Common Orthopaedic Conditions of the Spine

Musculoskeletal Galaxy

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Disclosures

- I have no relevant relationships with ineligible companies to disclose within the past 24 months.
- The surgical pathologies discussed in this presentation reflect my training and bias and may be different from what would be offered by other spine surgeons

OBJECTIVES

At the conclusion of this session, participants should be able to…

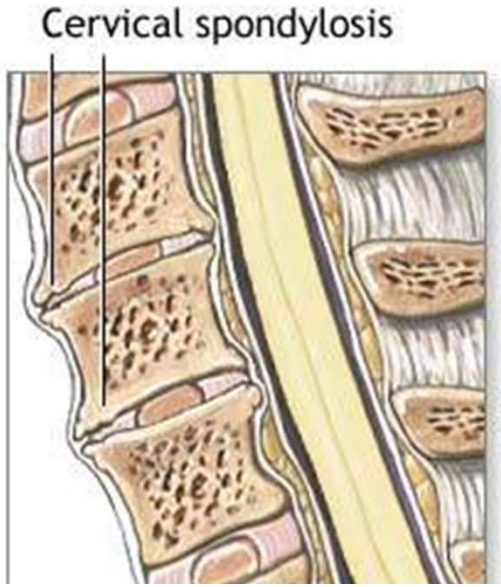
- Understand how spine anatomy is related to symptom presentation.
- Establish a reasonable differential diagnosis based on history and physical exam findings.
- Provide patients with appropriate conservative treatment options and know when to refer for interventional or surgical treatment.

My neck, my back…

Cervical spine conditions	Lumbar spine conditions
• Spondylosis • Disc herniation • Radiculopathy • myelopathy	• Spondylosis • Disc herniation • Radiculopathy • Neurogenic claudication • Spinal stenosis

BACKGROUND

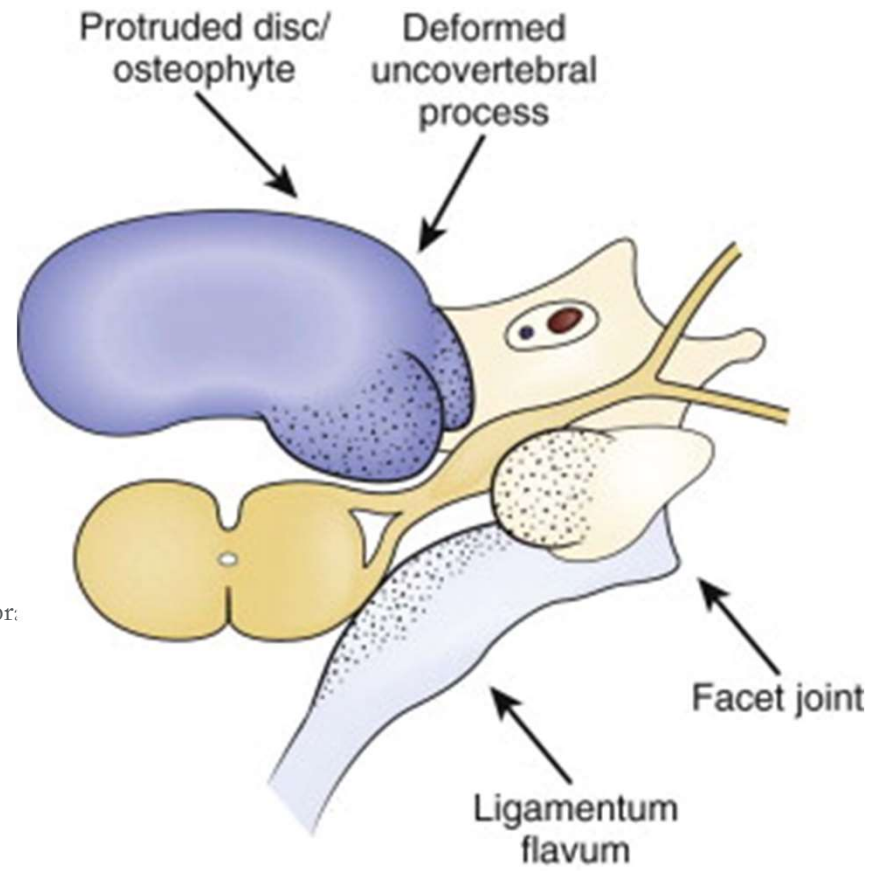
- *Spondylosis*
  - Age-related degenerative changes within spinal column
  - 3 main symptom complexes
    - *Axial neck pain*
      - Pain along spinal column and related paraspinal musculature
    - *Cervical radiculopathy*
      - Pain radiating into arm
      - May be accompanied by sensory or motor changes
        - » Radicular distribution
    - *Cervical spondylotic myelopathy*
      - Long tract signs



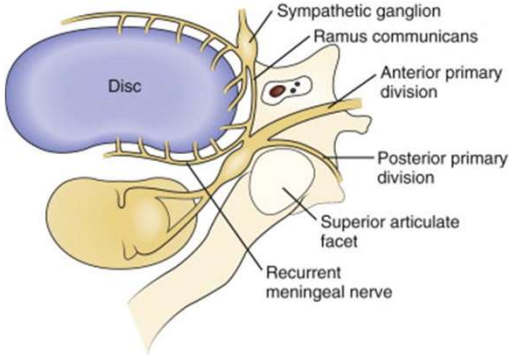
PATHOLOGY

Degeneration → Mechanical Compression

- Degenerative changes within cervical disc
  - 3rd decade
    - *Alteration in proteoglycan content*
      - Keratin sulfate increases
      - Chondroitin sulfate decreases
- Loss of disc height
  - Bulging of anulus
  - Infolding
    - *Ligamentum flavum*
    - *Facet joint capsule*
  - Anterior height > Posterior height
    - *Loss of cervical lordosis*
      - Positive feedback cycle
        - » Greater force placed on ventral aspect of vertebr
          - Kyphosis
- Arthrosis
  - Uncovertebral and facet joints
- Motion aberrations between two vertebral bodies
- Reduces dimensions of canal and foramen
- Inflammatory response
- Most frequently affected level?
  - C5-6

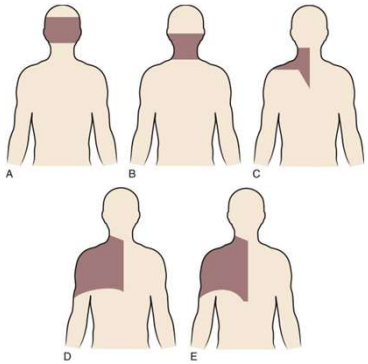


PATHOLOGY



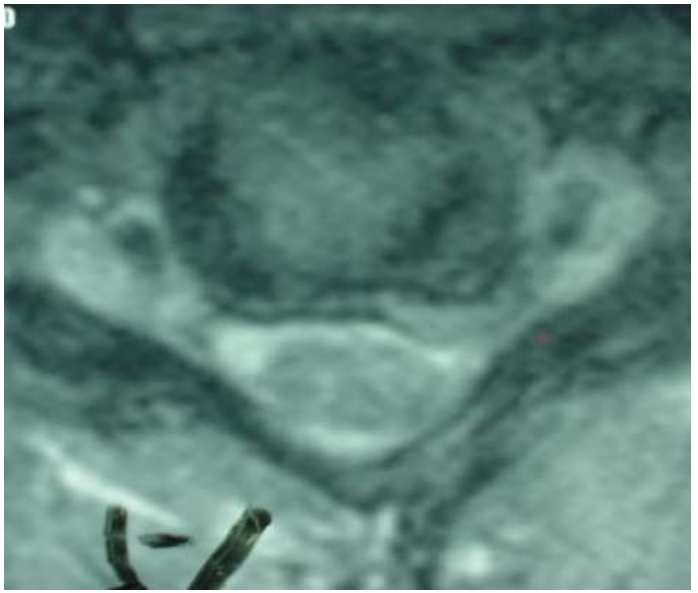
Degeneration → Mechanical Compression

- Disc
  - Sinuvertebral nerve
    - *Innervates intervertebral disc*
    - *Supplies portions:*
      - Annulus
      - Posterior longitudinal ligament
      - Periosteum of vertebral body and pedicle

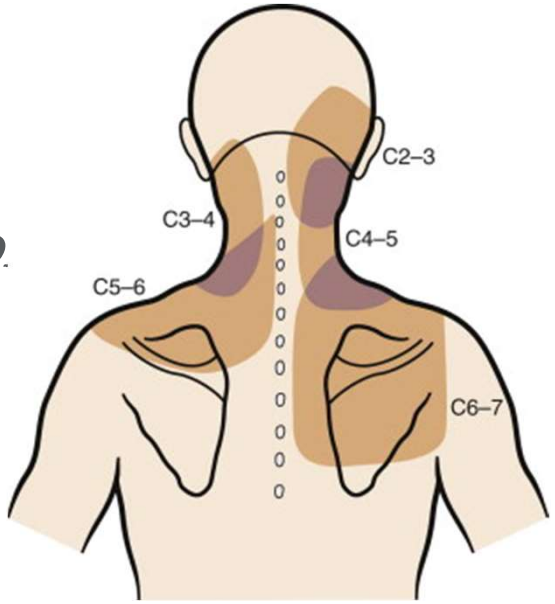


  - Grubb SA et al, Cervical Discography: Clinical Implications from 12 years of experience. Spine, 2000
    - *Stimulation of each disc results in consistent and predictable patterns of neck pain*

Cervical Disk Herniation



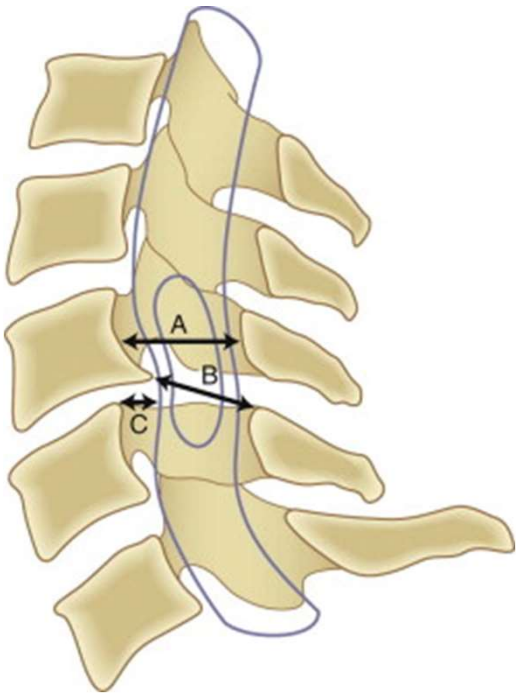
PATHOLOGY



Degeneration → Mechanical Compressio

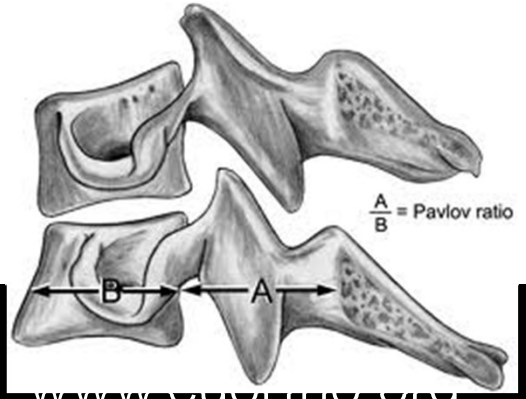
- Facet joint
  - C2-3 facet joint
    - *Innervation → 3rd occipital nerve*
  - C3-4 to C8-T1 facet joints
    - *Innervation → Medial branches of cervical dorsal rami*
  - Dwyer A et al, Spine, 1990
    - *Provocative injections into facet joints of asymptomatic volunteers*
    - *Reproducible pain patterns*

PATHOLOGY



Congenitally Stenotic Canal

- Normal AP diameter
  - Spinal canal → 17 to 18 mm
  - Cord → 10 mm
  - Extension and flexion of neck alter diameter of canal by 2 mm
- < 13 mm → Congenital cervical stenosis
  - Lowers threshold of cumulative effects of various degenerative structures encroaching

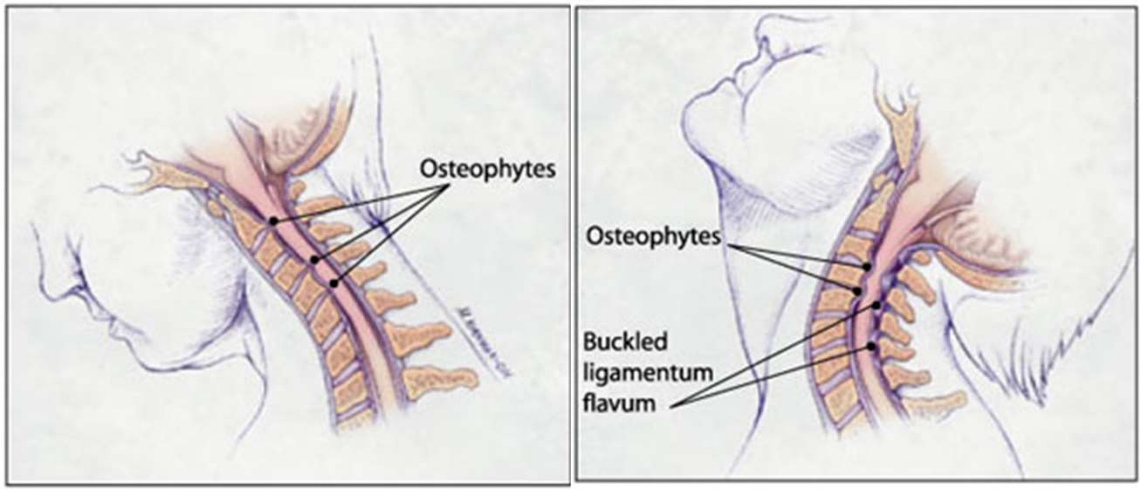


AXIAL NECK PAIN WITHOUT RADICULOPATHY OR MYELOPATHY

- 66% lifetime prevalence
  - "overwhelmingly benign"
  - DDD – poorly localized, radicular to head, shoulder
  - Facet arthrosis – localized pain, extension worse
  - Kyphosis – extensor muscle fatigue
  - Instability – spondylolisthesis
  - Bad – tumor, infection, fracture, dislocation
  - Non-spine – GB, coronary, RTC, brachial plexus

