



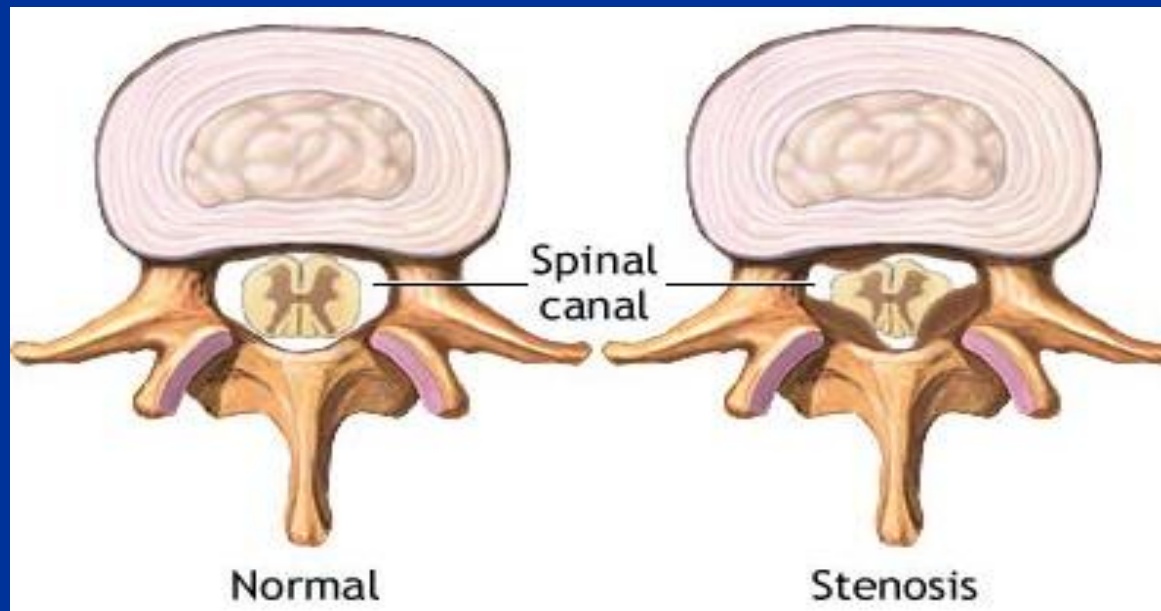
Lumbar canal stenosis

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Stenosis – “being narrow”

A radicular syndrome from developmental narrowing of the lumbar vertebral canal.

