Spine Care: Diagnostic Imaging, Lab Interpretation, and Treatment Approaches

Sixtus Z. Atabong DMSc. PA-C

OBJECTIVES

🧠 **Degenerative Spine Disease** – Prevalence, risk factors, and burden.

🦴 **Spine Anatomy** – Vertebrae, discs, nerves, and regions.

🧑‍⚕️ **Patient Evaluation** – History, physical exam, red flags.

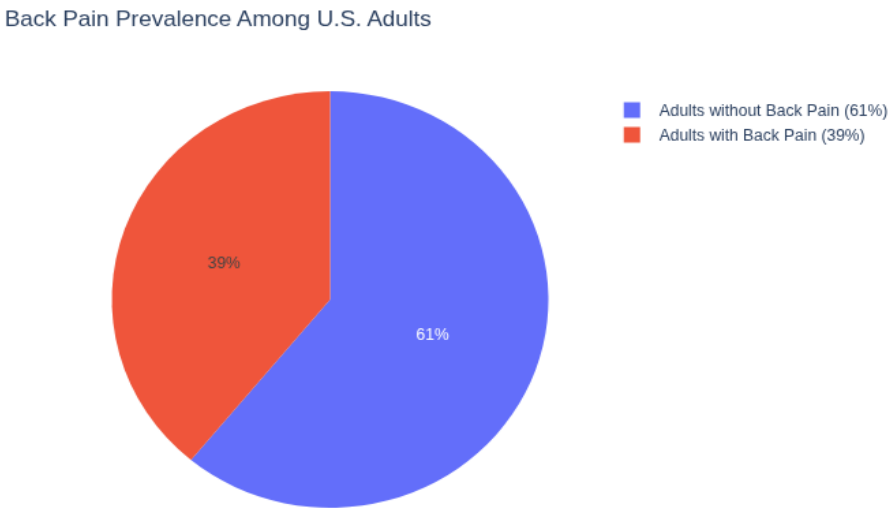
🖼️ **Diagnostic Imaging** – X-ray, MRI, CT scan interpretation.

🧪 **Lab Interpretation** – CBC, ESR, CRP, autoimmune markers.

💊 **Treatment Approaches** – Conservative, interventional, surgical.

📊 **Case Studies** – Real-world examples (time permitting).

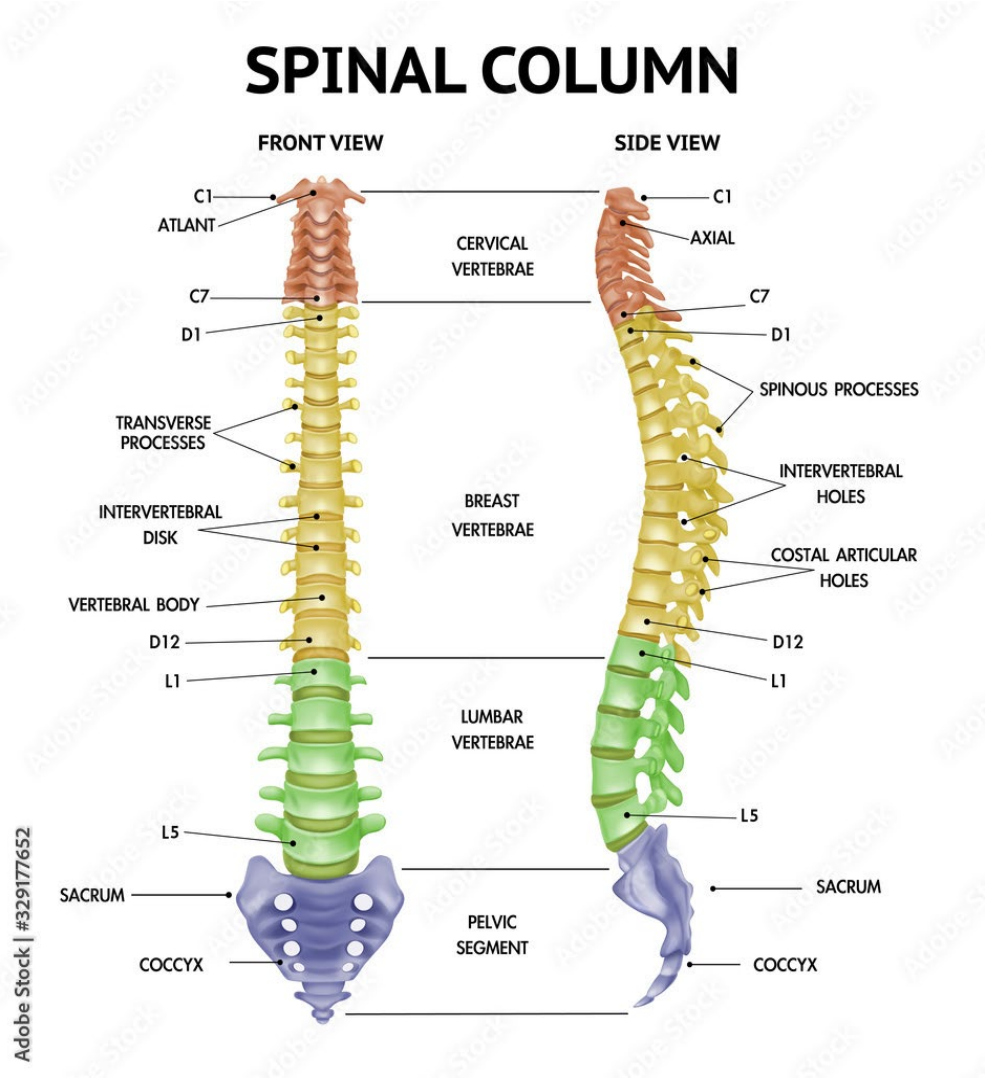
COMBINED ECONOMIC BURDEN OF BACK AND NECK PAIN