Axial Neck Pain

- Pain along posterior neck and trapezius muscles without radiation into upper extremity
  - Localize to posterior paraspinal musculature
  - Radiation
    - *Occiput*
    - *Shoulder*
    - *Periscapular regions*
    - *Headaches*



Axial Neck Pain

- Multitude of potential causes

- Anterior
  - Sprains and strains
    - *Sternocleidomastoid*
    - *Strap muscles*
- Posterior
  - Suboccipital
  - Subaxial
    - *Muscular or ligamentous imbalances*
    - *Poor posture*

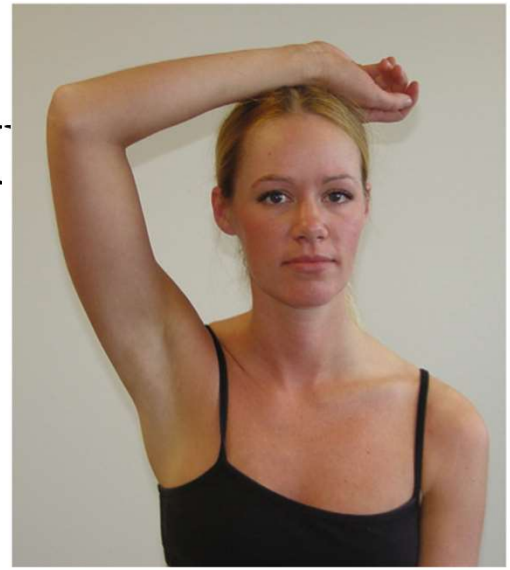
Axial Neck Pain

- No true natural history studies exist
  - All published studies involve some form of treatment
- Early presentation with single episode
  - Reassurance
- Persistent or recurrent symptoms
  - 25% → Residual moderate to severe pain

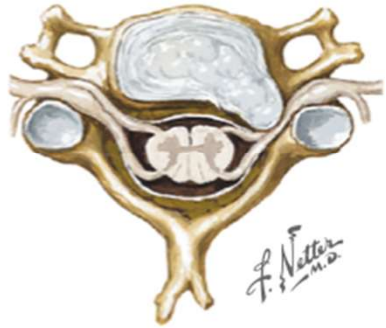
CERVICAL RADICULOPATHY

- Symptoms
  - Specific dermatomal distribution
  - Sharp pain, tingling, or burning sensations
  - Sensory or motor loss corresponding to nerve root involved
  - Reflex activity diminished
  - Frequently unilateral
- Henderson et al, *Neurosurgery* 1983
  - Reviewed clinical presentations in 736 patients with cervical radiculopathy
    - *99.4% → Arm pain*
    - *85.2% → Sensory deficits*
    - *79.7% → Neck pain*
    - *71.2% → Reflex deficits*
    - *68% → Motor deficits*
    - *52.5% → Scapular pain*
    - *17.8% → Anterior chest pain*
    - *9.7% → Headache*
    - *5.9% → Anterior chest and arm pain*
    - *1.3% → Left-sided chest and arm pain*
      - Cervical angina
  - Neurologic deficits corresponded with offending disc level in approximately 80%

CERVICAL RADICULOPATH

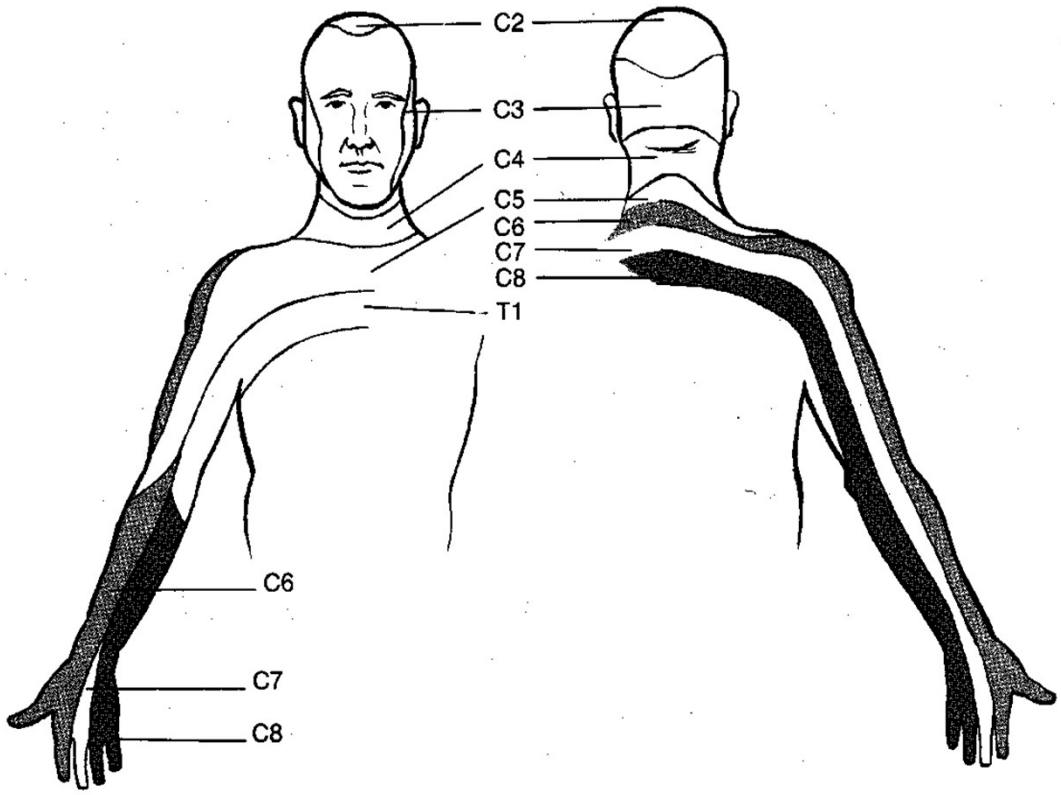


- Shoulder abduction sign
  - Hold arm over head
  - Relative laxity in dural ligaments
  - Lifts sensory root (dorsal root ganglion) cephalad
  - Decompresses epidural veins
- Spurling maneuver
  - Vertical compression
  - Extension
  - Lateral rotation of head to side of pain



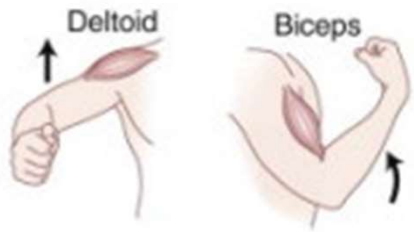
EVALUATION

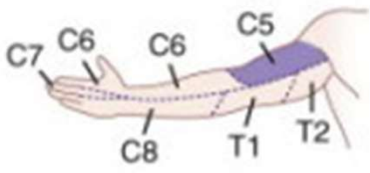
- Dermatomes
  - Greek for "skin slice"
  - Area of overlying skin innervated by specific spinal nerve
  - Distinct motor and sensory findings pinpoint levels of injury

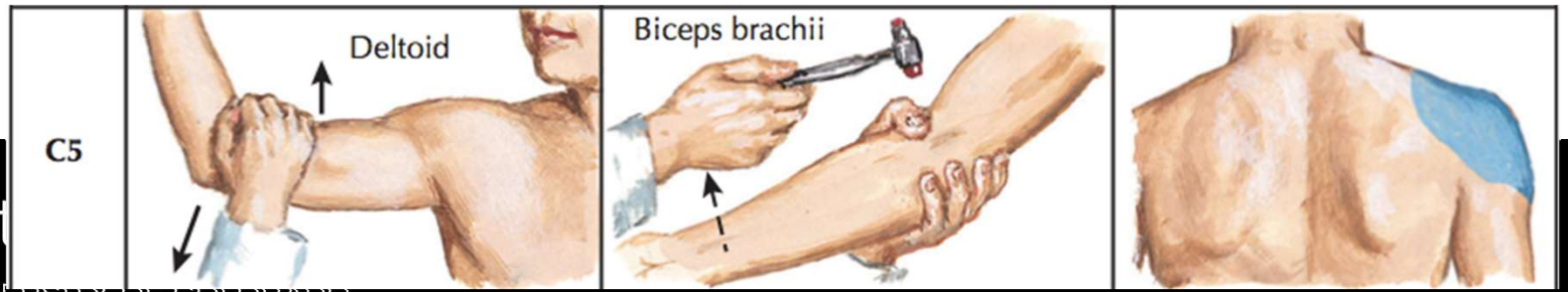


Cervical Radiculopathy

- C5 radiculopathy
  - Pain / Paresthesia
    - *Superior aspect of shoulder extending laterally to mid-arm*
  - Motor deficits
    - *Profound*
      - Deltoid
    - *Subtle*
      - Supraspinatus
      - Infraspinatus
      - Biceps brachialis
  - Decreased biceps reflex

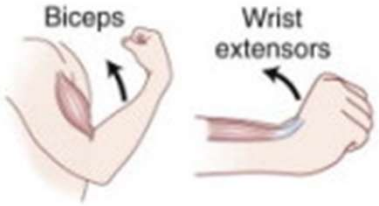




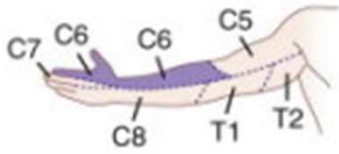


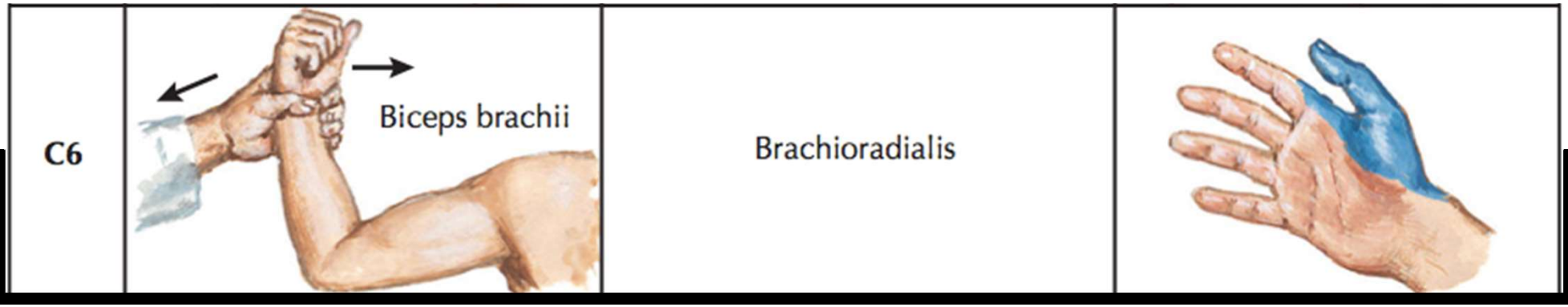
Cervical Radiculopathy

- C6 radiculopathy
  - Pain / Paresthesia
    - *Base of neck → Lateral aspect of elbow → Radial forearm and radial digits / t*
  - Motor deficits
    - *Wrist extensors*
    - *Elbow flexion*
    - *Forearm supination*
  - Decreased brachioradialis reflex



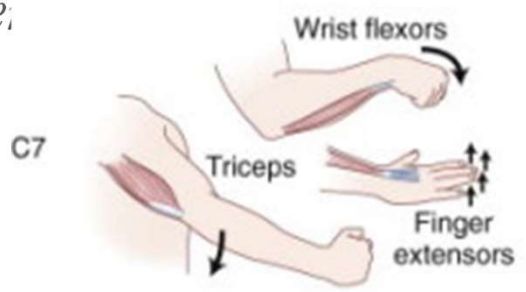
C6

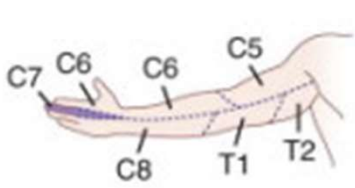


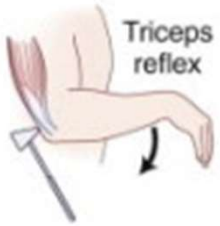


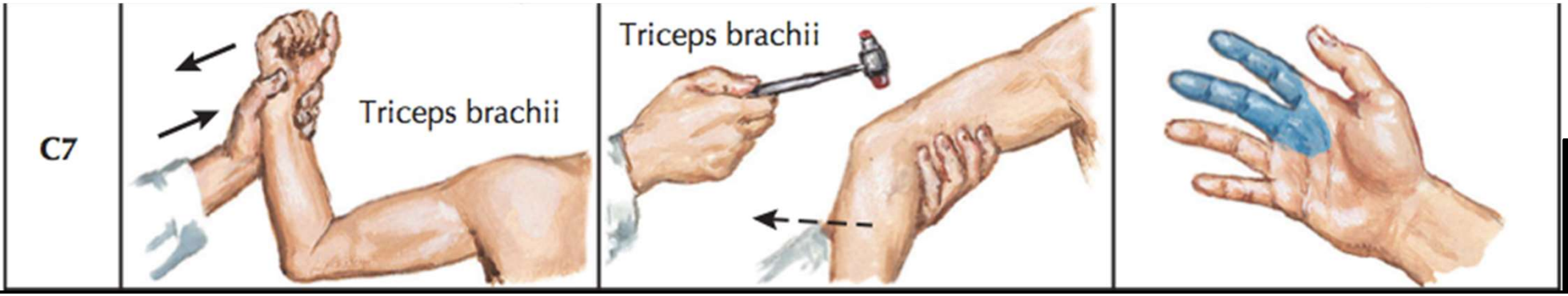
CERVICAL RADICULOPATHY

- C7 radiculopathy
  - Most frequently involved nerve root
  - Pain / Paresthesia
    - *Neck → Shoulder / Posterior arm → Dorsum of forearm → Dorsum of middle finge*
  - Motor deficits
    - *Triceps*
    - *Wrist flexors*
    - *Finger extensors*
  - Decreased triceps reflex



