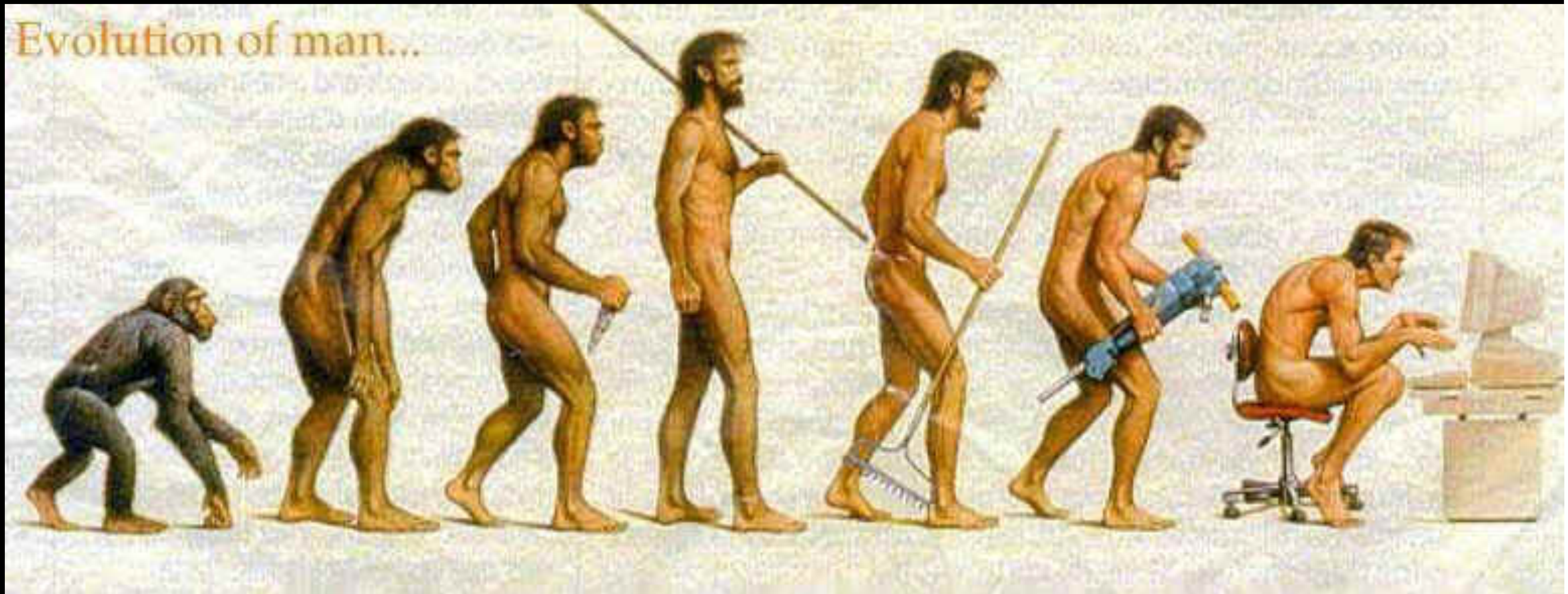
Lumbar Spine & Spinal Pathology


Evolution of man...


Acute Low Back Pain

- Low back pain affects a reported 5.6 percent of U.S. adults each day

Loney PL, Stratford PW. The prevalence of low back pain in adults: a methodological review of the literature. Phys Ther 1999;79:384-96.

- The lifetime prevalence of low back pain is estimated to be at least 60 to 70 percent

Hart LG, Deyo RA, Cherkin DC. Physician office visits for low back pain. Frequency, clinical evaluation, and treatment patterns from a U.S. national survey. Spine 1995;20:11-9.

- Acute low back pain is defined as pain that occurs posteriorly in the region between the lower rib margin and the proximal thighs and that is of less than six weeks' duration

- Serious conditions such as cancer, infection, and visceral disease account for only a small percentage of back pain cases, and vertebral compression fractures account for less than 5 percent

McGuirk B, King W, Govind J, Lowry J, Bogduk N. Safety, efficacy, and cost effectiveness of evidence-based guidelines for the management of acute low back pain in primary care. Spine 2001;26:2615-22.

Herniated disks, which are often managed initially like lumbar strains, account for only 4 percent of back pain cases

Hart LG, Deyo RA, Cherkin DC. Physician office visits for low back pain. Frequency, clinical evaluation, and treatment patterns from a U.S. national survey. Spine 1995;20:11-9.

Most back pain is nonspecific lumbar strain or idiopathic back pain

Deyo RA, Rainville J, Kent DL. What can the history and physical examination tell us about low back pain? JAMA 1992;268:760-5.

Table 1. Differential Diagnosis of Low Back Pain

Condition (prevalence)*	*Signs and symptoms*
Mechanical low back pain (97%)	
Lumbar strain or sprain (≥ 70%)	Diffuse pain in lumbar muscles; some radiation to buttocks
Degenerative disk or facet process (10%)	Localized lumbar pain; similar findings to lumbar strain
Herniated disk (4%)	Leg pain often worse than back pain; pain radiating below knee
Osteoporotic compression fracture (4%)	Spine tenderness; often history of trauma
Spinal stenosis (3%)	Pain better when spine is flexed or when seated, aggravated by walking downhill more than uphill; symptoms often bilateral
Spondylolisthesis (2%)	Pain with activity, usually better with rest; usually detected with imaging; controversial as cause of significant pain
Nonmechanical spinal conditions (1%)	
Neoplasia (0.7%)	Spine tenderness; weight loss
Inflammatory arthritis (0.3%)	Morning stiffness, improves with exercise
Infection (0.01%)	Spine tenderness; constitutional symptoms
Nonspinal/visceral disease (2%)	
Pelvic organs—prostatitis, pelvic inflammatory disease, endometriosis	Lower abdominal symptoms common
Renal organs—nephrolithiasis, pyelonephritis	Usually involves abdominal symptoms; abnormal urinalysis
Aortic aneurysm	Epigastric pain; pulsatile abdominal mass
Gastrointestinal system—pancreatitis, cholecystitis, peptic ulcer	Epigastric pain; nausea, vomiting
Shingles	Unilateral, dermatomal pain; distinctive rash

Most Common Diagnosis

Age 17- 44

1. General medical exam
2. Pregnancy care
3. Acute URI
4. Vaginitis
5. Contraception
6. Low back pain

Age 45- 64

1. General medical exam
2. Hypertension
3. Acute URI
4. Diabetes
5. Low back pain

Age >65

1. Hypertension
2. General medical exam
3. COPD
4. CAD
5. URI
6. Diabetes
7. Arthritis
8. Low back pain

Blount, et al J Am Board Fam Pract 1999;6:143-52

Sources of Low Back Pain

- Superficial somatic
- Deep somatic
  - Muscle, joint, tendon, bursa
- Radicular – nerve root
- Visceral referred – sympathetic afferents
- Neurogenic
  - Mixed motor sensory nerves
- Psychogenic – cerebral cortex

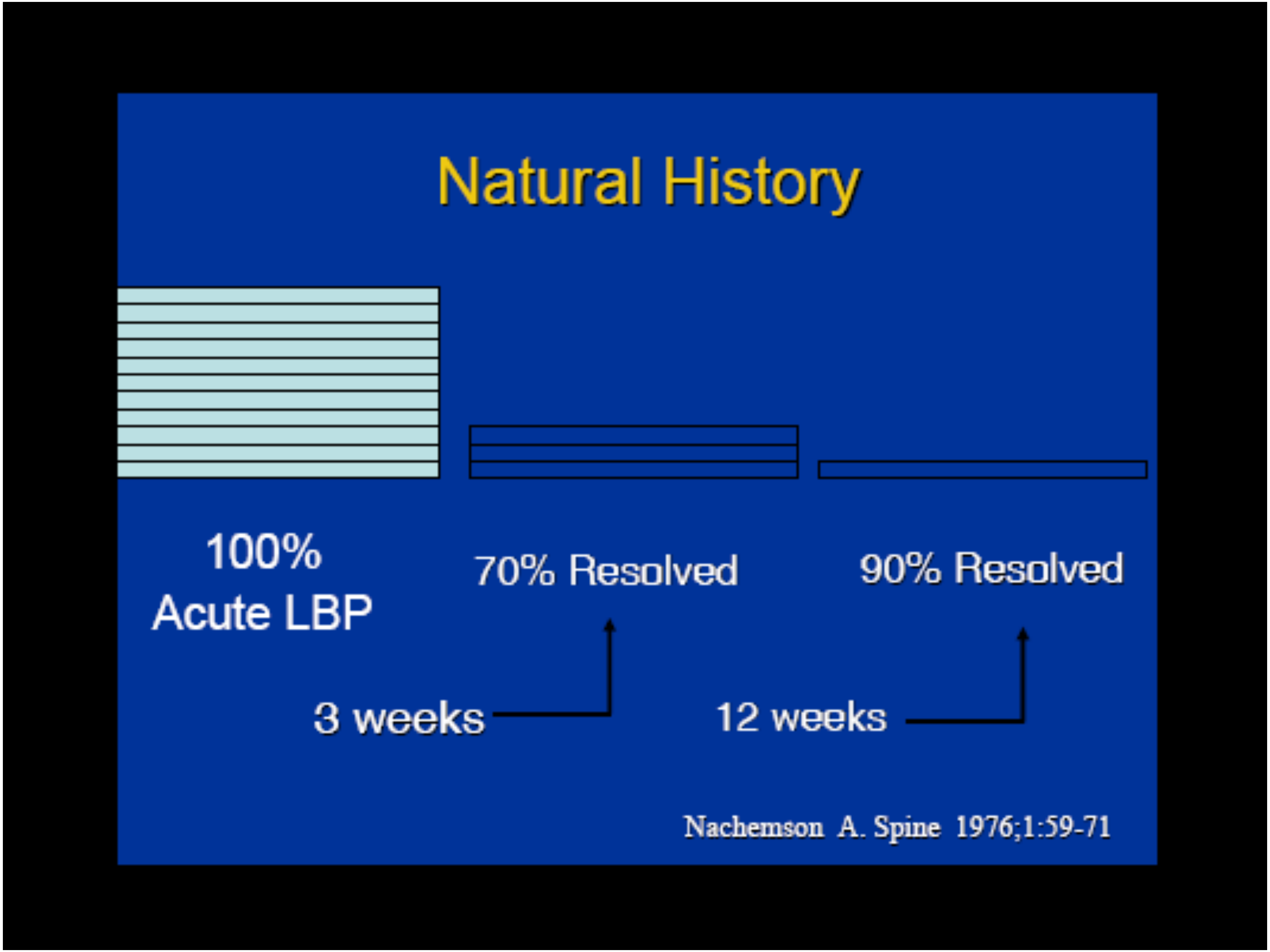

Natural History
100%
Acute LBP
70% Resolved
90% Resolved
3 weeks
12 weeks
Nachemson A. Spine 1976;1:59-71

Table 4. Return-to-Work Guidelines for Patients with Acute Low Back Pain

	Expected return to unmodified work with:			
Activity level	*Mild low back pain*	*Severe low back pain*	*Sciatica*	*Typical modified duty*
Light work (i.e., mostly sitting, occasional standing and walking, lifting and carrying up to 20 lb [9 kg])	0 days	0 to 3 days	2 to 5 days	No lifting more than 5 lb (2.25 kg) three times per hour No prolonged sitting, standing, or walking without a five-minute break every 30 minutes
Medium work (i.e., equal standing, sitting, and walking; occasional bending, twisting, or stooping; lifting and carrying up to 50 lb [22.5 kg])	—	14 to 17 days	21 days	—
Heavy work (i.e., constant standing or walking; frequent bending, twisting, or stooping; lifting up to 100 lb [45 kg])	Up to 7 to 10 days	35 days	35 days	No lifting more than 25 lb (11.25 kg) 15 times per hour No prolonged standing or walking without a 10-minute break every hour Driving car or light truck up to six hours per day; driving heavy vehicle or equipment up to four hours per day

NOTE: *Times until return to full duty will vary with severity and role and are typical for ages 35 to 55 years. Times for younger workers are approximately 20 to 30 percent shorter.*

Information from reference 38.

Denniston PL, ed. Official Disability Guidelines. 11th ed. Encinitas,Calif.: Work Loss Data Institute, 2005.

Lumbar Spine

- Five vertebral bodies
- Sacrum
- Five intervertebral discs
- Five lumbar nerve roots exit through the intervertebral foramen
- Five sacral nerve roots exit through the sacral foramen

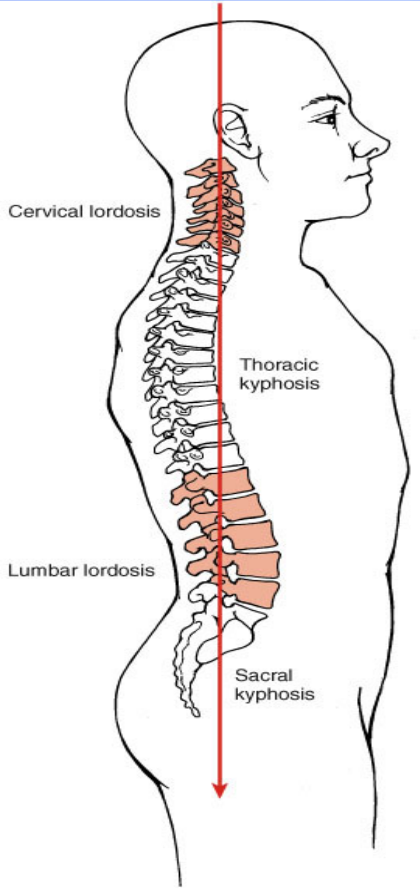


Figure 32.1: Sagittal view of the entire spine. Note the anteriorly convex lumbar and cervical lordosis and the posteriorly convex thoracic kyphosis. A plumb line dropped through the center of the spine transects the transitional zones.

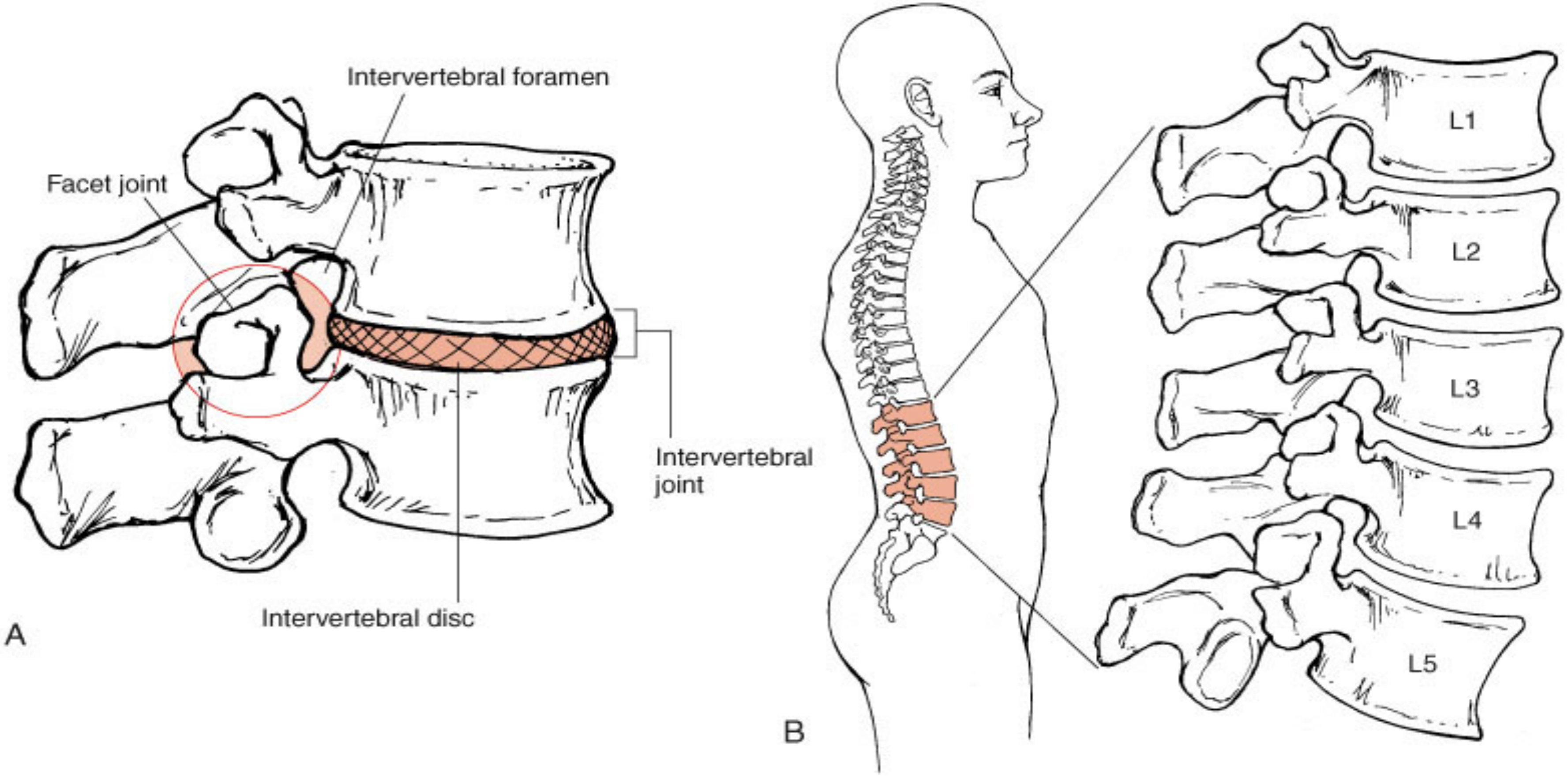


Figure 32.2: **A.** Lateral view of two adjacent vertebrae and the interposed intervertebral disc. This system, along with associated soft tissues, is referred to as a *lumbar motion segment*. Note the intervertebral joint anteriorly and the paired facet joints posteriorly. **B.** When the motion segments are joined, a complex multijoint system is formed.