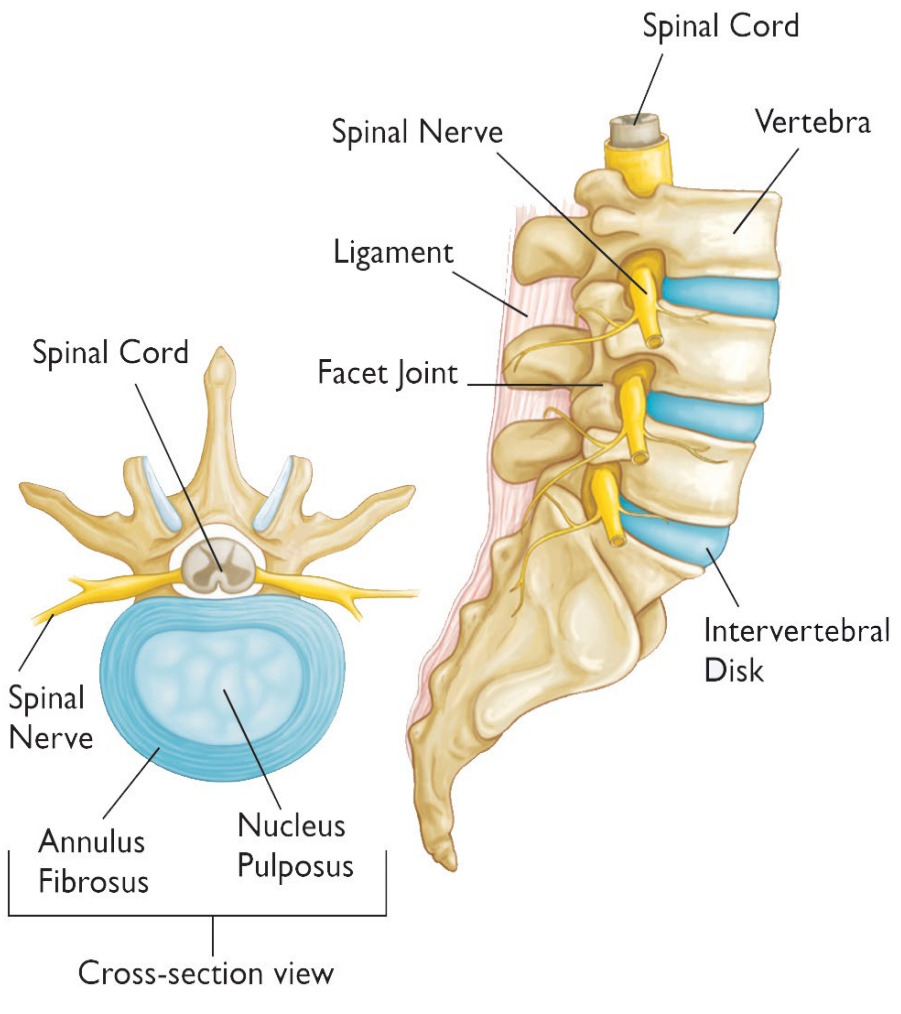


39% of Adults currently suffering with Back and/or Neck Pain

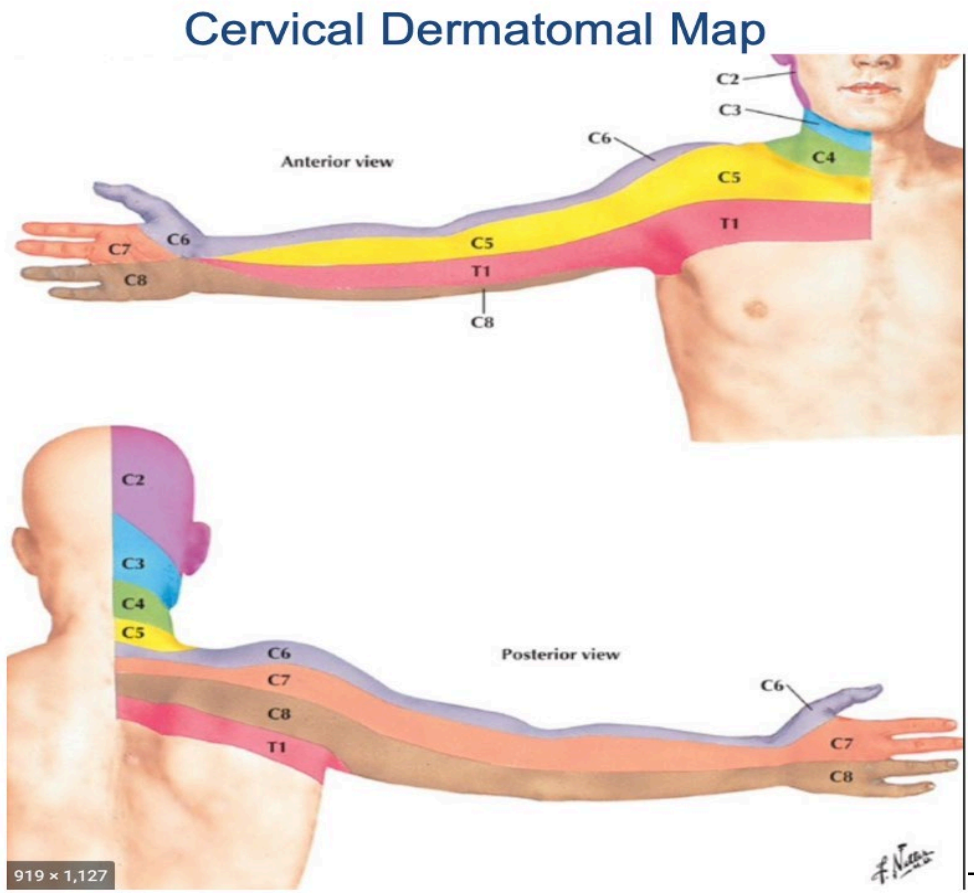
CONDITION	TOTAL ANNUAL COST (BILLION USD)	AVERAGE COST PER PATIENT (USD/YEAR)
Back Pain	40	2,000
Neck Pain	30	1,500

OVERVIEW OF SPINE ANATOMY





OVERVIEW OF SPINE ANATOMY



C1: It's common for people not to have a C1 spinal nerve, which means they also don't have a C1 dermatome. For people who do, this dermatome is at the center of the back of their head.

C2 to C3: Upper neck, a small area of your jaw underneath each ear and back of your head

C3 to C4: Lower neck, upper chest and upper back.

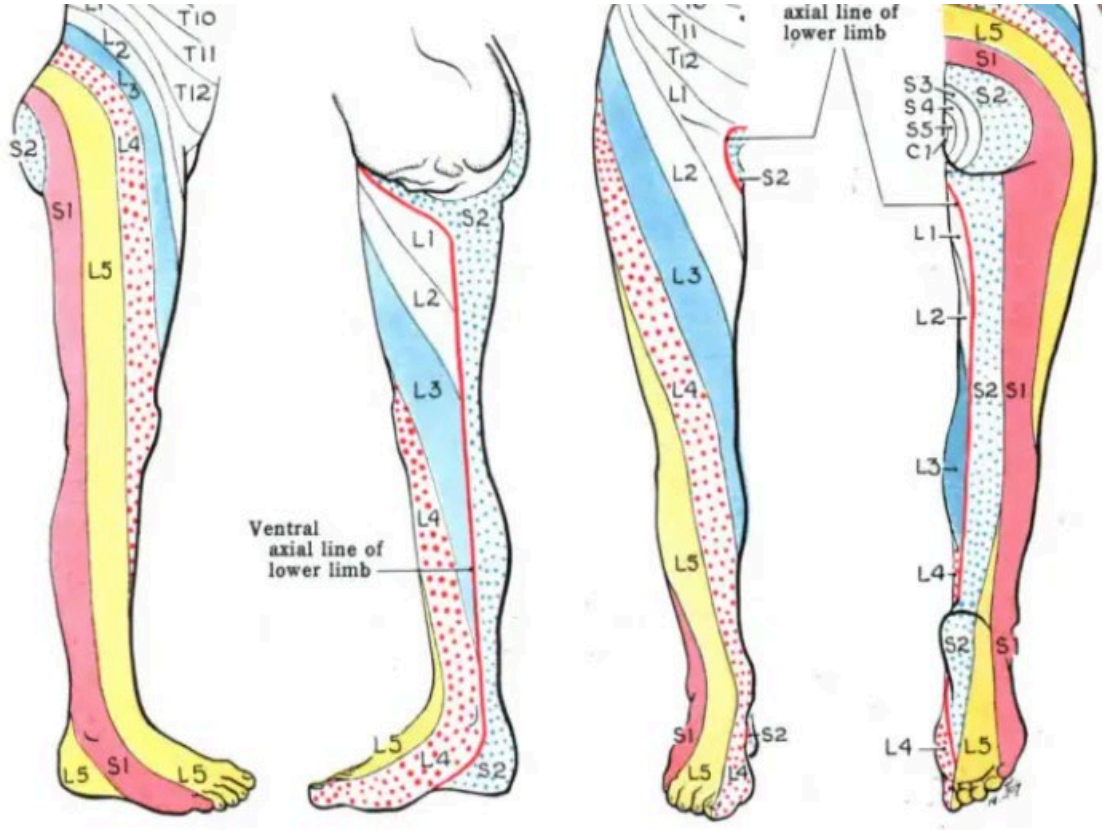
C4 to C5: Shoulders and upper arms.

