

Lumbar Spinal Stenosis

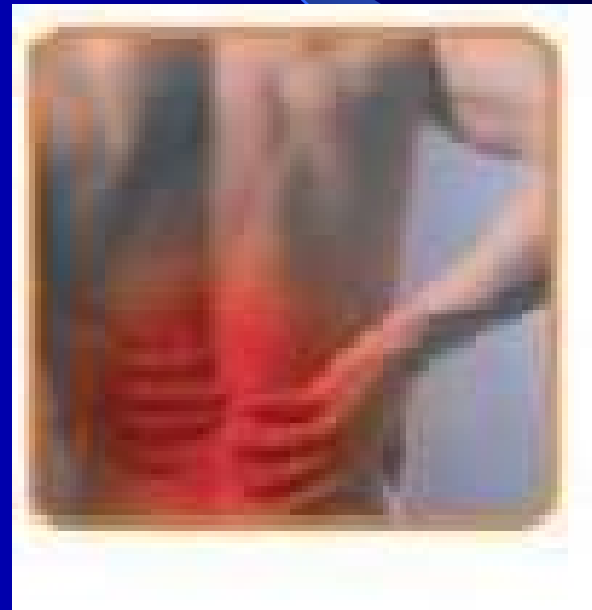
Traditional Non-Operative Care When Enough is Enough

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History and Physical Examination

History

- Chief Complaint:
Back Pain
 - Location
 - Quality
 - Chronicity
 - Severity



History

- Specific Information from History

- Patient age
- Sudden vs. insidious onset
- Duration of pain
- Axial vs. radicular pain
- Fever/chills/weight loss
- Exacerbating/relieving factors

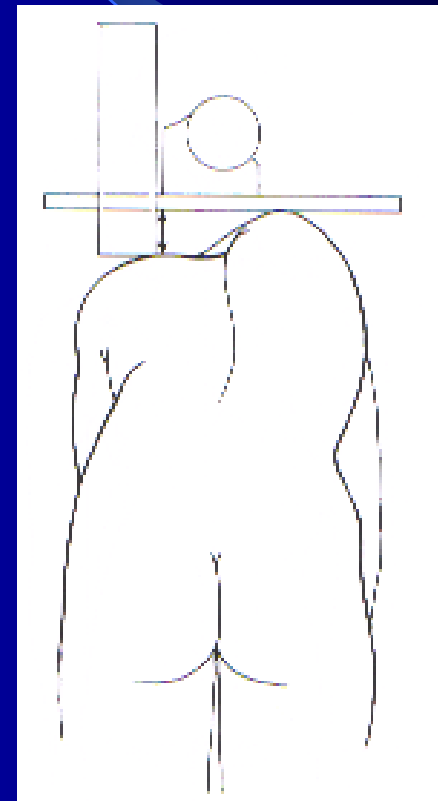
- Bowel/bladder changes
- Gait changes
- History of infection or malignancy
- Past treatment
- Family medical history
- Employment status
- Work related injury
- Litigation

Red Flags

| Possible Condition | Findings from History |
|-----------------------|--|
| Fracture | Major trauma (MVA, fall from height) Minor trauma in older/osteoporotic patient |
| Tumor or infection | Age >50 or <20 History of cancer Recent bacterial infection Constitutional symptoms Immunosuppression Intravenous drug use Pain worse at night or supine |
| Cauda Equina Syndrome | Severe progressive neurologic deficit Saddle anesthesia Recent onset bladder dysfunction |

Physical Examination

- Observation
 - Gait
 - Trendelenburg
 - Antalgic
 - Heel/toe walk
 - Posture
 - Deformities in sagittal or coronal planes
 - Gibbus deformity
 - Scoliosis
 - Forward bending test