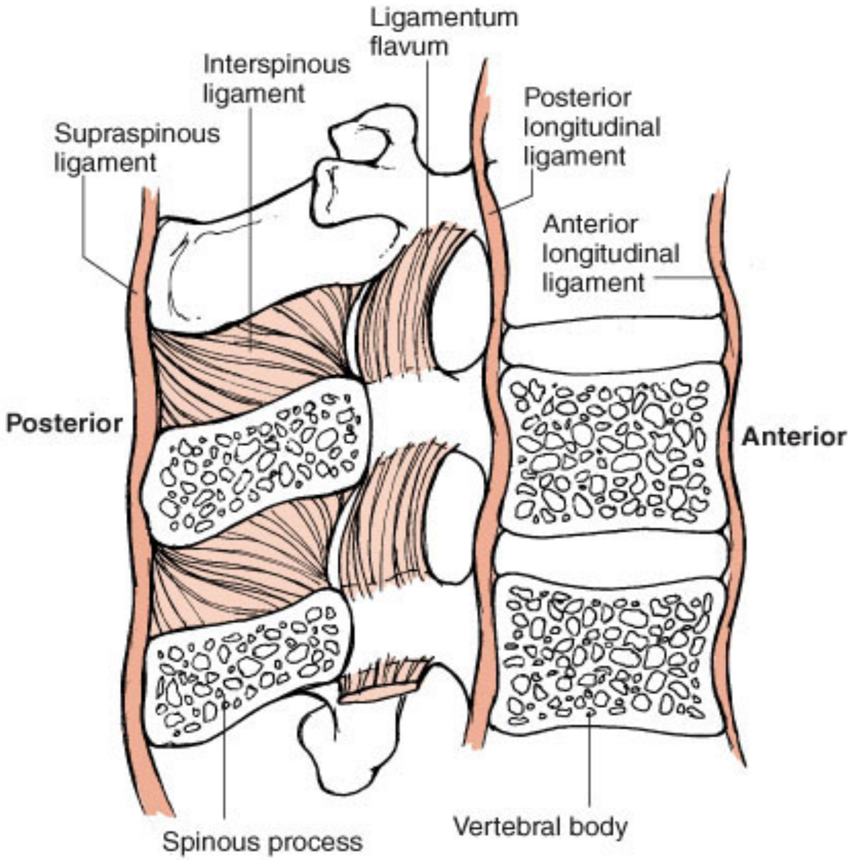


Figure 32.6: Midsagittal view of the lumbar spine demonstrates the spinal ligament system.

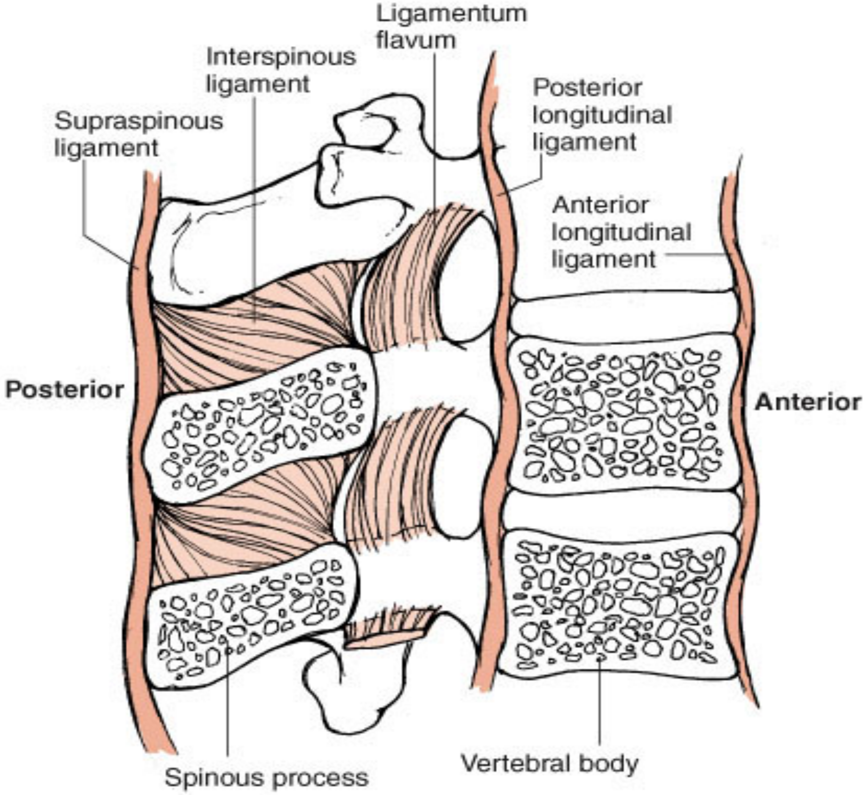


Figure 32.6: Midsagittal view of the lumbar spine demonstrates the spinal ligament system.

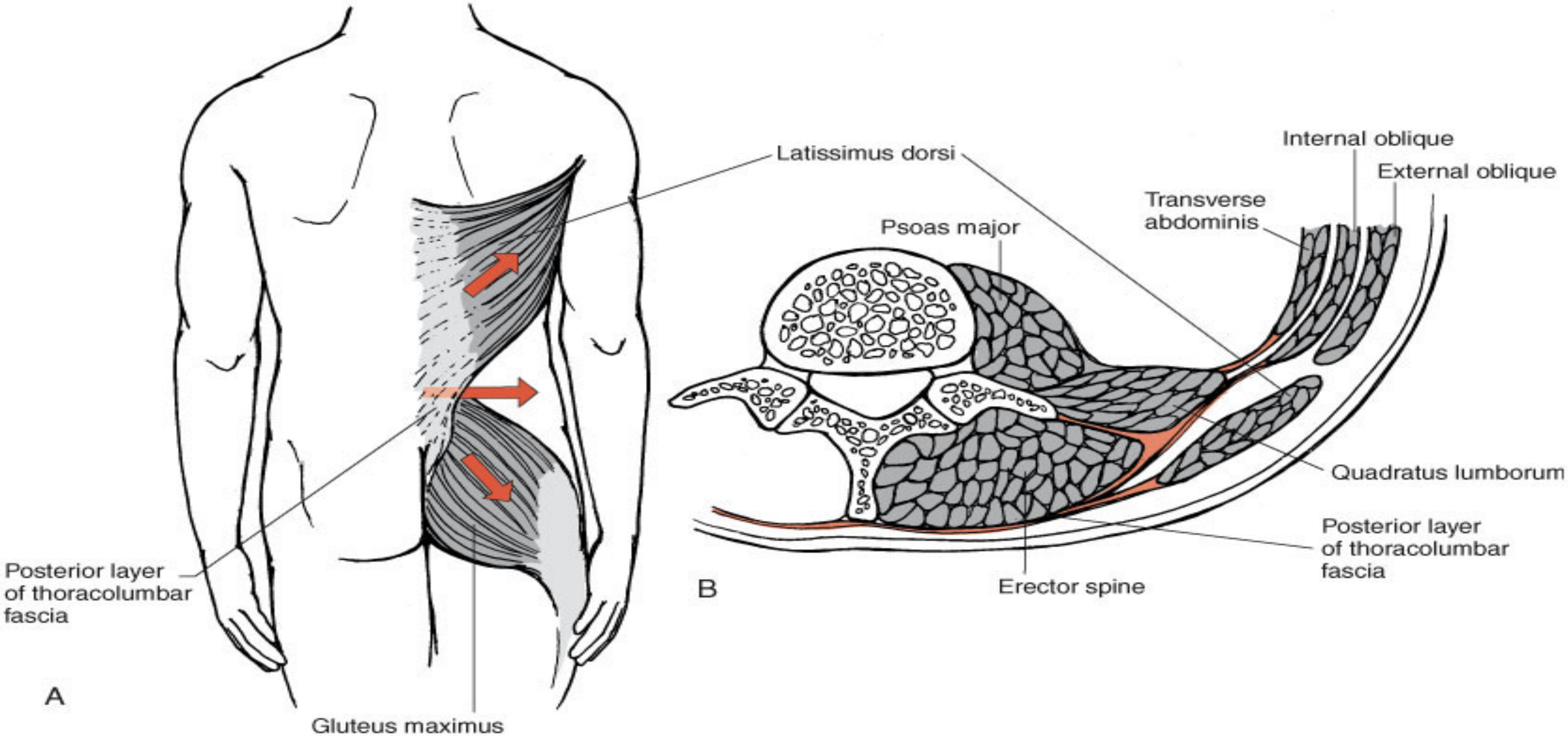


Figure 32.7: A. Posterior view of the TLF. Note how various muscles act to exert tension on this structure, thus providing dynamic stability to the low back. **B.** Axial (transverse) view of the posterior lumbar spine shows the layers and attachments of the TLF.

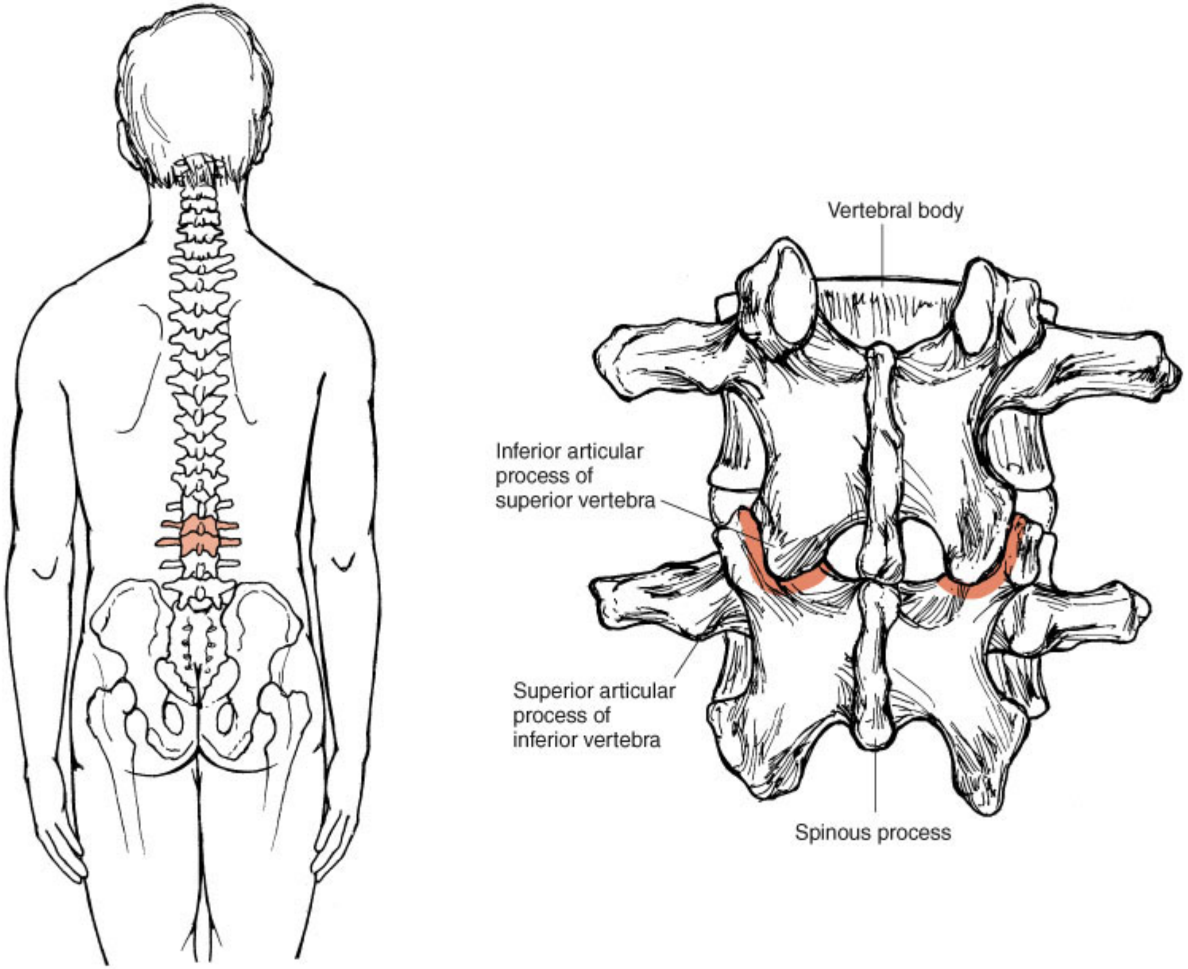


Figure 32.8: Posterior view of a lumbar motion segment illustrates the bony components of the lumbar facet joints. Note how the inferior articular processes of the superior segment "nest" into the superior articular processes of the inferior segment.

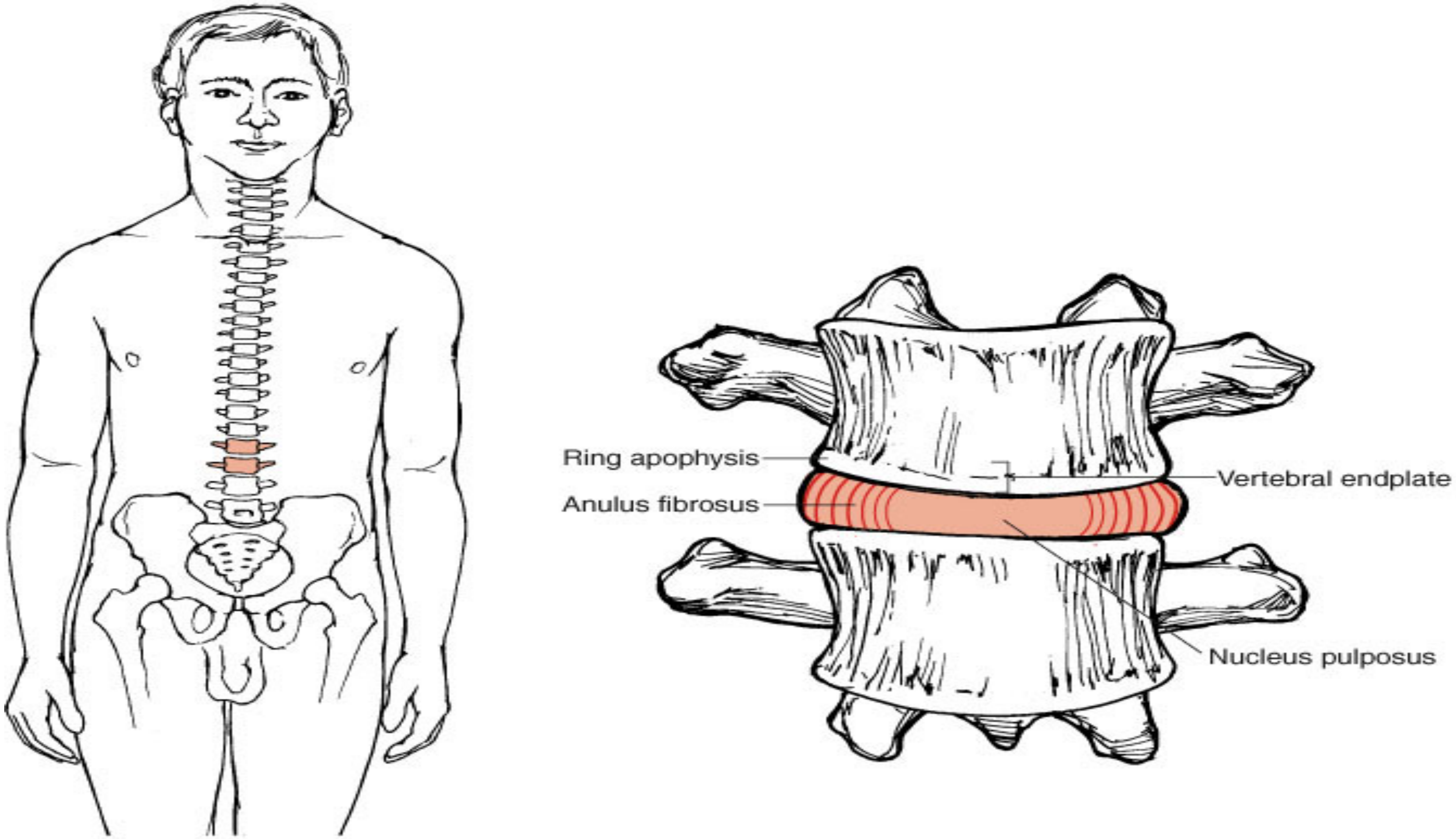
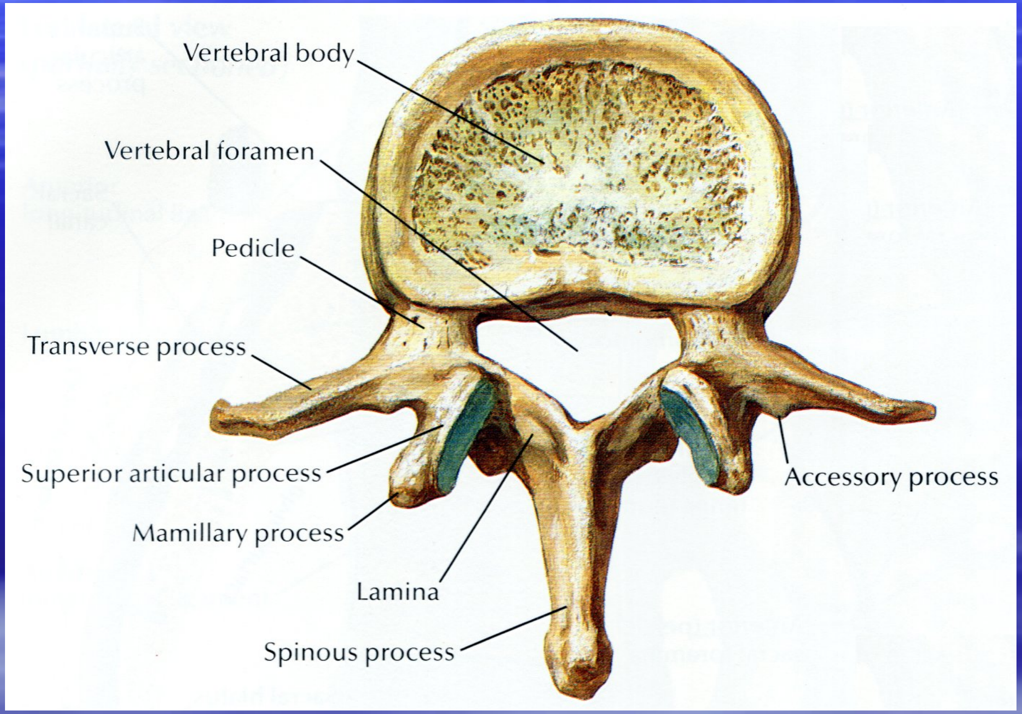


Figure 32.10: The lumbar intervertebral joint consists of the IVD, the vertebral endplate, and the ring apophysis.