C5 to C6: Thumb side of your upper arm and forearm, and your thumb itself.

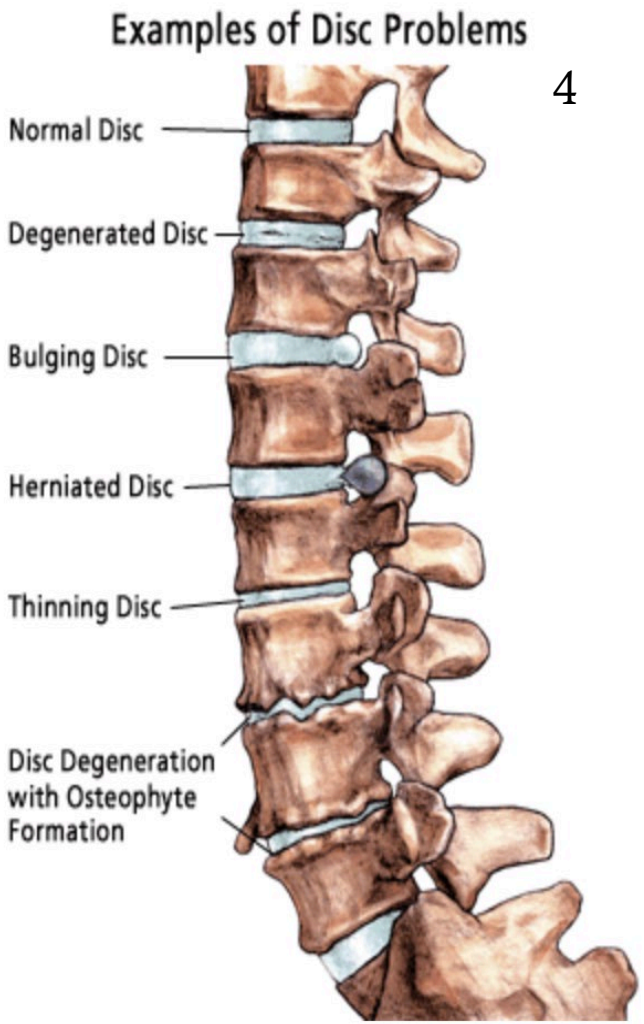
C6 to C7: Thumb side of your forearm and your index and middle fingers.

C6 to C8: Pinky side of your lower forearm and wrist, as well as your ring and pinky fingers.

OVERVIEW OF SPINE ANATOMY



- L2
  - **Hip flexion**.
- L3
  - **Knee extension**.
  - Hip external rotation.
- L4
  - **Foot dorsiflexion**.
  - Hip extension, abduction, internal rotation
  - Knee flexion
  - Toe: Metacarpal and interphalangeal extension
- L5
  - **Great toe** dorsiflexion (movement towards the shin).
- S1
  - **Foot plantar flexion**.



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COMMON DISORDERS

- DDD
- Spondylosis
- Spondylolysis
- Radiculopathy
- Stenosis
- Spondylolisthesis
- Herniated Nucleus Pulposus
- Facet Arthropathy

INITIAL EVALUATION

- **Accurate history is critical first step**
  - Pain, numbness, weakness, location of symptoms
  - Anatomic distribution of symptoms
  - Activities and neck/back position increase or decrease symptoms
  - Changes in gait, bowel or bladder dysfunction, or upper/lower-extremity sensory changes or weakness
  - Previous episodes
  - Previous treatment - results

INITIAL EVALUATION

- Physical Examination

  - Gait and Balance Testing
    - Romberg
    - Heel to toe
    - Foot drop test
    - Walk on tiptoes
  - Strength Testing
    - HF, KE, KF, TA, EHL
  - Reflex Testing
    - Biceps,Triceps, BR, Patella, Achilles
  - Sensation

- Don't miss…

  - Hips
  - Sacroiliac Joint
  - Knees

  - Cervical/Thoracic Myelopathy
    - Hyperreflexia
    - Changes in gait
    - Paresthesia
    - Motor weakness
  - Consider Lab Tests
    - CBC, ESR, CRP, Procalcitonin, HLA B27

INITIAL EVALUATION AND TREATMENT

Conservative/Non-Invasive

1. Self-management options and lifestyle modifications:
   - Weight loss, stay active, do stretches and strengthening exercises
   - local heat or ice
- TENS unit (electrical stimulation)
- Stress management: relaxation techniques, meditation (calm.com, headspace.com)
2. Physical therapy and/or Chiropractic Care
3. Medications: NSAIDS, Muscle relaxants, Neurontin, Lyrica, pain medications.

Schedule Follow-up typically for 6 weeks

If symptoms persist, then X-rays, CT, MRI

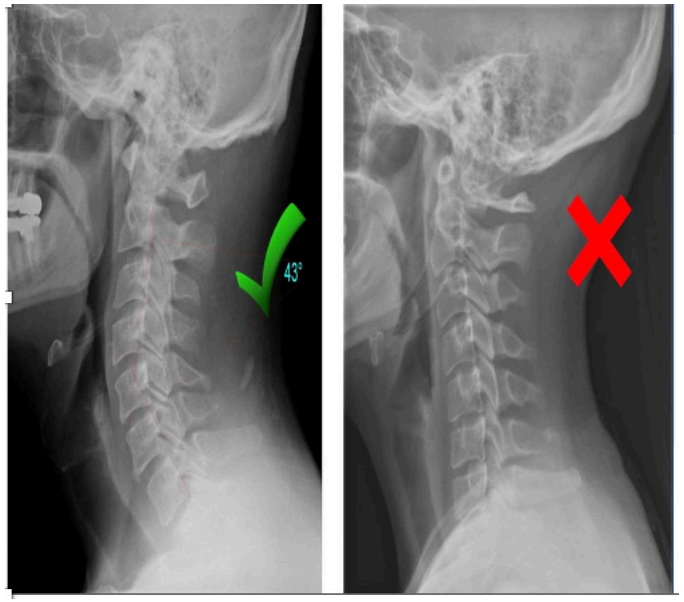
Pain Management Referral

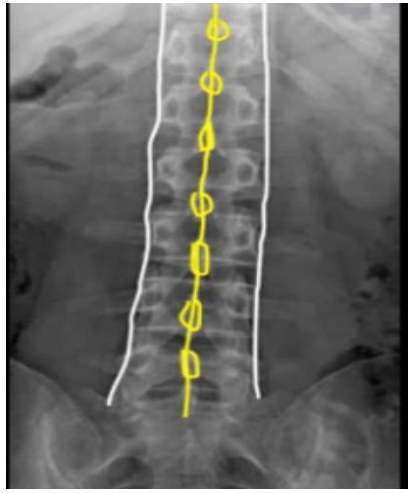
- Diagnostic Injections
- Therapeutic Injections