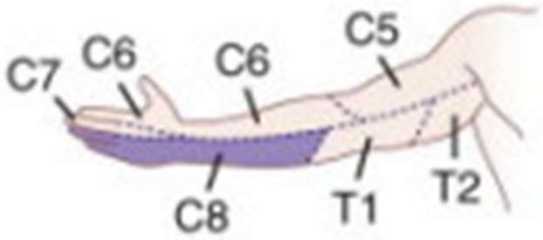
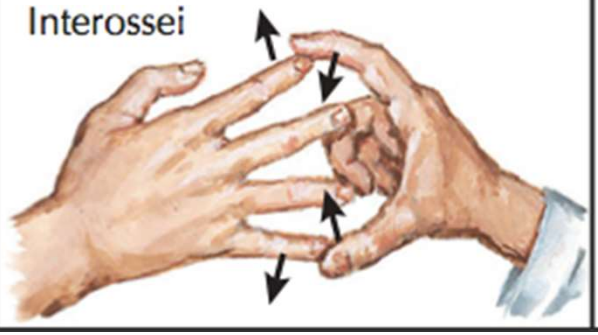






CERVICAL RADICULOPATHY

- C8 radiculopathy
  - Pain / Paresthesia
    - *Ulnar border of arm and forearm → Ulnar aspect of hand → Small and ring finger (Dorsal and volar)*
  - Weakness

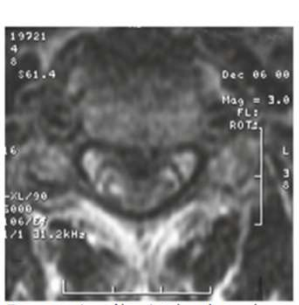
C8			No reflex
C8		None	

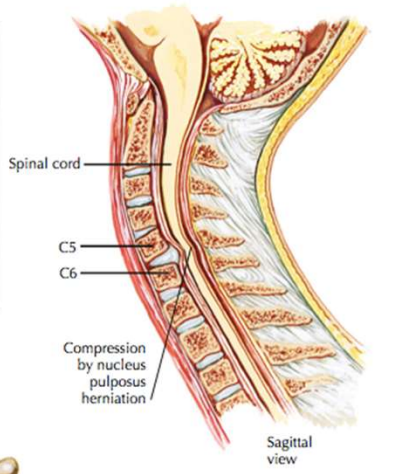
Cervical Radiculopathy

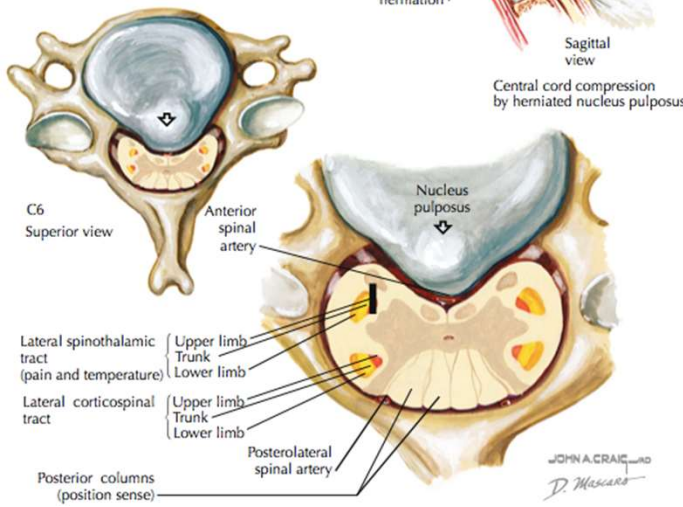
- No studies on true natural history exist
- Varying degrees of nonoperative management
  - 45% → Good resolution of symptoms within 6 weeks of onset
  - 55% → Minor to moderate degree of long term morbidity

Cervical Myelopathy

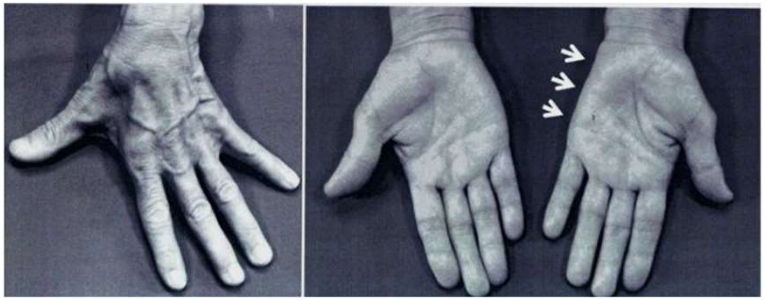
- Diagnostic challenge
  - Subtle nature of early clinical findings
  - Combined cervical and lumbar involvement present (13%)
- Vary depending on anatomic portion primarily involved
  - Sensory symptoms
    - *Compression at 3 discrete locations*
      - Spinothalamic tract
        - » Contralateral pain and temperature sensation
      - Posterior columns
        - » Ipsilateral position and vibration
          - Gait disturbances
      - Dorsal root
        - » Dermatomal sensation
  - Motor and reflex examination
    - *LMN signs at levels of cervical lesions*
    - *UMN signs below lesions*


Demonstration of herniated nucleus pulposus at C3-4 interspace with compression of spinal canal





Cervical Myelopathy



- Presentation
  - Insidious onset
  - "Myelopathy hand"
    - *High cervical involvement → Above C5*
    - *Clumsiness*
    - *Diffuse numbness*
    - *Wasting of intrinsics*
    - *Worsening handwriting*
    - *Declining fine motor skills*
      - Grasping or holding objects
    - *Finger-escape sign*
      - Patient attempts to extend digits fully with palm facing down
      - Ulnar 2 or 3 digits drift into abduction and flexion after 30 seconds
    - *Grip-and-release test*
      - Decreased ability to open and close fist rapidly
        - » Weakness and spasticity
      - Normal → > 20 grip- and-release movements in 10 seconds

Cervical Myelopathy

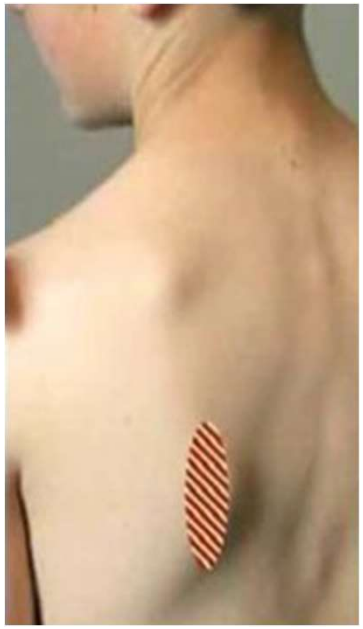
- Presentation
  - Gait abnormality (Nurick system for grading disability)
    - *Increasingly clumsy*
    - *Difficulty with balance*
    - *Loss of proprioception*
      - Unsteady, broad- based gait

Table II.
Nurick's Functional Scale

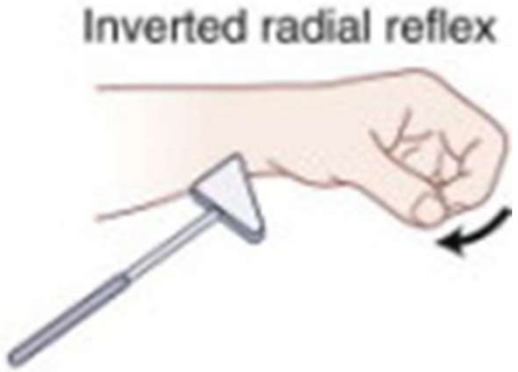
Grade	Level of Neurological Involvement
Grade I	No difficulty in walking
Grade II	Mild gait involvement not interfering with employment
Grade III	Gait abnormality preventing employment
Grade IV	Able to walk only with assistance
Grade V	Chairbound or bedridden

Cervical Myelopathy

- Physical examination
  - Exaggerated deep tendon reflexes
  - Sustained clonus
  - Presence of pathologic reflexes
  - Diminished superficial reflexes
    - *Abdominal*
    - *Cremasteric*
  - Pathology cephalad to C3
    - *Hyperactive scapulohumeral reflex*
      - Stretch reflex of trapezius muscle
        - » Tapping of scapula or acromion
        - » Brisk scapular elevation or humerus abduction or both

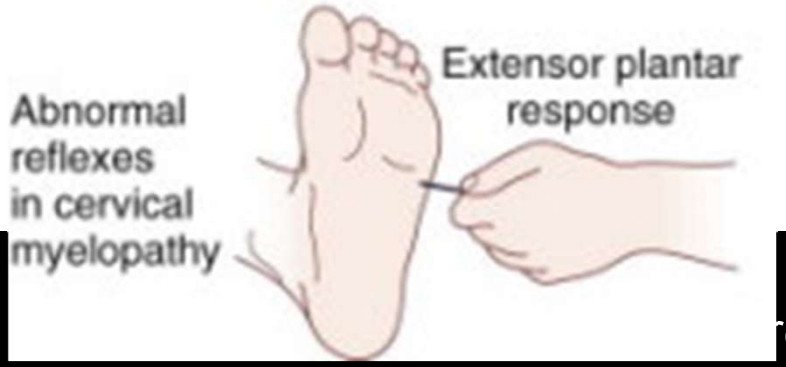


Cervical Myelopathy



- Physical examination
  - Pathologic reflexes
    - *Inverted radial reflex*
      - C6
      - Brachioradialis reflex hyporesponsive
      - Ipsilateral fingers flex briskly

    - *Hoffman reflex*
      - Volar surface of distal phalanx of long finger flicked into extension
      - Ipsilateral interphalangeal joints of thumb and index finger flex
    - *Babinski sign*
      - Rubbing of lateral sole of foot from heel along curve to metatarsal pads with blunt object
      - Hallux dorsiflexes
      - Lesser toes fan out

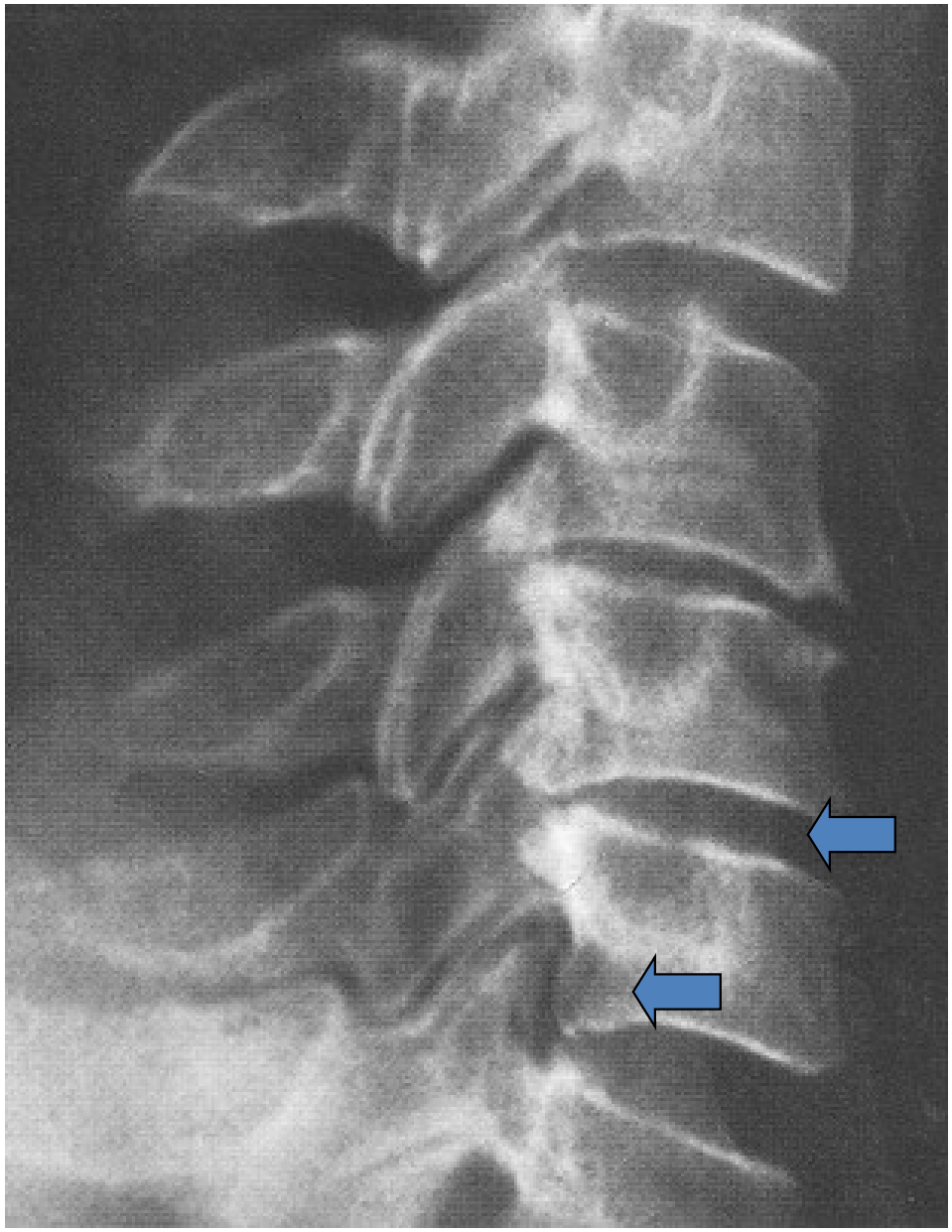


Cervical Myelopathy

- No modern studies on true natural history exist
  - Surgical intervention is so commonly part of treatment
- Progressive deterioration
  - Stepwise
  - Intervening variable periods of stable disease

Imaging

- Plain films
  - Review alignment (kyphosis vs. lordosis)
  - May show disc space narrowing, osteophytes and instability



Imaging

- MRI
  - Very sensitive
  - Can identify abnormalities in asymptomatic patients

Nonoperative

- Natural histories of most nonmyelopathic spondylotic cervical disorders are statistically favorable
  - Most cases respond to course of nonoperative treatment
- Surgical indications
  - Neurologic deficits
  - Progressive dysfunction
  - Failure to improve after an appropriate course of nonoperative treatment

NONOPERATIVE

- Definition of what constitutes appropriate course has not been standardized
- Unclear
  - Improve on natural history?
    - *No controlled trials have compared various nonoperative regimens versus natural history*
  - Outcomes equal outcomes of surgery?
- Many patients improve without surgery, when and in whom should surgery be recommended
  - Is there a way to predict who needs surgery at the outset to avoid delays in delivering the ultimately needed treatment?

