Degenerative Disease of the Spine

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Introduction: Talk Overview

- I. Anatomy
- II. Overview of Disease Processes:
 A. Spondylosis
 B. Intervertebral Disc Disease

- III. Diagnosis
- IV. Therapy

Introduction: Myelopathy vs. Radiculopathy

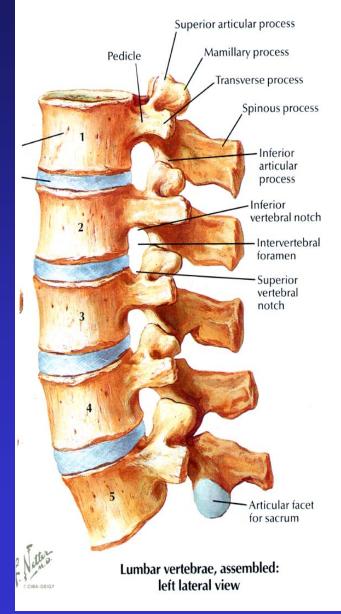
• Myelopathy

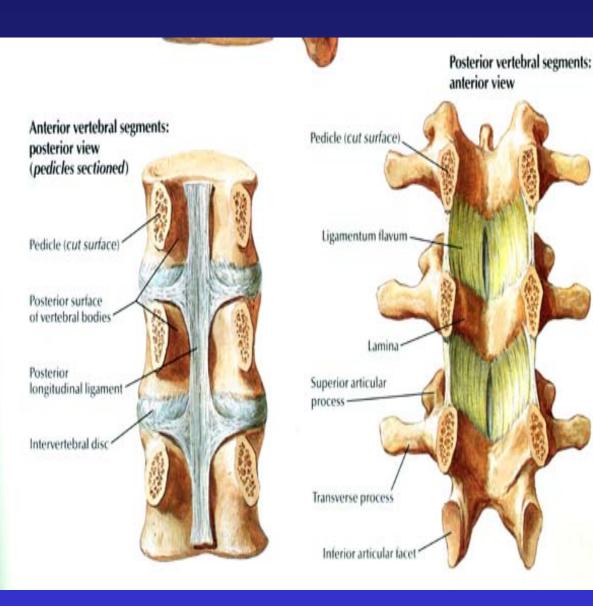
- Disease/compression of the spinal cord itself

Radiculopathy

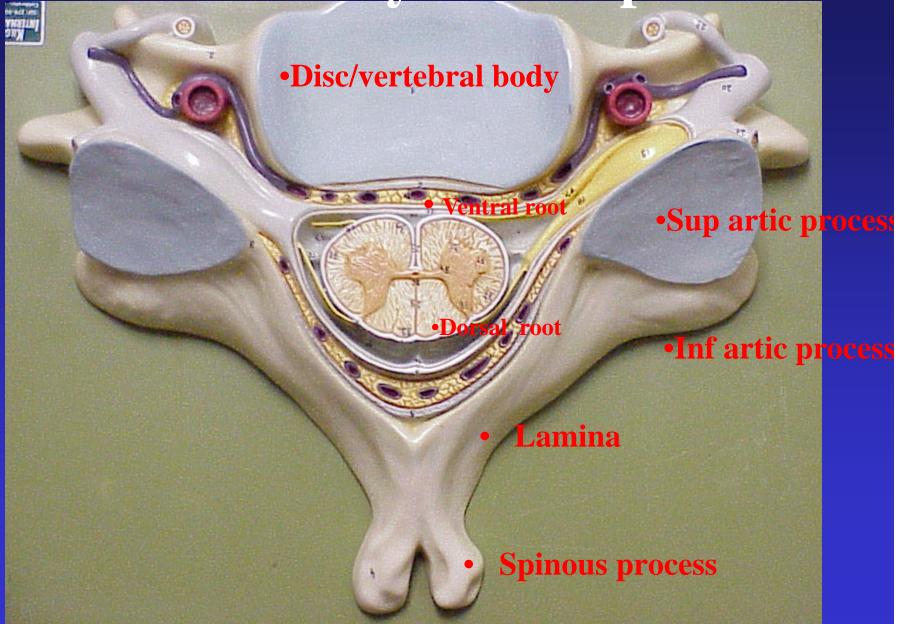
 Disease/compression of a *specific* nerve root (i.e., a right-sided L5 radiculopathy)