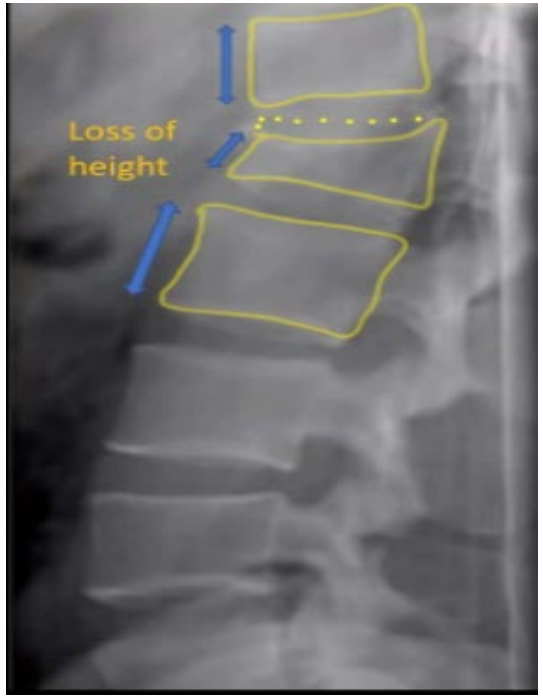
Consider EMG

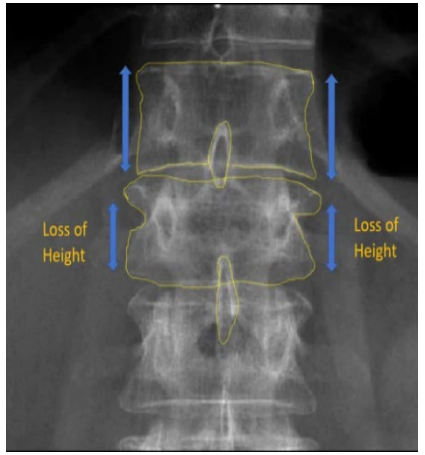
Refer to Surgeon

INITIAL EVALUATION AND TREATMENT – PLAIN X-RAYS









SPECIAL CONSIDERATIONS: CT VS MRI

Computerized Tomography

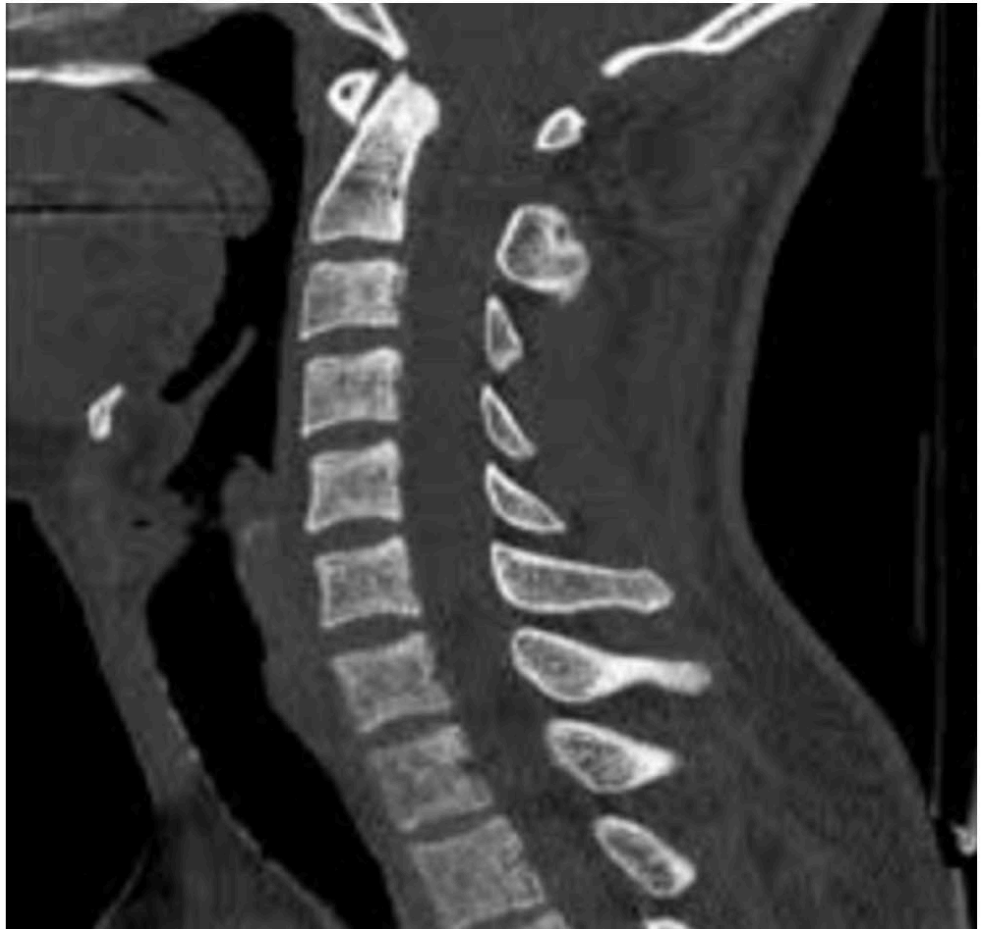
- Bony structures (fractures)
- Radiation exposures
- Preferred with implants (DCS)
- Lower cost $$
- Less time, better for claustrophobia
- No anesthesia
- Bony lesions

