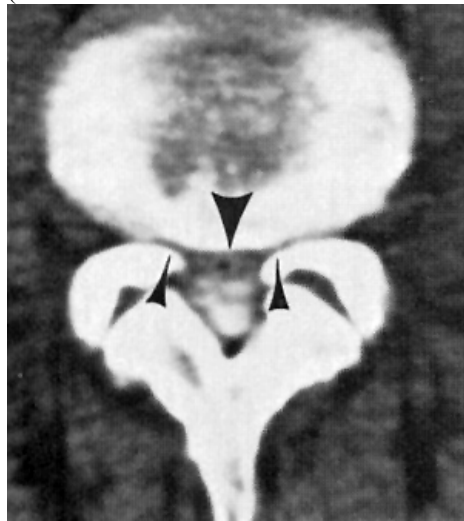
Central lumbar stenosis (congenital + acquired):



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):

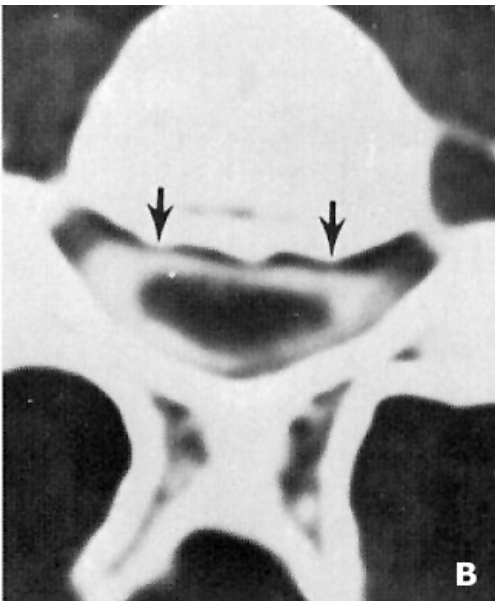
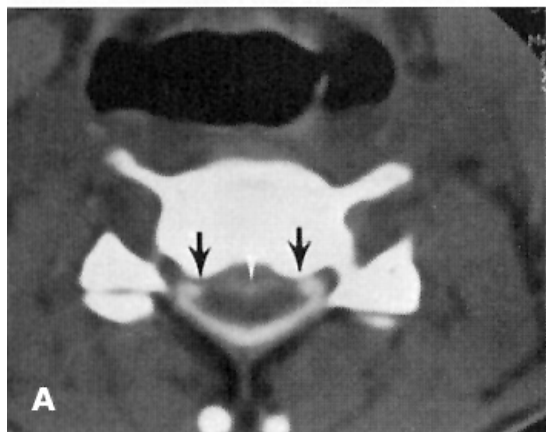


Congenital + superimposed acquired cervical central stenosis in 44-year-old woman with **achondroplasia** (T2-MRI); note punctate foci of increased signal within cord below narrowed foramen magnum and at level of C5 (*arrows*):

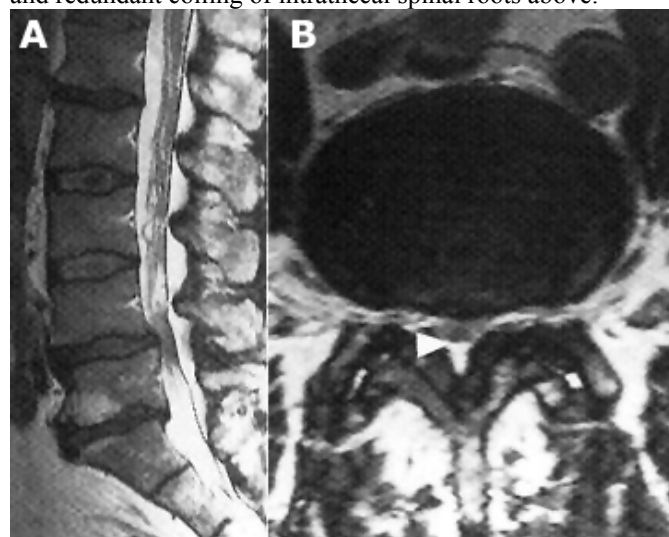


Cervical degenerative changes (CT myelography):

A) hypertrophic unciniate 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.



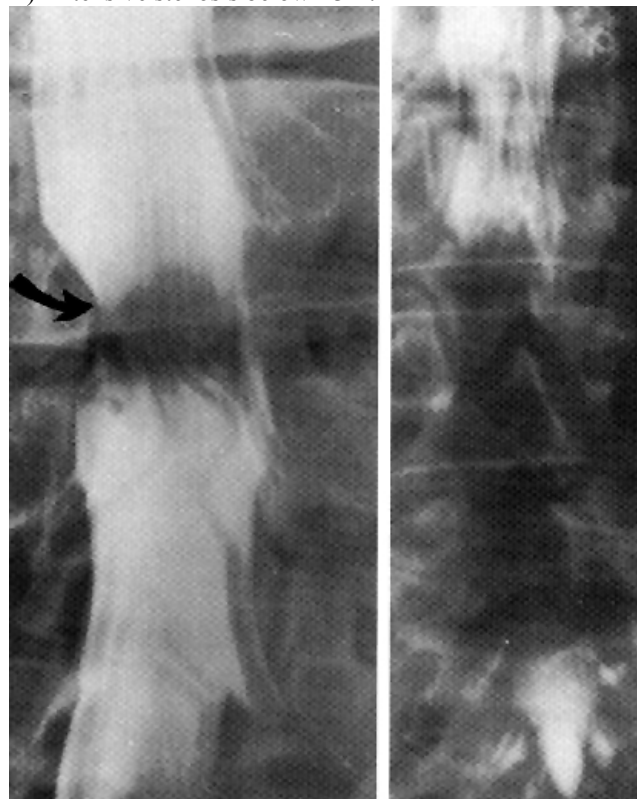
Degenerative **lumbar stenosis** (T2-MRI): severe stenosis at L4–5 with entrapment of cauda equina (obliteration of CSF signal from thecal sac at site of compression - *arrowhead*) and redundant coiling of intrathecal spinal roots above:



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.



MEDICAL THERAPY

1. Physical therapy, exercise to reduce lumbar lordosis
2. Anti-inflammatory drugs
3. Epidural steroid injections.
4. **PGE₁** IV shows promise in treating neurogenic intermittent claudication.

SURGICAL THERAPY

INDICATIONS

1. **Myelopathy** → **urgent surgery**
2. **Cauda equina syndrome** → **urgent surgery**
3. **Severe radiculopathy**:
 - 1) significant muscle weakness.
 - 2) pain affecting patient's quality of life.

Lumbar stenosis → **LAMINECTOMY & POSTERIOR FORAMINOTOMY** at involved levels.

- most difficult and time-consuming part - *developing plane between dura and ligamentum flavum* (frequently hypertrophic and closely adherent to underlying dura – risk of dural lesion with CSF escape).
- 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*; H: spinal fusion.
- "**failed back syndrome**" (scar, residual stenosis); H: reoperation.

Cervical stenosis - decompression through:

- A) **posterior approach** – 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*; H: use alternative techniques (instead of laminectomy):
 - a) *laminoplasty* - decompression of cord and unilateral roots with preservation of contralateral facet joints.
 - b) *suspension laminotomy* - laminae are divided and separated from lateral elements by fragments of bone held in place by sutures.
- B) **anterior approach** – for anterior compression at few levels.
 - often requires fusion. see p. Spin11 >>

Thoracic stenosis – as for **cervical**.

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