Cervical Radiculopathy and Myelopathy

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Definitions

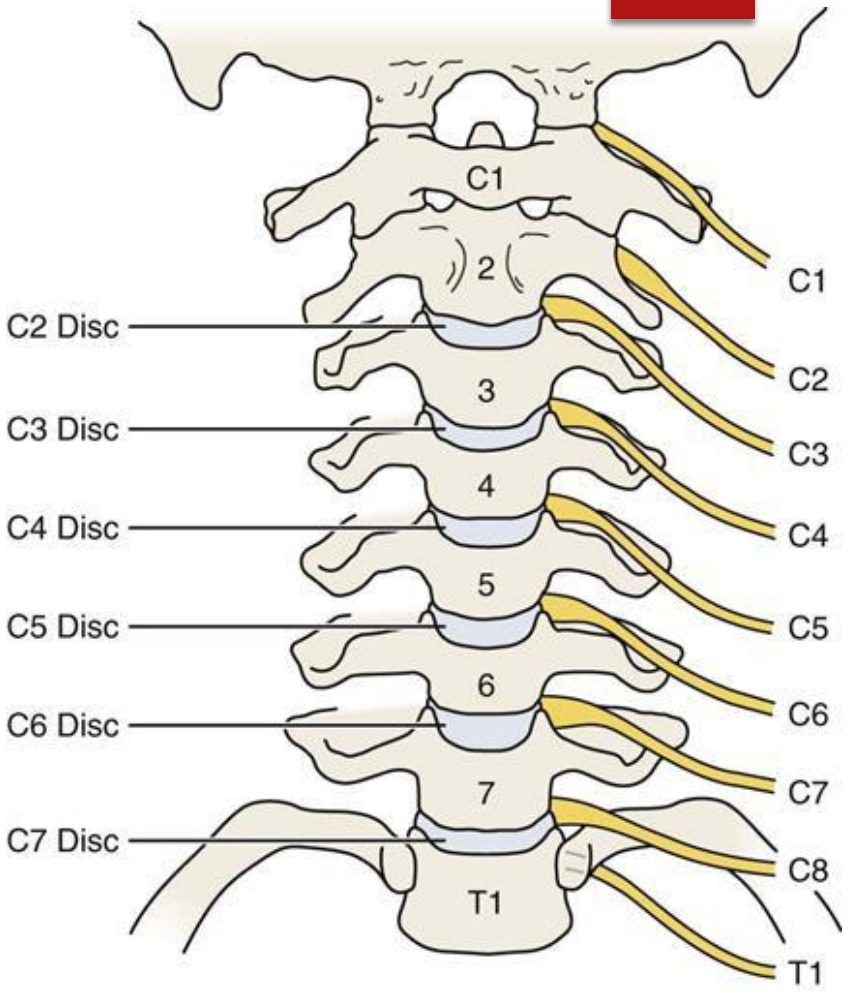
- Radiculopathy
  - **Objective** neurological deficit (diminished reflex, sensory abnormality, motor weakness) related to compression of a peripheral nerve root
- Radicular pain/Radiculitis
  - **Subjective** pain in a dermatomal distribution
    - Related to chemical irritation of nerve

Definitions

- Myelopathy
  - Neurological deficit(s) related to compression and dysfunction of the spinal cord
    - Not confined to a specific nerve root distribution
    - Upper and **lower extremity** weakness, loss of hand dexterity, gait dysfunction, bowel and bladder dysfunction
- Myeloradiculopathy
  - Myelopathy and radiculopathy can occur together