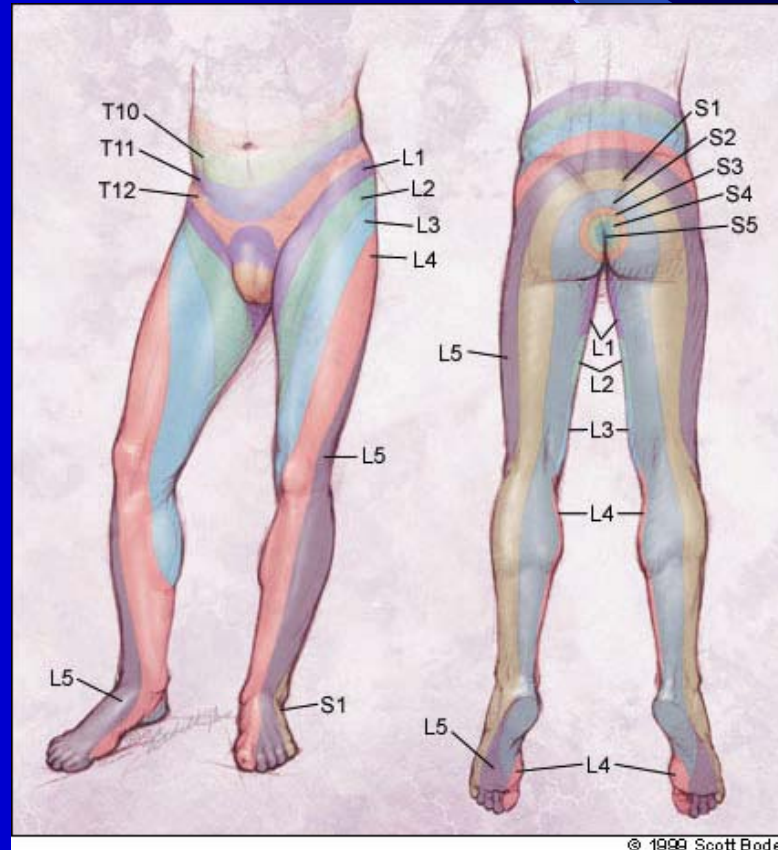


Physical Examination

- Pain with forward flexion
 - Nonspecific
 - Disc herniation
- Painful extension
 - Spondylolysis
 - Spondylolisthesis
 - Facet arthropathy
 - Spinal stenosis

Neurologic Examination

- Lumbar Examination
 - Dermatomes

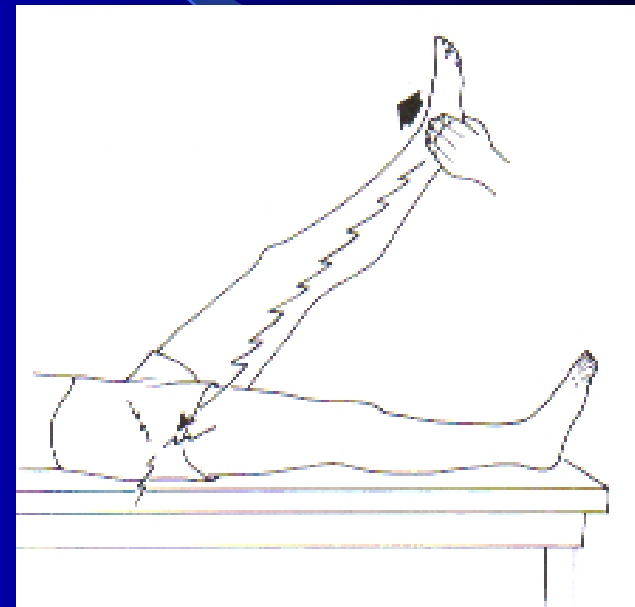


Neurologic Examination

| Root | Reflex | Muscles | Sensation |
|------|----------|---|---|
| L2 | N/A | Iliopsoas | Anterior thigh, groin |
| L3 | Patellar | Quadriceps | Anterior and lateral thigh |
| L4 | Patellar | Anterior tibialis | Medial leg and foot, medial malleolus |
| L5 | N/A | EHL, hip abductors | Lateral leg, dorsum foot, first web space |
| S1 | Achilles | Peroneus longus and brevis, gastrocsoleus | Lateral foot, small toe |

Physical Examination

- Nerve root tension signs
 - Straight leg raising test (L4-S1)
 - Seated or supine
 - Sciatic nerve does not realize tension until 30-35 degrees of leg elevation
 - 35-70 degrees places increasing stretch on sciatic nerve
 - Positive test:
 - reproduction of leg pain or paresthesias distal to knee