NONOPERATIVE

- Modifiable factors
  - Smoking
  - Occupational hazards
    - *Excessive cervical motion and overhead work*
    - *Vibration caused by heavy equipment*
  - Obesity
  - Psychological factors
- Active litigations claims
- Workers' compensation

Nonoperative

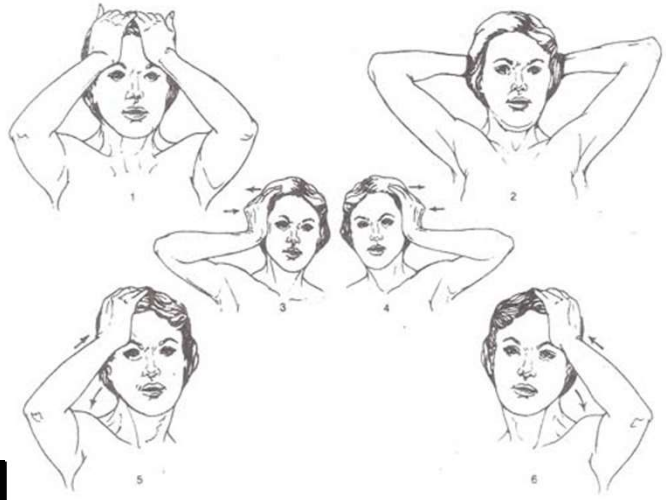
Modality	Pros	Cons
Cervical collars	Immobilization may decrease inflammation and muscle spasm	Muscle atrophy from prolonged use
Ice or heat	Ice may relieve acute pain and spasm; heat beneficial when regaining motion	Heat may exacerbate pain in acute period
Traction	With neck in flexion may relieve foraminal compression	Avoid in myelopathic patients; if neck extended, may worsen compression of narrowed foramen
NSAIDs	Safe, cost-effective method to decrease inflammation	Gastrointestinal side effects, cardiovascular risks with COX-2 inhibitors
Narcotics	Rapid pain relief in acute period	Constipation, sedation, depression, and potential for abuse
Corticosteroids	May decrease radicular pain acutely	Avascular necrosis, increased blood glucose, unproven long-term benefits
Muscle relaxant	Acute relief of muscle spasms	Sedation, fatigue, abuse potential, limits participation in rehabilitation
Exercise and physical therapy	Well tolerated, aerobic conditioning	No long-term pain benefits shown, forceful passive range of motion may lead to further injury and increased pain
Cervical manipulation	Some anecdotal reports of relief	No objective evidence of improvement in pain; rare potential complications including myelopathy, spinal cord injury, vertebrobasilar artery injury
Cervical steroid injections	Anti-inflammatory effect, interruption of nociceptive input/sympathetic blockade, mechanical disruption of adhesions	Rare complications include dural puncture, meningitis, epidural abscess, intraocular hemorrhage, epidural hematoma, adrenocortical suppression, paralysis

Nonoperative

- Medications
  - NSAIDs
  - Antidepressants
  - Anticonvulsants
  - Systemic corticosteroids
  - Muscle relaxants
  - Narcotic analgesics
- Initial treatment
  - Beneficial
    - *Under correct circumstances*
    - *With proper supervision*

NONOPERATIVE

- Rehabilitation protocol
  - Active more likely to be successful than use of passive modalities
  - Home exercise program
    - *May help to prevent future episodes of pain*
    - *Increase chances of long-term success*



Nonoperative

- Cervical manipulation
  - Not to be undertaken without adequate radiographic examination
    - *Potential instability*
  - Reported complications
    - *Radiculopathy*
    - *Myelopathy*
    - *Spinal cord injury*
    - *Vertebrobasilar artery injury*

What can surgeons do?

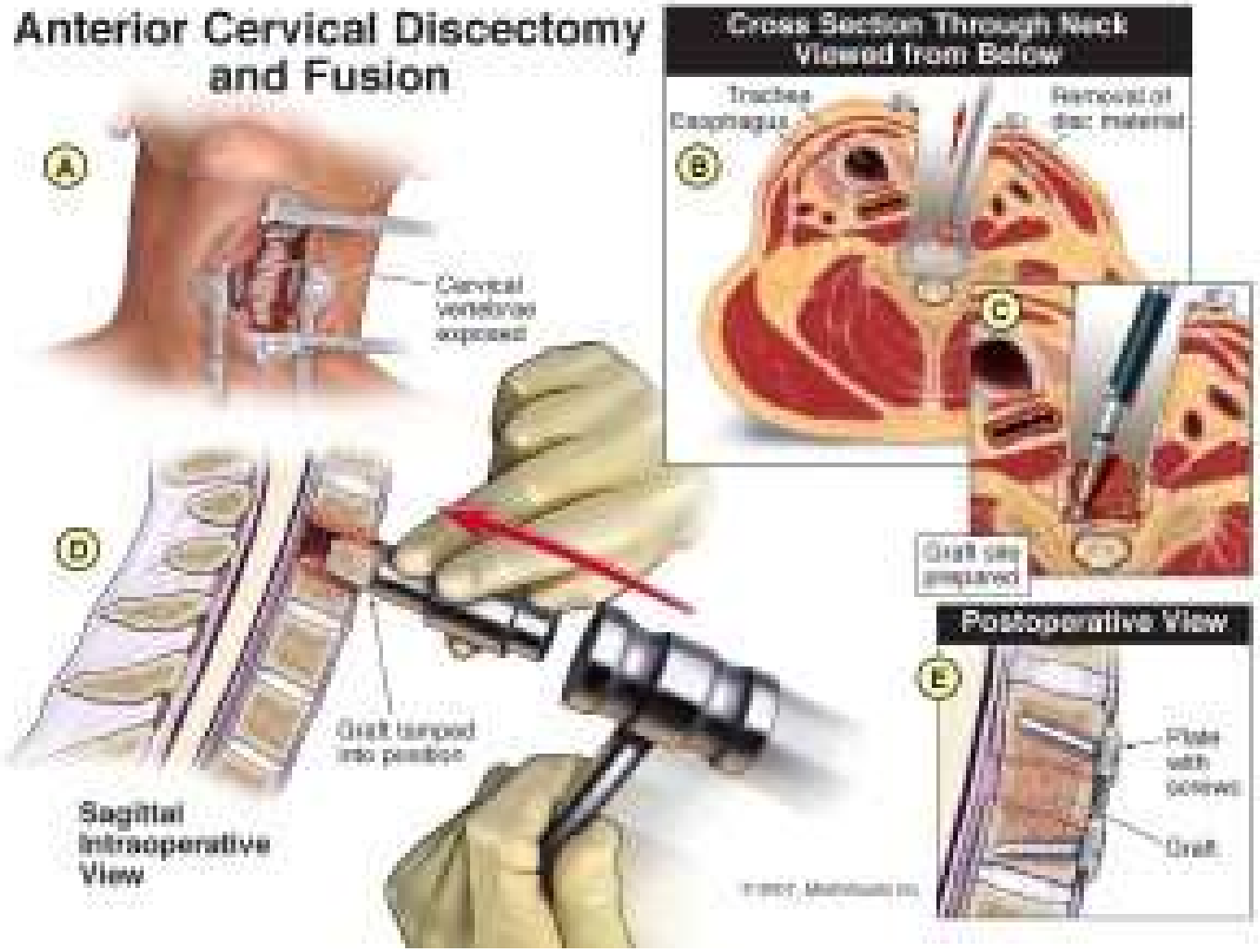
Decompress

Stabilize

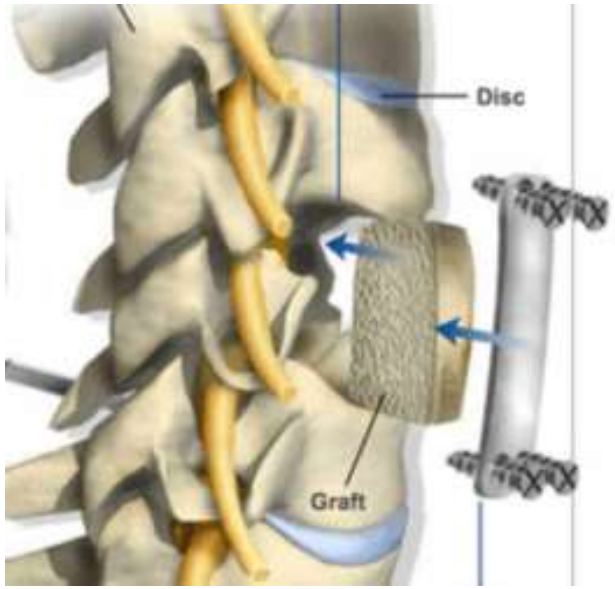
Goals of Operative Treatment

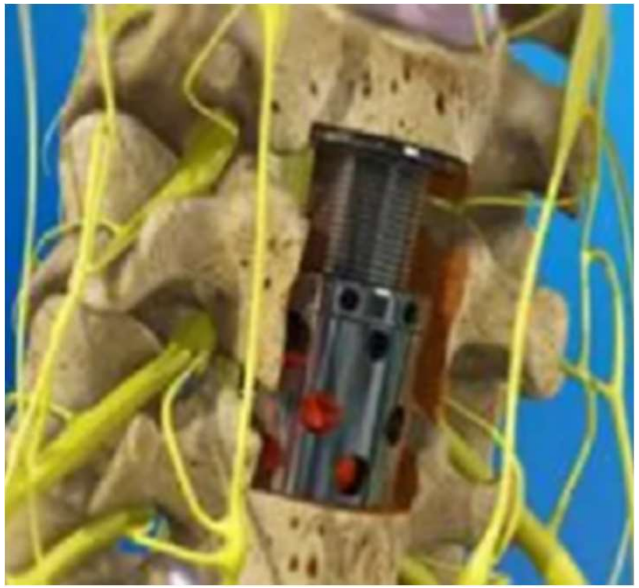
- Neural decompression
- Correction of deformity
- Immediate stability