Magnetic Resonance Imaging

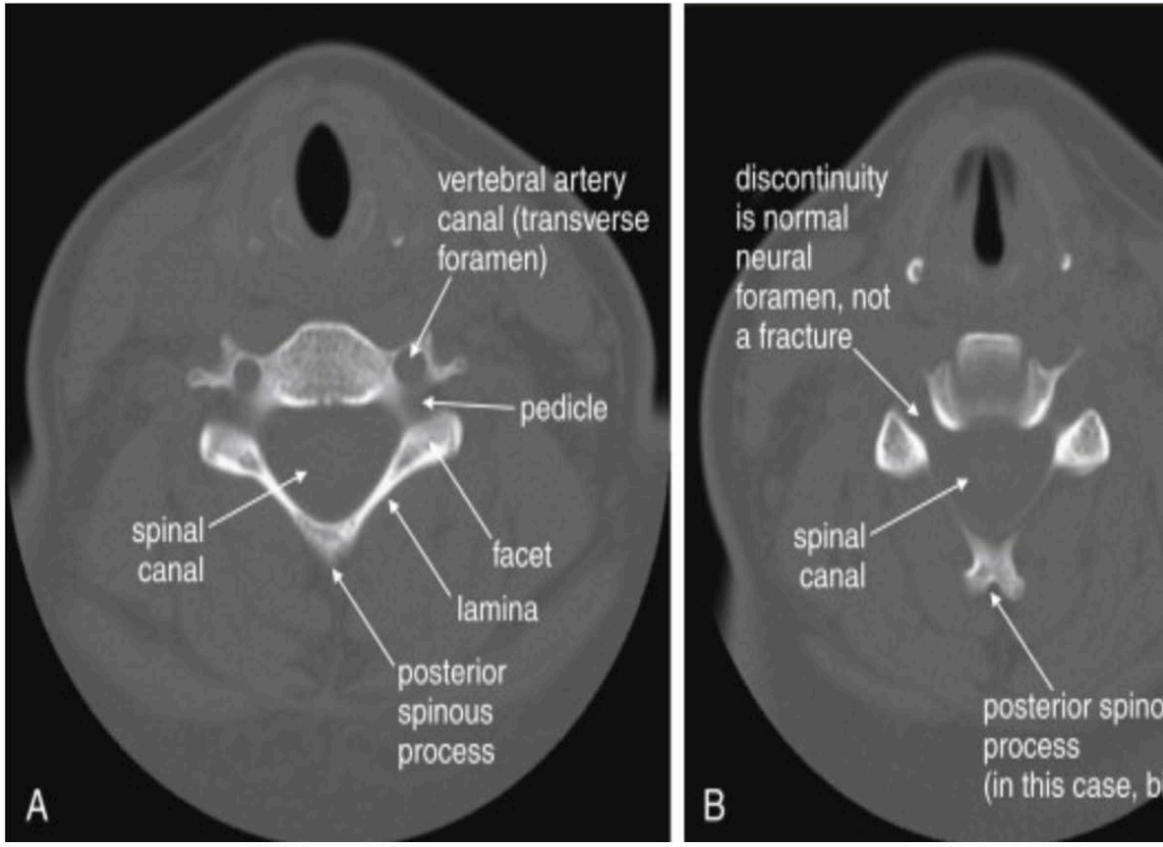
- Soft tissue esp. water containing
- No radiation or side effects
- Contraindicated - implants
- Cost $$$
- More time, sound, claustrophobia
- May require anesthesia
- Better for osteomyelitis/tumors[2]