I. Anatomy of the Spine

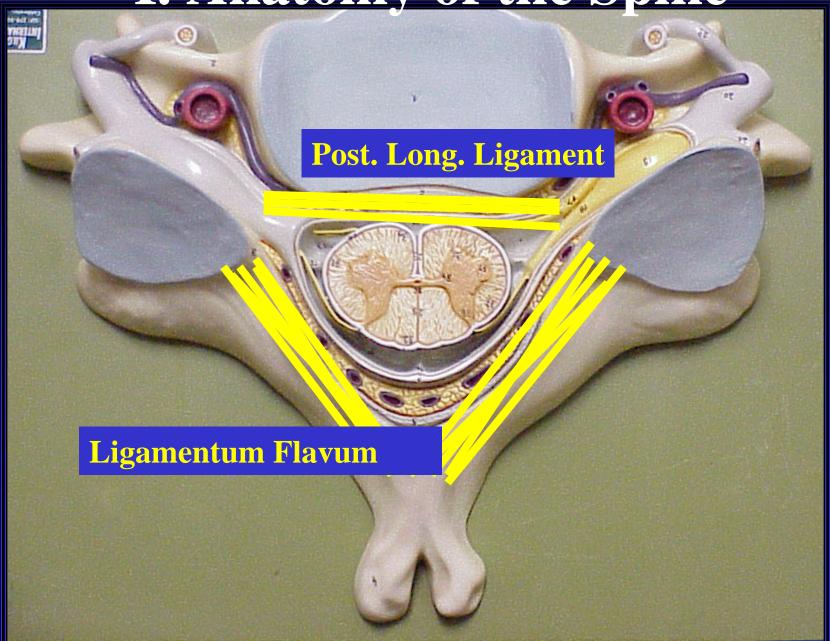




I. Anatomy of the Spine

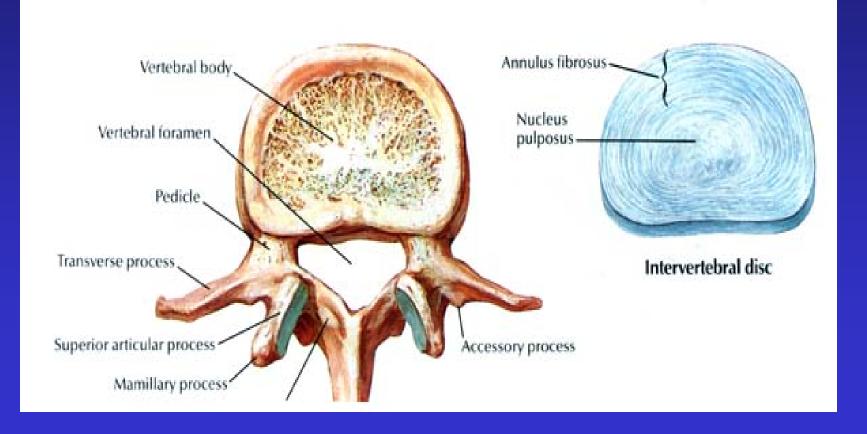


I. Anatomy of the Spine



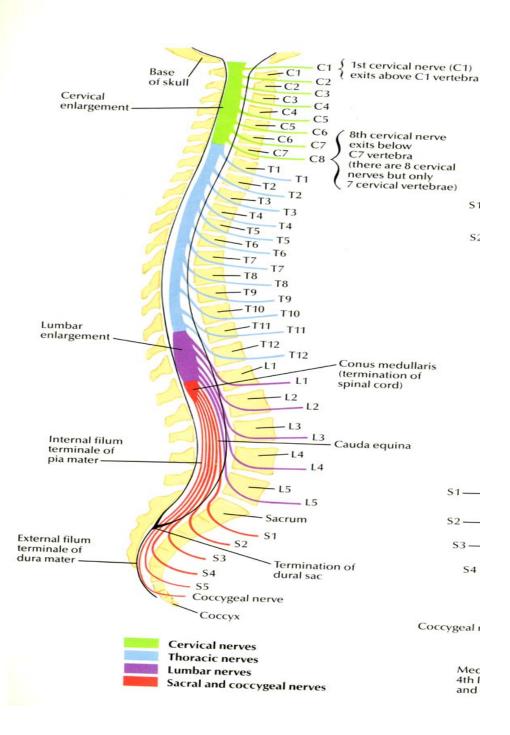
I. Anatomy of the Intervertebral Disc

- Annulus fibrosis: peripheral disc
 - Nucleus pulposus: central disc



I. Anatomy of the Spinal Cord

- Spinal cord terminates at L1 vertebra in conus medullaris
 - Individual nerve roots continue as *cauda equina*

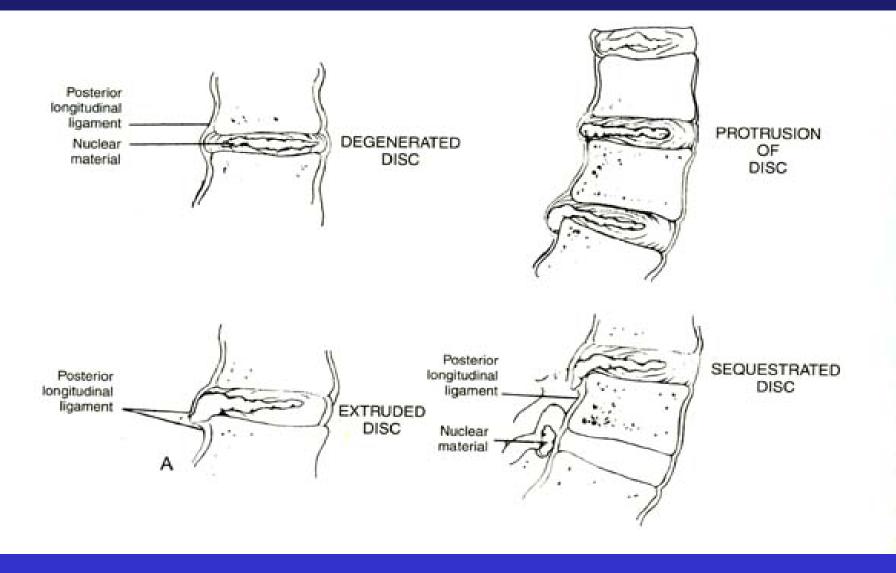


II. Overview of Disease Processes: A. Intervertebral Disc Disease