ANTERIOR CERVICAL DISCECTOMY AND FUSION



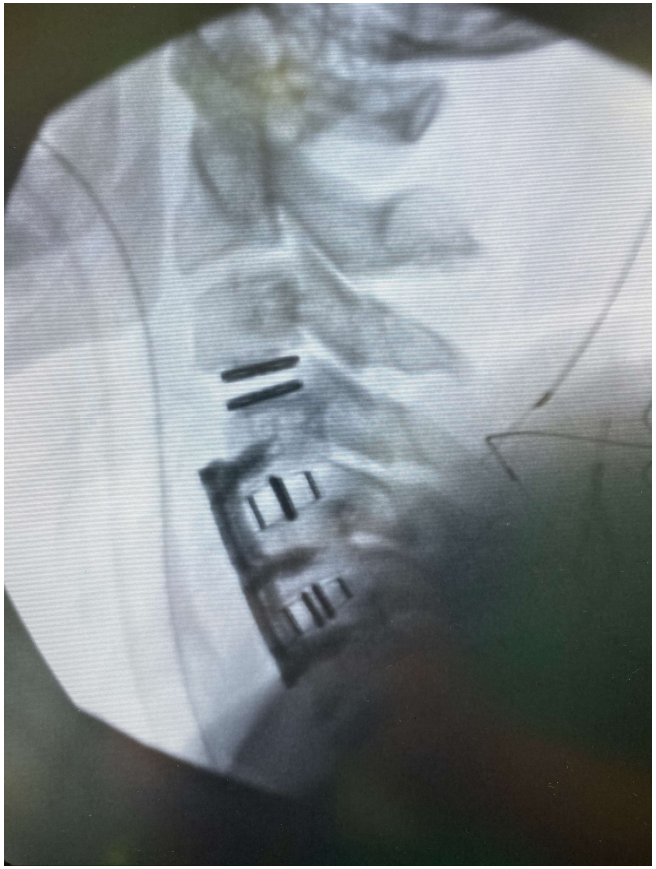
Cervical corpectomy

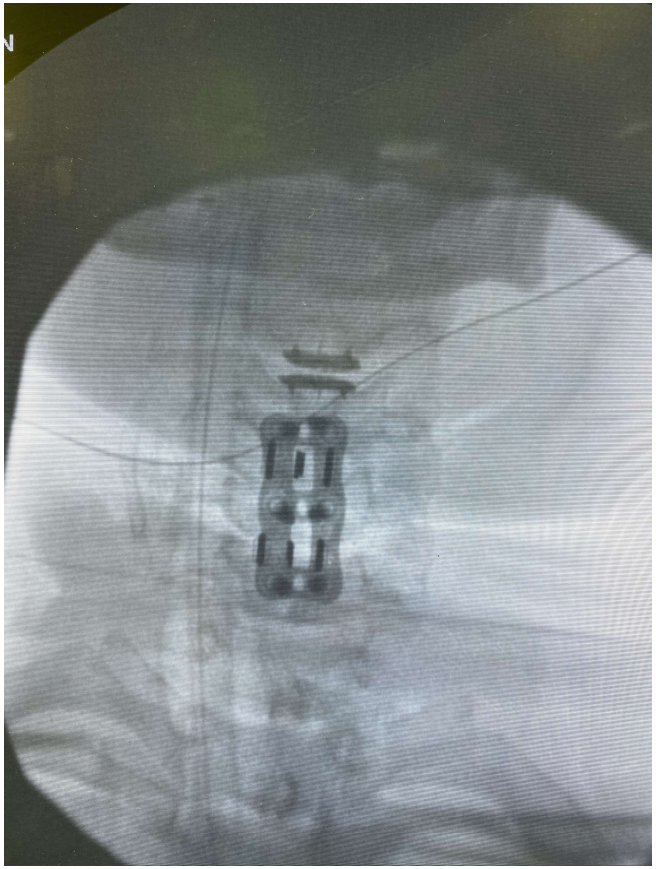




Anterior Cervical Discectomy and fusion

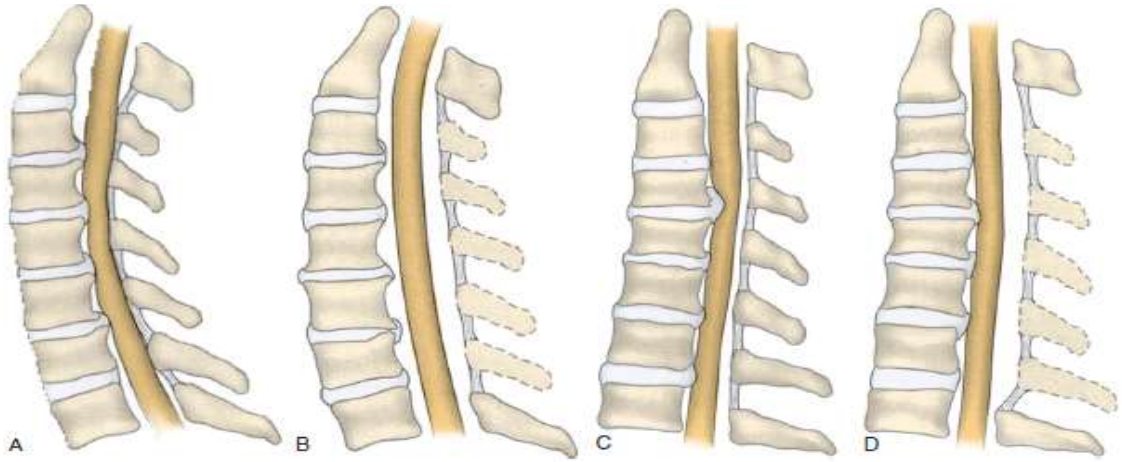
Artificial cervical disc replacement



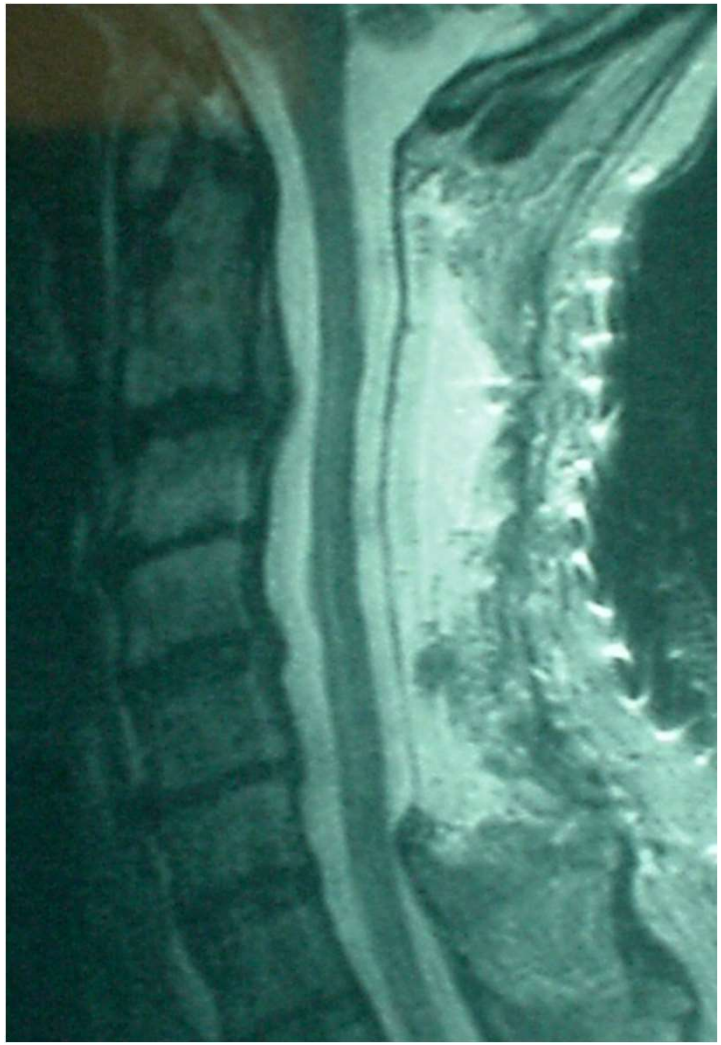


POSTERIOR APPROACH

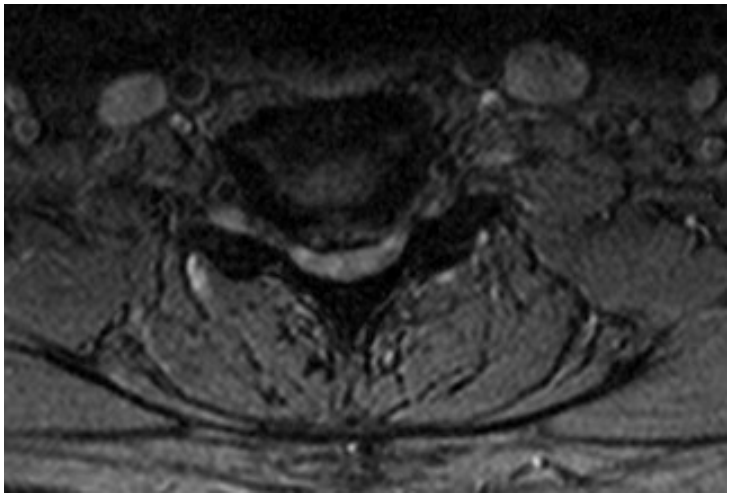
- Congenital stenosis, multilevel, OPLL, infolding ligamentum flavum
- Direct & indirect decompression
  - Canal expansion allows cord to shift posterior

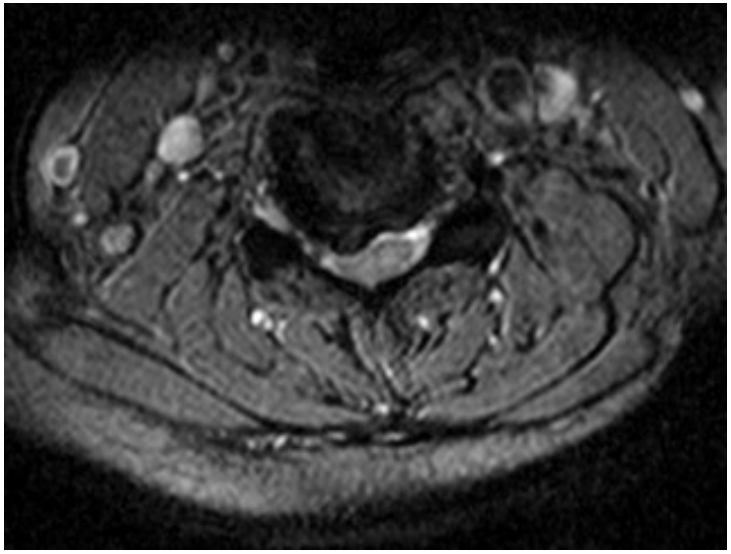


Cervical Laminectomy

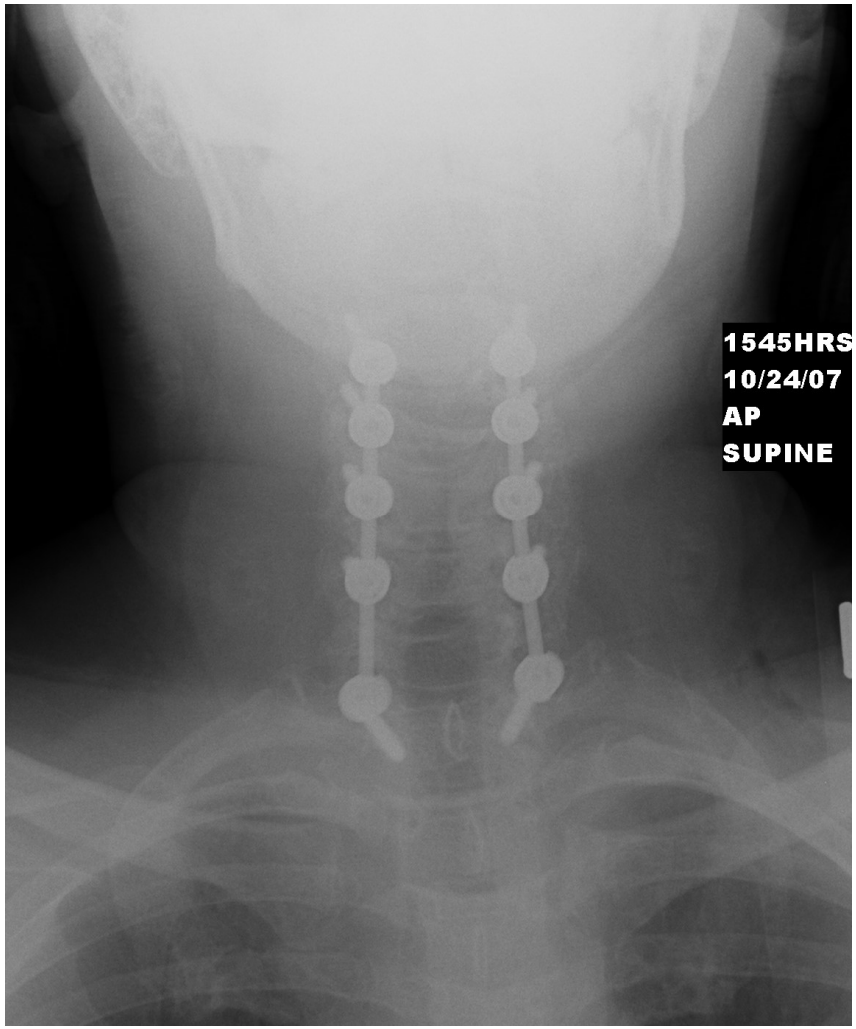


Sub-axial Cervical Stabilization





Sub-axial Cervical Stabilization



OPEN-DOOR LAMINOPLASTY

- Posterior hinge

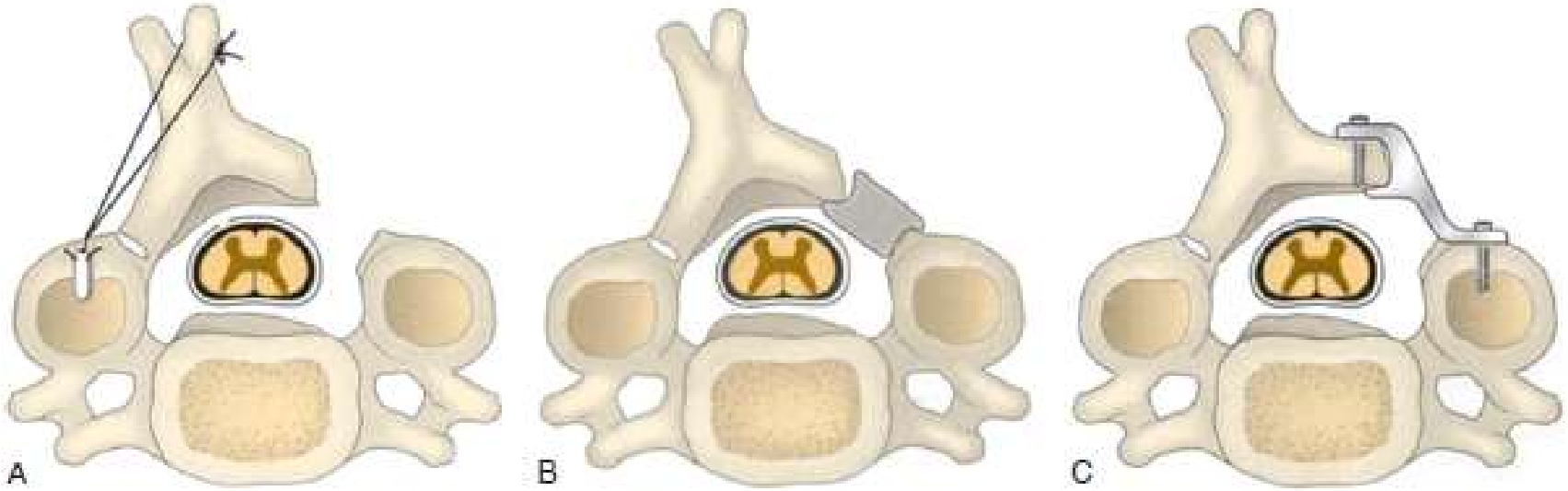
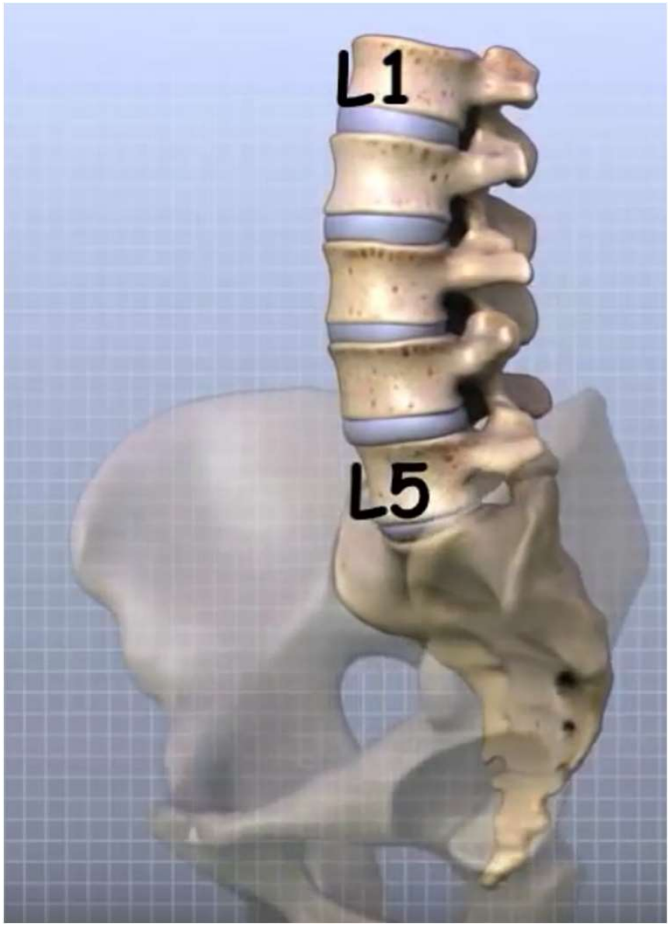


FIGURE 41–10 Methods of stabilizing expanded posterior arch with open-door laminoplasty. **A,** Tethering from hinge side with lateral mass suture anchor. **B,** Propping expanded arch open with contoured strut. **C,** Rigid intrasegment fixation with a plate and screw system.