- Verbiest H. JBJS (Br) 1954; 36-B: 230-237



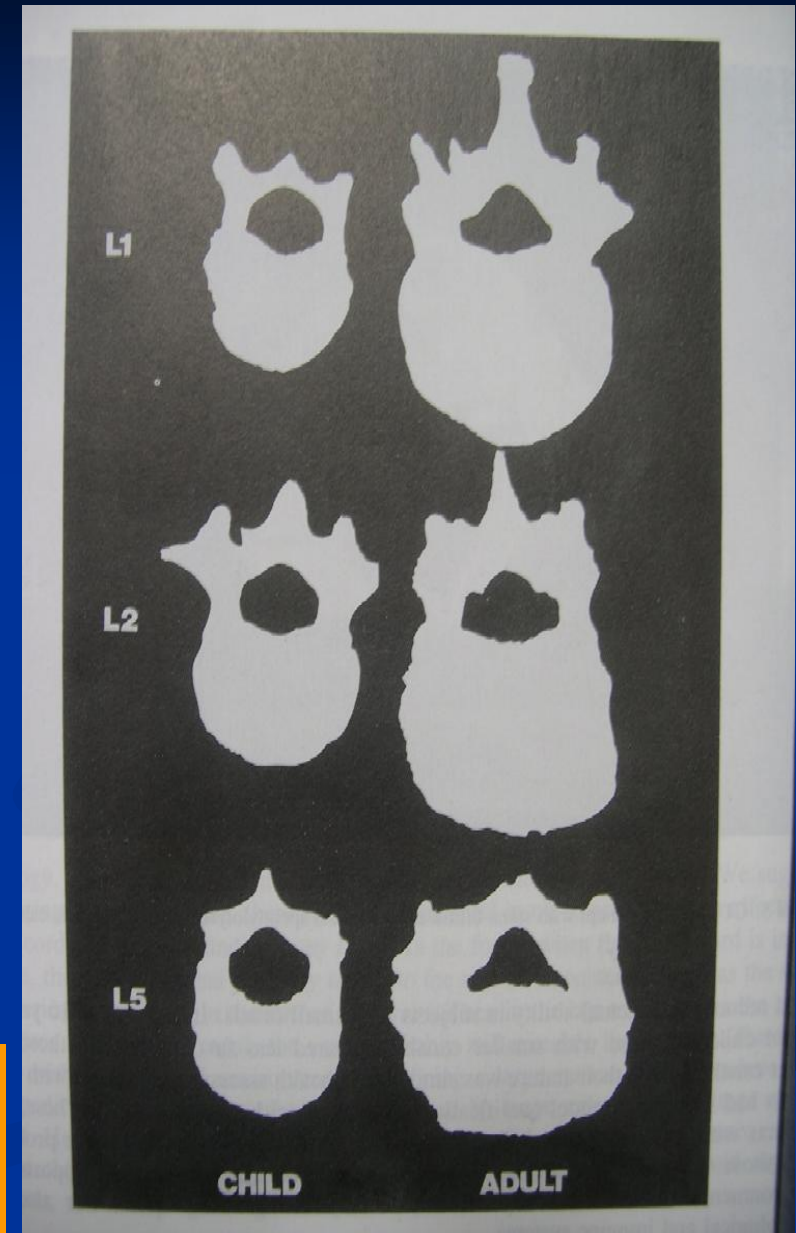
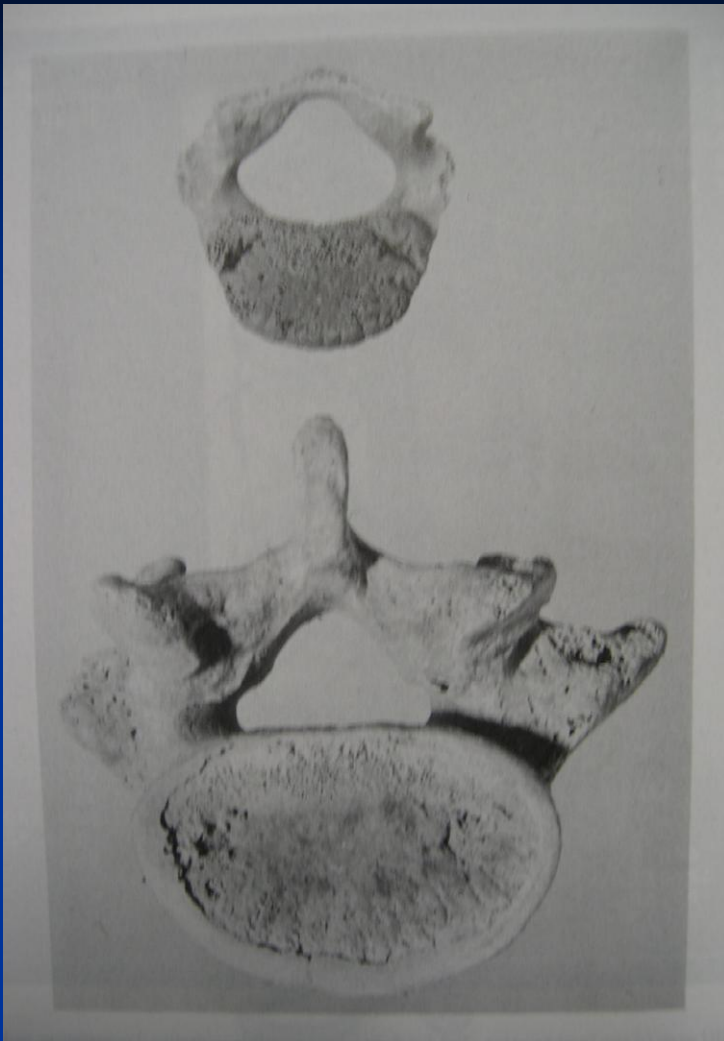
Discrepancy between the container and contents