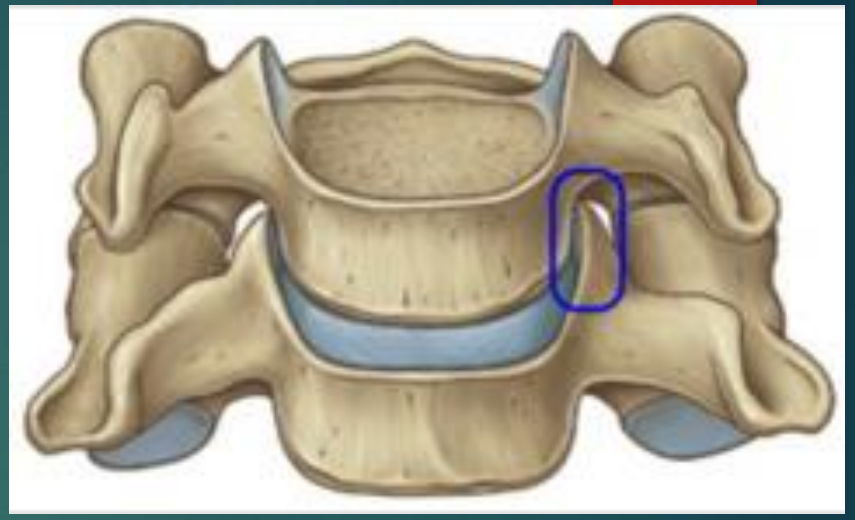
Anatomy

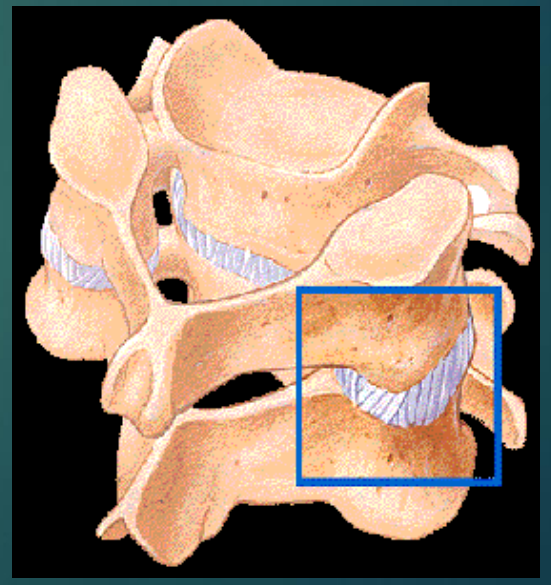
- Cervical Spine
  - 7 cervical vertebrae, 8 cervical nerves
  - Nerve root exits **above** corresponding vertebral body level
    - C6 nerve exits between C5-C6
    - C8 nerve exits between C7- T1
- Thoracic and Lumbar Spine
  - Nerve root exits **below** corresponding vertebral body level