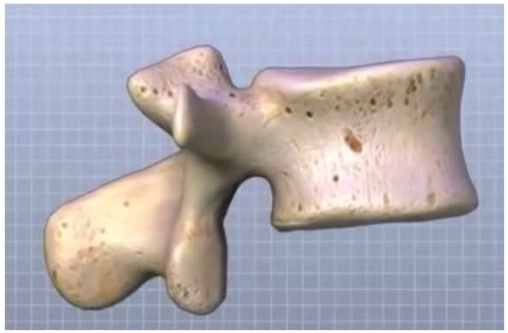
Lumbar spine anatomy

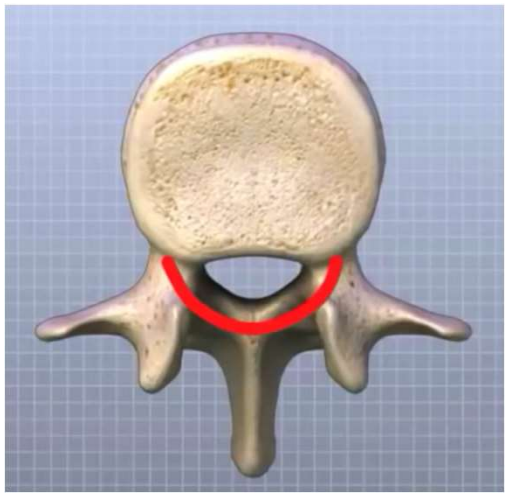
- Lumbar Spine
  - a.k.a. the "Low Back"
- Bottom 5 vertebrae between the rib cage and the pelvis
  - L1 to L5
- Largest in the spine due to large loads that are carried by them



Lumbar spine anatomy

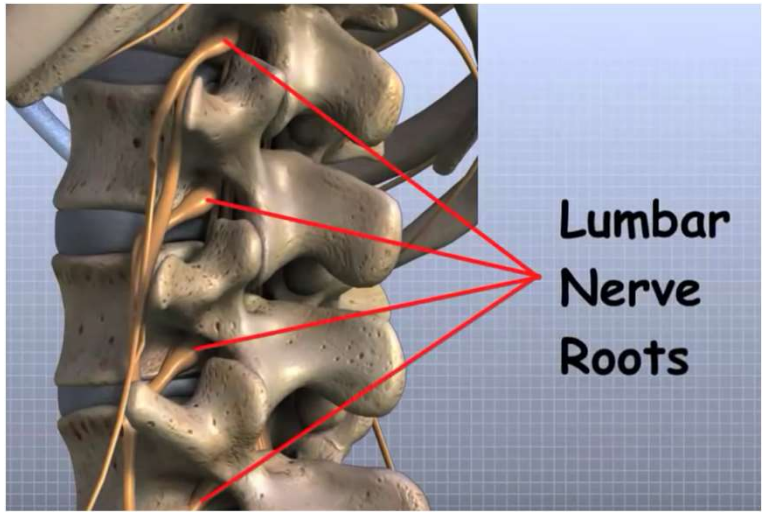
- Vertebrae
  - Anterior vertebral body
  - Posterior ring – formed by pedicles, laminae and spinous processes





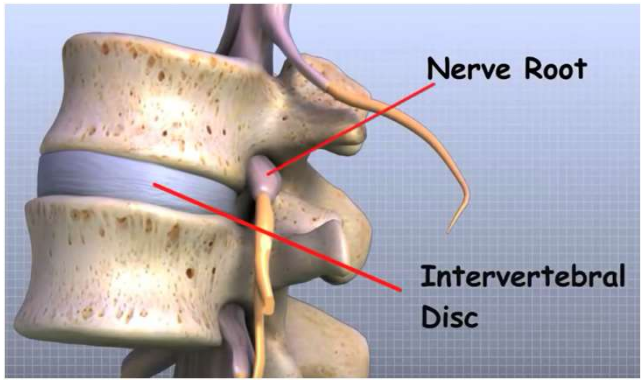
Lumbar spine anatomy

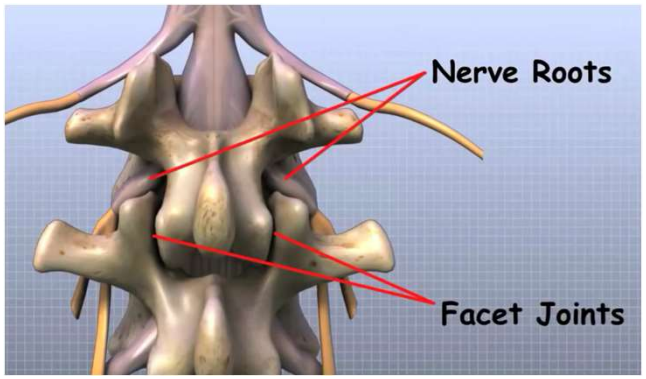
- Stacked vertebrae form the spinal canal which carries the cauda equina
  - Lumbar nerve roots
  - One exits at each level between the vertebral bodies at the level of the disc



Lumbar spine anatomy

- Lumbar spine motion segments
  - 2 vertebral bodies
  - 1 intervertebral disc
  - 2 facet joints

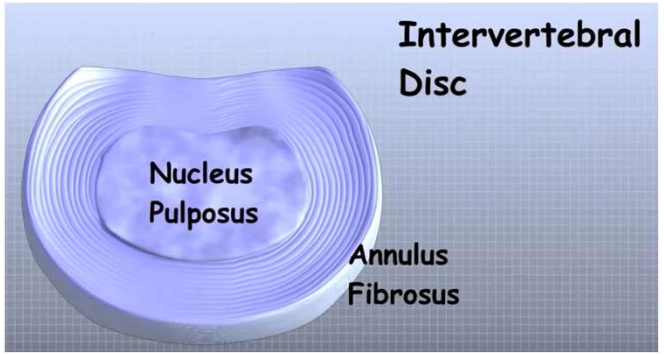


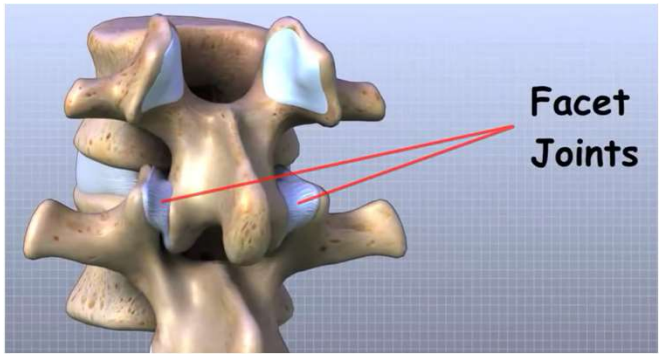


Lumbar spine anatomy

- Intervertebral disc
  - Inner nucleus pulposus
  - Outer annulus fibrosus

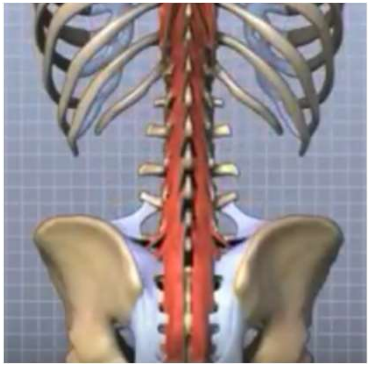
- Facet joints
  - 2 at each level
  - Surfaces of joints are covered by cartilage
  - Alignment allows for flexion and extension





Lumbar spine anatomy.

- Bony structures supported by three layers of muscles running along the spine from the skull to the pelvis



The degenerative cascade

	Annulus fibrosus	Nucleus pulposus	Vertebral endplate
Molecular	Cross-linking	altered PGs altered pH dehydration	Altered PGs
Microscopic	Delamination, tears, fissures	Cracks, tears, fibrosis	Thickening, cracks, fractures
Biomechanical	Stiffening, increased stress	Depressurised	Weakening, bowing
Macroscopic & imaging	Osteophytes	Reduced signal	

Disc degeneration

Hadjipavlou et al. *JBJS(Br)*. 2008;90-B(10):1261-1270.

The degenerative cascade

Normal MRI

Lumbar Disc Degeneration

Loss of water and change of molecular structure

Loss of internal disc height

Disc cracking and bulging

Load transfer to facet joints

Ligament thickening & bone spur growth

SYMPTOMATOLOGY

Back Pain

Causes (?):
- Disc degeneration
- Facet arthritis
- Muscle weakness/spasm

Treatment:
- Non-surgical

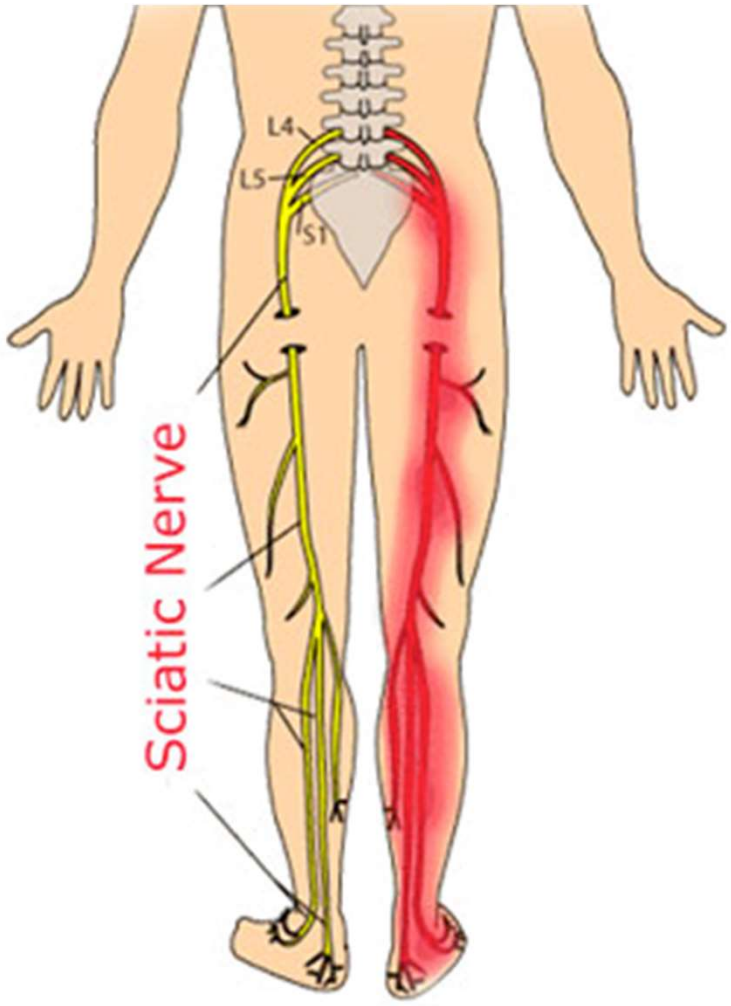
Leg Pain

Radiculopathy (a.k.a. "sciatica")

Neurogenic Claudication

RADICULOPATHY

- a.k.a. "Sciatica"
  - Pain in the path of a single nerve
    - *Often associated with numbness and/or weakness*
  - Most common at the L5 and S1 levels
  - Can occur at any level in the spine
  - Causes: disc herniation, spondylolisthesis, spinal stenosis



NEUROGENIC CLAUDICATION

- Bilateral leg pain with walking
  - May be associated with weakness/numbness/tingling with activity
  - Aggravated by spine extension
  - Relieved by rest or spine flexion
    - *"Shopping Cart Sign"*
  - Causes: spinal stenosis, spondylolisthesis

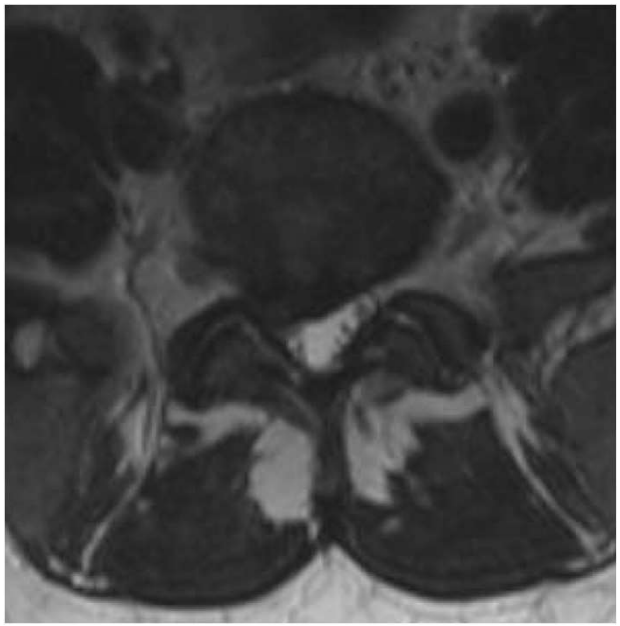
Lumbar disc herniation

Herniation = Focal displacement of disc material beyond the normal margins of annulus fibrosus

Bulging = generalized outpouching of the peripheral margin of the annulus fibrosus associated with loss of disc height

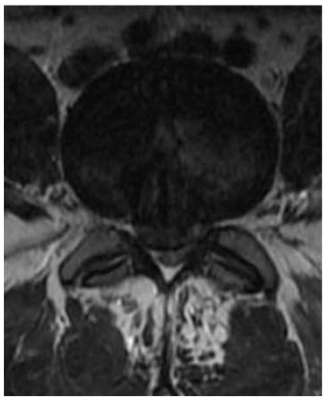
Lumbar disc herniation

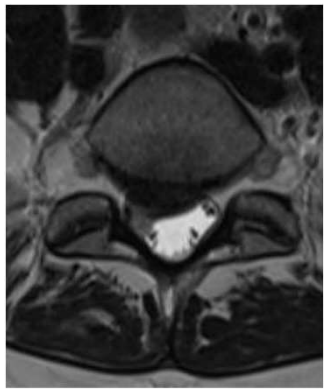
- Occurs due to disc degeneration with or without associated trauma
- Common cause of lumbar radiculopathy in adults
- Occurs most commonly at L4-5 and L5-S1
- 80% of patients will improve with nonsurgical treatment in 8-12 weeks