Neural arch Dimensions

Roaf 1971

AGE	WIDTH (cm)	A-P (cm)	HEIGHT (cm)
Neonate	1.0	1.0	0.8
1 year	1.7	1.5	1.7
1 ½ years	1.6	1.5	1.8
3 years	1.8	1.5	2.0
5 years	1.8	1.5	3.3
12 years	1.8	1.5	3.5
Adults	2.1	1.7	3.9
Multiple of birth dimension	x 2	x 1.7	x 5

- Cross sectional area and mid-sagittal diameter of L1 to L4 - **Mature by 1 yr**
- L5 canal size matures by 5 years



Canal area and mid-sagittal diameter similar in infants and adults

Space available for neural structures

Absolute stenosis – mid-sagittal diameter < 10 mm

Relative stenosis - 10 – 13 mm

- **Transverse area of dural sac** (more reliable)
 - < 100 mm² is absolute stenosis
 - 100-130 mm² is relative stenosis
 - > 130 mm² is normal
- **Lateral recess** - < 3 mm is absolute stenosis
 - 3 – 5 mm is relative stenosis

Classification :

Based on -

- Etiology
- Location of stenosis

Primary stenosis — **Small original canal**

1. **Congenital**

a. Spinal dysraphism

b. Failure of vertebral segmentation

2. **Developmental**

a. Inborn errors of bone growth

- 1. Achondroplasia
- 2. Morquio disease
- 3. Multiple exostosis

b. Idiopathic

- 1. Bony hypertrophy of arch
- 2. Absence of bony hypertrophy

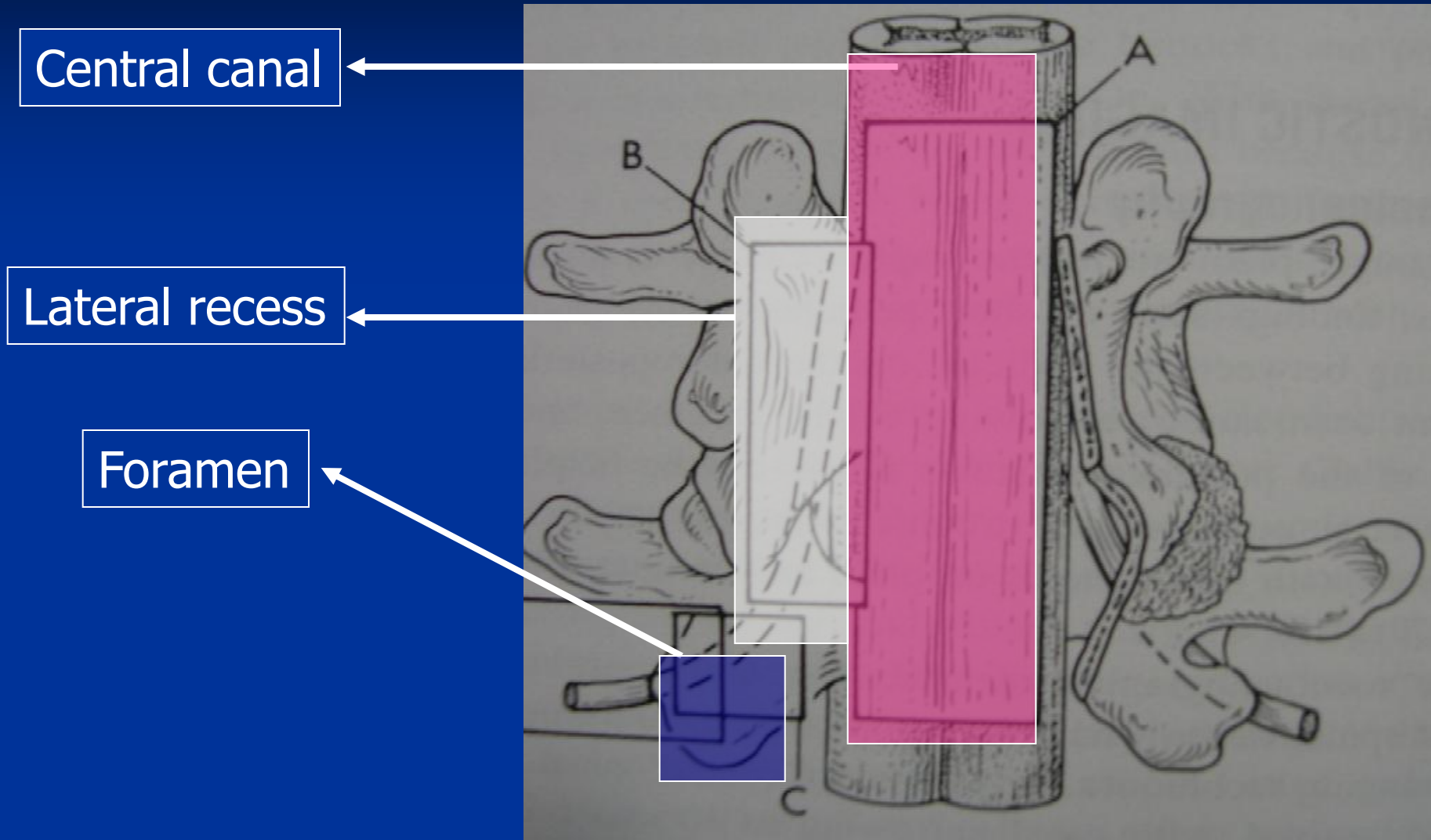
Acquired stenosis – Normal original canal