• A. Definitions:

- Desiccation: loss of disc water
- Disc bulge: circumferential enlargement
- Protrusion: HNP eccentric to one side
- Extruded disc: HNP through annulus into epidural space
- Sequestered disc: HNP is a free fragment

IIA. Intervertebral Disc Herniation: Definitions



IIA. Intervertebral Disc Herniation

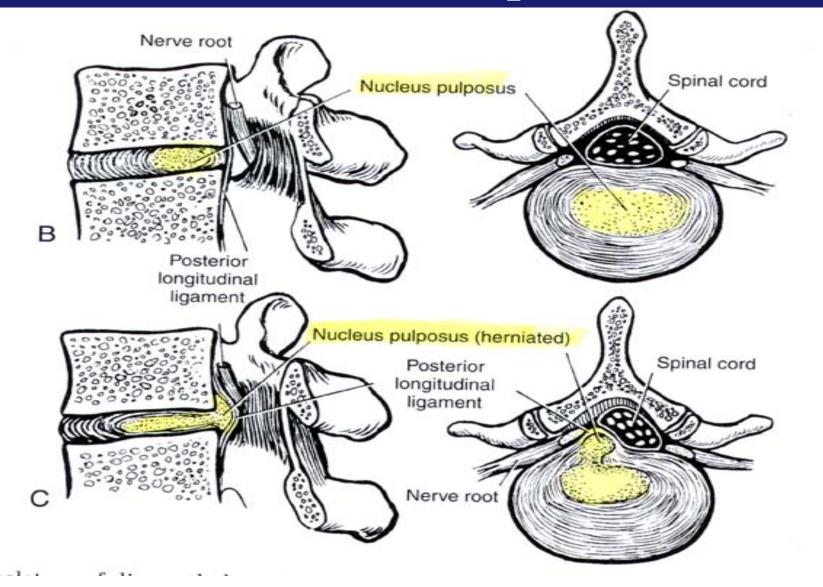
• **B. Epidemiology:**

- Young population (25-45 y.o.)
 - *C-spine*: most occur at C5-6, C6-7
 - *T-spine*: uncommon (<1% of all disc herniations)
 - *L-spine*: most occur at L4-5, L5-S1