Anatomy

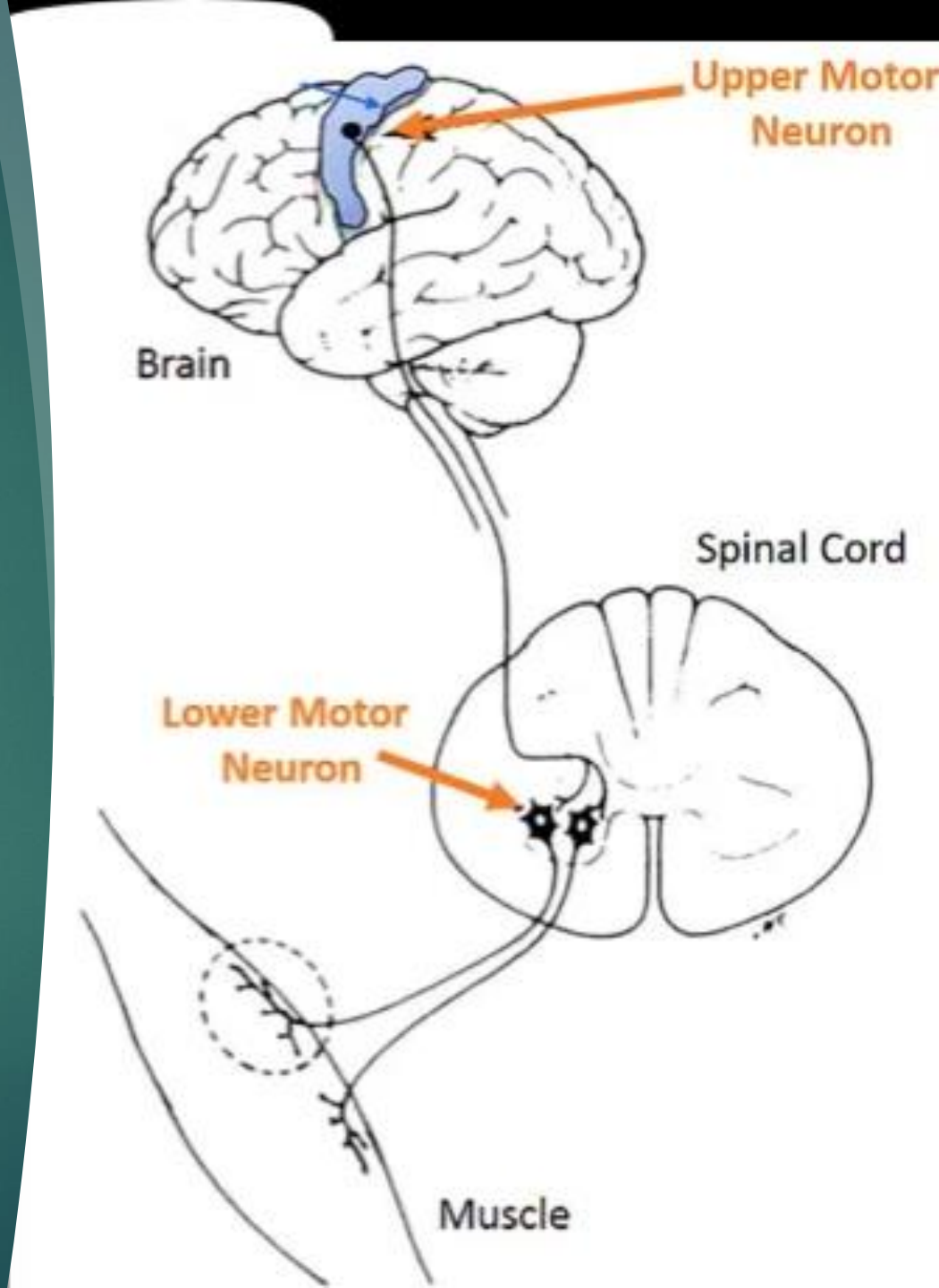
- Uncovertebral Joints (Joints of Luschka)
  - Formed by the uncinate process and superior vertebral body
    - Uncinate Process
      - Bony protuberance located on the lateral margins of the superior endplate
- Facet Joints
  - Link adjacent vertebral bodies
  - Provide stability