- Degenerative
- Congenital + degenerative
- Iatrogenic
- Post – traumatic
- Miscellaneous

Miscellaneous

- Pagets disease
- Fluorosis
- DISH
- Hyperostotic lumbar spinal stenosis
- Oxalosis
- Pseudogout

Classification - Location of stenosis

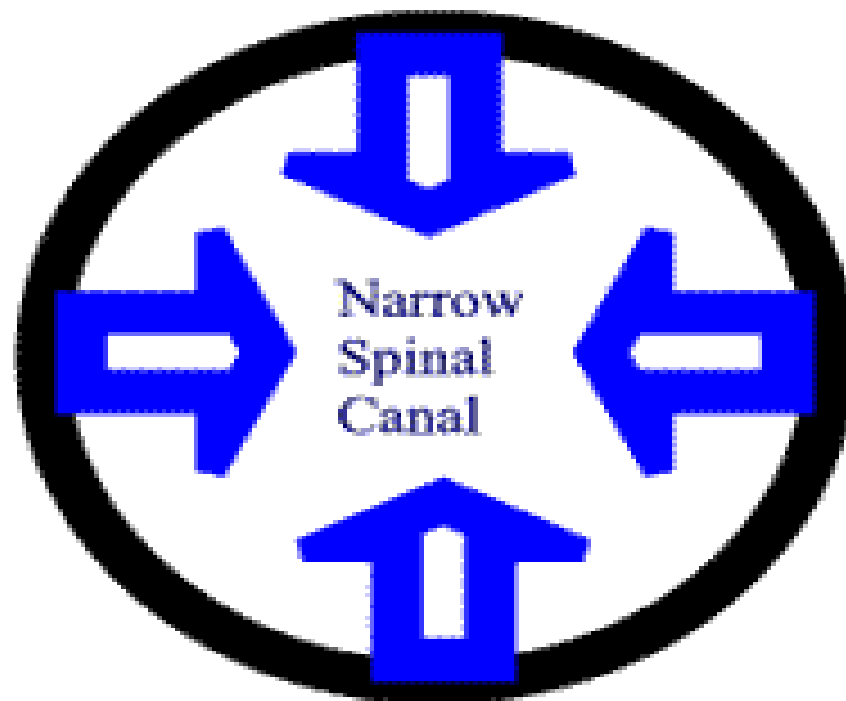


Etiopathology

Front

Vertebra Spurs
Disc Bulging

Facet Spurs



Facet Spurs

Lamina Enlargement
Thickened Ligament

Back

Disc degeneration

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graph TD; A[Disc degeneration] --> B[Disc space reduces]; A --> C[Posterior bulging of disc and osteophytes]; A --> D[Increased facet stresses and movement]; B --> E[Foraminal narrowing up down]; B --> F[Ligamentum flavum buckling]; D --> G[Facetal osteophytes];
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Disc space reduces

Posterior bulging of disc and osteophytes

Foraminal narrowing (up down)