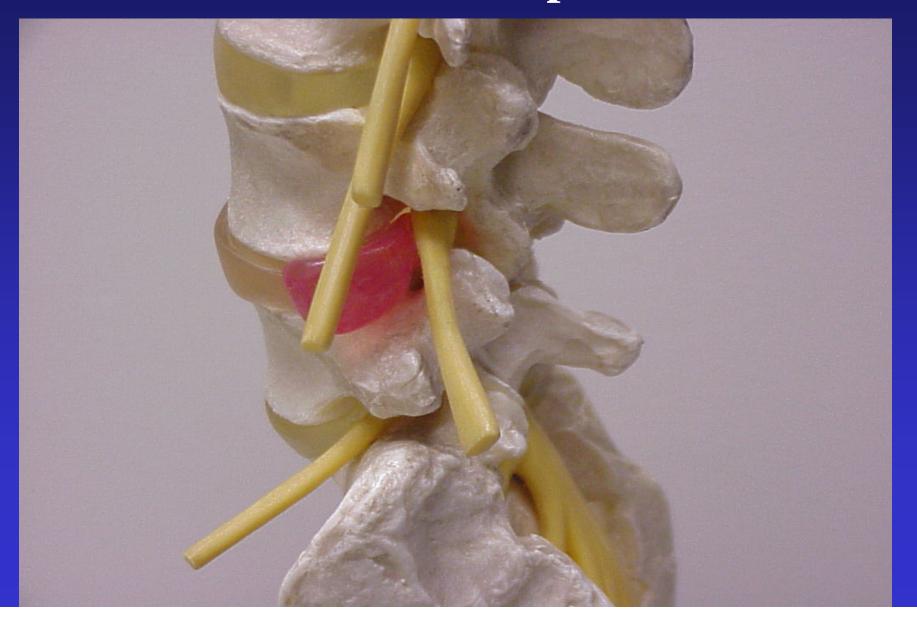
• C. Pathophysiology:

- With repeated minor trauma *or* aging . . .
 Desiccation disc flattens axial loading stretches annular fibers:
 - Disc bulges (concentric)
 - Tears in annulus fibrosus
 - Herniation of nucleus pulposus (eccentric)

IIA. Intervertebral Disc Herniation: Nerve Root Compression



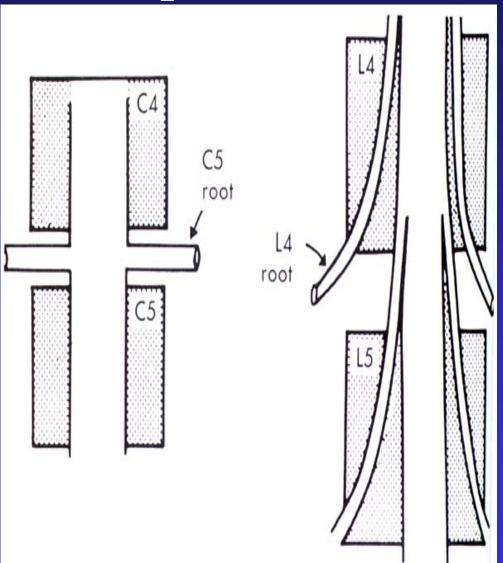
IIA. Intervertebral Disc Herniation: Nerve Root Compression



IIA. Intervertebral Disc Herniation: Which Root is Compressed?

- Cervical Spine
 - Nerve roots exit
 <u>above</u> pedicle of
 like-named vertebra
 - C1 root exits below occiput
 - A C4-5 HNP usually involves the C5 nerve root!