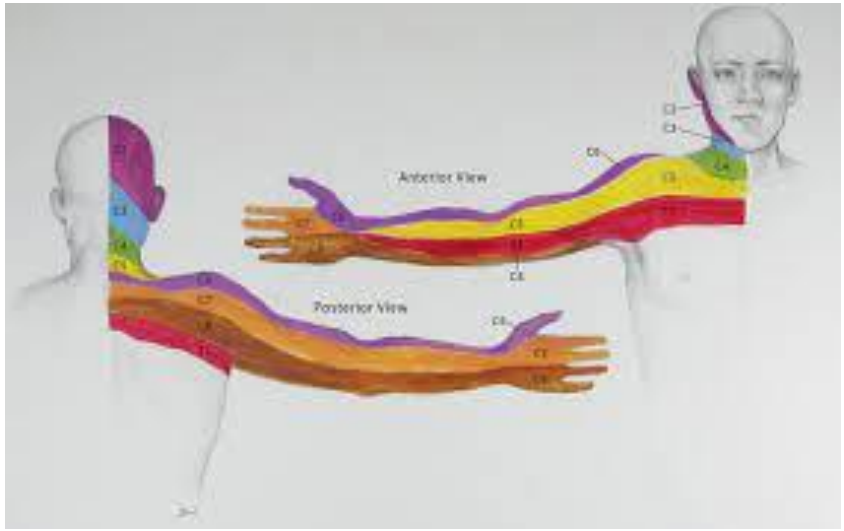
Anatomy

- Voluntary movement
  - Accomplished via a two-**neuron** circuit
  - **Upper motor neurons (UMN)**
    - Originate in cerebral cortex and travel down to the spinal cord
  - **Lower motor neurons** (LMN)
    - Originate in spinal cord and travel down to innervate skeletal muscle
  - **Myelopathy**
    - UMN syndrome
  - **Radiculopathy**
    - LMN syndrome



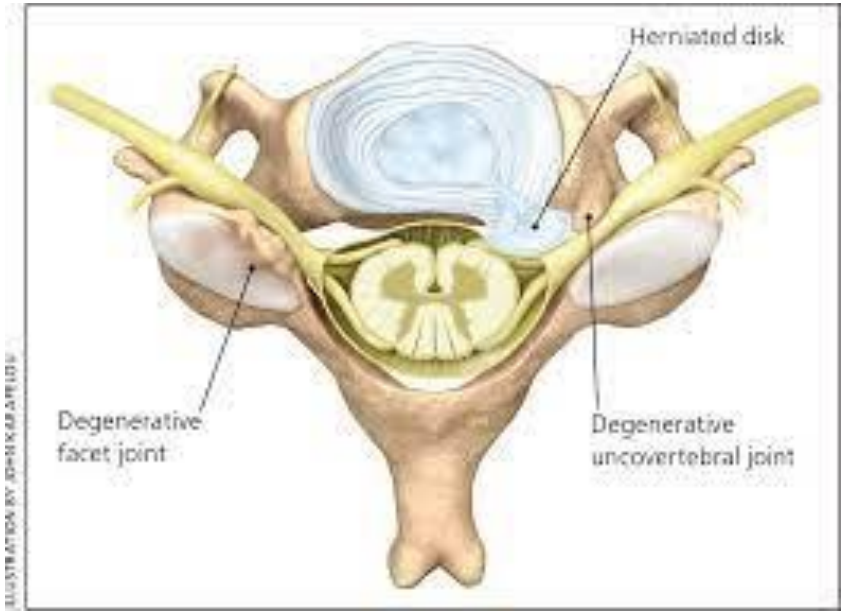
Anatomy

- Dermatomes
  - C5-T1
- Myotomes
  - C5: Shoulder external rotation, abduction, arm flexion
  - C6: Shoulder external rotation, abduction, arm flexion, wrist extension/flexion
  - C7: Wrist extension/flexion, arm extension
  - C8: Finger extension/flexion, hand intrinsics
  - T1: Hand intrinsics, especially thumb



Radiculopathy: Etiologies

- 2 most common mechanisms
  - Cervical Spondylosis
    - Disc, facet, uncovertebral joints
  - Disc Herniation



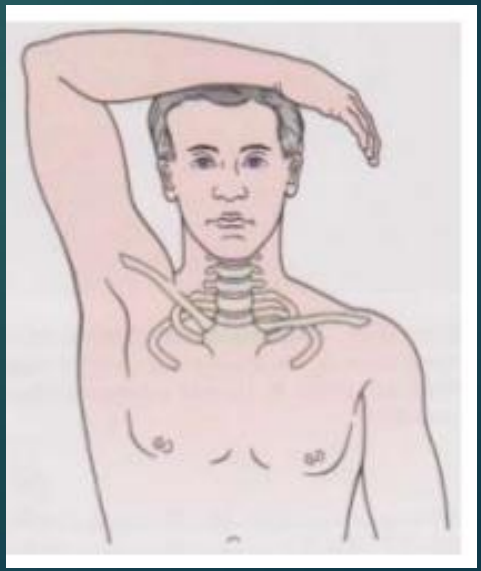
Myelopathy: Etiologies

- Cervical Spondylotic Myelopathy
  - Most common cause
  - Degeneration of disc, disc herniation, facet joint, joints of luschka, osteophytes of vertebral body, ligamentous hypertrophy
  - Risk factor: congenitally narrowed cervical spinal canal
- Other etiologies
  - Infection, tumor, syrinx, hematoma, trauma