Vertebae



- Vertebral body
- Pedicles
- Articular processes
- Lamina
- Spinous process

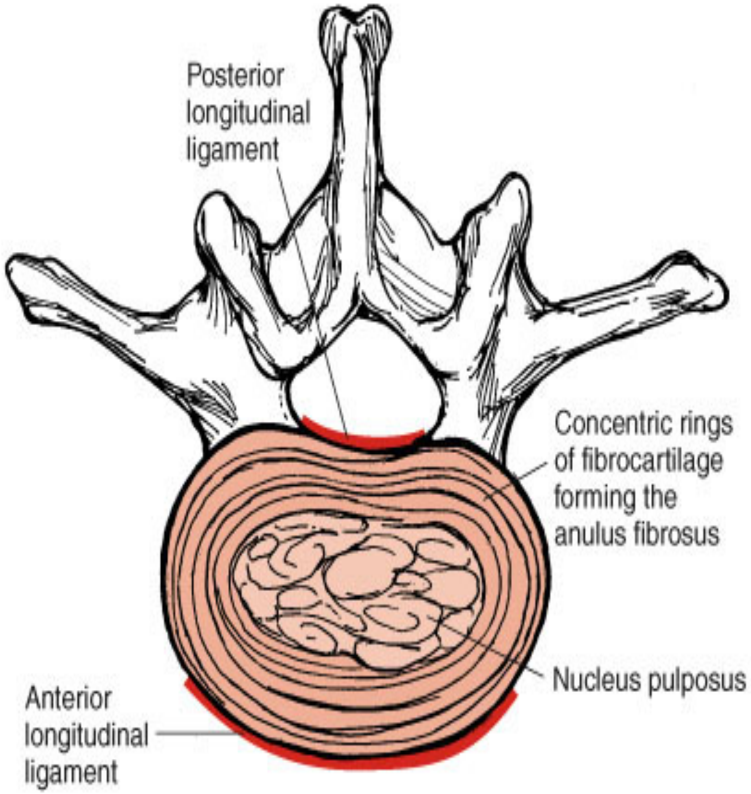
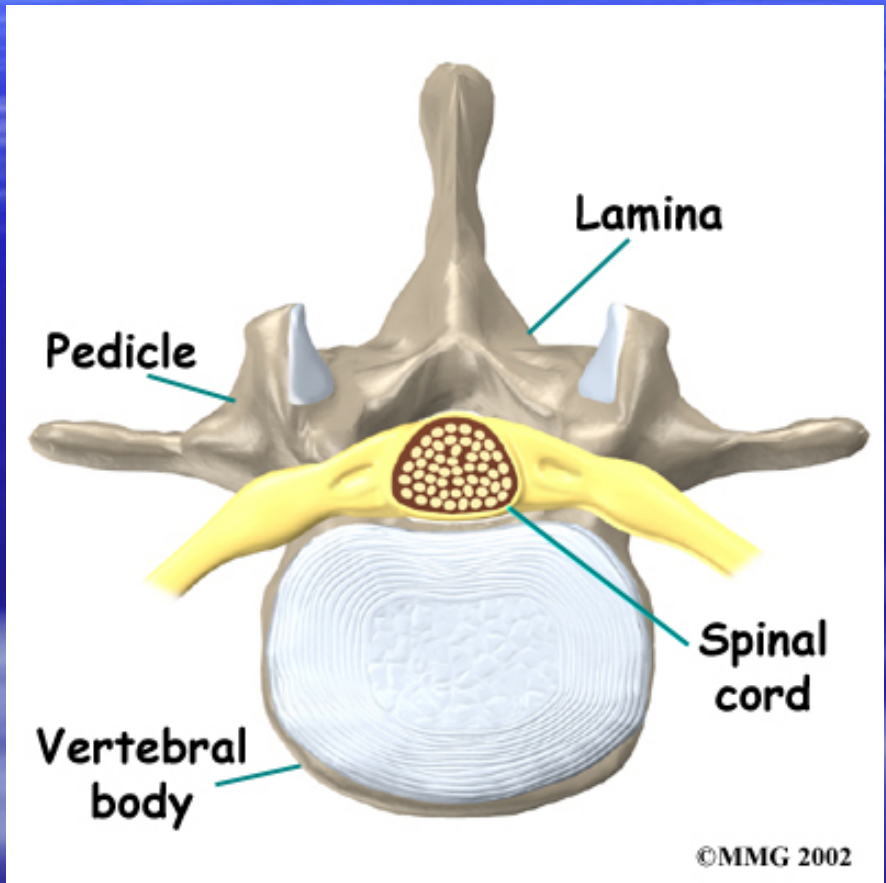


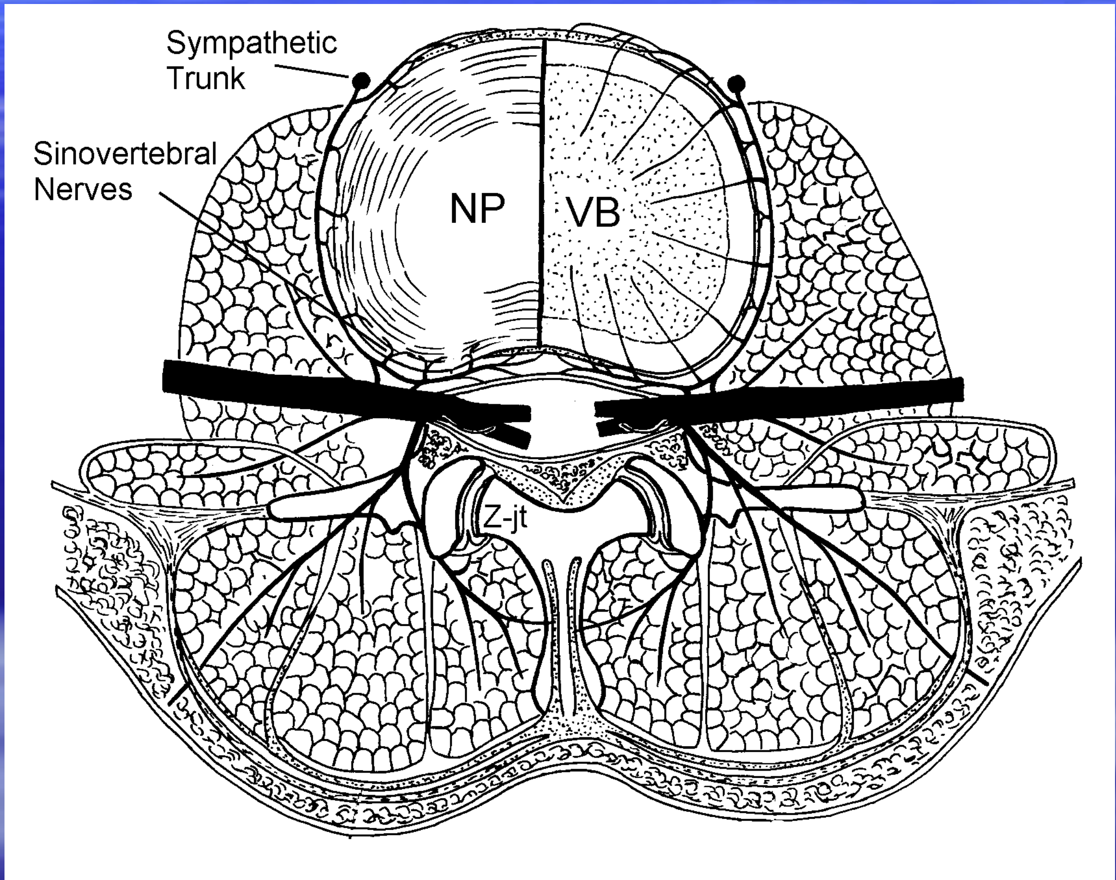
Figure 32.11: Axial view of the lumbar IVD. Note the posterior concavity and the close relationships of the anterior and posterior longitudinal ligaments to the anterior and posterior anulus fibrosus.

Spinal Canal



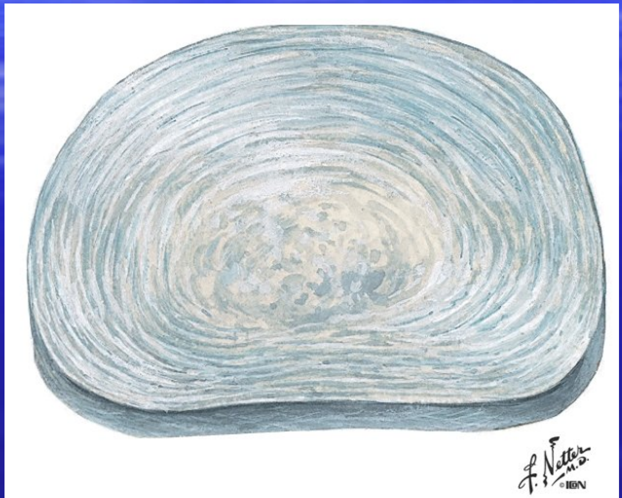
- Bordered anteriorly by the vertebral body or intervertebral disc
- Bordered laterally by the pedicles
- Z-joints posterolateral
- Posteriorly bordered by lamina and ligamentum flavum

Innervation



- Outer 1/3 of anulus and PLL innervated by sinuvertebral nerves
- Anterior disc has some sensory input through sympathetic trunk
- Posterior spinal elements carry nociception through medial branch nerves

Intervertebral Disc



- Nucleus Pulposus - Semifluid mass with consistency similar to toothpaste
- Annulus fibrosis - 10-20 sheets (average 17) of collagen fibers called *lamellae* arranged in concentric rings surrounding the nucleus

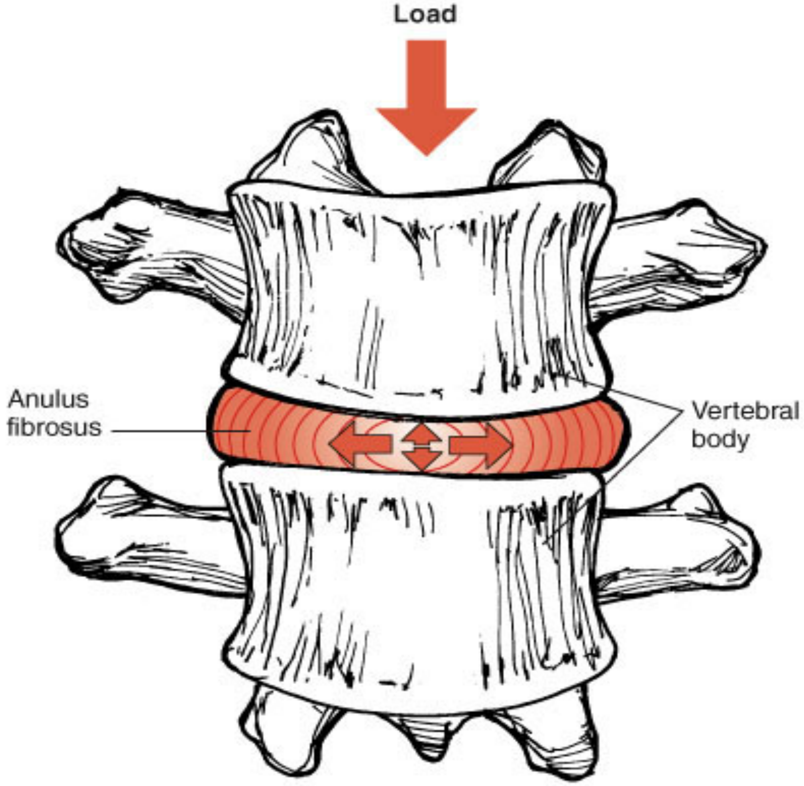


Figure 32.13: An example of the "hoop stress" created within the IVD during compressive load bearing. Compressive loading on the nucleus pulposus causes it to exert radial stresses on the anulus fibrosus.

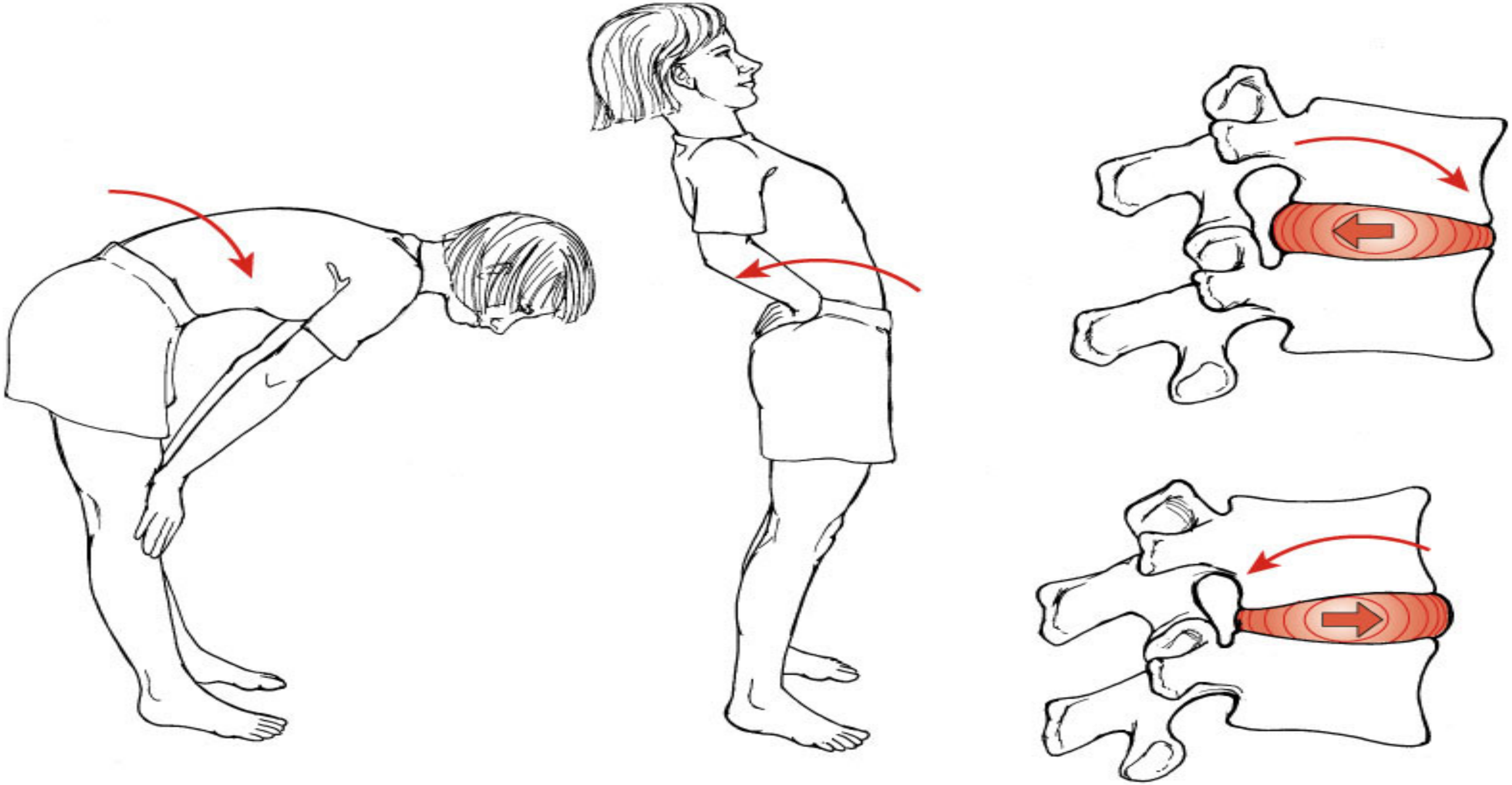


Figure 32.14: The concept of the nucleus pulposus acting as a ball bearing during lumbar motion. This principle results in deformation of the nucleus in the direction opposite the motion. During lumbar flexion, the nucleus pulposus tends to deform posteriorly; in lumbar extension, the nucleus pulposus tends to deform anteriorly.

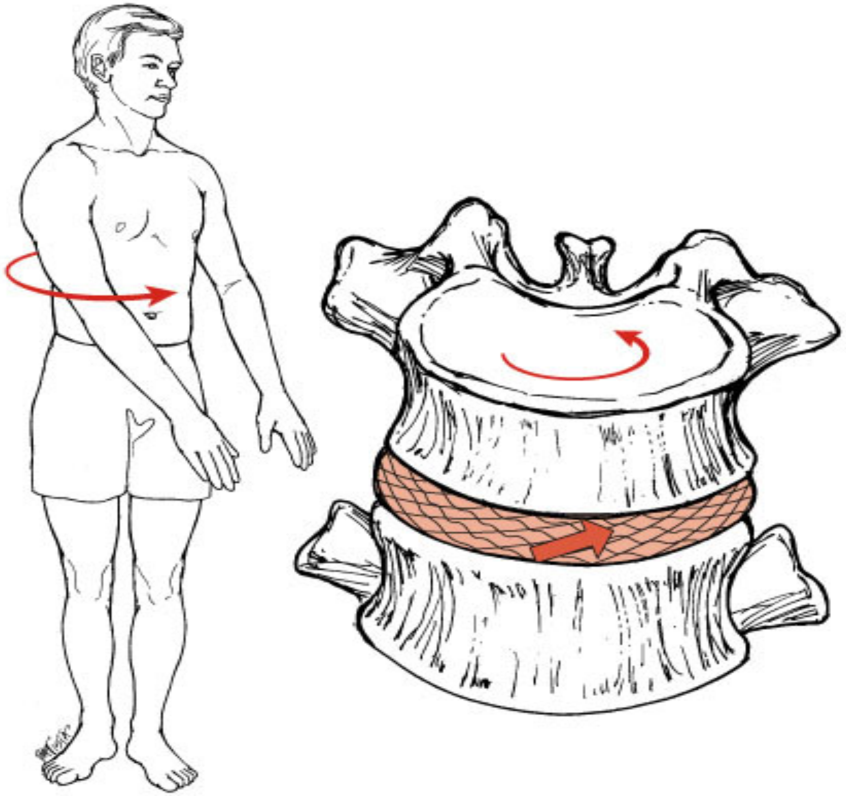
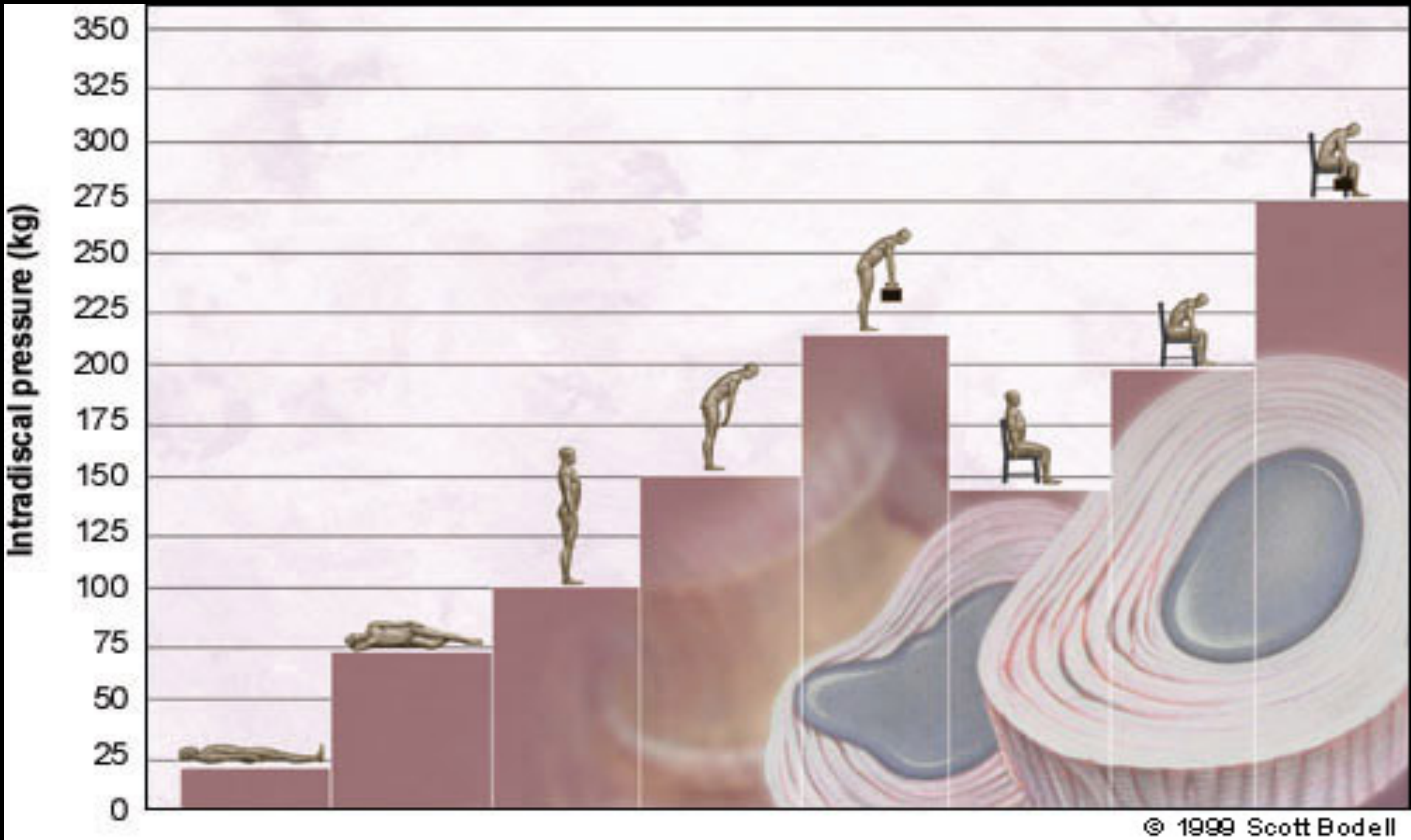


Figure 32.16: Stress on the fibers of the anulus fibrosus during lumbar rotation. The criss-cross arrangement of the collagen fibers results in only a portion of the fibers being loaded.