• Lumbar Spine different!



IIA. Intervertebral Disc Herniation: Which Root is Compressed?

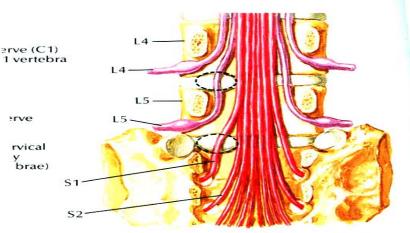
- Lumbar (and thoracic) Spine
 - Nerve roots exit <u>below</u> pedicle of named vertebral body
 - The C8 nerve root exits below C7
 - T1 nerve root is *below* T1 vertebra
 - It follows that the L4 nerve root exits at L4-5

-Does the L4-5 HNP therefore affect the L4 nerve root??

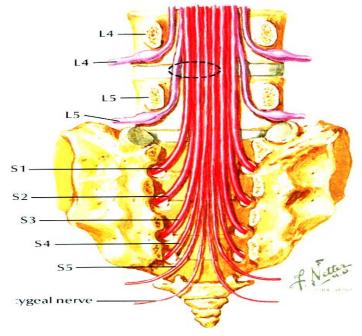
- » No, unless extreme lateral HNP
- » Reconsider the anatomy of the cauda equina

IIA. Intervertebral Disc Herniation:

Extreme lateral disc herniations are *rare* (<10%)



Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4–5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5–S1 affects 1st sacral nerve, not 5th lumbar nerve



Medial protrusion at disc level L4–5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st–4th sacral nerves

RACK ANT

II. Overview of Disease Processes: B. Spondylosis

• A. Definition:

- Non-specific degenerative dz of spine
 - (1) End plate osteophytes pain & neural compression if posteriolateral
 - (2) Facet joint arthritis pain & neural compression (lateral recess vs. central stenosis)
 - (3) Ligamentous hypertrophy
- Not = to spondylo<u>lysis</u> (or spondylo<u>listhesis</u>)
- **B. Epidemiology:**
 - Older population

IIB. Spondylosis: A Spectrum of Pathologic Changes in Facet Joints and Discs

• C. Pathophysiology:

Table 60-1 Spectrum of pathological changes in facet joints and discs and the interaction of these changes

Phases of spinal degeneration	Facet joints		Pathological result		Intervertebral disc
	Synovitis	\rightarrow	Dysfunction	€	Circumferential tears
Dysfunction	(Hypermobility		Ţ	1	
	Continuing degeneration	1	Herniation	←	Radial tears
Instability	∫ Capsular laxity	\rightarrow	Instability	-	Internal disruption
	Subluxation	\rightarrow	Lateral nerve entrapment	(Disc resorption
Stabilization	∫ Enlargement of articular	\rightarrow	One-level stenosis	÷	Osteophytes
	processes	`	Multilevel spondylosis and stenosis	4	60 Y

Modified from Kirkaldy-Willis WH, editor: Managing low back pain, New York, 1983, Churchill Livingstone.

IIB. Spondylosis: Facet Joint Hypertrophy





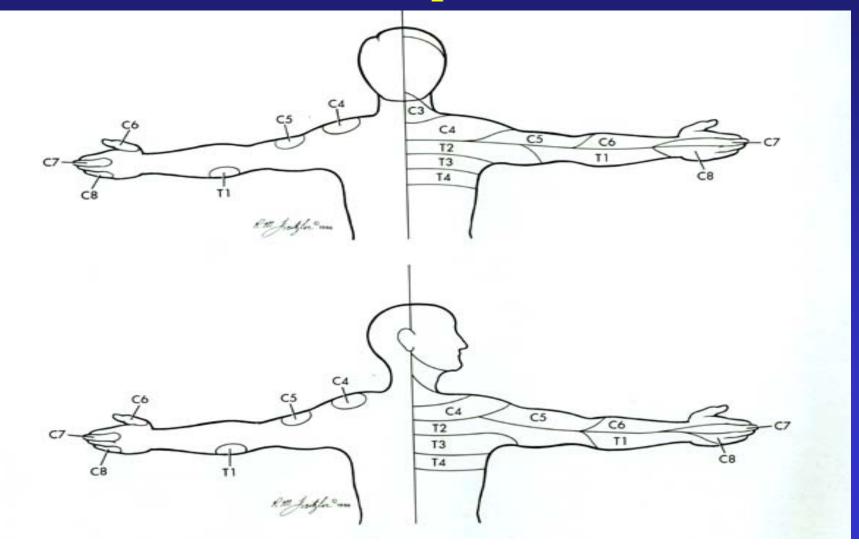
III. Diagnosis: Broad Differential Is presentation c/w a . . .