Radiculopathy: Clinical Presentation

- Pain and/or weakness corresponding to dermatomal and myotomal nerve root(s) involvement

- Pain
  - Timing: more acute with a disc herniation, insidious if degenerative
  - Description: paresthesias, numbness
  - Location: neck, interscapular region, shoulder, distally into fingers
  - Bakody sign
    - Abducting shoulder above head relieves radicular pain



Myelopathy: Clinical Presentation

- Pain
  - Neck pain, radicular symptoms, or nonspecific paresthesias
  - Insidious
  - Unilateral or bilateral
- Weakness
  - Loss of dexterity/fine motor coordination in hands, dropping objects
  - Gait dysfunction, history of imbalance or falls
- Bowel and bladder dysfunction
  - Retention, urgency, incontinence
    - Occurs in less than 20% of patients with CSM

Physical Examination

- Standard musculoskeletal assessment with **emphasis on neurological exam**
  - Inspection, palpation, ROM testing of neck and shoulders, special testing of shoulder
- Neurological Examination
  - If concerned about myelopathy, should test lower extremity
  - Sensory
    - Isolate symptoms to a specific nerve root?
  - Motor
    - If significant pain, objective testing may be limited
    - Should test all myotomes C5-T1
    - Is weakness present in a myotomal distribution?

Physical Examination

- Reflexes
  - C5 (biceps), C6 (brachioradialis), C7 (triceps)
  - **Hypo-**reflexic with radiculopathy
  - **Hyper-**reflexic with myelopathy
    - Include L4 (patella) and S1 (Achilles) if myelopathy concerns
- Upper Motor Neuron Reflexes
  - Negative in radiculopathy
  - Positive in myelopathy (maybe)
  - Hoffman
    - Flicking middle finger produces passive flexion of index or thumb

Physical Examination

- Upper Motor Neuron Reflexes
  - Clonus
    - Quickly dorsiflex foot and release
    - If foot bounces back and forth, positive finding
  - Babinski
    - Elicited when the sole of the foot is stimulated
    - Upward response (great toe extension) is positive finding

Physical Examination

- Special Testing

- Spurling Test
  - Assesses for radiculopathy
  - Rotate, extend, and apply axial compression
  - If concordant radicular pain provoked, + finding
  - Sensitivity and specificity
    - 30 and 90 percent respectively

Differential Diagnosis

- Myelopathy
- Radiculopathy
- Spondylosis
- Myofascial Pain
- Shoulder pathology
- Peripheral Nerve syndromes
  - Carpal tunnel syndrome
  - Cubital Tunnel syndrome
  - Brachial plexopathy

Diagnostics

- Clinical diagnosis supported by imaging and/or EMG/NCS
- Plain films (AP and lateral)
  - Baseline structural assessment
    - Disc degeneration, osteophytes, spondylolisthesis
- Considerations:
  - Dynamic testing (flexion, extension)
  - Swimmer's view
    - Cervicothoracic junction

Diagnostics

- MRI
  - Imaging study of choice for radiculopathy, myelopathy
  - Assessment of nerve root, spinal cord, central canal
  - < 10 mm AP diameter: severely stenotic
- CT Myelogram
  - Next best study if MRI contraindicated