S.C. HUMPHREYS and ECK JS: Clinical Evaluation and Treatment Options for Herniated Lumbar Disc.

Am Family Phy, 1999.



Red Flags

Cancer Related Red Flags

- History of cancer
- Unexplained weight loss >10 kg within 6 months
- Age over 50 years or under 17 years old
- Failure to improve with therapy
- Pain persists for more than 4 to 6 weeks
- Night pain or pain at rest

Cauda Equina Syndrome Related Red Flags

- Urinary incontinence or retention
- Saddle anesthesia
- Anal sphincter tone decreased or fecal incontinence
- Bilateral lower extremity weakness or numbness
- Progressive neurologic deficit

Infection Related Red Flags

- Persistant fever (temperature over 100.4 F)
- History of intravenous drug abuse
- Recent bacterial infection
  - UTI or pyelonephritis
  - Cellulitis
  - Pneumonia
- Immunocompromised states
  - Systemic corticosteroids
  - Organ transplant
  - Diabetes mellitus
  - HIV
  - Rest Pain

Acute Abdominal Aneurysm Red Flags

- Abdominal pulsating mass
- Atherosclerotic vascular disease
- Pain at rest or nocturnal pain
- Age greater than 60 years

- Knowing the prevalence of various etiologies of back pain, looking for “red flag” findings

- B=bowel or bladder dysfunction
- A=anesthesia
- C=constitutional symptoms/malignancy
- K=chronic diseases
- P=paresthesia
- A=age>50
- I=infection, IV drug use
- N=neuromotor deficits

Table 2. "Red Flag" Findings and Evaluation Strategies for Patients with Low Back Pain

	Diagnosis of concern				*Evaluation strategy**		
Finding	*Cauda equina syndrome*	*Fracture*	*Cancer*	*Infection*	*CBC/ESR/CRP*	*Plain radiography*	*MRI*
Age > 50 years		X	X		1†	1	2
Fevers, chills, recent urinary tract or skin infection, penetrating wound near spine				X	1	1	1
Significant trauma		X				1	2
Unrelenting night pain or pain at rest			X	X	1†	1	2
Progressive motor or sensory deficit	X		X				1E
Saddle anesthesia, bilateral sciatica or leg weakness, difficulty urinating, fecal incontinence	X						1E
Unexplained weight loss			X		1†	1	2
History of cancer or strong suspicion for current cancer			X		1†	1	2
History of osteoporosis		X				1	2
Immunosuppression				X	1	1	2
Chronic oral steroid use		X		X	1	1	2
Intravenous drug use				X	1	1	2
Substance abuse		X		X	1	1	2
Failure to improve after six weeks of conservative therapy			X	X	1†	1	2‡

CBC = complete blood count; ESR = erythrocyte sedimentation rate; CRP = C-reactive protein; MRI = magnetic resonance imaging.

NOTE: *"Red flag" findings indicate the possibility of a serious underlying condition.*

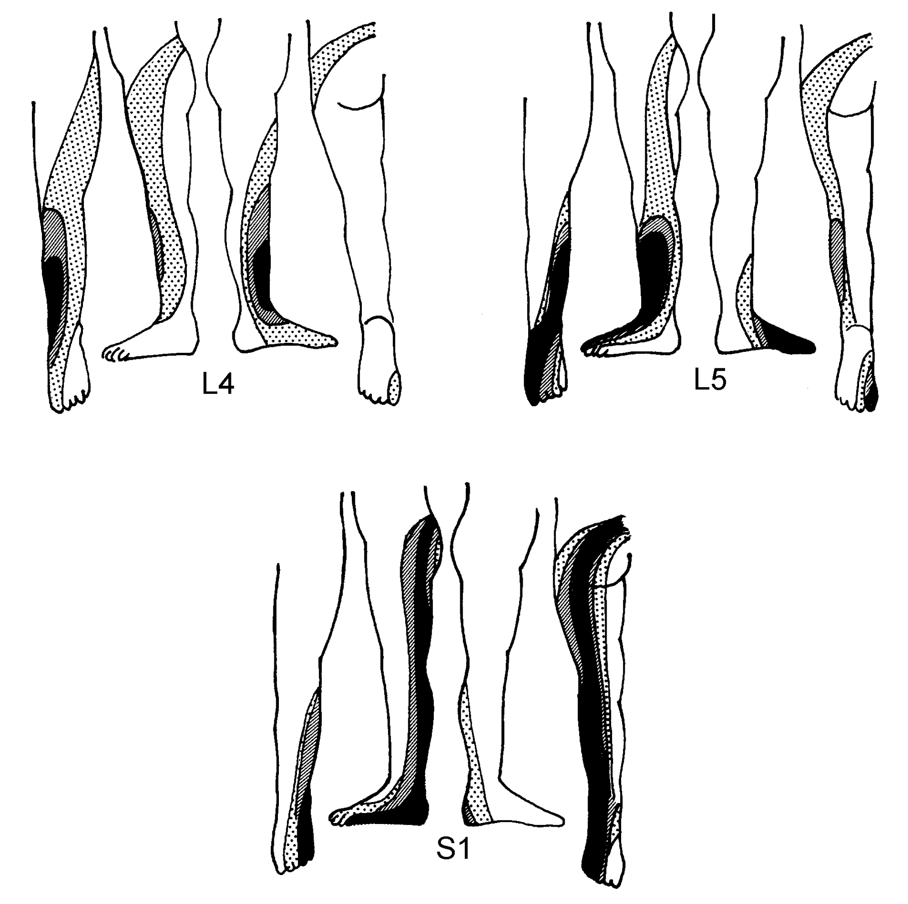
**—1 = first-line evaluation in most situations; 2 = follow-up evaluation; E = emergent evaluation required.*
†—Prostate-specific antigen testing may be indicated in men in whom cancer is suspected.
‡—Or unnecessary.

Information from reference 16.

Table 3. Physical Examination Findings in Nerve Root Impingements

Herniation	*Nerve root affected*	*Sensory loss*	*Motor weakness*	*Screening examination*	*Reflex*
L3-L4 disk	L4	Medial foot	Knee extension	Squat and rise	Patellar
L4-L5 disk	L5	Dorsal foot	Dorsiflexion ankle/great toe	Heel walking	None
L5-S1 disk	S1	Lateral foot	Plantarflexion ankle/toes	Walking on toes	Achilles

Dermatomes



- May be described as numbness, an “ache”, or less commonly paresthesias
- Dermatomes suggestive but not absolute

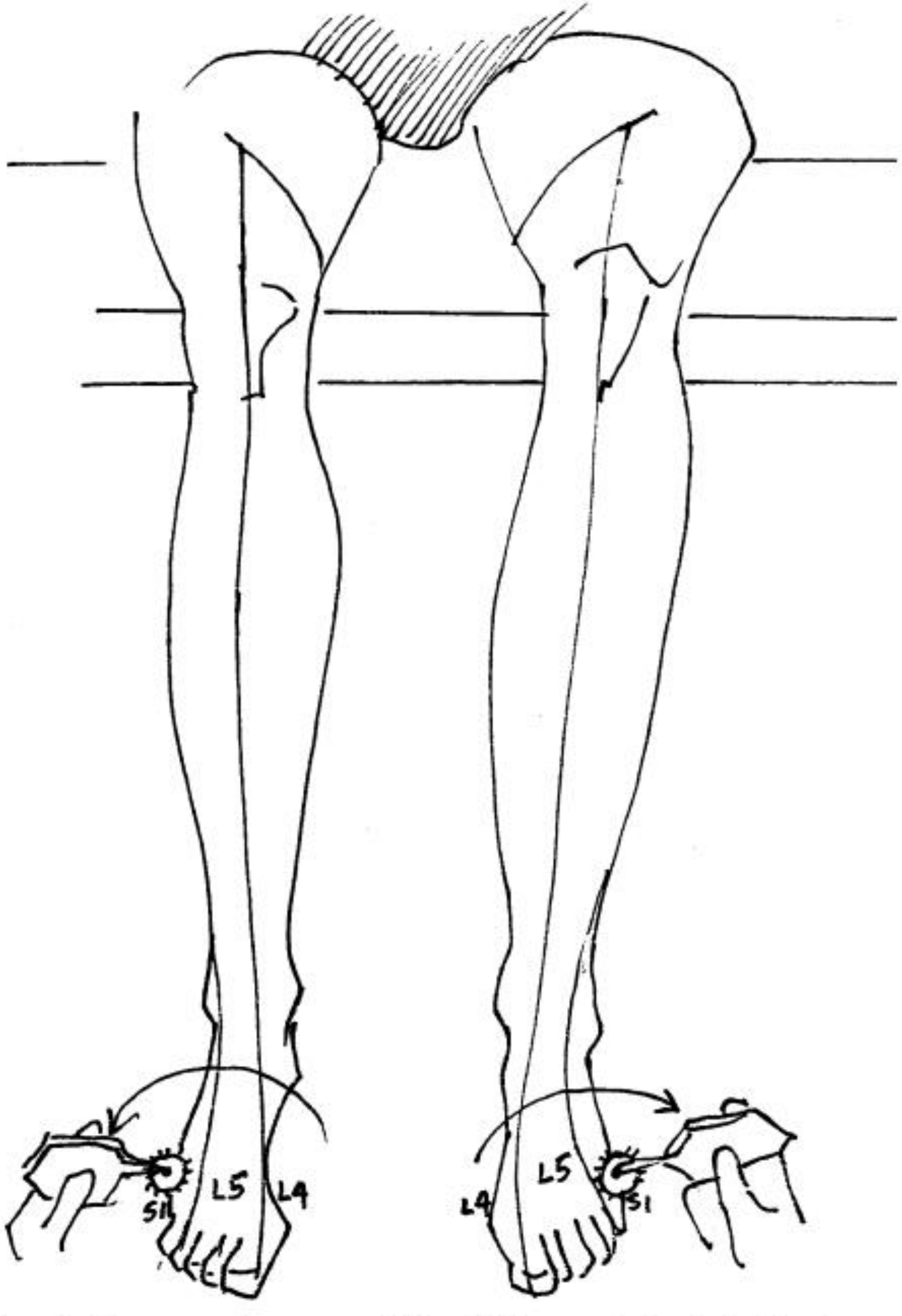


Figure 8: The sensory dermatomes (A) and (B) a practical method of testing sensation across the dorsum of the foot.

Myotomes

T12, L1, L2, L3

- Iliopsoas

L2, L3, L4

- Quadriceps
- Hip adductor group

L4

- Tibialis anterior
- Knee Jerk reflex

L5

- Extensor hallucis longus
- Gluteus medius
- Extensor digitorum longus & brevis

S1

- Peroneus longus & brevis
- Gastrocnemius-Soleus
- Gluteus maximus
- Ankle Jerk reflex

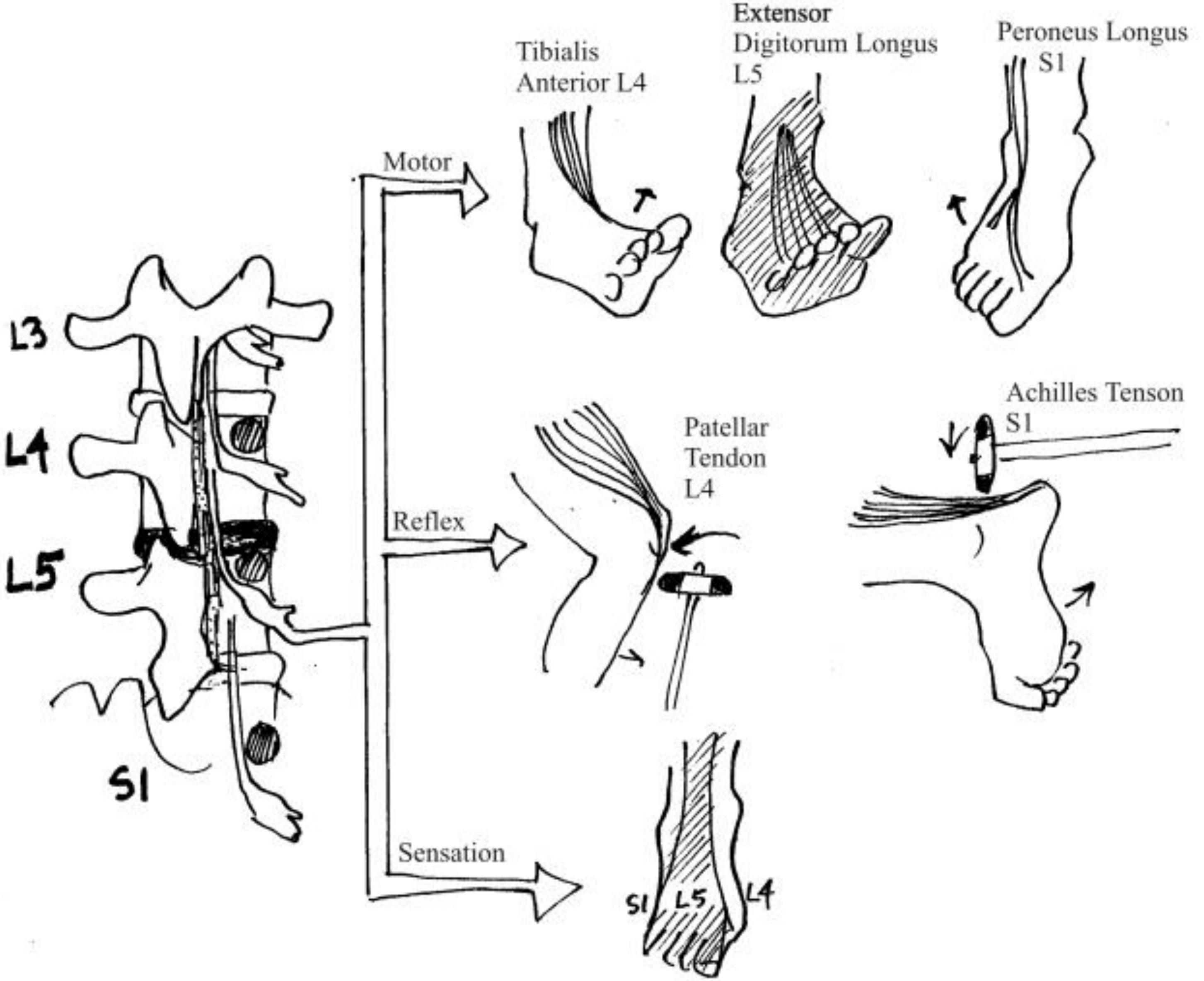


Figure 10: A herniated disc between vertebrae L4 and L5 involves the L5 nerve root. This is the second most common level of disc herniation in the lumbar spine.