Physical Examination

- Nerve root tension signs
 - Contralateral straight leg raising test (L4-S1)
 - Elevate contralateral (asymptomatic) leg
 - Positive test:
 - Reproduction of pain in the symptomatic extremity, not the extremity being elevated

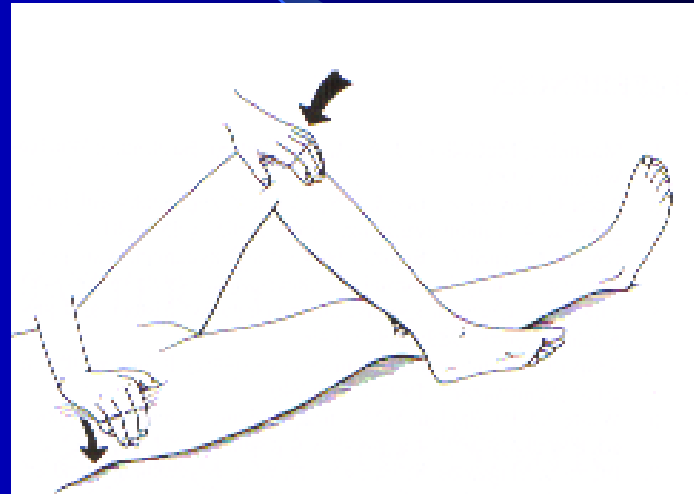
Physical Examination

- Nerve root tension signs
 - Femoral nerve stretch test (L2-4)
 - Patient prone
 - Simultaneously extend hip and flex knee
 - Positive test:
 - Reproduction of pain into anterior and lateral thigh



Physical Examination

- Sacroiliac Joint Tests
 - Patrick test
 - FABER
 - Flexion
 - ABduction
 - External Rotation



Physical Examination

- Waddell signs
 - Tenderness (excessive or widespread reaction)
 - Superficial, nonanatomic
 - Simulation (pain reported with sham maneuvers)
 - Axial loading, rotation
 - Distraction (less pain when attention diverted)
 - Straight leg raising
 - Regional (wide-spread give-way or dysethesias)
 - Weakness, sensory
 - Overreaction (disproportionate psychomotor response)

Imaging Studies

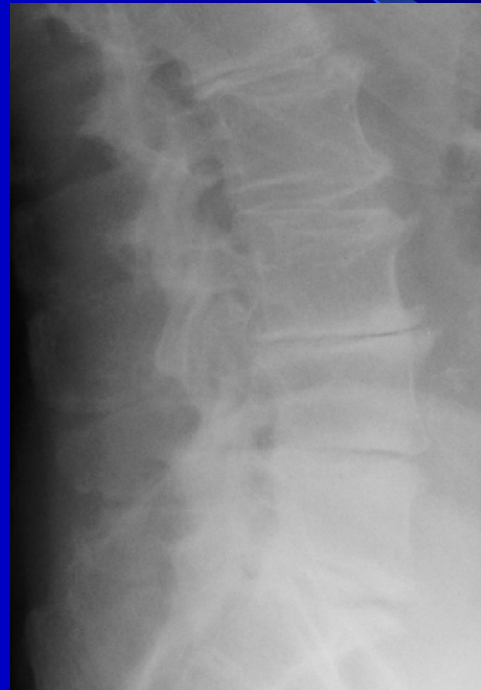
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Imaging Studies

- Plain Radiographs
 - High rate of age-related asymptomatic changes
 - AP, lateral views
 - Oblique views
 - Facet joints
 - Spondylolysis
 - 12% of abnormalities not visualized on AP or lateral

Imaging Studies

- Plain Radiographs
 - Vacuum phenomenon
 - Linear radiolucency in the disk space
 - Typical finding of degenerative disk disease
 - Virtually excludes infection



Imaging Studies

- Plain Radiographs
 - Posterior disc height (PDH) most sensitive for degenerative disc disease
 - PDH < 5.4 mm = DDD
 - PDH > 7.7 mm = no DDD
 - Pre-operative standing x-rays prior to lumbar decompression for stenosis to rule out degenerative scoliosis or spondylolisthesis