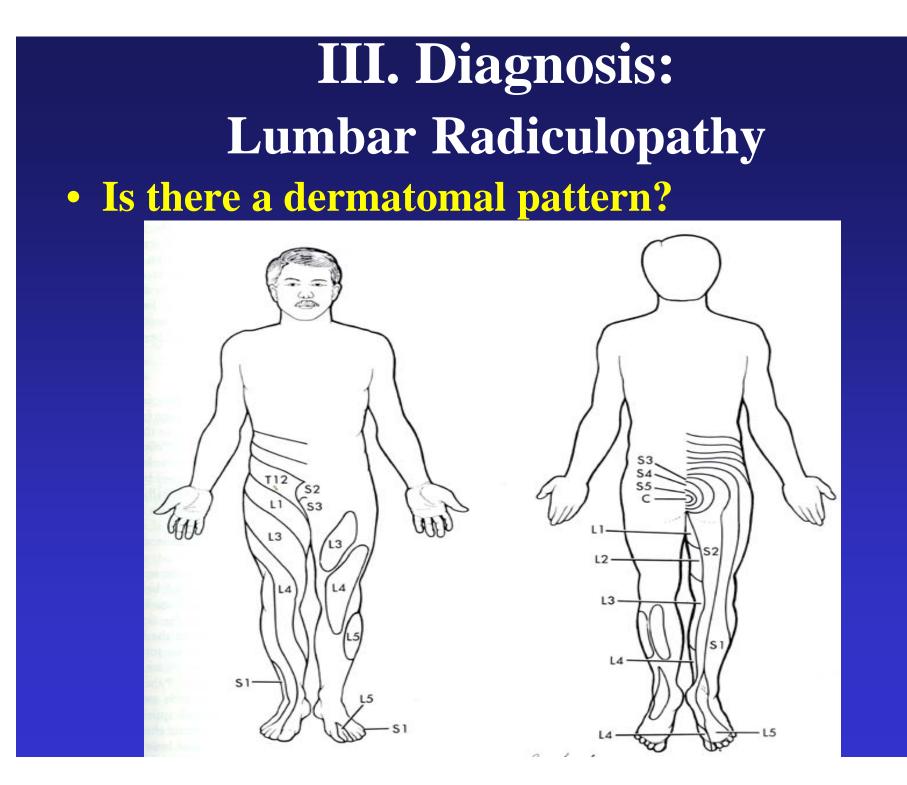
- <u>Radiculopathy?</u>
 - Lateral HNP
 - Neural Foraminal (Lateral Recess)
 Stenosis
 - Facet joint spondylosis/hypertrophy
 - (More distal lesion)

- <u>Myelopathy?</u>
 - Central Stenosis
 - Congenital or Acquired
 - Bilateral facet joint hypertrophy
 - Hypertrophy of supporting ligaments
 - Spondylolisthesis
 - Central HNP (cervical)
 - (Tumor, Infection, etc.)

III. Diagnosis: Cervical Radiculopathy

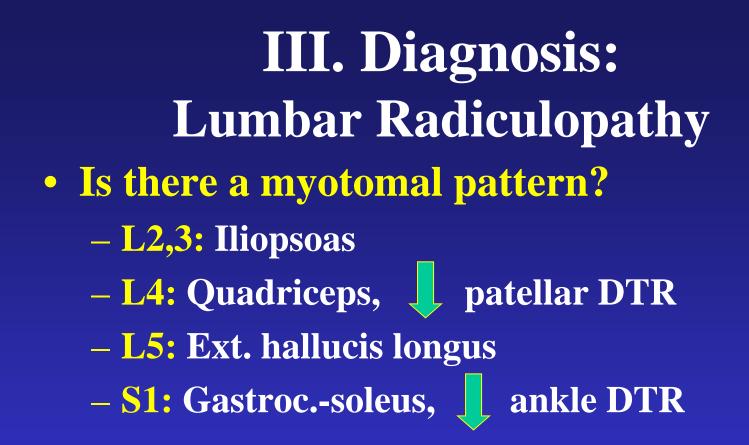
• Is there a dermatomal pattern?