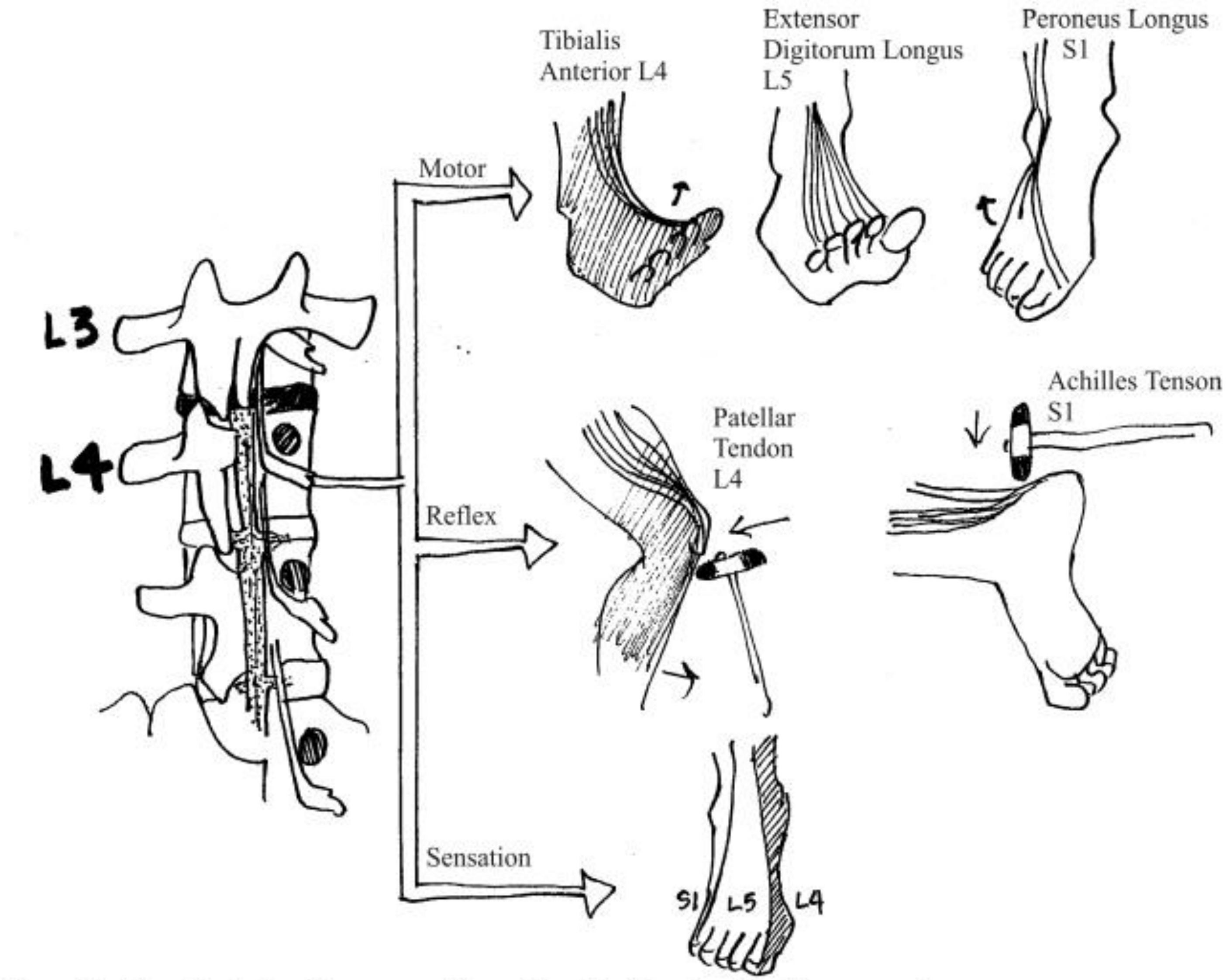


Figure 9: A herniated disc between vertebrae L3 and L4 involves the L4 nerve root.

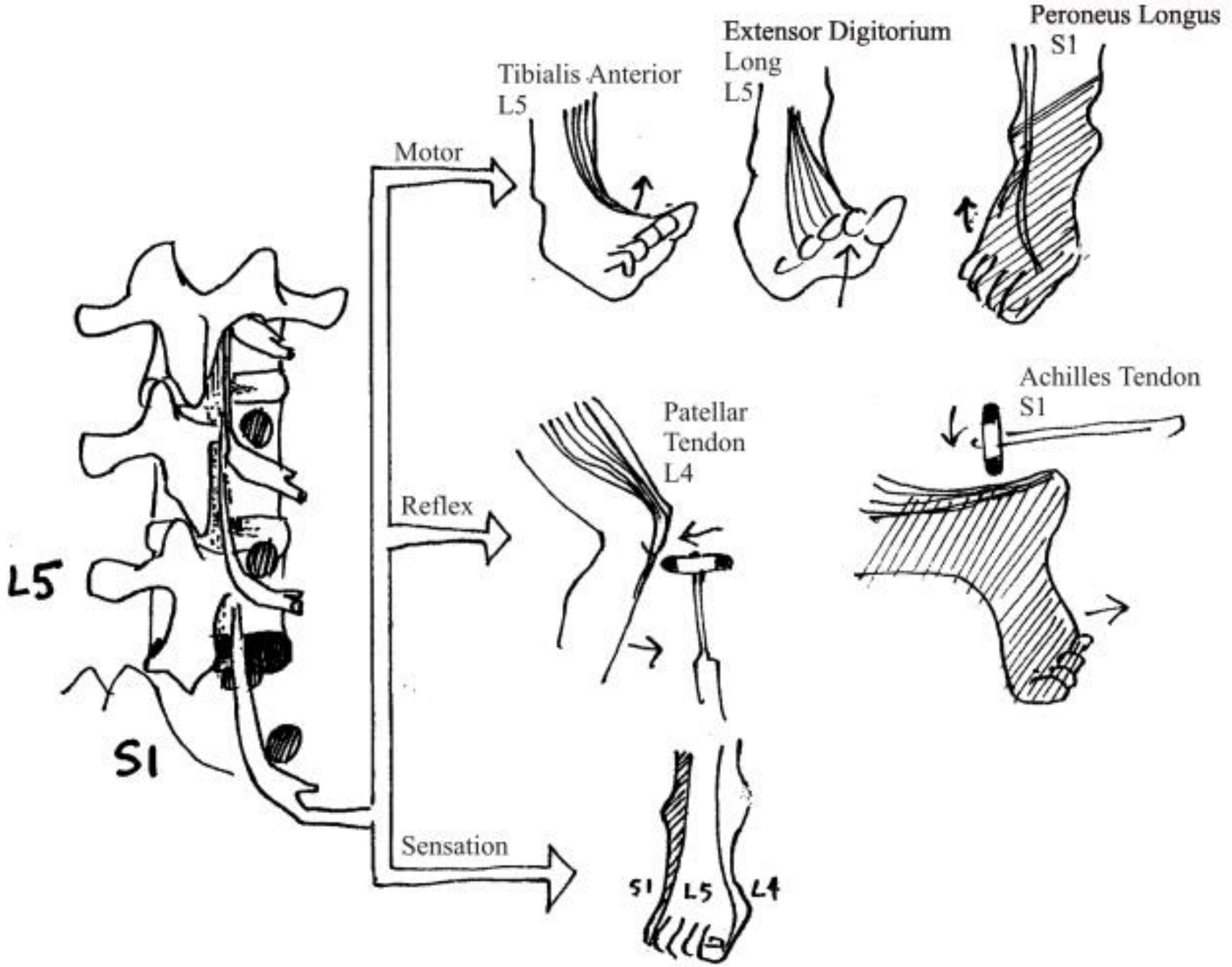
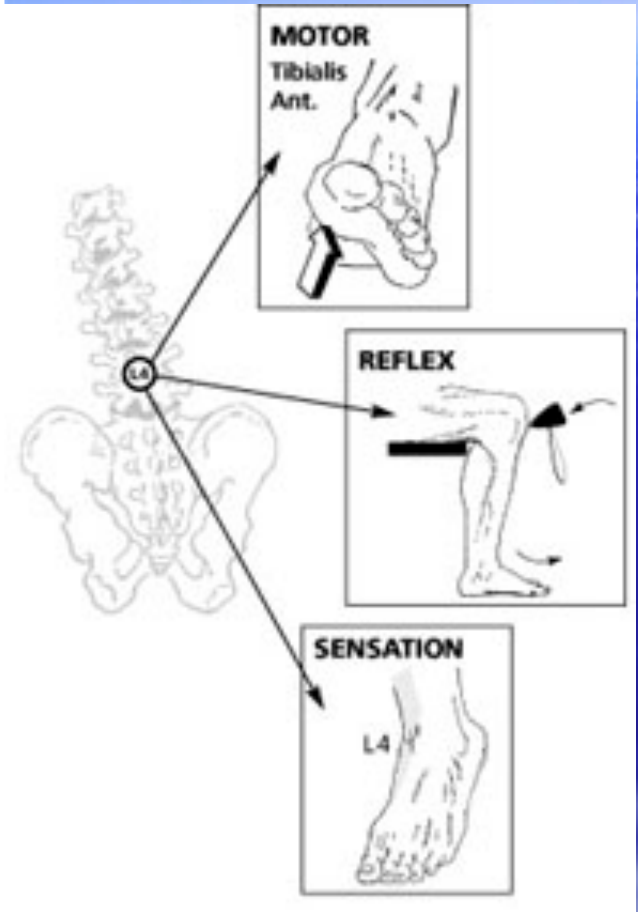


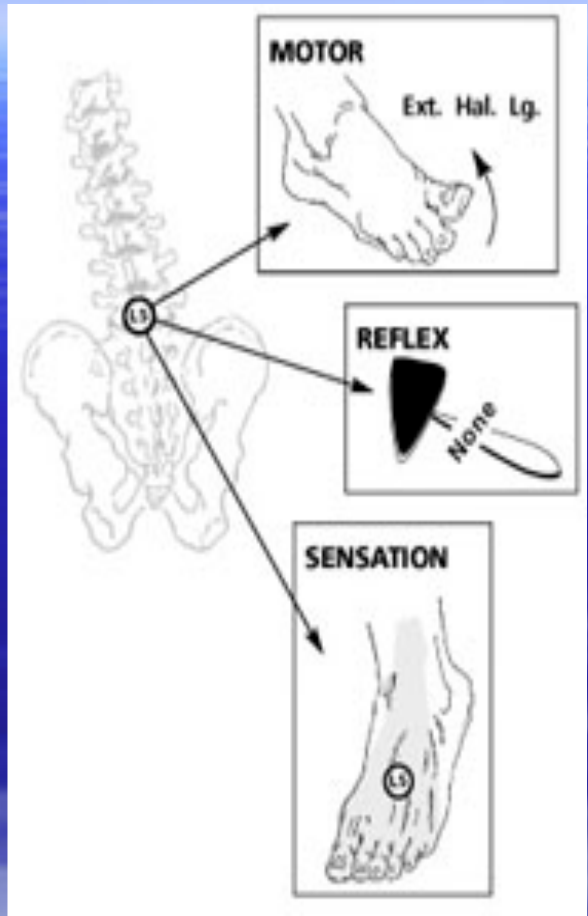
Figure 11: A herniated disc between vertebrae L5 and S1 involves the S1 nerve root. This is the most common level of disc herniation in the lumbar spine.

Reflexes

- L4 patellar
- L5 medial hamstrings
- S1 Achilles




MOTOR
Tibialis
Ant.
L4
REFLEX
SENSATION
L4


MOTOR
Ext. Hal. Lg.
L5
REFLEX
None
SENSATION
L5

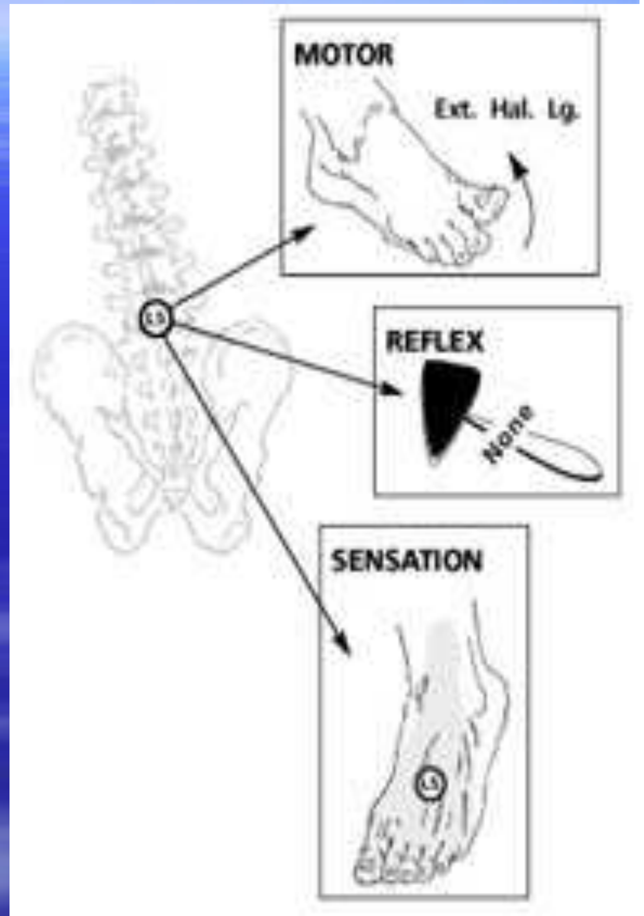
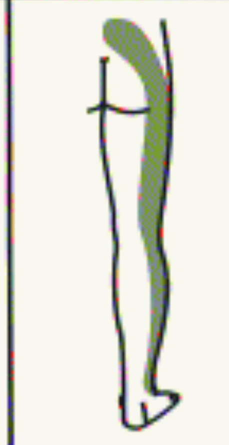
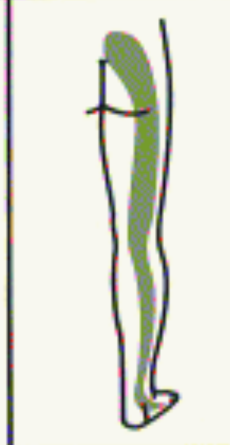
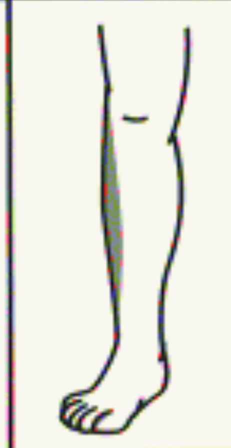

MOTOR
Ext. Hal. Lg.
L5
REFLEX
None
SENSATION
L5

Figure 1. Testing for lumbar nerve root compromise.

Nerve root	L4	L5	S1
Pain			
Numbness			
Motor weakness	Extension of quadriceps.	Dorsiflexion of great toe and foot.	Plantar flexion of great toe and foot.
Screening exam	Squat & rise.	Heel walking.	Walking on toes.
Reflexes	Knee jerk diminished.	None reliable.	Ankle jerk diminished.

Sacral Iliac Joint Dysfunction

Supporting Musculature

Pain Patterns & Diagnosis

Mitigating Factors

Treatment Including Rehabilitation

Ultrasound evaluation of sacroiliac motion in normal volunteers.

Lund PJ; Krupinski EA; Brooks WJ

Department of Radiology, University of Arizona, Tucson 85724-5067, USA

Acad Radiol 1996 Mar;3(3):192-6

ABSTRACT:

RATIONALE AND OBJECTIVES: We demonstrated quantitatively, using ultrasound imaging, the passive range of motion of the normal sacroiliac (SI) joint. METHODS: Ultrasound images of the SI joints of 22 adults at rest and during a manual medicine maneuver designed to induce a passive range of motion in the SI joint were obtained. Differences between the baseline alignment of the SI joint and alignment during induced passive motion were observed and measured by six radiologists. RESULTS: Significant movement (> 2 mm) of at least one SI joint was demonstrated in 82% of the subjects using ultrasound recordings. Interobserver (r = .49 - .81) and intraobserver (r = .87) correlations were high. CONCLUSION: The results suggest that the range of passive SI joint motion is more than 2 mm, and may be up to 10 mm in some normal subjects, and that ultrasound imaging could be a useful method for assessing passive SI movement.

Sacroiliac Motion for Extreme Hip Positions: A Fresh Cadaver Study.

Spine. 22(18):2073-2082, September 15, 1997.

*Smidt, Gary L. PhD, PT; Wei, Shun-Hwa PhD, PT; McQuade, Kevin PhD, PT; Barakatt, Ed MA, PT; Sun, Tiansheng MD; Stanford, William MD **

Abstract:

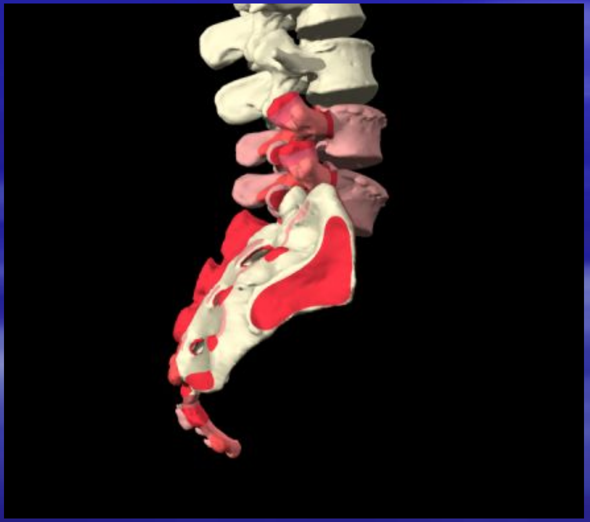
Study Design. This study placed fresh cadavers in different hip positions and obtained sacroiliac kinematics. The magnitudes and directions of angular and linear sacroiliac motion are reported.

Results. The methods used in this study were validated. The largest amount of sacroiliac motion occurred in the sagittal plane (7^{o} on left and 8^{o} on the right, with a range of $3^{o}$to 17^{o}). Definite trends in the direction of angular sacroiliac motion occurred with respect to both bilateral and reciprocal hip joint positions. The translation or linear motion of the posterior superior iliac spines with respect to the sacrum ranged from 4 to 8 mm. This motion tended to occur in all directions, with no detectable trends.

Conclusions. Even though the subjects in this study were elderly, considerable angular and linear motion was in evidence. As such, it appears that extreme hip positions are necessary to elucidate full range of motion at the sacroiliac joint.