Spine Anatomy General Overview
Cervical Spine CT

Sagittal

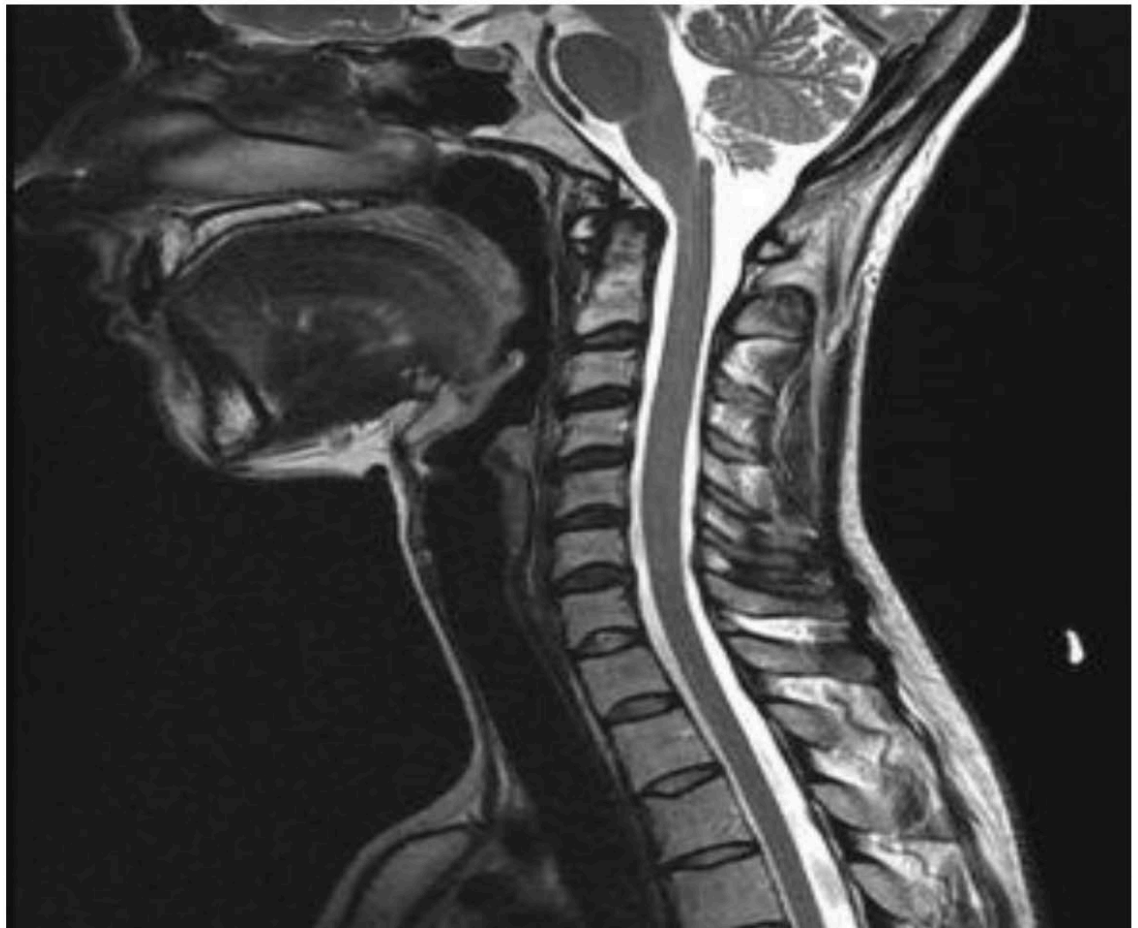


Axial

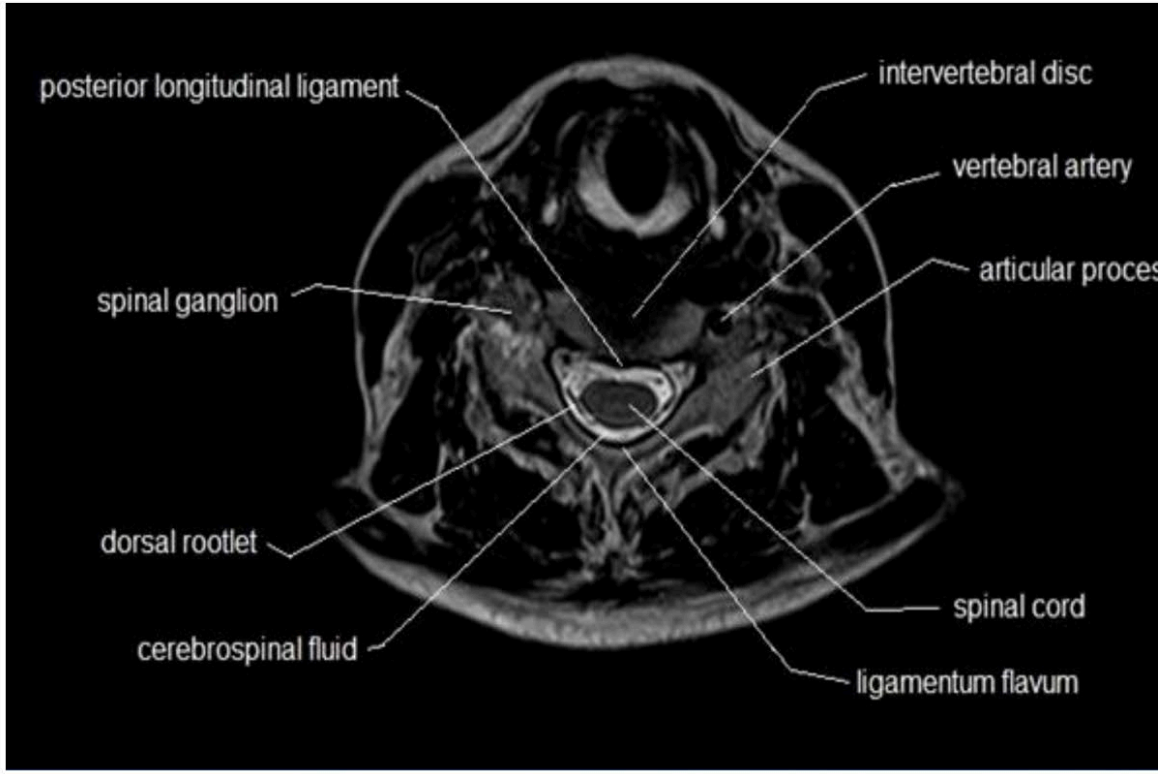


Spine Anatomy General Overview
Cervical Spine MRI

Sagittal

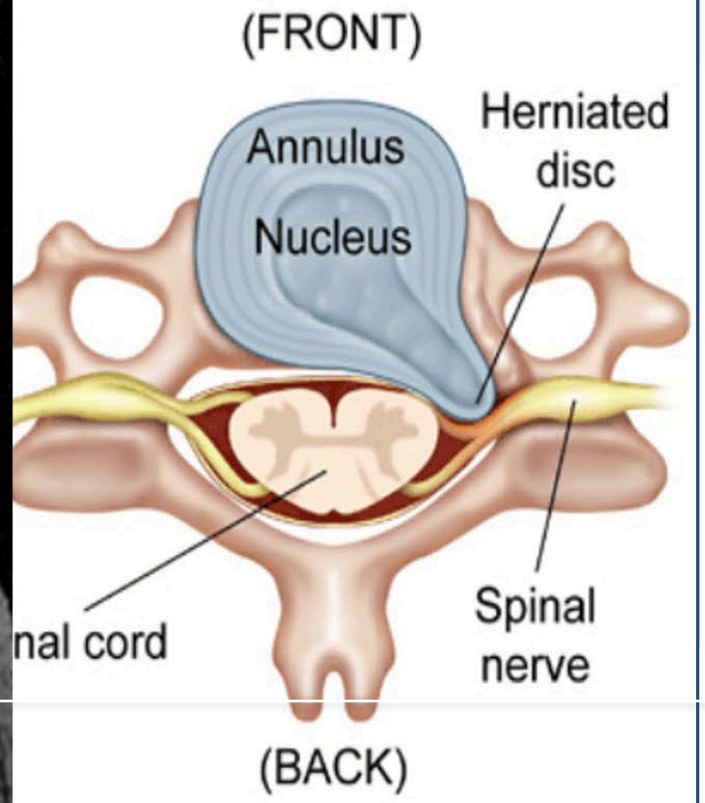


Axial