Ligamentum flavum buckling

Increased facet stresses and movement

Facetal osteophytes

Disc pathology is the first stage in the degeneration cascade in a majority

Facet degeneration and synovitis

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graph TD; A[Facet degeneration and synovitis] --> B[Thinning of facet cartilage and loosening of the capsule]; B --> C[Increased spinal movement and disc degeneration]; C --> D[Auto-stabilising facet osteophytes]; D --> E[Canal narrowing - superior facet osteophytes - lateral recess - inferior facet osteophytes - central];
```

Thinning of facet cartilage and loosening of the capsule

Increased spinal movement and disc degeneration

Auto-stabilising facet osteophytes

Canal narrowing - superior facet osteophytes – lateral recess
- inferior facet osteophytes - central

Clinical features

Disease of symptoms

- **Neurogenic claudication**
- Back, buttock, thigh and calf pain – usually B/L
- Pain on standing and walking and relieved by sitting / lying with hips flexed
- Neurological symptoms and signs

Table 2. Frequency of symptoms in patients with lumbar spinal stenosis

Symptoms	
Numbness/tingling	50 (66.6)
Back pain	47 (62.7)
Neurogenic claudication	46 (61.3)
Weakness of the lower limbs	45 (60.0)
Radicular pain	35 (46.7)
Unsteadiness	15 (20.0)
Bladder symptoms	10 (13.3)
Bowel symptoms	4 (5.3)

The Clinical Syndrome Associated with Lumbar Spinal Stenosis

**European
Neurology**

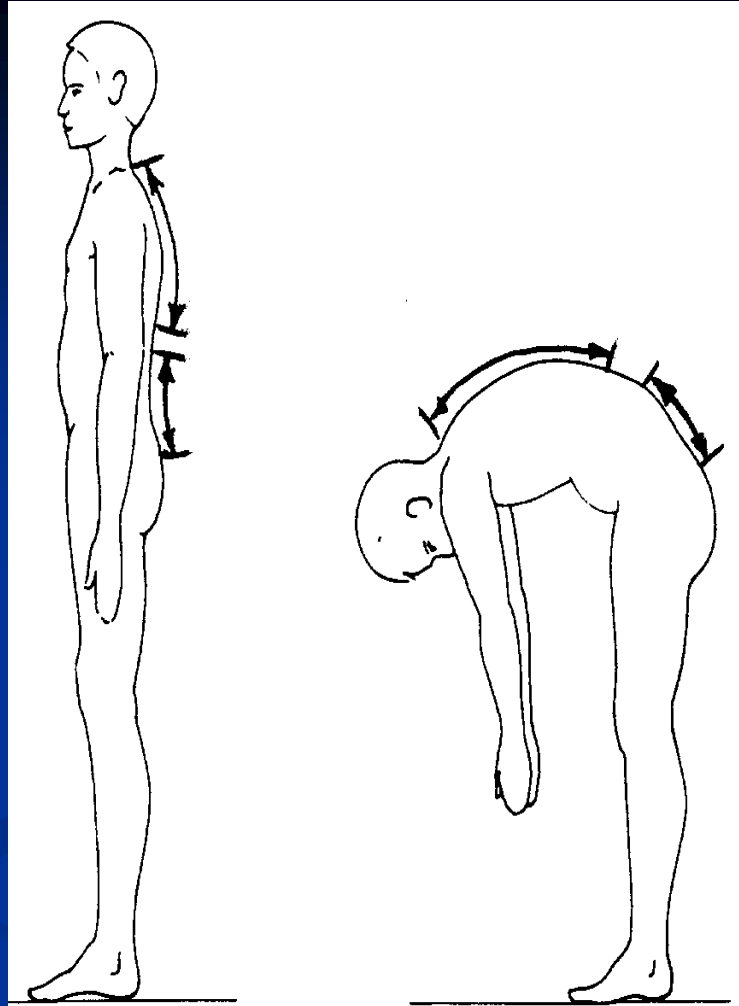
Neurogenic claudication

The onset of pain, tension and weakness upon walking in one or both legs progressively increasing until walking becomes impossible and subsequent disappearance of symptoms after a period of rest.