III. Diagnosis: Cervical Radiculopathy • Is there a myotomal pattern? – C5: Deltoid – C6: Biceps, 📘 biceps DTR – C7: Triceps, 📘 triceps DTR - C8-T1: Interossei, abd. dig. minimi

- Compression, tilting head towards sx side (Spurling's sign) may exacerbate
- Extension may exacerbate
- Distraction, flexion may relieve



• Straight leg raise may exacerbate

Passive hip flexion reproduces sxs <u>distal</u> to knee, worsened with ankle dorsiflexion (Lasegue maneuver)

III. Diagnosis: Keep in mind more distal etiologies . . .

– Plexus

• Thoracic outlet syndrome

- Nerve

- Peripheral neuropathy
- Compression syndrome
- Neuromuscular Junction

- Muscle

III. Diagnosis: If c/w a radiculopathy . . .

Intervertebral Disc Herniation

- Suspect in younger pts
- Acute onset
- Pain increased on sitting

and/or ...

Spondylosis — Lateral Recess Stenosis

- Suspect in *older* patients
- Insidious onset
- Pain better on sitting

III. Diagnosis: Myelopathy

- Central Stenosis

 Cervical:
 Spasticity, hyperreflexia

 Lumbar (remember, cord ends approx. @ L1 vertebra):

 Parasthesias, pain +/- weakness
 Warsa w/ well-inc
 - Worse w/ walking
 - Can imitate vascular claudication

III. Diagnosis: Lumbar Myelopathy

• Neurogenic claudication

- On rest, sxs persist *unless* pt. flexes spine
- Sxs more proximal (thigh and calves)
- Better at "bicycle test"
- Nl foot color/pulses/temp

- Vascular claudication
 - On rest, crampy pain stops immediately
 - Sxs more distal (primarily calves)
 - Worse at "bicycle test"
 - 📕 Foot color/pulses/temp

It is possible for **both** to be present

III. Diagnosis: Radiographic

• I. Plain Film

- Identifies degenerative changes

• II. MRI (or CT)

Defines nerve root and/or spinal cord compression

• III. Myelography

Water-soluble intra-thecal contrast

• IV. Discography

III. Diagnosis:RadiographicIntervertebral Disc

Degeneration and Herniation (MRI)

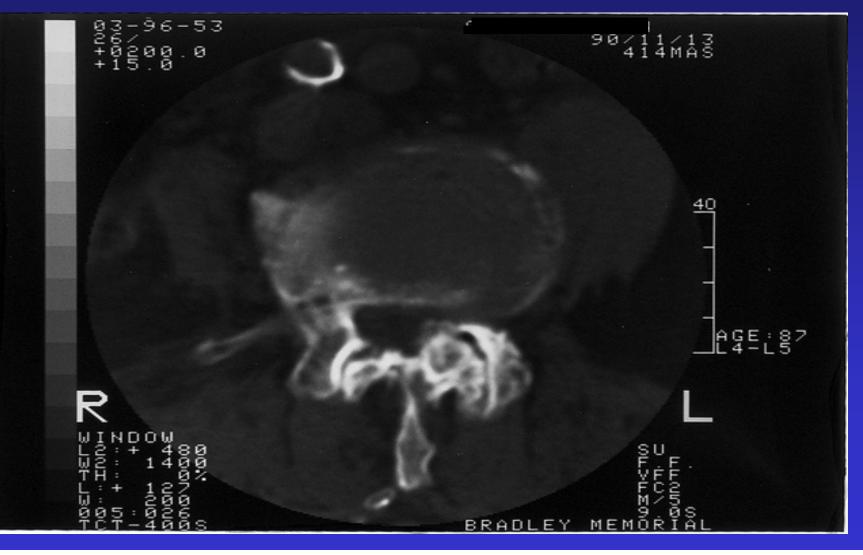


III. Diagnosis: Radiographic Intervertebral Disc Herniation (CT)



III. Diagnosis: Radiographic

• Facet Joint Spondylosis w/ Spinal Stenosis (CT)