Lumbar disc herniation

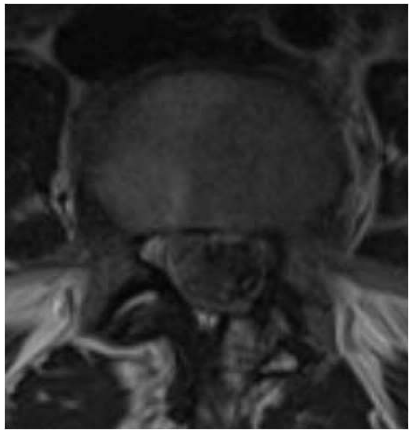
- Locations
  - Central
    - *Affect traversing nerve root*
    - *May cause bilateral symptoms*
  - Paracentral
    - *Most Common*
    - *Affect traversing nerve root*
  - Far lateral/Foraminal
    - *Affect the exiting nerve root*





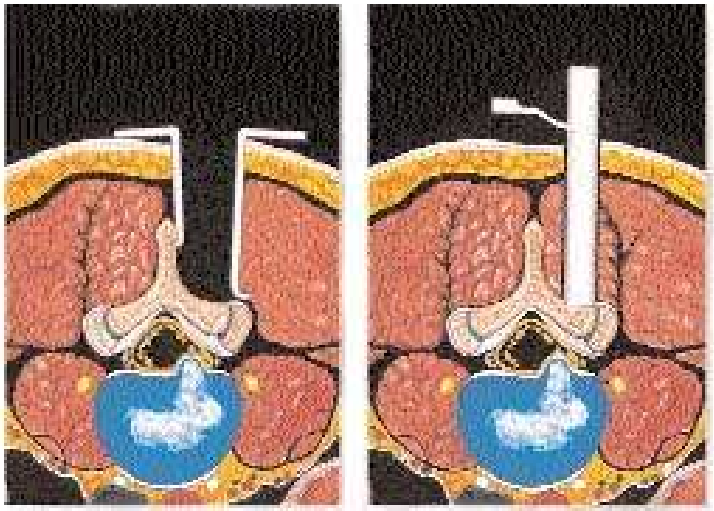
LUMBAR DISC HERNIATION

- Indications for surgery:
  - Failure to improve with non-surgical treatment
  - Bowel or bladder dysfunction (i.e. cauda equina syndrome)
  - Progressive weakness



LUMBAR DISC HERNIATION

- ***Central/Paracentral Lumbar Microdiscectomy***
  - 1-2 hour procedure
  - Open or minimally invasive technique
  - Typically day-surgery
  - Rapid recovery
    - *No lifting > 10 pounds for 6 weeks*
    - *Avoid repetitive bending and twisting*
    - *Return to work 1-6 weeks*

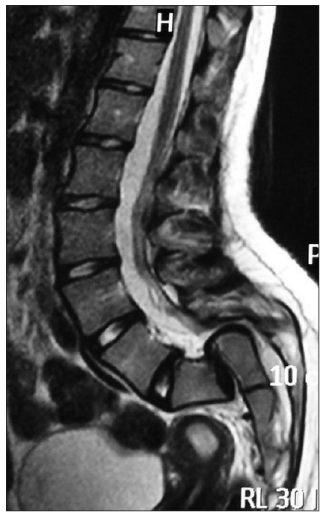


Open Microdiscectomy

Minimally Invasive Approach

SPONDYLOLISTHESIS

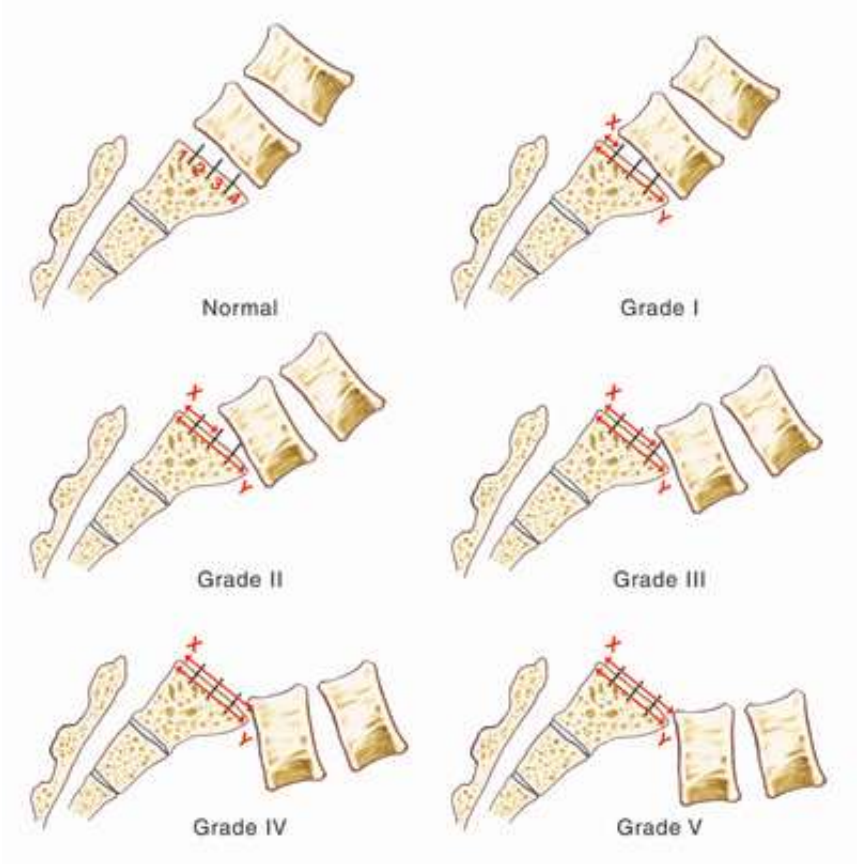
- From the Greek “spondylos” meaning vertebra and “olisthanein” meaning to slip
- First described in 1782 by Herbiniaux
  - Belgian obstetrician
  - Patient with complete L5 dislocation on sacrum
  - Narrowing of birth canal and difficulty with L & D



SPONDYLOLISTHESIS

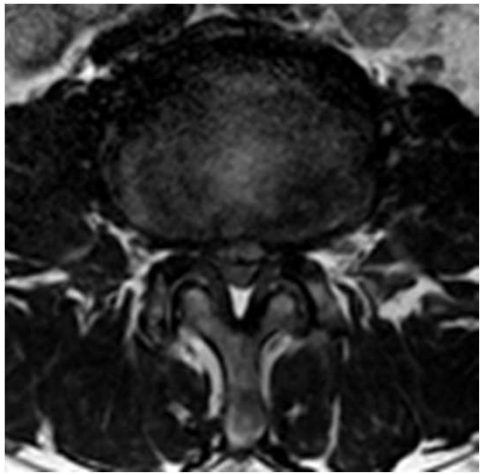
- Wiltse Classification (Etiology)
  - Dysplastic
    - *A – facet with axial orientation*
    - *B – facet with sagittal orientation*
  - Isthmic
    - *A – lytic (#2)*
    - *B - elongation*
    - *C – fracture*
  - Degenerative (#1)
  - Post-traumatic
  - Pathologic
  - Iatrogenic (i.e. post-surgical)

- Meyerding Classification (Severity)



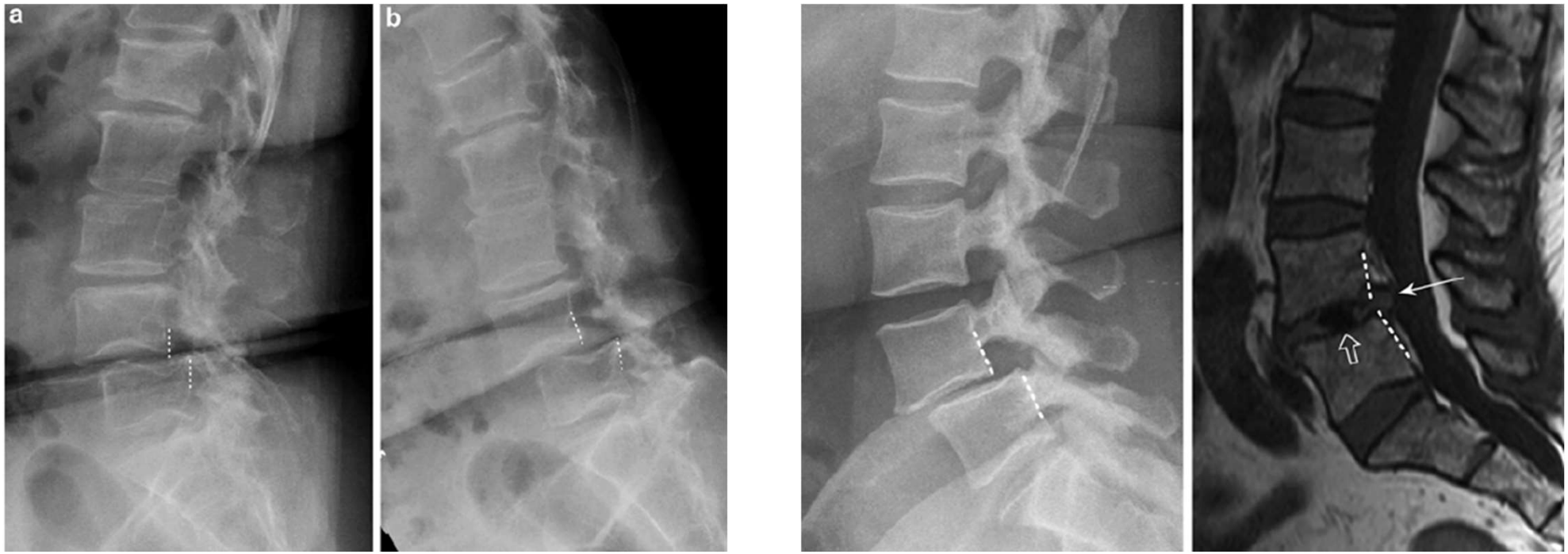
Degenerative spondylolisthesis

- Occurs most commonly at L4-5
- May present with radiculopathy or neurogenic claudication
- Treatment depends on:
  - Motion of the slip
  - Location of nerve compression



Degenerative spondylolisthesis

Neutral Flexion X-Ray MRI

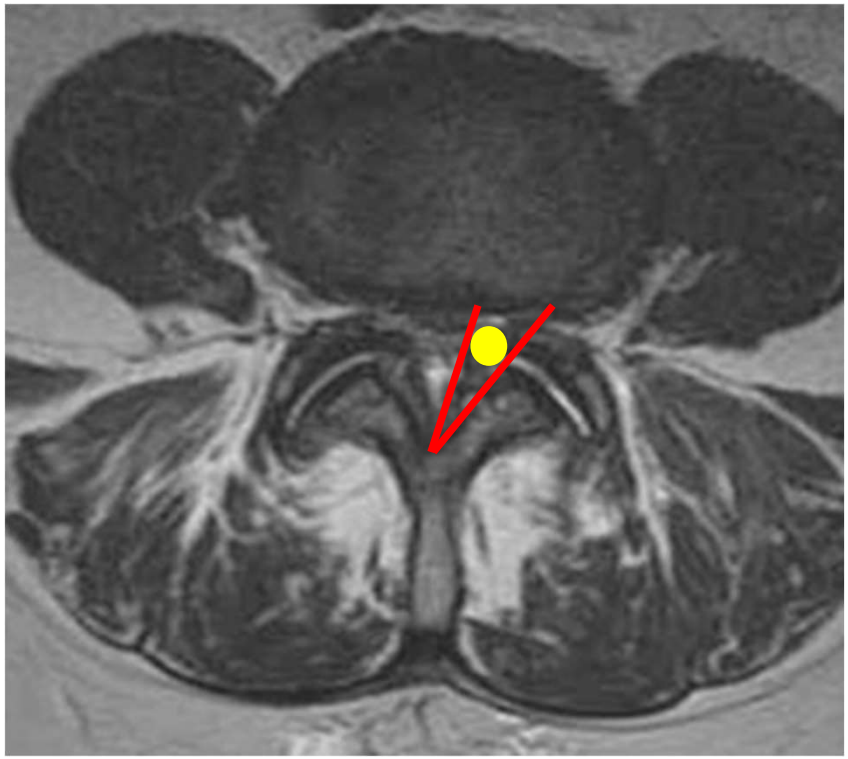


Motion → Decompression & Fusion

No Motion → Location of nerve compression?

DEGENERATIVE SPONDYLOLISTHESIS

LATERAL RECESS



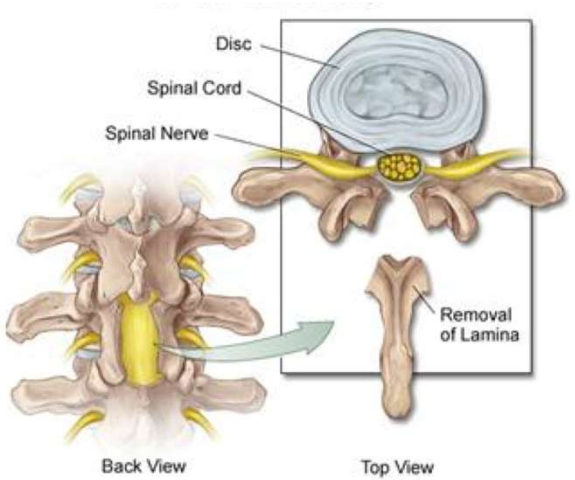
DECOMPRESSION

FORAMEN

DECOMPRESSION + FUSION

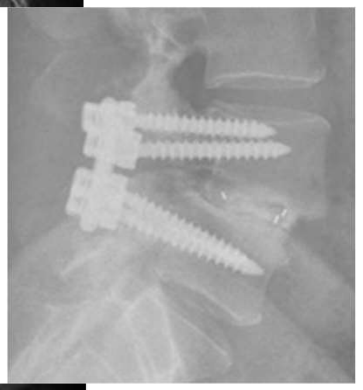
DEGENERATIVE SPONDYLOLISTHESIS

- ***Lumbar Decompression***
  - Laminectomy - bilateral
  - Laminoforaminotomy – unilateral or bilateral
- 1-1.5 hour surgery
  - Open or minimally invasive techniques possible
- May be done as day surgery or require 1-night stay
- Rapid recovery
  - No repetitive bending/lifting/twisting
  - No lifting restrictions
  - Return to work 1-6 weeks