Diagnostics

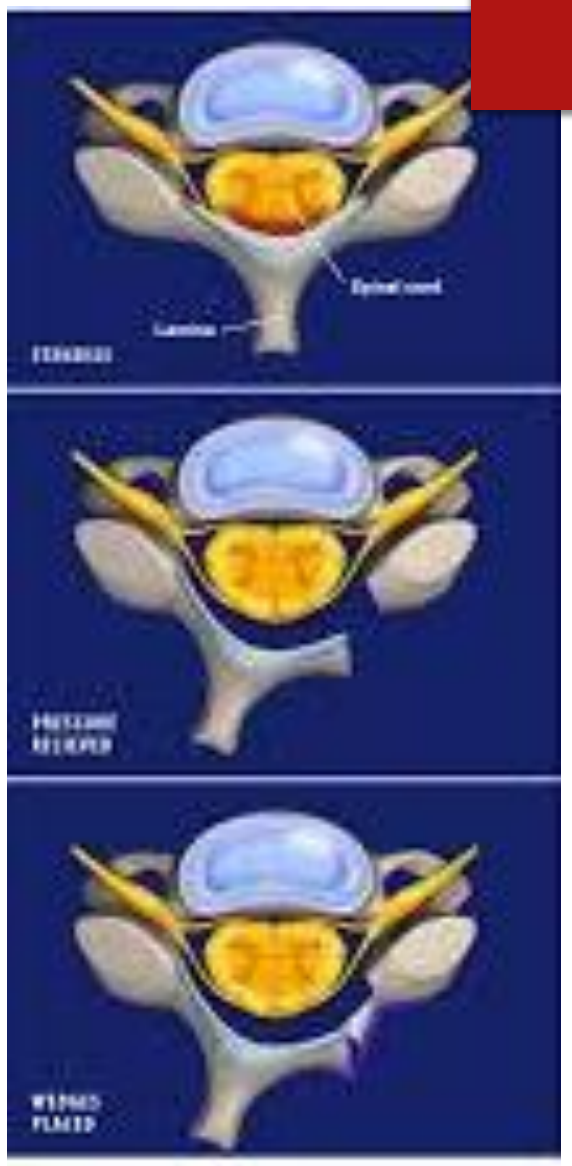
- EMG/NCS
  - Needle electrode placed into muscle and electrical activity recorded
- Radiculopathy
  - Confirms radiculopathy
    - Abnormalities present in at least 2 muscles which share same nerve root, innervated by different peripheral nerve
    - If positive, recommend surgical consult
    - Poorly sensitive, highly specific
  - If primarily sensory symptoms (radiculitis) and strength preserved, will likely be negative
  - Can evaluate for peripheral nerve syndromes
- Myelopathy
  - Cannot confirm or exclude diagnosis
  - EMG/NCS only evaluates LMN system

Myelopathy: Management

- Mainstay of treatment is **surgical decompression**
  - Progressive neurological deficits
  - Intractable pain
- Clinical features mild and non-progressive:
  - Recommend at least a surgical consultation
  - If surgery is deferred, need close follow up to assess neurologic status for any progression
- If no neurologic impairments, surgery not recommended

Management: Myelopathy

- Surgical Decompression
  - 50-80 % improve following surgery
- Anterior Cervical Diskectomy and Corpectomy
  - Removal of disc and portion of vertebral body
- Posterior Approaches
  - Laminectomy and fusion
  - Laminoplasty
    - Creates a hinge, which enlarges laminar arch and decompresses spinal canal



Myelopathy: Conservative Management

- Physical Therapy
  - Fall Prevention
  - Serial neurological assessment
- Pain Control
  - Oral Medications
    - NSAIDs
    - Muscle Relaxants
    - Neuromodulators (gabapentin, pregabalin)
  - Epidural Injections:
    - Transforaminal: reasonable if radiculopathy present
    - Interlaminar: not recommended

Radiculopathy: Management

- Conservative therapy recommended first
- Indications for surgical consultation and/or intervention:
  - Myeloradiculopathy
  - Motor weakness at clinical presentation
  - Progressive neurologic deficits
  - Intractable pain
  - Persistent symptoms after 6-8 weeks of failed conservative care