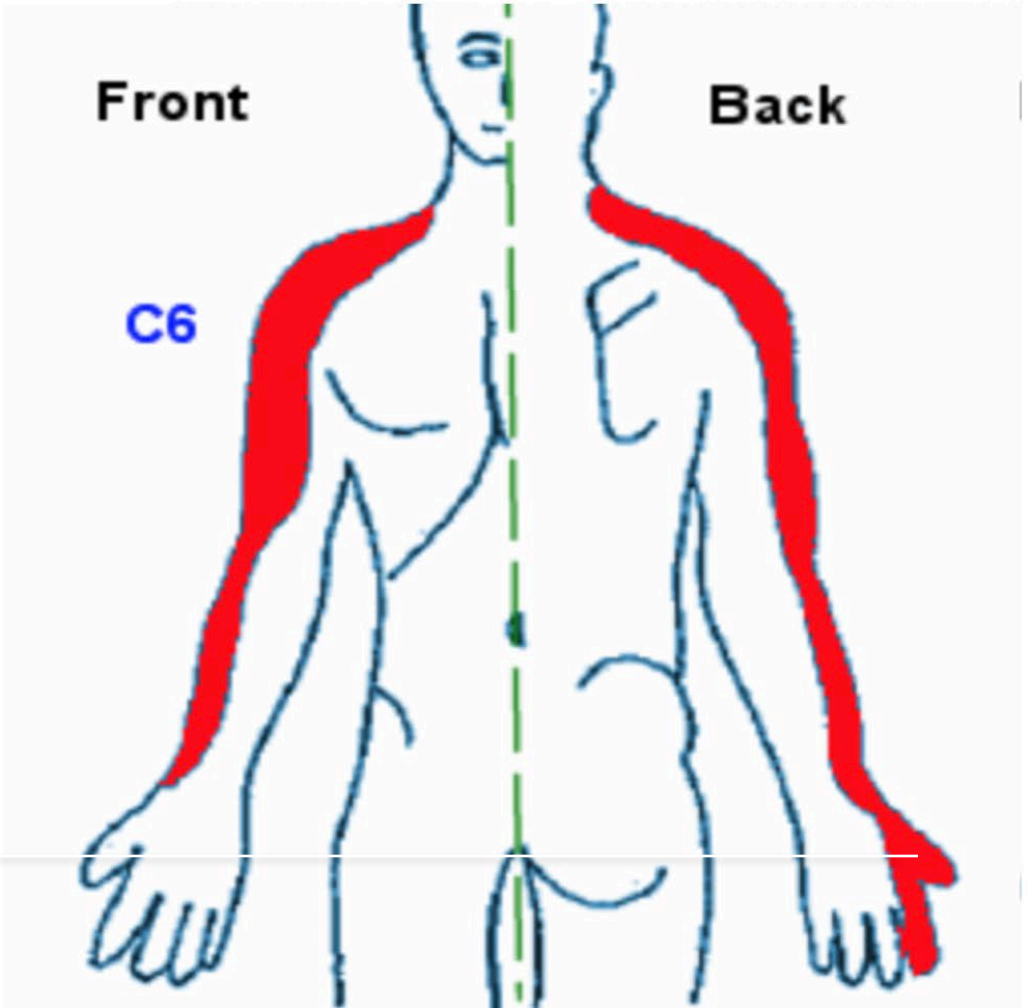


Common Pathologies-Cervical

Left C5-6 disc herniation



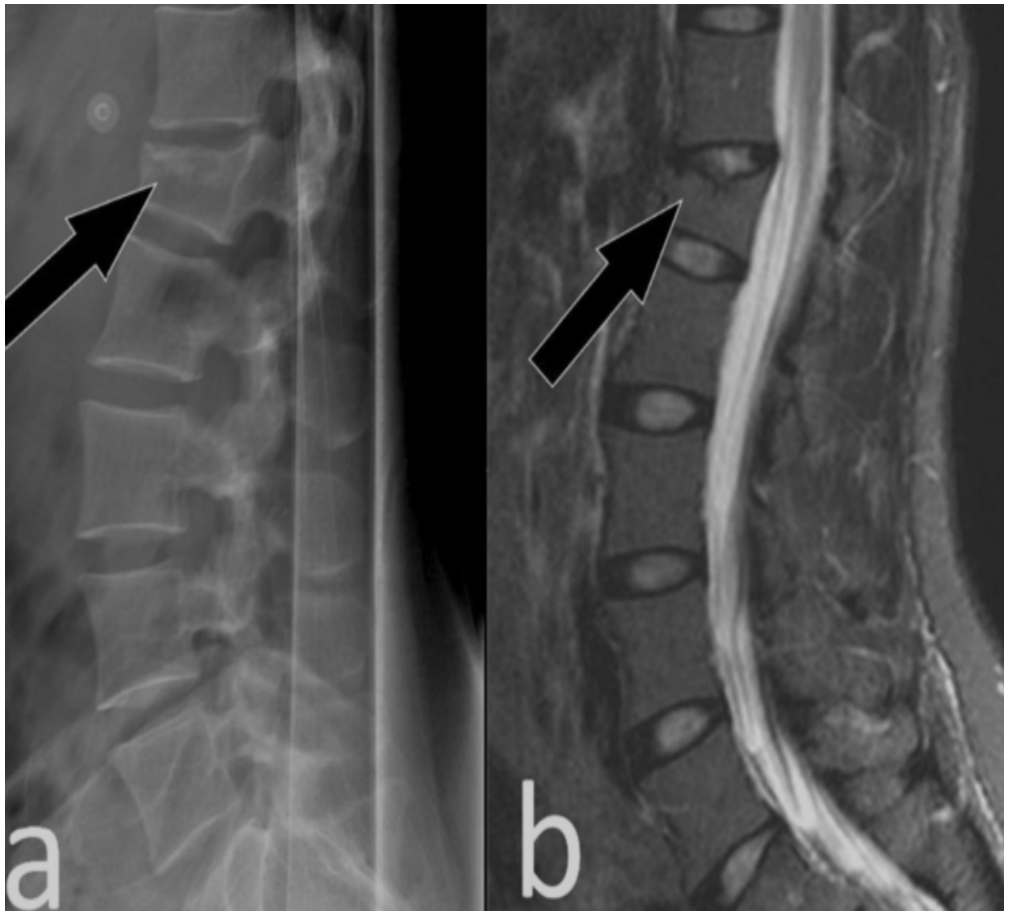
Left C6 radiculopathy



COMMON PATHOLOGIES-LUMBAR SPINE

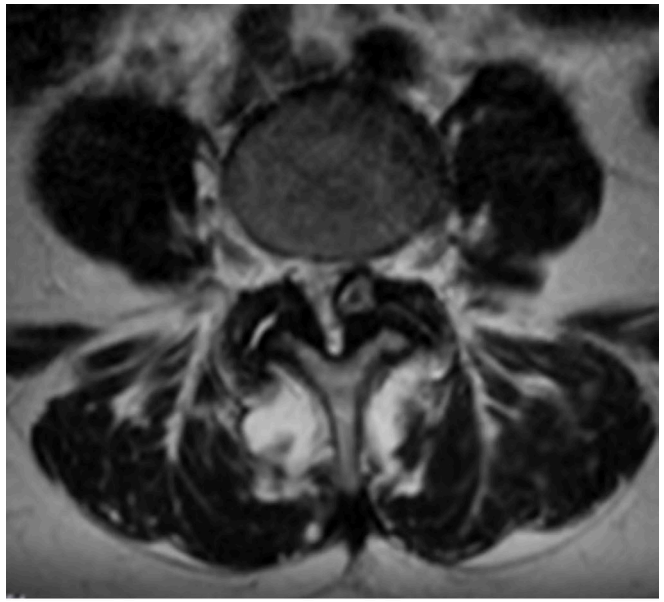
Degenerative disc disease

Lumbar compression fractures