-Verbiest

Flexion to extension

Space for cauda equina reduces
by 40 mm² (16 %)



Extension or rotation decreased the sagittal diameters and cross-sectional areas of the dural sac and spinal canal and increased the thickness of the ligamentum flavum, whereas flexion had the opposite effects.

Activities providing pain relief

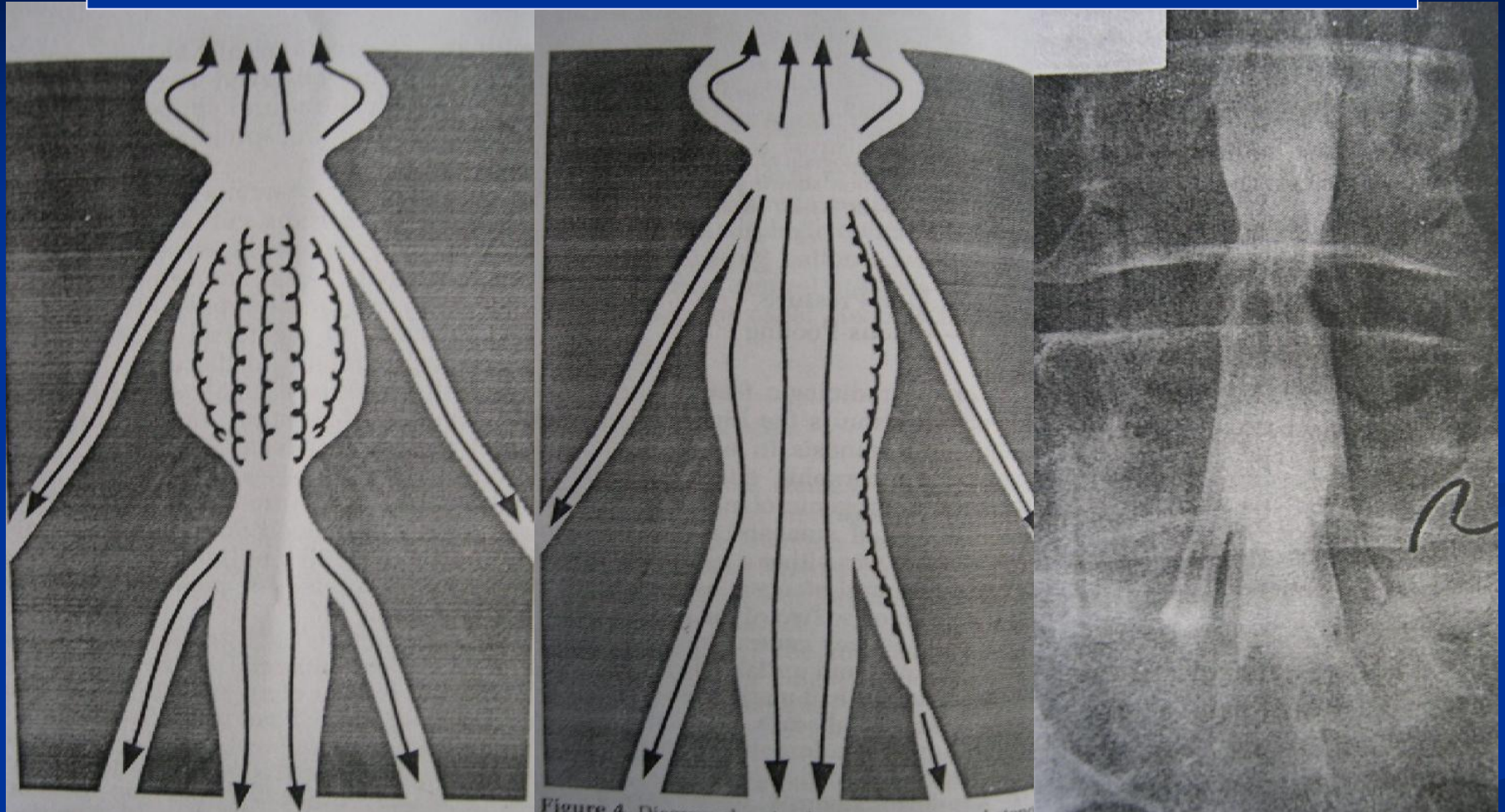


Shopping cart test



Bicycle test

Two level central stenosis or a central stenosis with a root canal stenosis



90 % with claudication had > 2 levels with dural cross-section below 100 mm²

Hamanishi et al 1994

Two level stenosis

Veins of root drain distally through foramen or proximally to the conus.

Two level block → congestion and pooling

Arterioles continue to feed the segment

+

Impaired drainage, ↓ blood flow, O₂ and nutrition



Buildup of metabolites in the uncompressed segment

■ Central stenosis –

- B/L symptoms
- Non – dermatomal
- Paraesthesias
- Weakness is rare

• Lateral recess stenosis -

- Usually unilateral
- Dermatomal distribution
- Neurological symptoms and signs more common

	Neurogenic	Vascular
1. Pulses	+	-
2. Walk distance	Variable	Fixed
3. Palliative factors	Bending	Standing
3. Provocative	Downhill	Uphill
4. Neuro exam after walking	+	-
5. Bicycle test	No pain	Pain
6. Pain	Crampy	Numbness
7. Atrophy	Uncommon	Occasional
8. Back pain	Common	No
9. Back motion	Limited	Normal

Imaging – Plain Radiograph

Congenital stenosis

- Interpedicular distance – Achondroplasia
- Short pedicles – Developmental stenosis

Degenerative stenosis

- Spondylophytes / Hypertrophic facets
- Degenerative listhesis / Scoliosis
- Instability