Radiculopathy: Conservative Management

- Relative rest, activity modification
- Physical Therapy
- Oral Analgesics
  - Prednisone
  - Tylenol, NSAIDs
  - Muscle relaxants
  - Neuromodulators

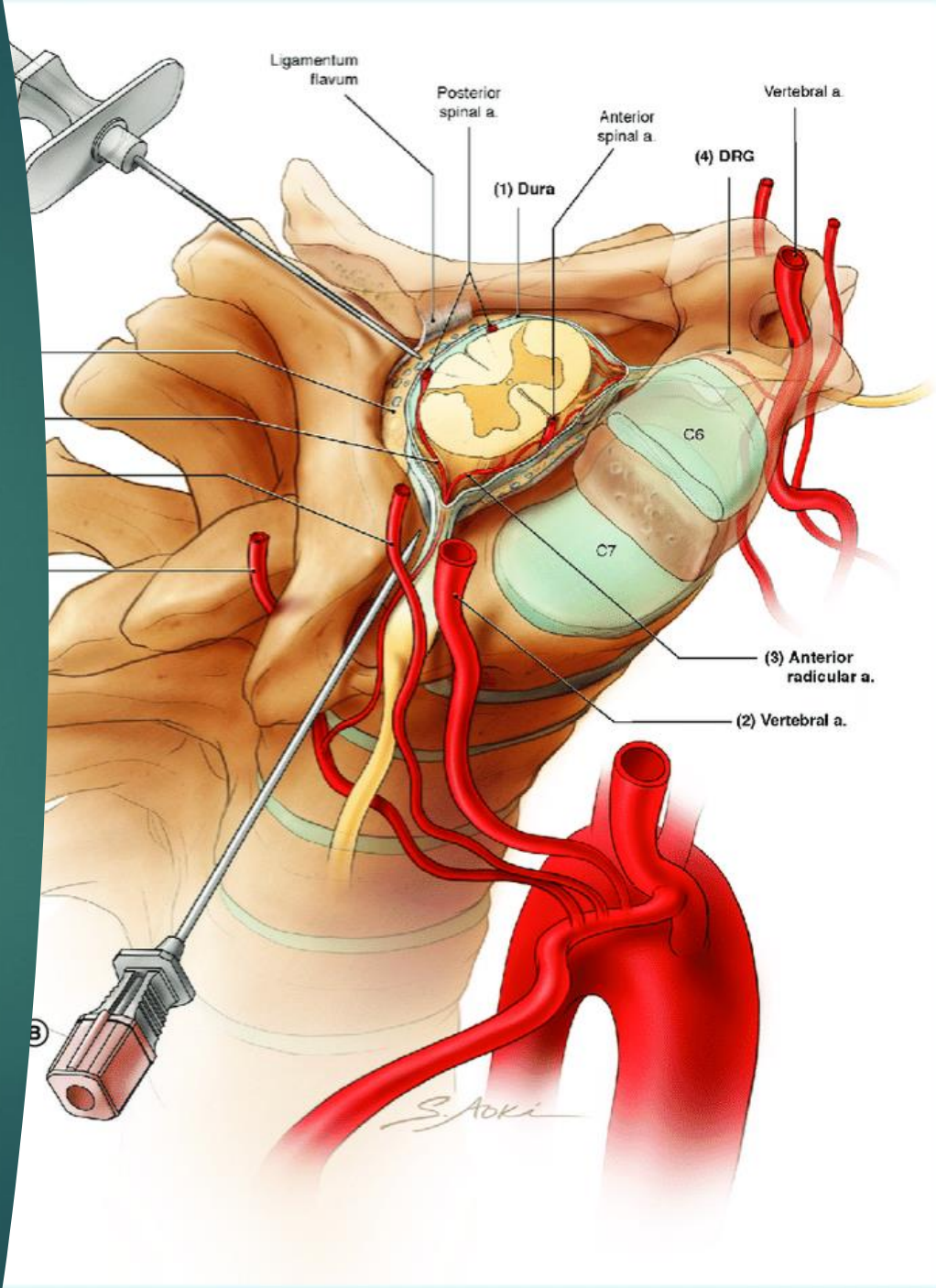
- Epidural Steroid Injections

Management: Radiculopathy

- Physical Therapy
- Progressive ROM and strengthening
  - Paraspinal/scalene musculature, rotator cuff, scapular stabilizers
- Cervical traction
  - Application of a distracting force to separate cervical segments
  - Possible benefit with neuroforaminal narrowing
  - Avoid in myelopathy, large disc herniations

Radiculopathy: Epidural Steroid Injections

- Conflicting literature, observational studies have shown sustained relief (>50%) 1-3 months post procedure