Biomechanical Function

- Movement of ileum forms an AP “glide”
- Contributes to a smooth gait

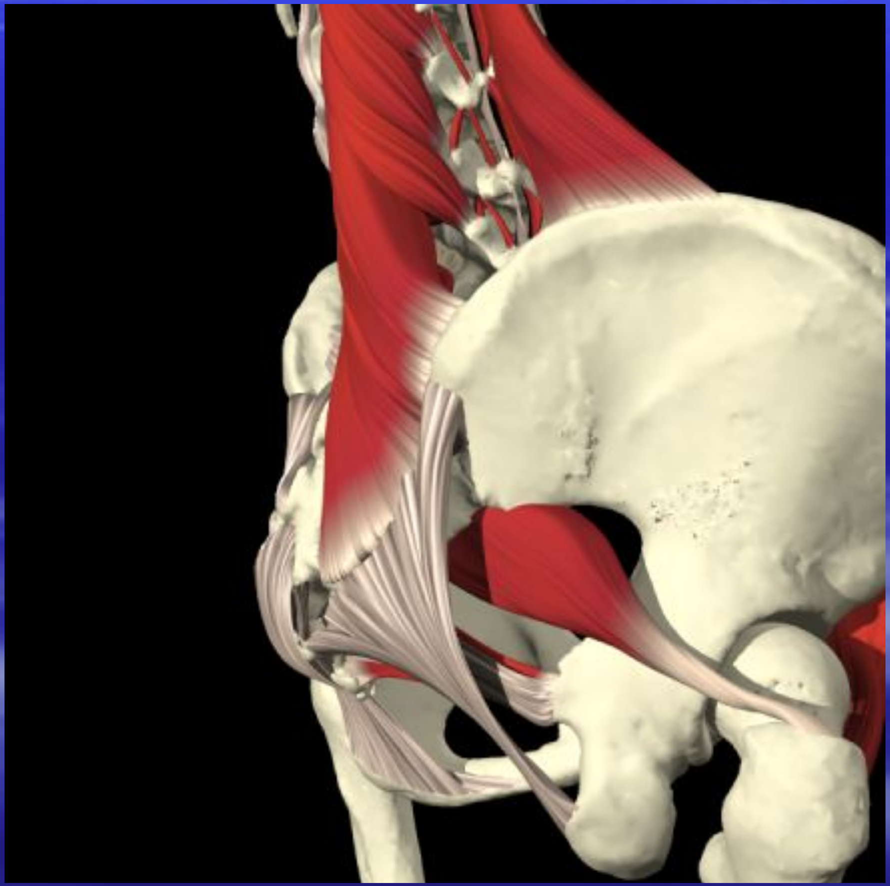


Supporting musculature

- Piriformis

Supporting musculature

- Quadratus lumborium
- Multifidius

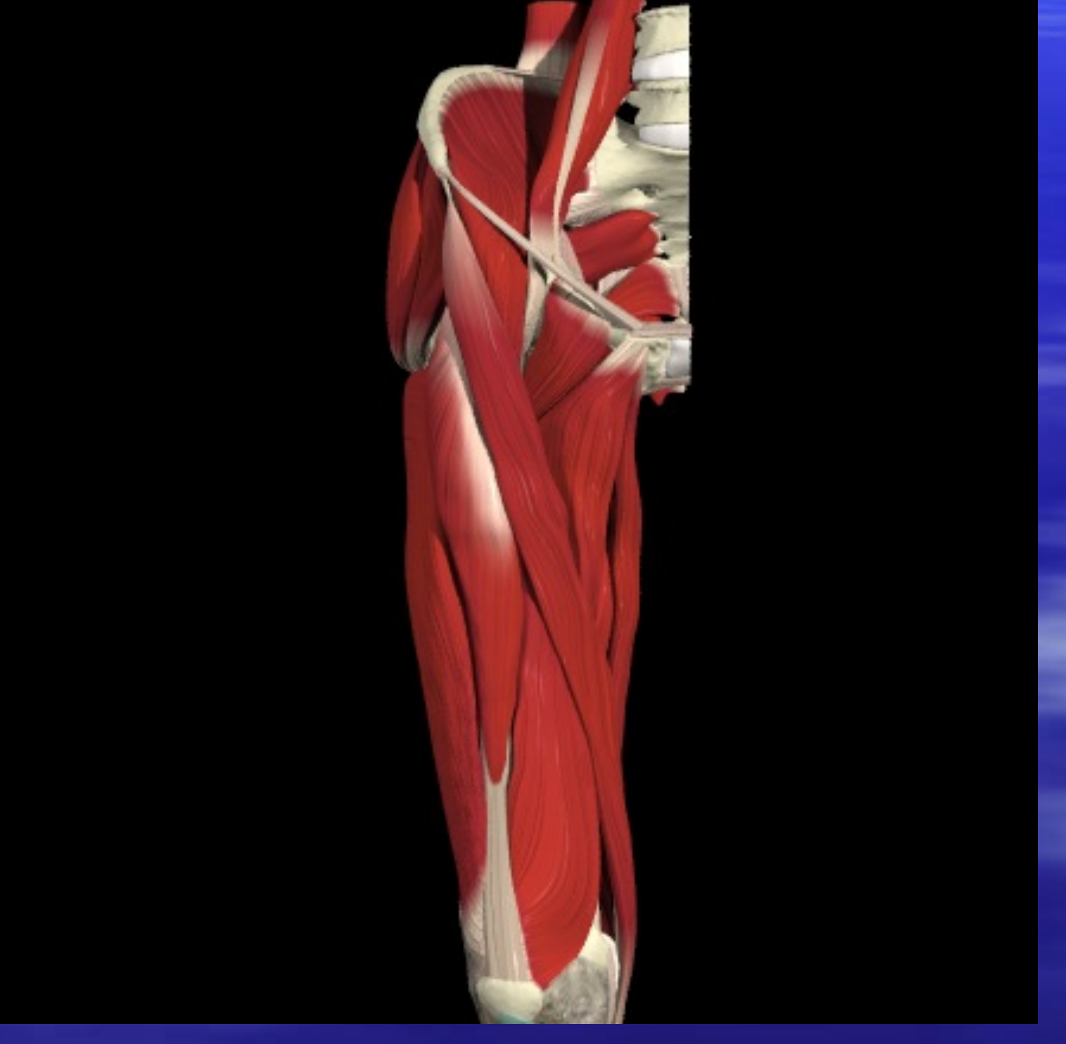


Supporting musculature

- Iliopsoas

Supporting musculature

- Quadriceps
- Adductors
- Sartorius



Supporting musculature

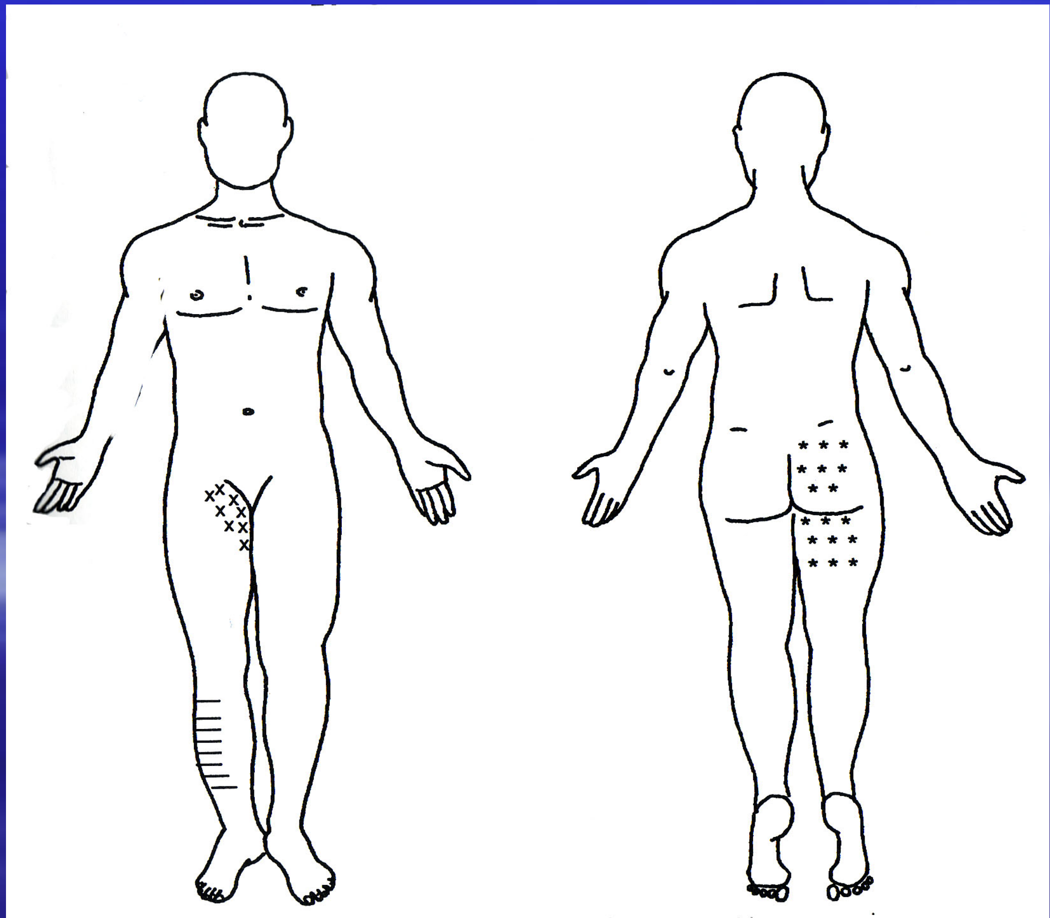
- Gluteals
- Hamstrings
- TFL

Typical Symptoms

- Pain localized to the SI joint alone
- Pain into the ipsilateral buttock
- Worse with sitting
- Occasionally pain may extend to:
  – Lateral & posterior calf
- Rarely occurring:
  – Paresthesias ipsilateral lower extremity

Pain Drawing

- Verbal description vs. drawing
- In the patient's own hand



Analog Pain Scale

- To what degree does it hurt
- Gives the doctor a scale for comparison
- Useful for reassessment

Least —————————————————— Worse

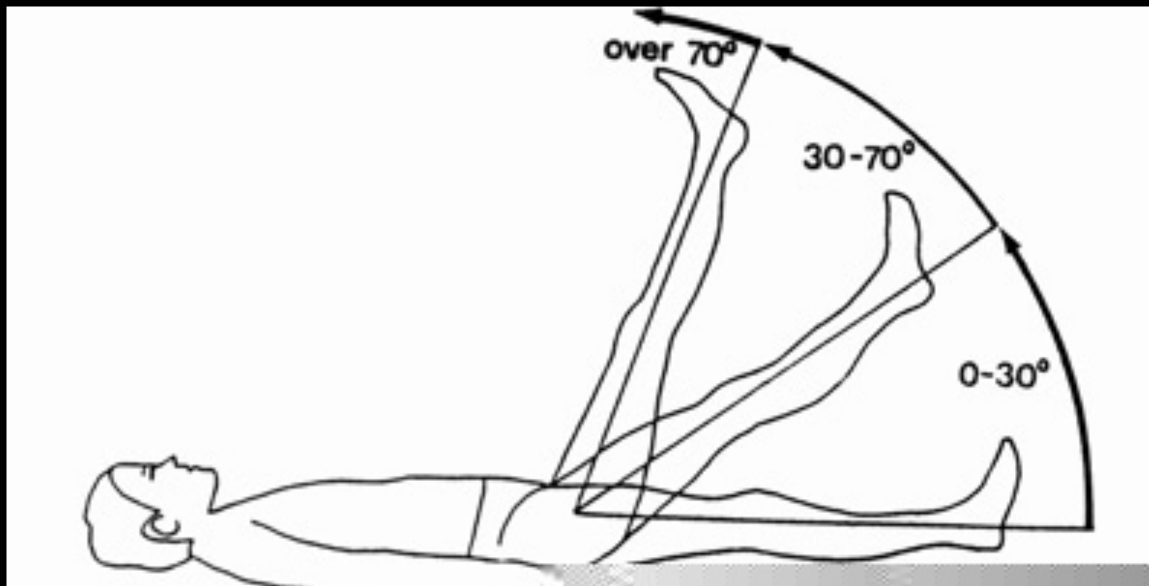
Ostwestry Index

- Quality of Life Indicators
- Scored by patient in various categories
- Allows doctor to gauge impact of problem
- Reassessment can be performed periodically
- Excellent for validating care to:
  - Patient
  - Yourself
  - Third Party Carrier

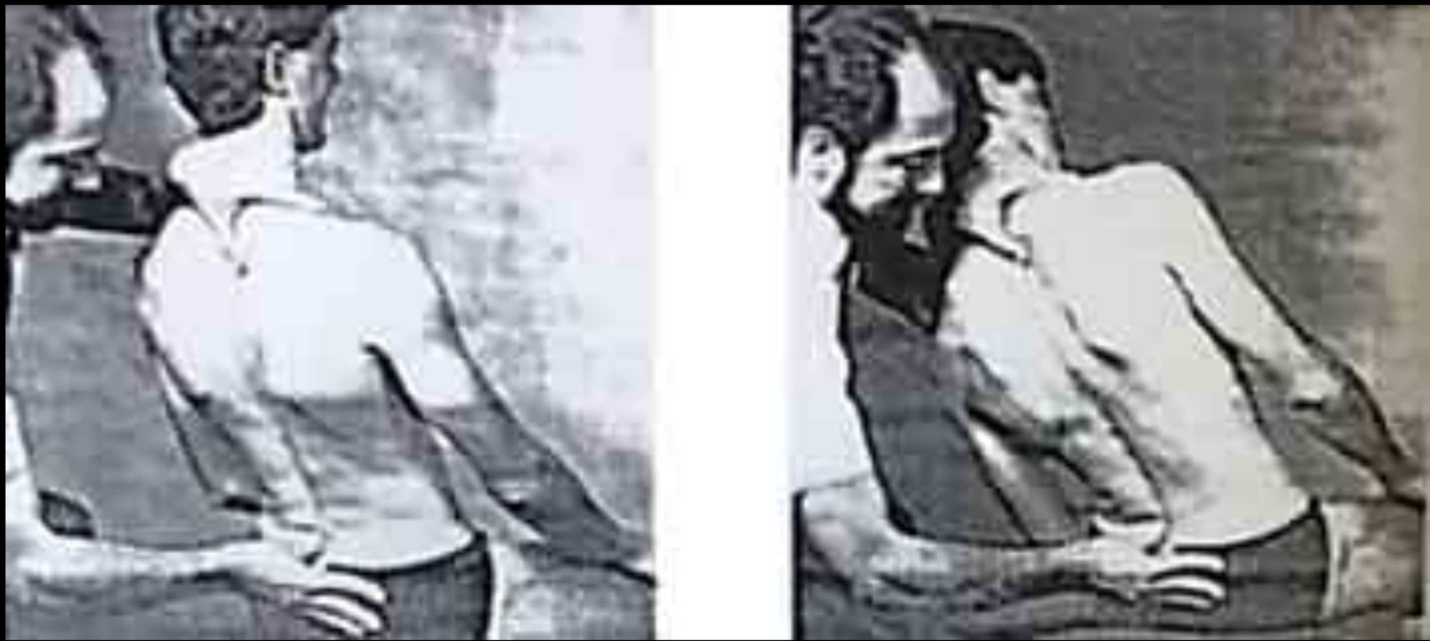
Orthopedic Evaluation

- Lasegue
- Kemp’s
- Bechterew’s sitting test
- Milgram’s
- Valsava’s

Orthopedic Evaluation

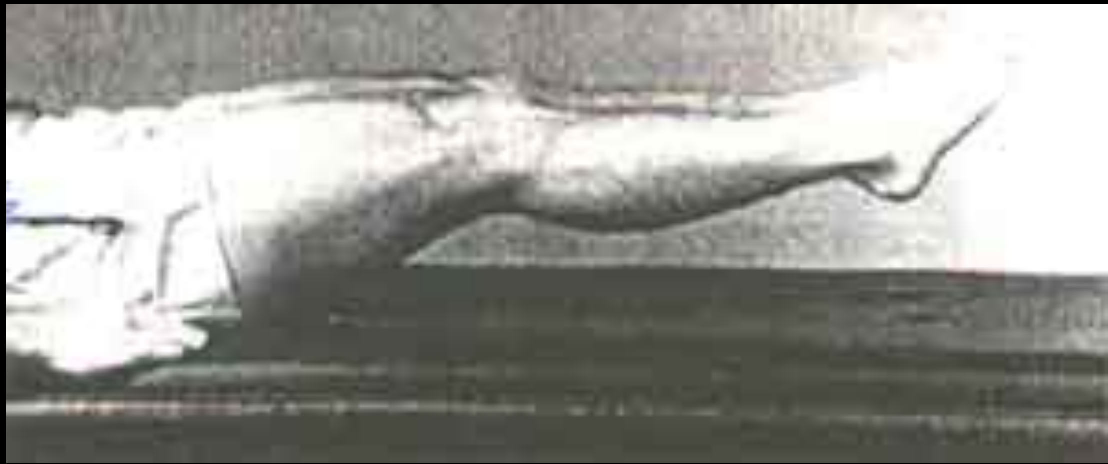


Orthopedic Evaluation



Orthopedic Evaluation

Orthopedic Evaluation



Orthopedic Evaluation

- Yeoman's

Orthopedic Evaluation

- Hibb's Test

Orthopedic Evaluation

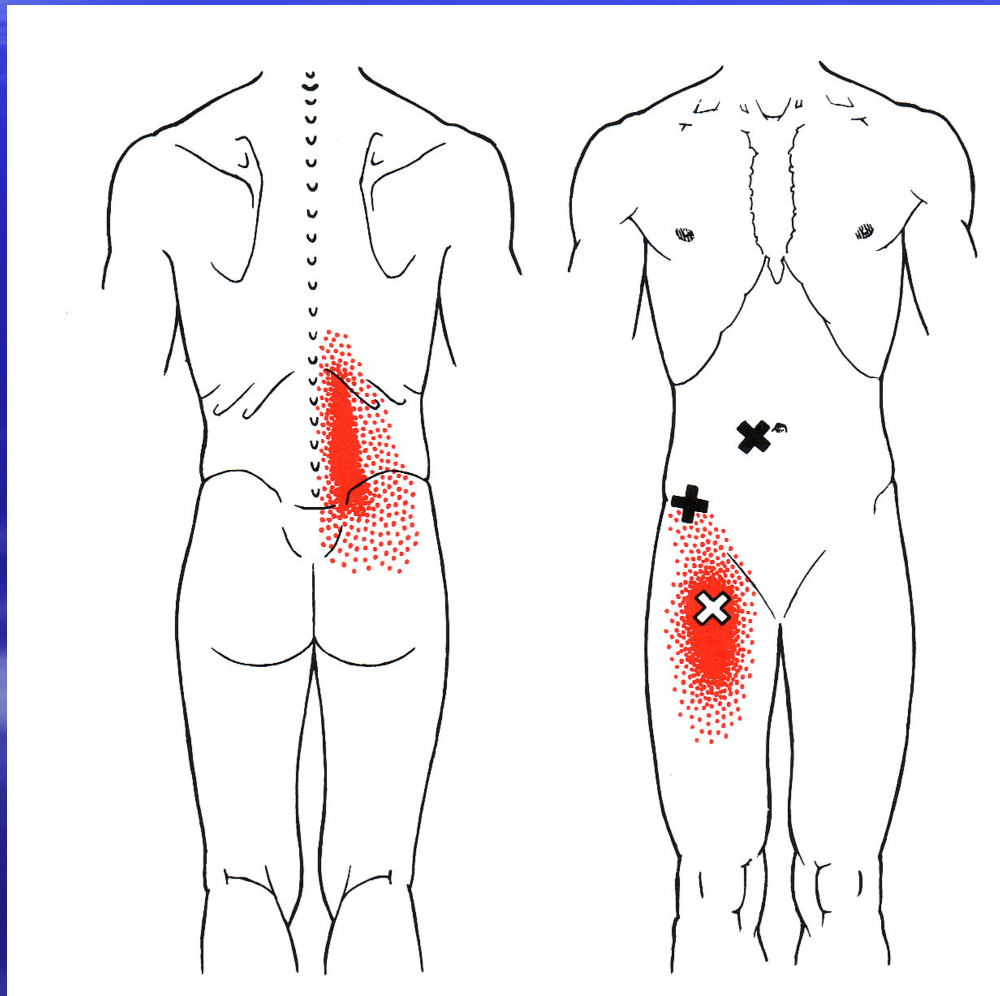
- Belt's Test

Orthopedic Evaluation

- SI Joint Approximation Test

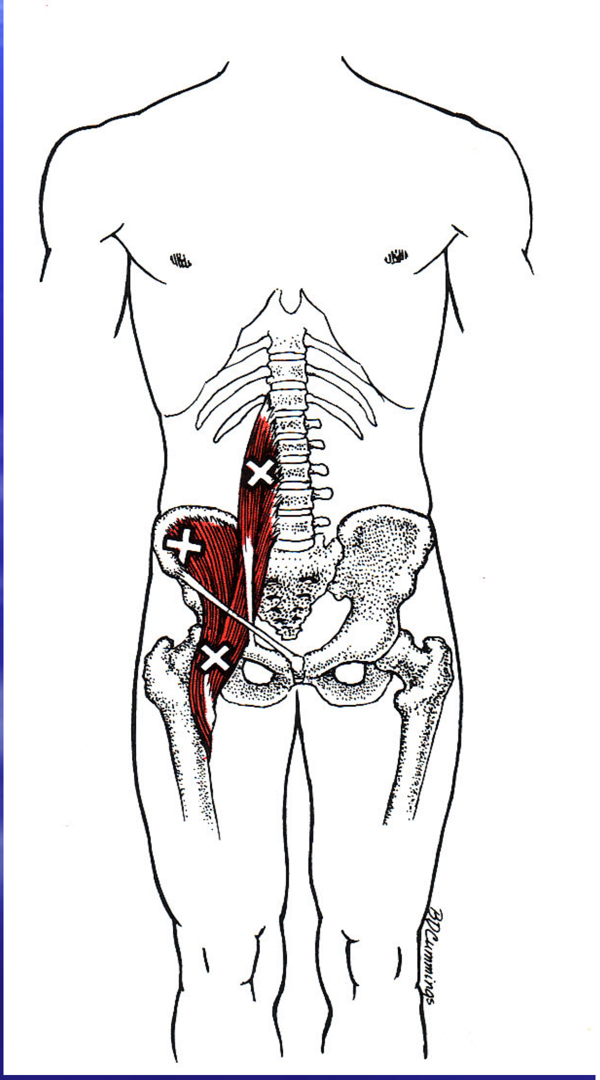
Trigger Point Involvement

- Iliopsoas muscle
  - Referral to SI joint region
  - Intensity of pain can be adequate to mimic SI joint pain