- Post traumatic / Postoperative changes

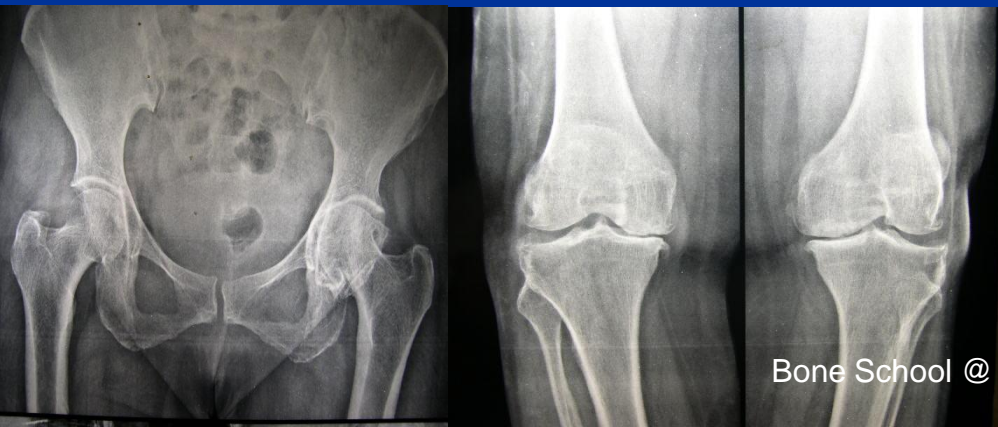
- CT Myelogram
- MRI



Tandem stenosis

Incidence - 5 – 25 %

Intermittent claudication
+
Gait disturbance
+
Combined UMN and LMN signs



Concomitant hip
and
knee arthritis

Surgical versus nonsurgical therapy for lumbar spinal stenosis

- 289 patients - randomized cohort and 365 - observational cohort.
- Combined as-treated analysis, surgical patients showed significantly more improvement in all primary outcomes

Natural history of LCS

27 patients followed over 4 years

- 70 % – Unchanged
- 15 % - Improved
- 15 % - Worsened (no serious sequelae)

Johnsson et al Clin Orthop 1992

Long-Term Outcomes of Surgical and Nonsurgical Management of Lumbar Spinal Stenosis: 8 to 10 Year Results from the Maine Lumbar Spine Study

Atlas SJ, Deyo RA et al Spine 2005

A prospective observational cohort study.

148 patients (Surgery- 81) (Conservative – 67)

- One yr and four yr – Results of surgery were better
- 8-10 years - leg pain relief and back-related functional status continued to favor surgical group.

What can we infer from the natural history?

- A majority of the patients remain the same
- Some improve
- A few deteriorate

How does it affect clinical decision making ??

- **Severe symptoms** - **Surgery**
- **Deteriorating symptoms** - **Surgery**
- **Mild/moderate symptoms** - **conservative treatment**

Surgical principles

Decompression



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graph TD; A[Decompression] --> B[Laminectomy]; A --> C[Laminotomy];
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Laminectomy

Laminotomy

Endpoint of surgery

- Mobile nerve roots



THANK YOU