- Transforaminal
  - Best suited for radicular pain specific to dermatomal distribution
  - Intravascular complications (CVA, seizures)
    - Particulate vs non-particulate steroid
- Interlaminar
  - Diffuse multilevel/bilateral pain, generalized spondylosis
  - No higher than C6-C7 levels
  - Gaps in ligamentum flavum, very small AP diameter of epidural space

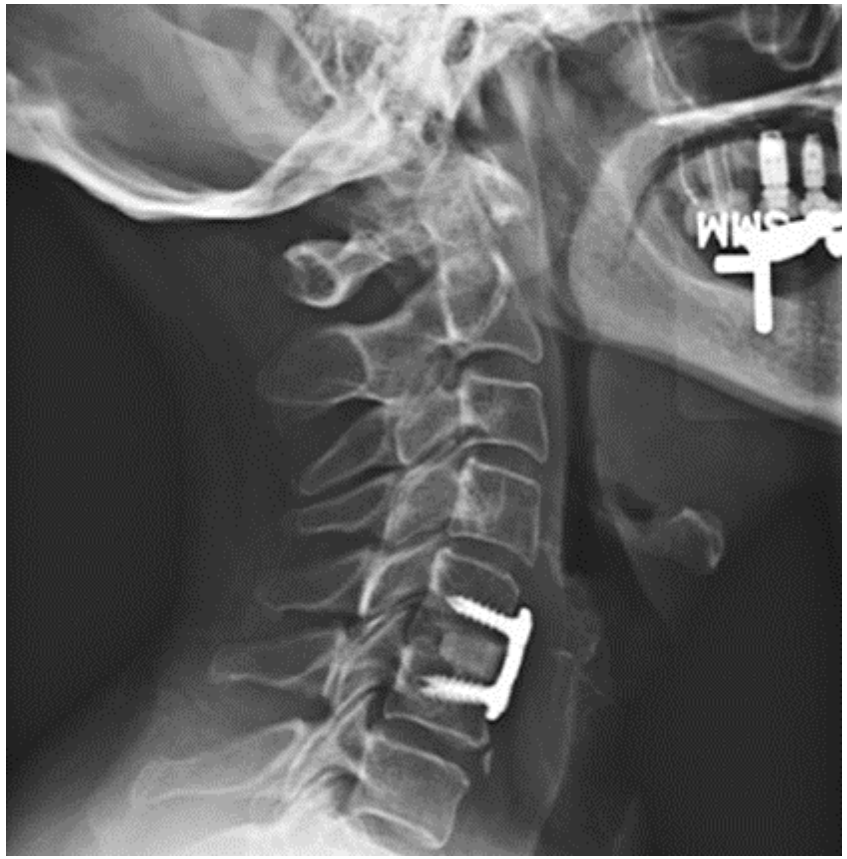


Management: Radiculopathy

- Surgical Approaches

- Anterior Cervical Discectomy and Fusion (ACDF)
  - Most common

- Posterior laminoforaminotomy
  - Indicated for posterolateral or foraminal disk herniation or osteophyte



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