Trigger Point-Palpation

- Best found immediately superior to the inguinal ligament
- Work with the patient's breathing to ease into the region



Mitigating Factors

- Instability arising from foot dysfunction
- Leg length discrepancies
- Ergonomics
- Repetitive Motion

- F/S Pelvis Analysis

Clinical case

Sciatica / Sciatic Neuralgia

Piriformis Syndrome

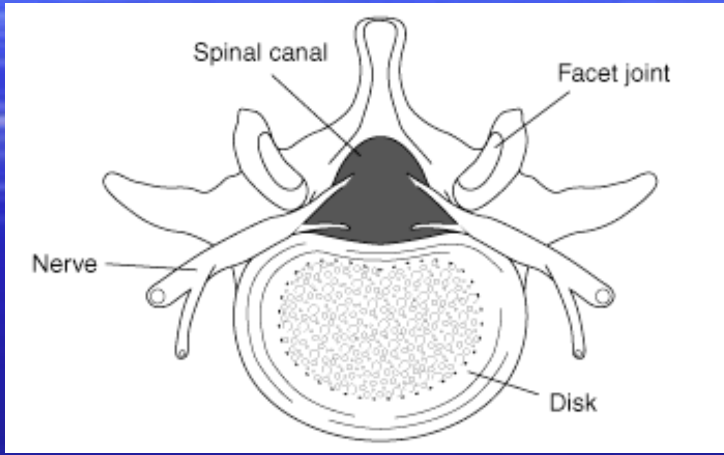
Spinal Stenosis

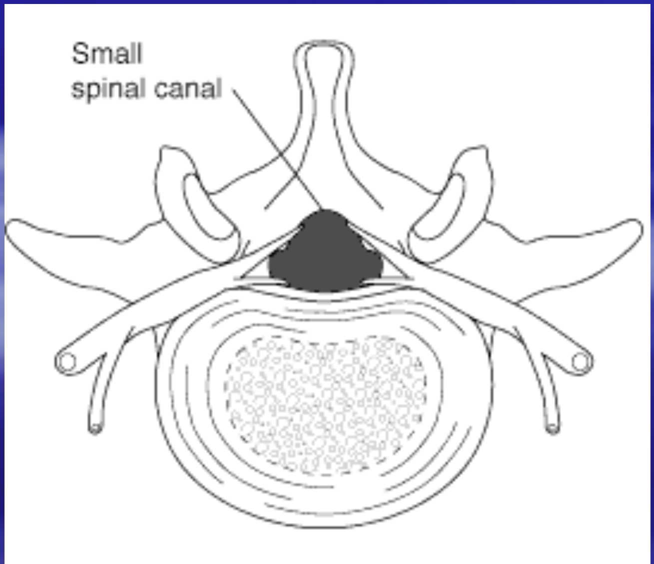
- Low back pain is the second most common reason that patients seek medical care
- More health care dollars are spent on back pain than any other condition
- 3-6 million patients in US with chronic back pain
- Of patients who see a specialist for back pain, 13-14% have spinal stenosis
- Other causes include disc injuries, posterior element pain, instability, fracture, etc

Lumbar Stenosis

- Congenital (Developmental)
- Acquired (Degenerative)
  - Herniated Disc
  - Spondylolisthesis
  - Osseous (hypertrophic)

Congenital Lumbar Stenosis





- Normally the spinal canal reaches "adult size" by age 4
- If it does not reach this size by that age, it will not catch up
- Radiographs reveal shortened pedicles (10-12mm in length)
- Stenosis is uniform throughout the spine

Other Conditions that May Contribute to Spinal Stenosis

- Bone dysplasia
- Calcium pyrophosphate deposition
- Achondroplastic dwarfism
- Diffuse idiopathic skeletal hyperostosis
- Senile ankylosing hyperostosis of the spine
- Ossification of the posterior longitudinal ligament
- Paget's disease of bone
- Previous lumbar surgery

Metabolic bone disease

- Hypoparathyroidism
- Renal osteodystrophy

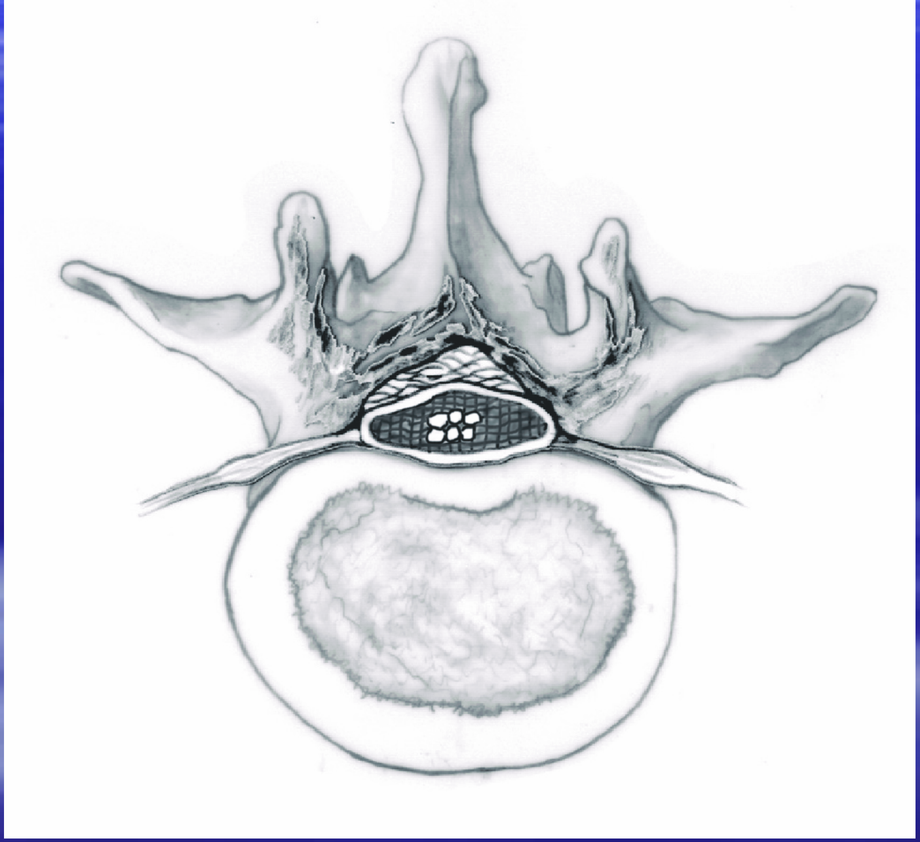
Infections

- Vertebral osteomyelitis
- Discitis

Tumors

- Epidural lipoma
- Intraspinal tumors or cysts

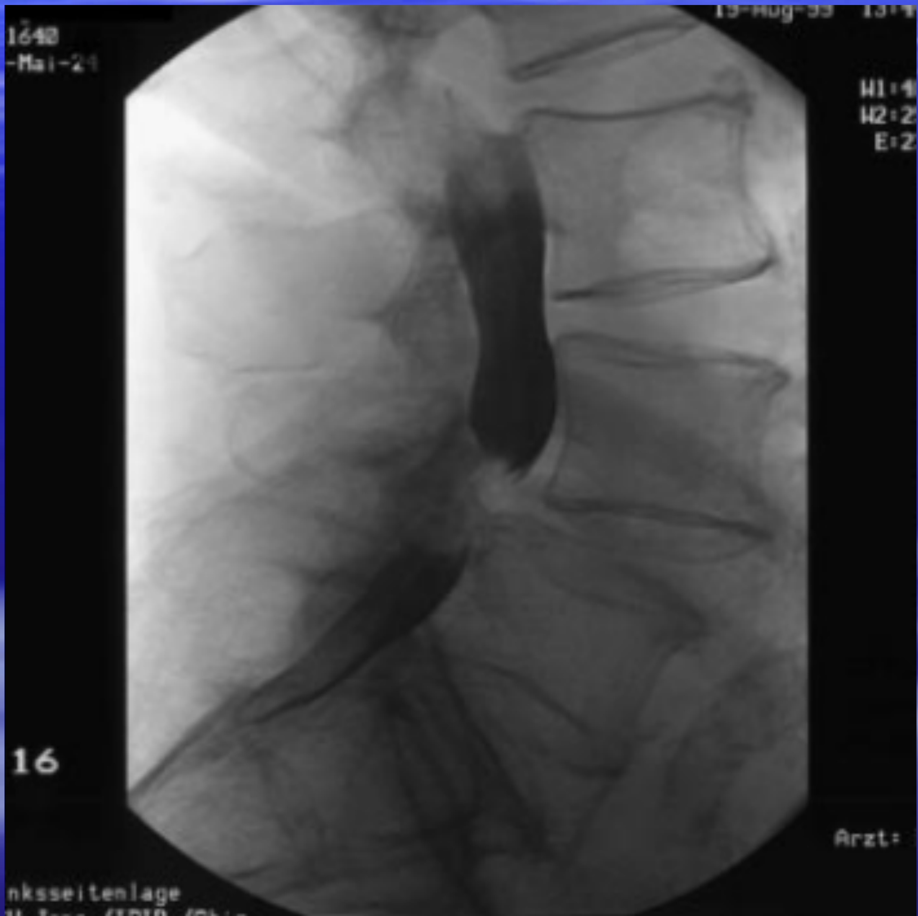
Degenerative Stenosis



- Hypertrophic Z-joints
- Ligamentum flavum hypertrophy
- Diffuse disc bulging usually present

Multifactoral Lumbar Stenosis

Spondylolisthesis



- A common cause of spinal stenosis
- May be a result of degenerative or isthmic listhesis
- Segmental instability more concerning that a “fixed” listhesis

Diagnosis

- History
- Examination
- Imaging
- Electrodiagnostic Studies

Complaints (Historic Features)

- Frequently present with diffuse low back pain, may be chronic or recently started
- Have difficulty standing or walking for prolonged period of time
- Pain increases with extension
- Classically, symptoms reduce when pushing a shopping cart
- Degenertive stenosis is most common in patients 55-64 years in age
- Lumbar instability is more common in patients under 45 years of age

Most common presenting complants[1]:

- Back pain (95%)
- Claudication (91%)
- Leg pain (71%)
- Weakness (33%)
- Bladder disturbances (12%)

[1]Amundsen T, et al. Lumber spinal stenosis. Clinical and radiologic features. *Spine*. 1995; 20:1178-1186.

Claudication

Sign or Symptom	Neurogenic	Vascular
Distal Pulses	Intact	Diminished or absent
Skin Changes	None	Mottled or atrophic Loss of pretibial hair growth
Positional Change	Pain improved with flexion	Pain unaffected by lumbar posture
Walking Distance	Variable	Increased pain with increased ambulation
Pain cessation after stopping ambulation	Prolonged	Almost immediate

Physical Examination

- Back pain is the most common complaint in patients with stenosis
- Patients typically demostrate a symian posture (stooped with flattening of normal lumbar lordosis)
- Peripheral vascular signs absent
- Focal weakness is not typically present, may demonstrate weakness in myotomes below the level of stenosis
- Diminished or absent reflexes in lower extremities may be present

Electrodiagnostic Studies

- Sensitivity is very low in patient's with lumbar radicular pain; about 77% sensitive if radiculopathy present[1]
- Few indications:
  - Exclusion of more distal nerve damage
  - Verification of subjective muscle weakness in patients presenting pain inhibition or lack of cooperation
  - Possibly if difficult surgery is expected
- No trials looking at the sensitivity of EMG to diagnose stenosis
- Electrophysiological evaluation does not directly evaluate neurologic mechanisms associated with pain generation
- Can not accurately determine the precise spinal nerve level

[1]Knutsson, et al. Spine 1993; 18:837-42

Radiographs

- Shows bones only
- Helpful in older patients where cause of stenosis is likely to be a result of degenerative changes or listhesis
- If spondylolisthesis is present, need flexion and extension views to evaluate for segmental instability
- Scoliosis evaluation may be beneficial in some cases

CT Scan

- Preferred method for bony evaluation of spine
- May diagnose disc pathology though sensitivity very low compared with MRI
- Helpful in fractures or other bony abnormalities, 3D reconstruction sometimes useful
- Particularly helpful in evaluating canal patency with post myelography scanning

MRI

- Provides the best anatomic picture and allows focus on soft tissue
- Needs to correlate with physical examination
- Many findings on MRI can be asymptomatic[1]
- High-field better than Open, need complete study

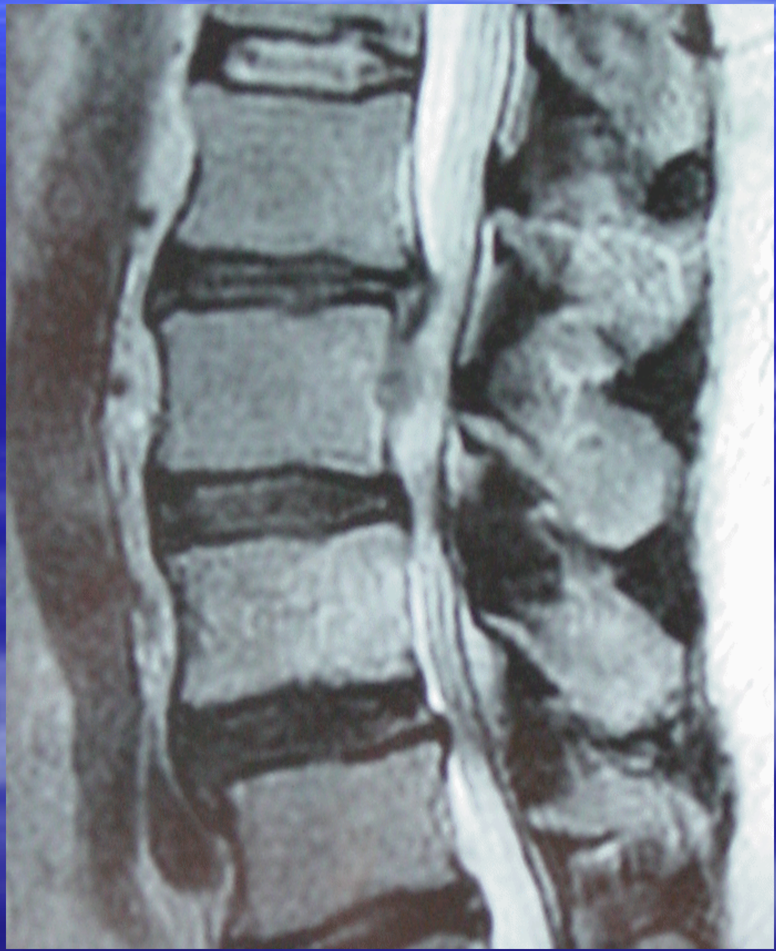
[1]Boden, et al. JBJS March 1990, 72A (3):403-8

MRI

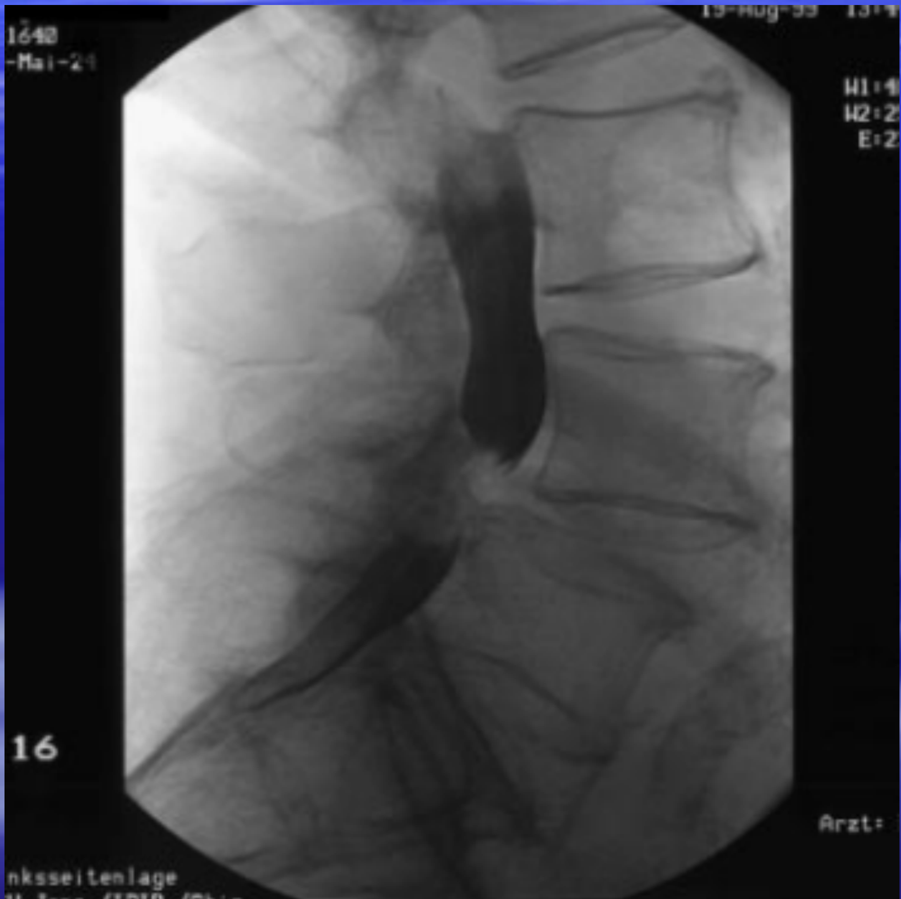
- Order urgently if Cauda Equina Syndrome red-flag condition exists
- If no red-flag:
  - Refrain from imaging on first visit, especially if early in course; wait until symptoms have persisted for ~6-7 wks
  - Attempt conservative management prior to MRI
- Need MRI if surgery or possibly epidurals considered

Bogduk. Acute Lumbar Radicular Pain. 1999. pp 43-51.