III. Diagnosis: Radiographic Facet Joint Spondylosis w/ Spinal Stenosis (CT)



III. Diagnosis: Radiographic

• III. Myelography



• Sxs usually resolve

 75-85% of patients w/ acute lumbar HNP improve with conservative tx (Weber, Lumbar Disc herniation: A controlled, prosepctive study with

ten years of observation. Spine 8:131-140, 1983).

• Epidural steroid injections offer shortterm pain relief

– 60-85% short-term success

- No difference from placebo at 6 mos.

(Cuckler, The use of epidual steroids in the treatment of radicular pain. JBJS 67A: 63, 1985).

- Surgical Discectomy
 - Indications:
 - Failure of conservative tx > 6 weeks
 - Progressive neurological deficit
 - Focal lower extremity weakness (i.e., foot drop)
 - Not for back pain
 - *Cauda equina syndrome* = a surgical emergency

Surgical Discectomy

– Results:

- Only as good as the pt. selection
 - 99.5% relief when disc sequestered
 - 38% relief when minimally bulging disc

(Spangfort, The lumbar disc herniation: a computer-aided analysis of 2,504 operations. Acta Orthop Scand Suppl 142:1, 1972).

Controversial long-term efficacy

– Beneficial at 1 year vs. conservative tx

- Not at 4 and 10 years f/u (Weber, 1983).

• Surgical results only as good as the pt. selection . . .

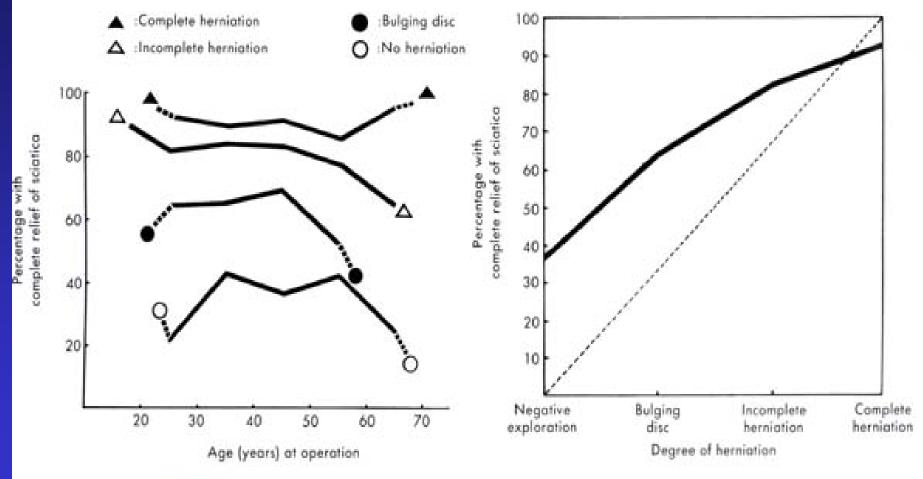


Fig. 60-24 Percent relief of sciatica with type of disc herniation. (From Spangfort E: Acta Orthop Scand Suppl 142:1, 1972.)

IV. Therapy: Spondylosis/Stenosis

• Sxs usually <u>do not</u> resolve with time and conservative tx

- Facet Joint Steroid Injections
 - Aid in dx and helpful in short-term pain relief
- Surgical Decompression +/- Fusion
 - No good RCTs on efficacy of fusion

(Gibson et. al., The cochrane review of surgery for lumbar disc prolapse and degenerative lumbar spondylosis. Spine 24: 1820-32, 1999).

Conclusion:

- I. Overview of degenerative spine disease
 - Spondylosis
 - Intravertebral disc disease
- II. Approach to patient
 Radiculopathy
 - Myelopathy
- **III. Surgery primarily aimed at** *sx relief* – Controversial long-term efficacy