DEGENERATIVE SPONDYLOLISTHESIS

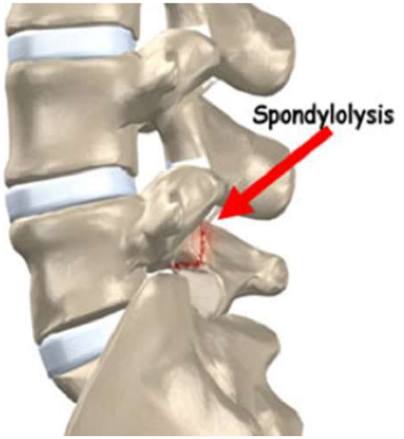
- ***Lumbar Decompression & Fusion***
- Multiple techniques possible – anterior, lateral, posterior
- 3-4 hour surgery
- 2-3 night hospital stay
- 6-12 week recovery
  - Walking, sitting, riding in a car and personal care OK
  - No repetitive bending or twisting
  - No lifting > 10 pounds
  - Return to work depends on job

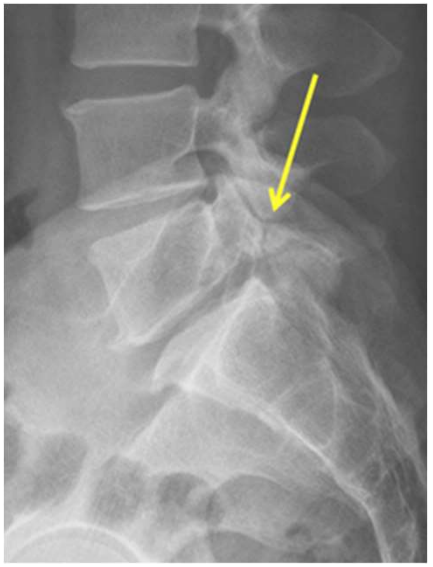


ISTHMIC SPONDYLOLISTHESIS

- Occurs most commonly at L5-S1

- Used to be called "congenital spondylolisthesis"
  - Infants are not born with pars defects (spondylolysis)
  - These are stress fractures that do not heal



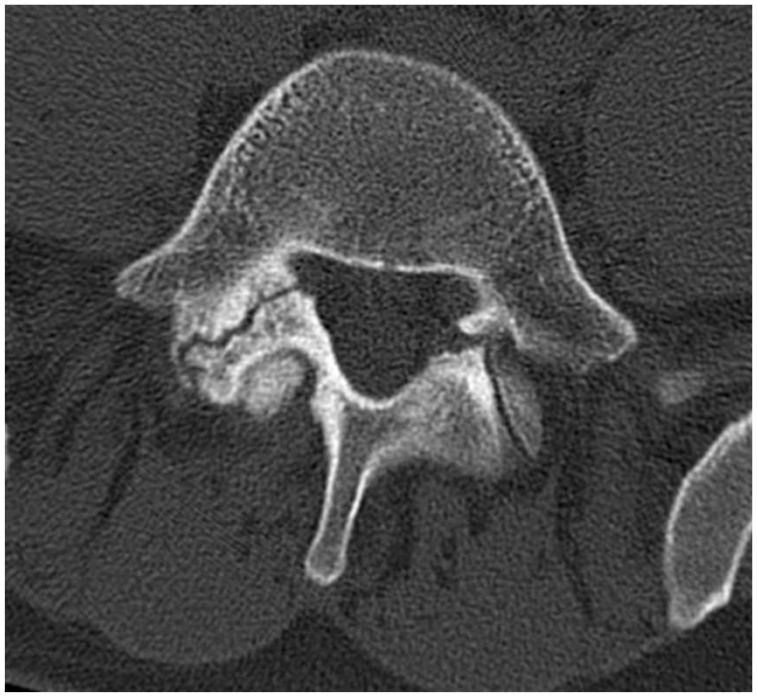


ISTHMIC SPONDYLOLISTHESIS

- Classic Radiologic Findings

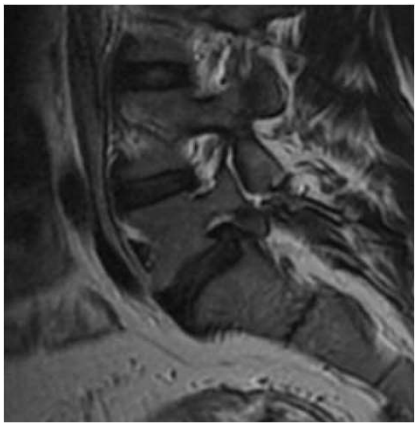
Scotty Dog Sign

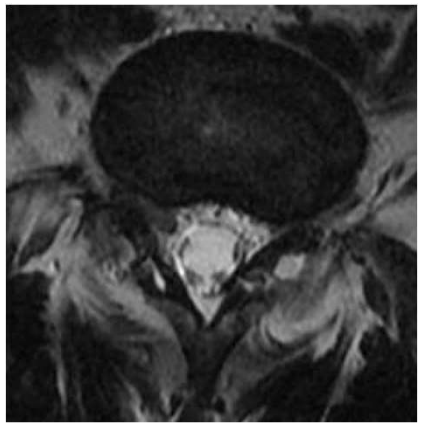
Double Facet Sign



ISTHMIC SPONDYLOLISTHESIS

- Presentation
  - Back Pain
  - Radiculopathy from foraminal stenosis (exiting nerve root)



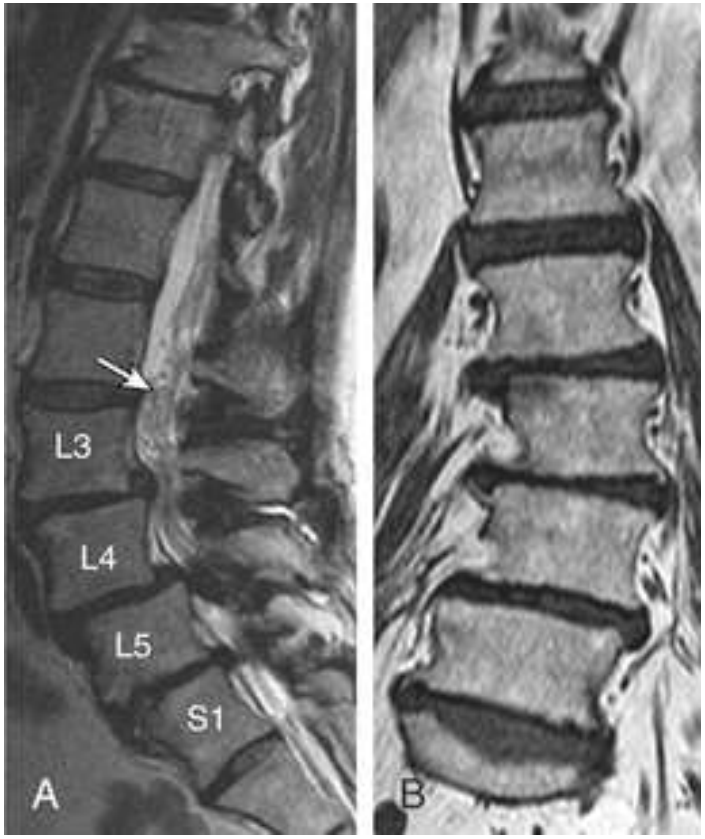


ISTHMIC SPONDYLOLISTHESIS

- Surgical Treatment
  - Pars Repair
    - *Back pain*
    - *< 25 years old*
    - *Normal disc on MRI*
    - *No spondylolisthesis*
    - *At least 50% Relief of back pain from pars injection*
  - Decompression and Fusion
    - *Anyone not meeting criteria for pars repair*

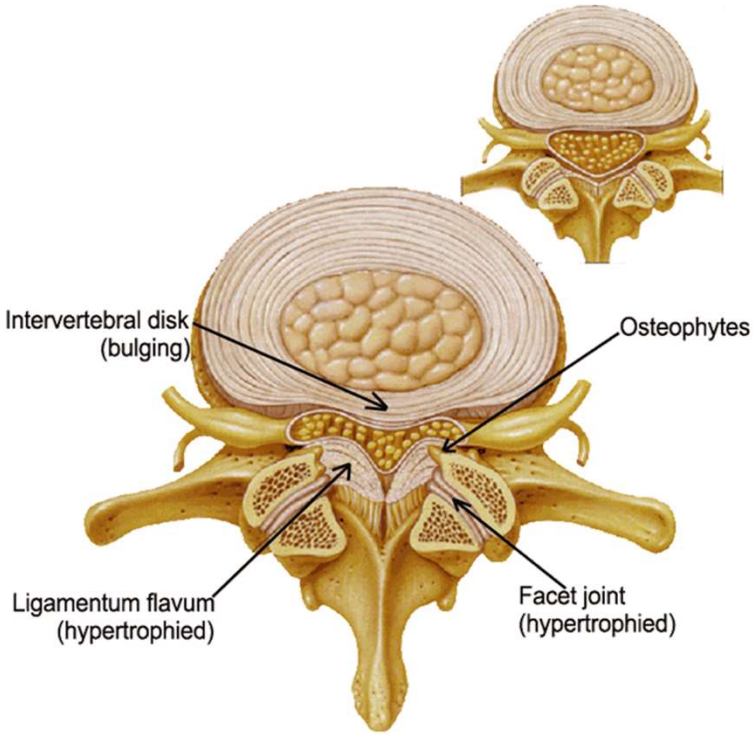
Spinal stenosis

- Common cause of functional disability in patients > 50 years of age
- May present with radiculopathy or neurogenic claudication depending on location of the stenosis
- Treatment is individualized based on:
  - Number of levels involved
  - Location of stenosis
  - Presence or absence of spondylolisthesis or other spine deformity



Spinal stenosis

- Narrowing of the spinal canal with nerve compression at one or more levels
- Can occur in a variety of locations
  - Central region
  - Lateral Recess
  - Foramen
- Usually due to degeneration
  - Disc bulging
  - Ligament thickening
  - Bone spur formation



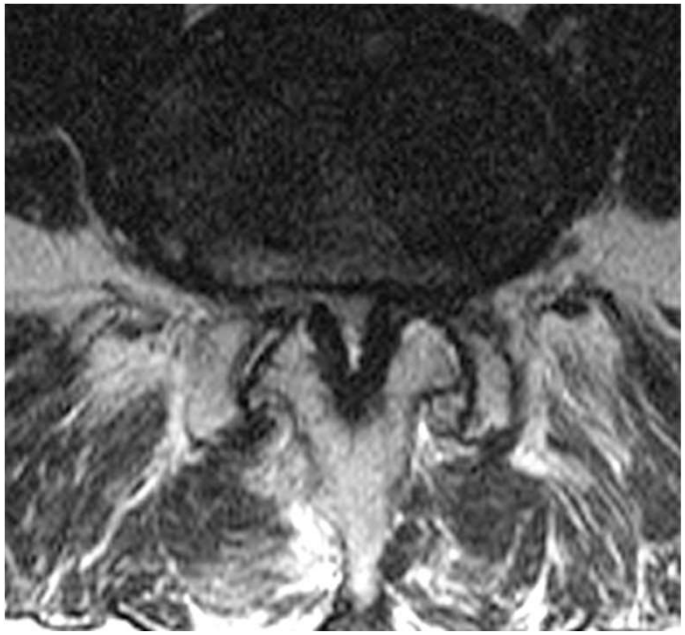
Spinal stenosis

- Clinical Presentation
  - Classically presents with neurogenic claudication
    - *Patients may complain of activity-related leg weakness, fatigue, numbness or pain*
  - If foraminal stenosis patients may present with activity-related or "claudicatory" leg pain in a single dermatome that is worse with standing/extension, better with flexion

Spinal stenosis

- Natural History at 4 years
  - 70% of patients will have stable symptoms
  - 15% will have slight improvement
  - 15% will have slight worsening

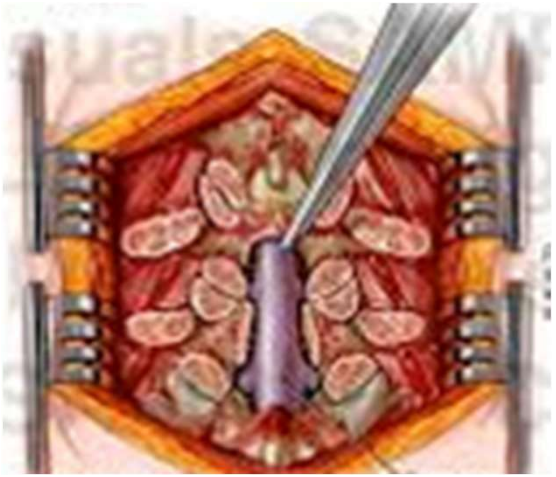
- Surgical Indications
  - Symptoms unresponsive to nonsurgical treatment
  - Progressive worsening of symptoms

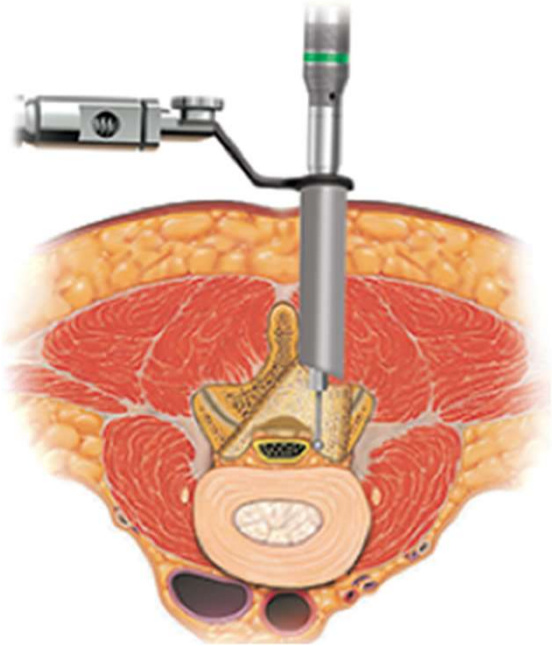


Spinal stenosis

- Treatment depends on:
  - Presence or absence of spondylolisthesis/spinal deformity
  - Location of stenosis (central/lateral recess/foraminal)

- Spinal Decompression
  - Laminectomy
    - *Open vs. Minimally invasive*
  - Laminotomy
  - Laminoforaminotomy





Take home points

- Spine degeneration is common and is often asymptomatic.
- Symptoms are best treated by first identifying the pathology that is causing them.
- Spine conditions are often very responsive to appropriate conservative treatment options.
- Patients respond well to spine surgery when the history, physical exam, and pathology all correlate with their symptoms.

Questions?

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