Imaging Studies

- Plain Radiographs
 - Schmorl nodes
 - Displacement of intervertebral disc into vertebral body
 - Moderate correlation with degenerative changes
 - **No** correlation with advanced disc degeneration



Imaging Studies

- Computed Tomography
 - Superior depiction of bony pathology
 - Higher spatial resolution
 - Postoperative imaging
 - Canal compromise in trauma
- Bone Scans
 - Spinal metastases
 - Facet arthropathy
 - Spondylolysis
 - Osteoid osteoma

Imaging Studies

- MRI
 - T2 images
 - Best for evaluation of disc
 - Overemphasizes size of disc pathology
 - T1 images
 - Screening for osseous metastatic disease
 - Gadolinium contrast
 - Postoperative scar (high signal) vs. recurrent disc herniation (low signal)
 - Infection

Imaging Studies

- Discography
 - Provocative diagnostic study
 - Localizes source of pain
 - Demonstrates concordant pain pattern after injection of contrast material into disc
 - Key points:
 - Must reproduce patient's typical pain pattern
 - Test adjacent (normal) levels
 - Use same examiner for consistent results

Electrodiagnostic Studies

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Electrodiagnostic Studies

- Document presence of radiculopathy
- Differentiate from peripheral neuronal deficits
- Determines segmental level and estimates chronicity of nerve root dysfunction
- Spinal nerve root pathology most commonly caused by compression


Electrodiagnostic Studies

- Needle EMG
 - Bipolar or monopolar needle inserted into muscle
 - Electrical activity monitored under various functional conditions
 - Normal muscle
 - Quiet at rest
 - Radiculopathy
 - Spontaneous activity at rest
 - Contraction of denervated muscle
 - Higher amplitude potentials, increased duration and number of phases

Electrodiagnostic Studies

- Needle EMG
 - Diagnostic abilities
 - Acute vs. chronic
 - Severity of dysfunction
 - Level of injury localized to within one or two segments
 - 84% accurate in level or radiculopathy in patients with clinical findings of nerve root pathology
 - Limitations
 - Provides no information on cause of nerve root compression

Degenerative Disorders

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Degenerative Disc Disease

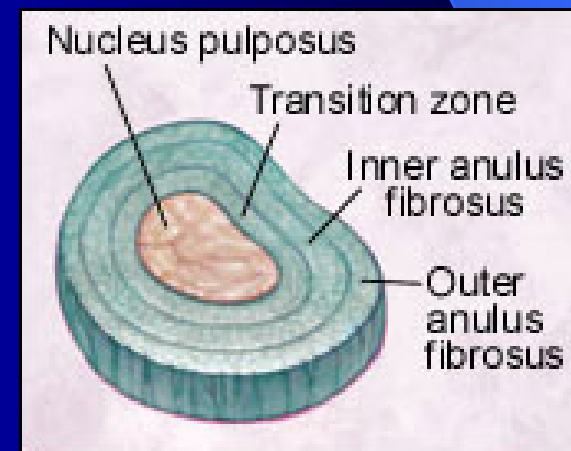
- Anatomy

- Intervertebral Disc

- Central nucleus pulposus
 - Avascular
 - 70-90% water
 - Type II collagen, proteoglycans, mucopolysaccharides
 - Depends on diffusion for nutrition

- Outer annulus fibrosus

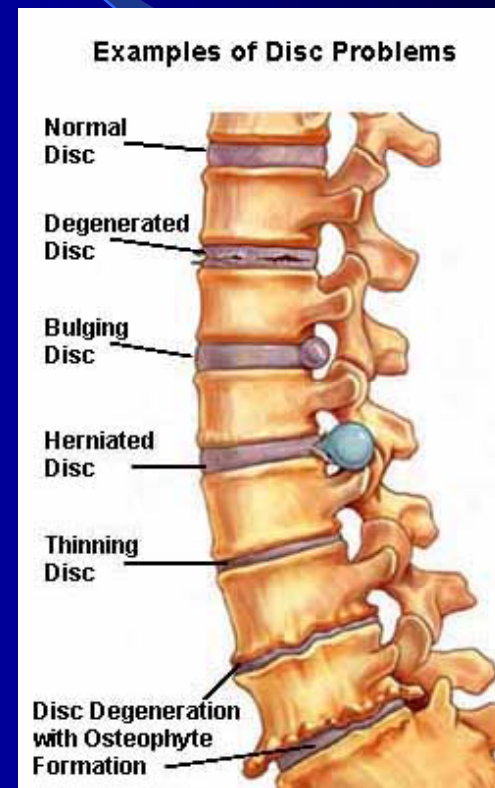
- Innervated by sinuvertebral nerves
- Concentric layers overlapping type I collagen