MRI



Myelogram



- Study of choice when MRI can not be done
- Can effectively identify the location of narrowing
- Frequently an uncomfortable procedure
- Post-myelogram CT can give additional information about canal contents

Treatment Options

- NSAIDs
- COX-II Inhibitors
- Oral Steroids
- Muscle Relaxants
- Narcotics
- TENs
- Physical Therapy
- Epidural Steroid Injections
- Laminectomy
- Multiple Laminotomy
- Fusion

NSAIDs

- Helpful in reducing acute and sub-acute pain
- May have therapeutic effect on decreasing epidural inflammatory response
- COX-II inhibitors equally as effective as non-selective NSAIDs, safety profile better (except Vioxx)
- Should be first line agent

Oral Steroids

- Can help decrease epidural inflammation
- Reserve for use in patients with severe pain
- Systemic effects greater than for epidural steroids
- Know safety profile

Muscle Relaxants

Gaba Agonists
- Baclofen (lioresal)

Alpha$_2$ Agonists
- Zanaflex (tizanidine)

SR Calcium Channel Blockers
- Dantrium (dantrolene)

CNS depressants
- Soma (carisoprodol)
- Robaxin (Methocarbamol)
- Skelaxin (Metaxalone)
- Flexeril (Cyclobenzaprine)

Benzodiazepines

Narcotics

- Helpful for severe, acute pain
- Lay out timeline to get patient off
- Avoid long-term use
- Plan for constipation, stool softeners with script

Physical Therapy

- No large, or controlled studies on the effectiveness of physical therapy for spinal stenosis
- Small observational studies indicate that manual therapy, core strengthening, individualized exercise programs and a walking program are beneficial in reducing pain and help walking ability[1,2,3]
- Should be used in conjunction with other treatment modalities (oral agents, injections, etc)

[1]Whitman JM, et al. Phys Med Rehabil Clin N Am. 2003 Feb;14(1):77-101, vi-vii.
[2]Fritz JM, et al. Phys Ther. 1997 Sep;77(9):962-73.
[3]Zeifang F, et al. Orthopade. 2003 Oct;32(10):906-10.

Chiropractic Care

- Lumbar stabilization is more effective than manipulation in long term pain relief[1]
- Modality care can be helpful in reducing inflammation and pain symptoms
- No trials to support chiropractic manipulation aids in reducing symptoms or pathology from spinal stenosis
- Can cause injury if mobilizes spine through an unstable spondylitic segment

[1]Rasmussen-Barr E, et al. Man Ther. 2003 Nov;8(4):233-41.

Epidural Steroid Injections

- ESIs in patients with spinal stenosis are not as effective as ESIs in patients with herniated discs[1]
- Have been shown to provide some patients with sustained relief and improve function in over ½ of patients[2]
- Transforaminal approach been shown to improve walking and standing tolerance in over 60% of patients at 1 year[3]
- The single RCT available used blind epidural injections and showed no difference between a group of patients who received mepivicaine and another group the received mepivicaine+methylprednisolone[4]

[1]Rivest C, et al. Arthritis Care Res. 1998 Aug;11(4):291-7.
[2]Delport EG, et al. Arch Phys Med Rehabil. 2004 Mar;85(3):479-84.
[3]Botwin KP, et al. Am J Phys Med Rehabil. 2002 Dec;81(12):898-905
[4]Fukusaki M, et al. Clin J Pain. 1998 Jun;14(2):148-51.

Epidural Steroid Injections

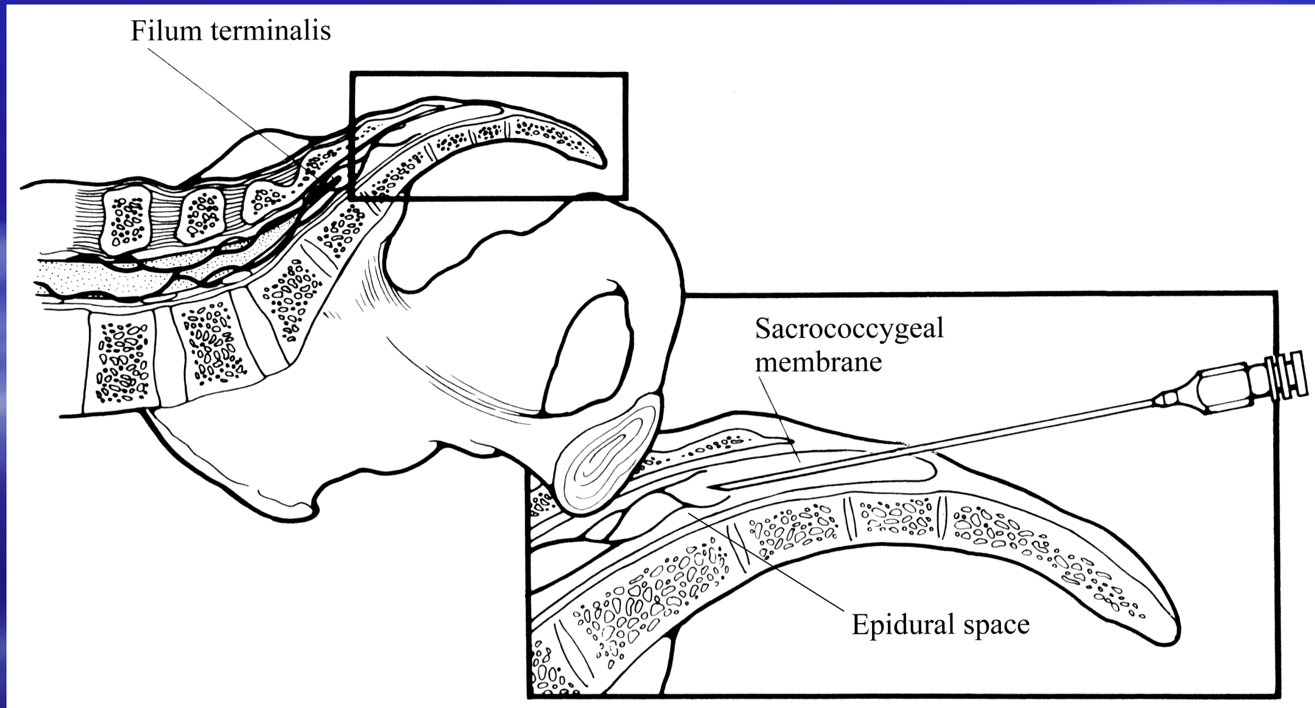
Approaches:

- Caudal
- Interlaminar
- Transforaminal

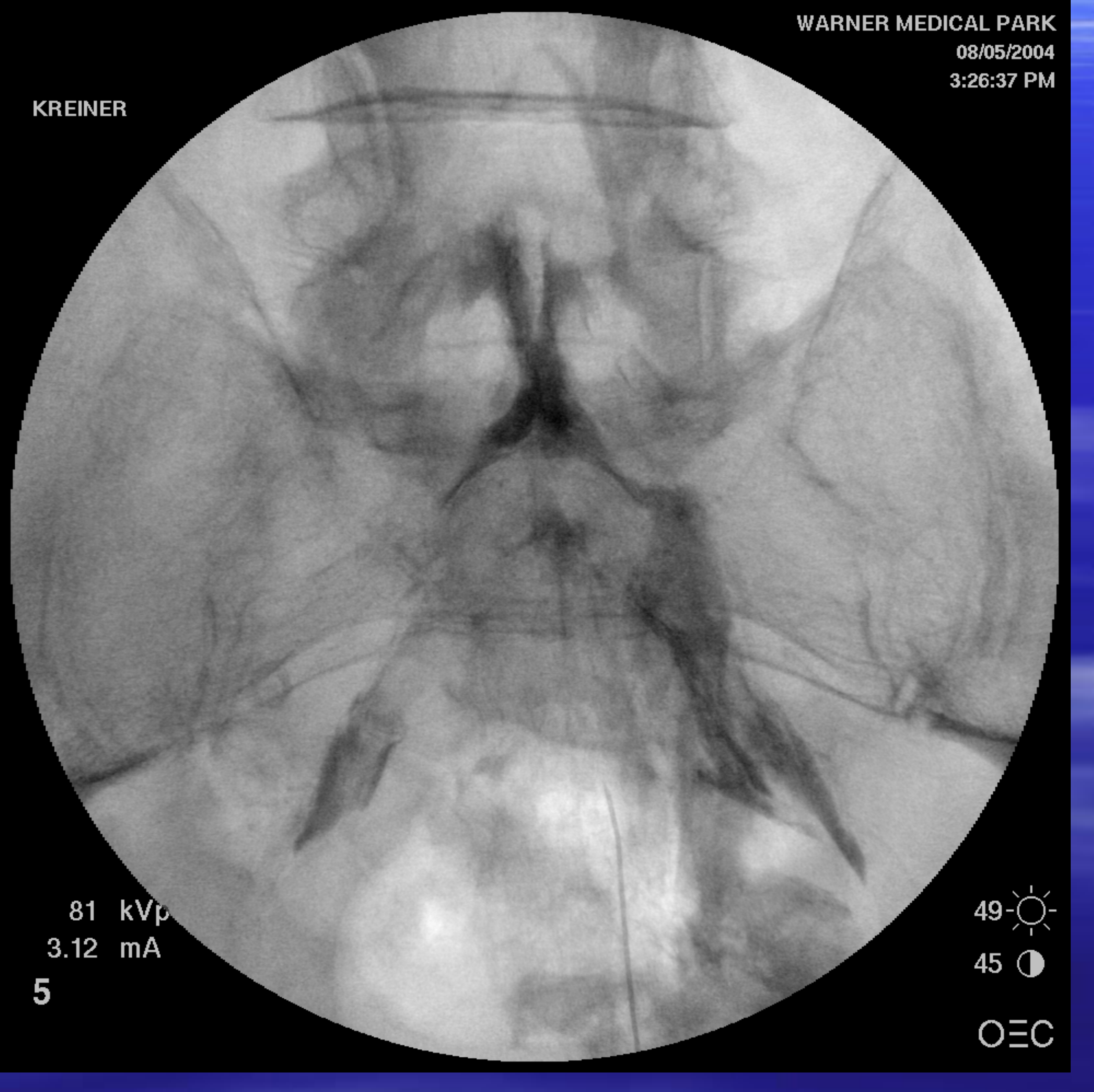
- Blind vs Flouroscopically-guided

Caudal Epidural Steroid Injections

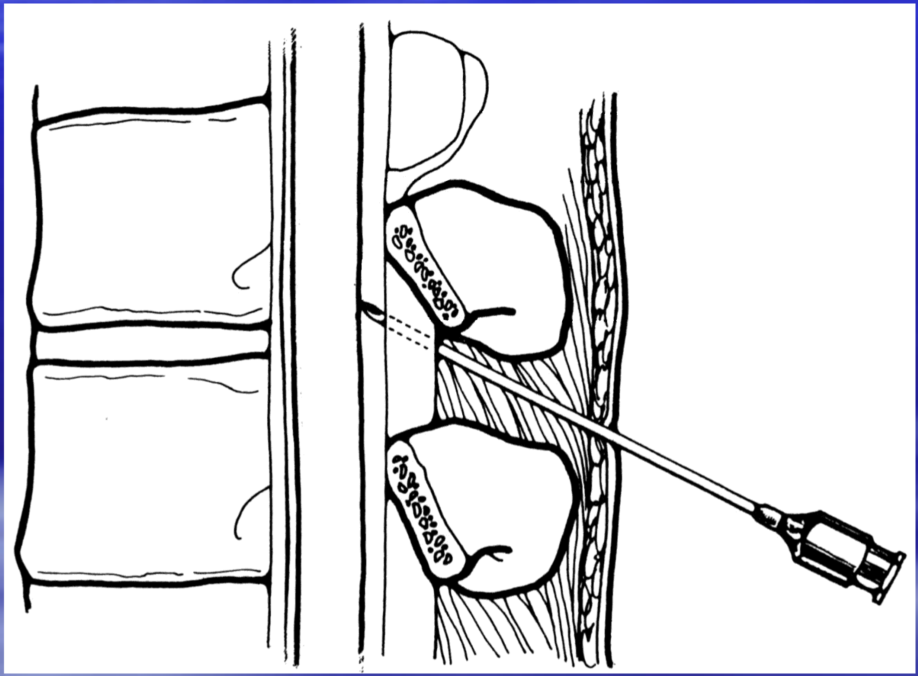
- Effective for multilevel pathology including spinal stenosis
- Uses most volume of any approach
- Non-selective
- May be performed under flouroscopic guidance or blind



Epidurogram

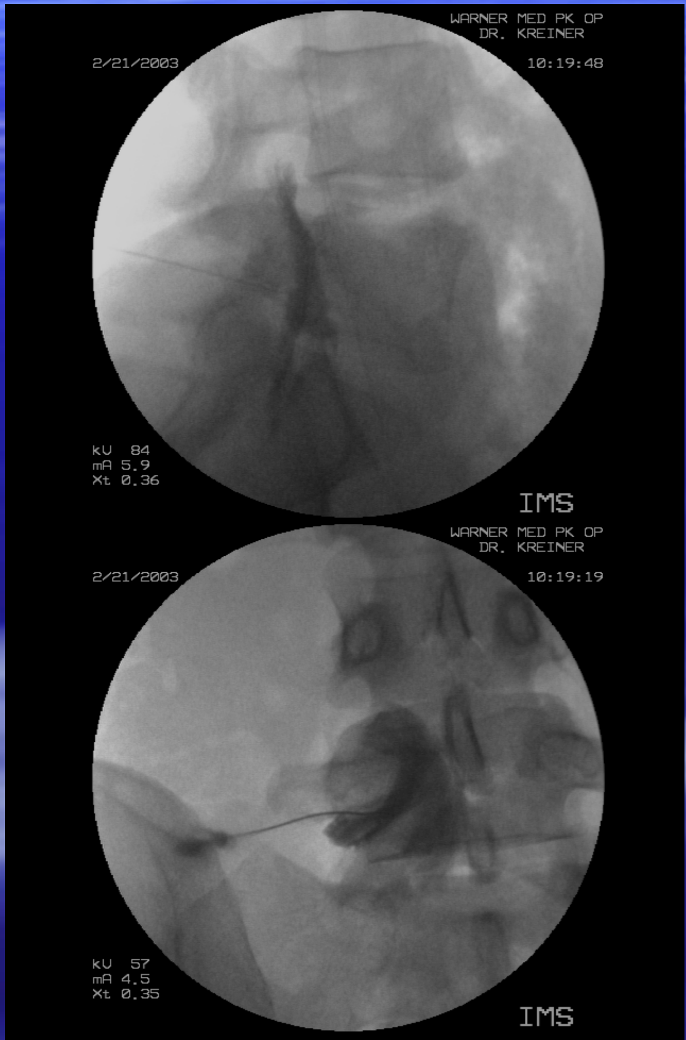


Interlaminar Epidural Steroid Injections



- May be done in office setting
- Does not require use of flouroscopy
- Covers a broader area than transforaminal injections since higher volume is used
- Solution placed in posterior epidural space
- In patients with spinal stenosis, access at the symptomatic level is difficult and can be dangerous

Transforaminal Epidural Steroid Injections



- Direct injectate to the *anterior* epidural space
- Diagnostic and therapeutic
- Lower volume of injectate
- Much lower risk of dural puncture and associated headache
- Decrease leg pain and increase standing and walking tolerance in LSS[1]

[1]Botwin KP, et al. Am J Phys Med Rehabil. 2002 Dec;81(12):898-905.

Flouroscopic vs Blind Injections

- Flouroscopic guidance is the only way to ensure that solution travels to the target location
- Flouroscopy decreases risk of complications
- Flouroscopic guidance is more effective than blind injections
- Flouroscopy does have risks associated with radiation exposure, though exposure is very limited

[1]White AH, et al. Spine. 1980;5:78-86.
[2]Stewart HD, et al. Br J Rheumatol. 1987;26:424-9.
[3]Renfrew DL, et al. Am J Neuroradiol 1991:12:1003-7.

Decompressive Surgery
(Laminectomy, Laminotomy, Facetectomy, etc.)

- Indicated when a stenosis symptoms exist for more than 8 weeks despite conservative care
- Patients with severe symptoms seem to benefit more from surgery than conservative treatment[1]
- More urgent if has progressive loss of motor, bladder, or bowel function or there is excruciating pain that can not be relieved by non-operative treatment
- Delay for longer than 6 months in face of persistent and severe symptoms may compromise best results
- Adequate decompression is the best way to ensure successful surgery

[1]Amundsen T, et al. Spine. 2000 Jun 1;25(11):1424-35.

Fusion

- Major indication in stenosis is for patients with spondylolisthesis
- Usually done in addition to laminectomy in these cases
- A solid fusion increases success[1], while posterior instrumentation may not be necessary[2]
- Risk failure at levels surrounding fusion

[1]Kornblum MB, et al. Spine. 2004 Apr 16;29(7):726-33.
[2]Fischgrund JS, et al. Spine. 1997 Dec 15;22(24):2807-12.

Surgery vs Conservative Care

Conservative

- Mild to moderate symptoms
- Can try briefly in patients with severe symptoms before surgery considered
- A comprehensive approach is best
- Epidural steroids can be beneficial (use flouro)
- Expect 50% of patients to improve

Surgery

- Severe symptoms or red flags
- Adequate decompression is the best indicator of success
- Fusion is helpful with spondylolisthesis
- Expect 70-80% of patients to improve

[1] Atlas SJ, et al. Spine. 2000. 25(5):556-62.
[2] Amundsen T, et al. Spine. 2000. 25(11):1424-35.

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