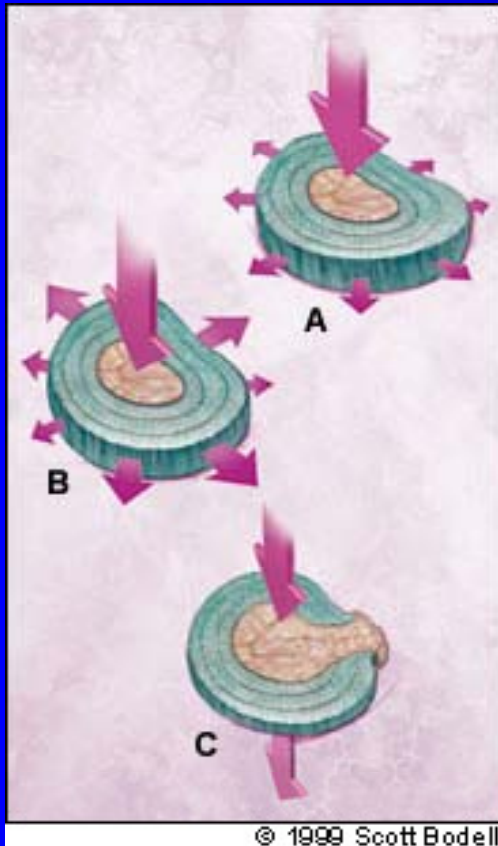
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Degenerative Disc Disease

- Anatomy
 - Facet Joints
 - Synovial joints
 - Richly innervated with sensory fibers
 - Carry 18% of load of lumbar spine



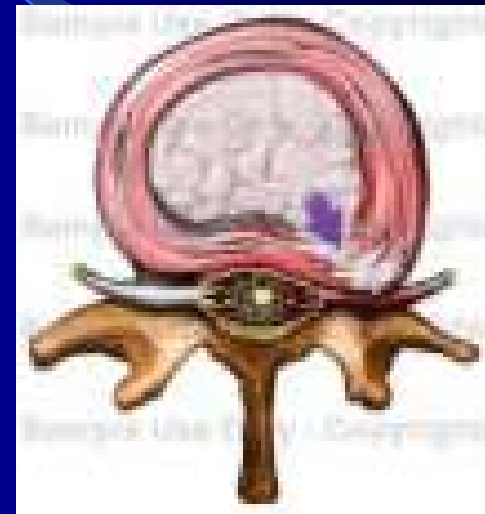
Lumbar Disc Herniation



- Pathophysiology
 - Dehydration
 - Collagen content increases
 - Decreased hydrostatic properties
 - Loss of disc space height
 - Stresses are unevenly distributed to annulus
 - Intradiscal fissuring
 - Annular disruption
 - Disc herniation

Lumbar Disc Herniation

- Pathophysiology
 - Most common at L4-5 and L5-S1
 - Most common posterolateral
 - Central narrowing of posterior longitudinal ligament at level of disc
 - Affects exiting nerve root at level of herniation (L4 root with L4-5 herniation)



Lumbar Disc Herniation

- Presentation

- Back pain
 - Early
 - Annular tear
 - Sinuvertebral nerves
- Radicular pain
 - Later finding
 - Herniated disc material compressing exiting nerve roots
 - Biochemical pain mediators (substance P)

- Imaging

- Disc abnormalities found in 37% of asymptomatic patients
- MRI gold standard

Lumbar Disc Herniation

- Treatment

- Nonoperative 6-12 weeks
- 1-2 days rest
- NSAIDs
- Oral steroids
- Muscle relaxants
- Epidural steroids
- Manipulation

- Surgical indications

- Failed conservative care
- Progressive neurologic deficit
- Cauda equina syndrome

Discogenic Back Pain

- Characteristics
 - 4th decade
 - Equal among genders
 - Persistent back pain
 - >90% self limiting
 - 3 categories
 - Internal disc disruption
 - Degenerative disc disease
 - Segmental instability

Discogenic Back Pain

- Internal disc disruption
 - Alteration in internal structure and metabolic function of disc
 - Does not include disc bulge, protrusions or herniations
 - Begins with annular tear, release of noxious proteins, irritation of nerves
 - Follows significant trauma or injury

Discogenic Back Pain

- Internal disc disruption
 - Midline back pain, increased with activity
 - Uncommon paresthesias
 - Paraspinous muscle spasms
 - Negative tension signs
 - Normal radiographs
 - Signal changes in MRI (dark disc disease)
 - Discogram positive



Discogenic Back Pain

- Degenerative disc disease
 - Lumbar spondylosis
 - Uncertain etiology
 - Normal change with ageing
 - Abnormal if <40
 - Begins with disc desiccation, decreased proteoglycan water binding
 - Gradual onset midline back pain, posterior thigh pain
 - Later lateral stenosis – radiculopathy
 - Normal neurologic exam

Discogenic Back Pain

- Degenerative disc disease

- Imaging findings
 - End plate sclerosis
 - Disc space narrowing
 - Osteophyte formation
- MRI signal intensity loss (Modic signal changes)
 - Modic I:
 - Decreased intensity T1, increased intensity T2
 - Disruption and fissuring endplates

- Modic II:

- Increased intensity T1, isointense T2
- Degenerative change on plain films
- Increased lipid content in marrow spaces
- End plate disruption
- Painful inflammatory response

- Modic III:

- Decreased intensity T1 and T2
- Extensive bony sclerosis on plain films
- Absence of marrow in endplates

Discogenic Back Pain

- Segmental instability
 - Spondylolisthesis
 - Lateral listhesis
 - Rotatory subluxation
 - Scoliosis

Discogenic Back Pain

- Treatment
 - Nonoperative
 - Limited bed rest
 - Exercise
 - Physical therapy
 - Manipulation
 - analgesics
- Surgical treatment
 - Radicular pain
 - Decompression, discectomy
 - Axial pain
 - Fusion
 - Disc replacement

Chronic Pain Management

Chronic Pain Management

- 90% of back pain improved within 6 weeks regardless of treatment
- 85% of patients with back pain never get diagnosis
- Effect of chronic pain
 - Depression
 - Pain becomes central focus of life

Chronic Pain Management

- Multidisciplinary pain centers
 - Psychiatry
 - Physical therapy
 - Occupational therapy
 - Vocational counselors
 - Pharmacists
- Reduction of opioid use in 73% of patients
- Significant reduction in related medical costs

Chronic Pain Management

- Treatment methods
 - Strong communication
 - Intense rehabilitation
 - Nerve block therapy
 - Trigger point injections
 - Facet joint injections
 - Transcutaneous electrical nerve stimulation (TENS)
 - Dorsal column stimulation
 - Spinal cord stimulators
 - Percutaneous electrical nerve stimulator (PENS)

Chronic Pain Management

- Epidural steroid injections

- Decreases inflammation
- Set of three
- LBP with radiculopathy
- Failure of conservative care
- Good short-term results
- Limited long-term success (>6 months)
- Risk of spinal headache

- Facet injections

- Performed using fluoroscopy
- Light sedation
- Maximal site of tenderness over facet joint
- Increased muscle tone over joint
- Failure of conservative care
- Limited evidence of success

Chronic Pain Management

- Pharmacologic treatment
 - Opioids
 - NSAIDs
 - Anti-depressants
 - Anticonvulsants
 - Drug contracts
 - Neuropathic drugs
 - Neurontin
 - Carbamazepine
 - Clonidine
 - Baclofen
- Other treatments
 - Biofeedback
 - Cognitive behavioral therapy
 - Relaxation techniques

Conclusions

- Low back pain is extremely common
- Majority of cases respond within 6 weeks regardless of therapy
- Must be able to recognize “red flag” to select appropriate patients for further imaging and laboratory studies
- Prompt referral for patients with “Red Flags”

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Thank You