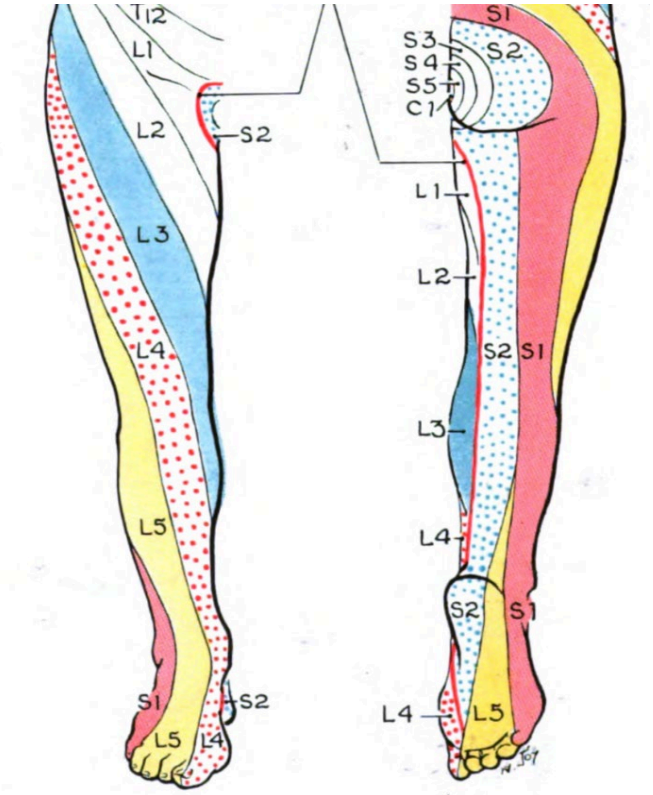


COMMON PATHOLOGIES

Left L4-5 facet arthropathy



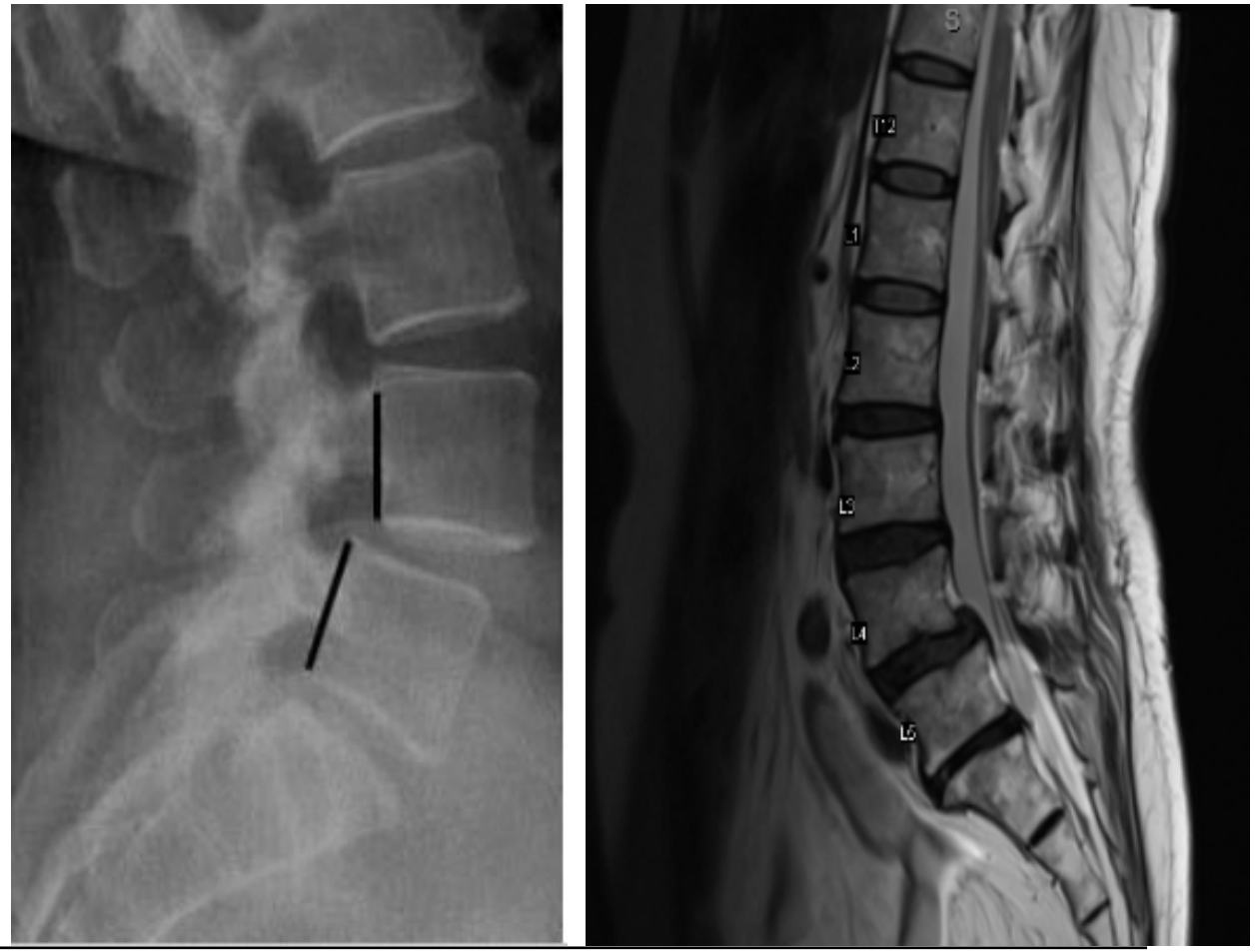
L5 radiculopathy



COMMON PATHOLOGIES-LUMBAR

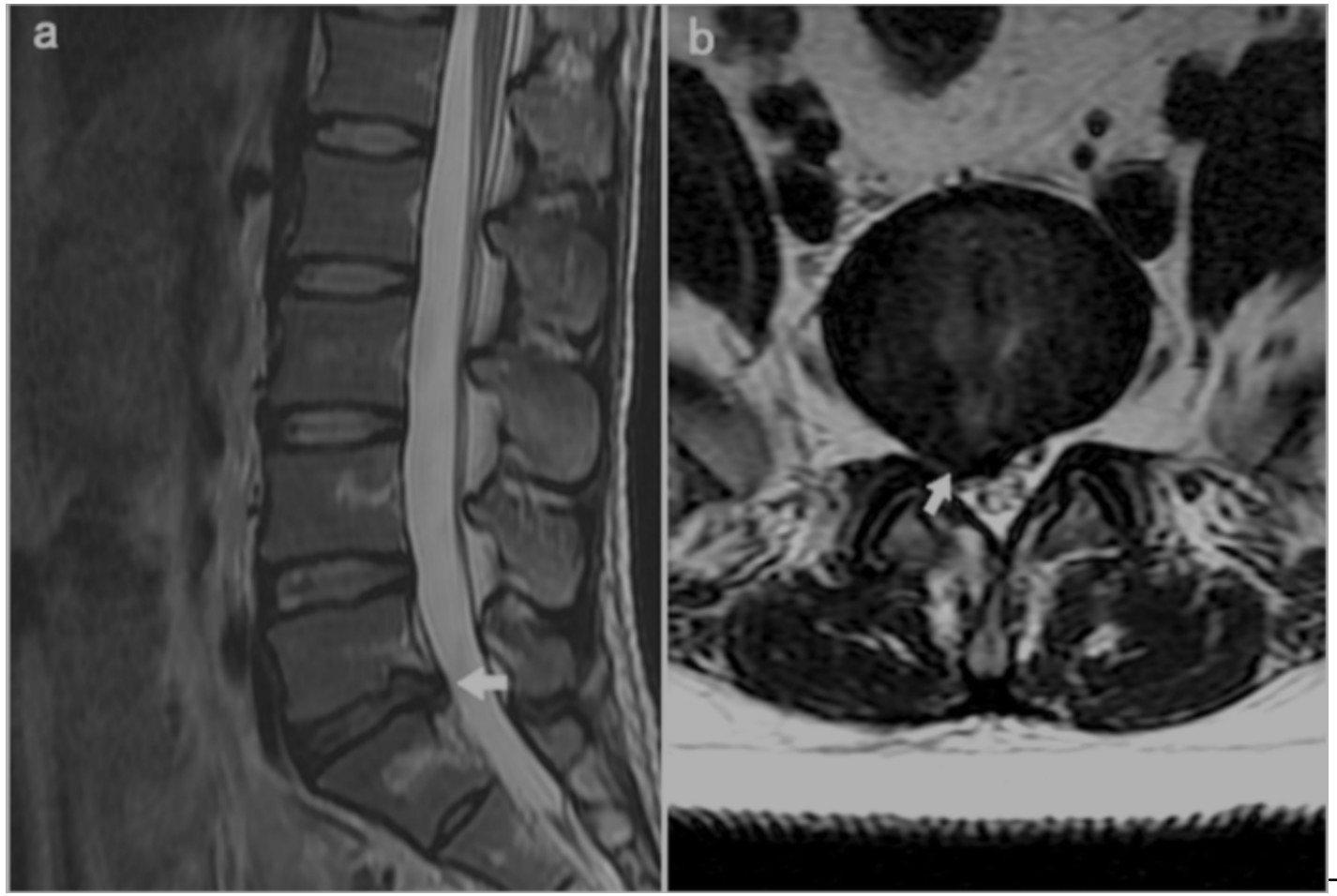
Congenital Spondylolisthesis

Degenerative Spondylolisthesis

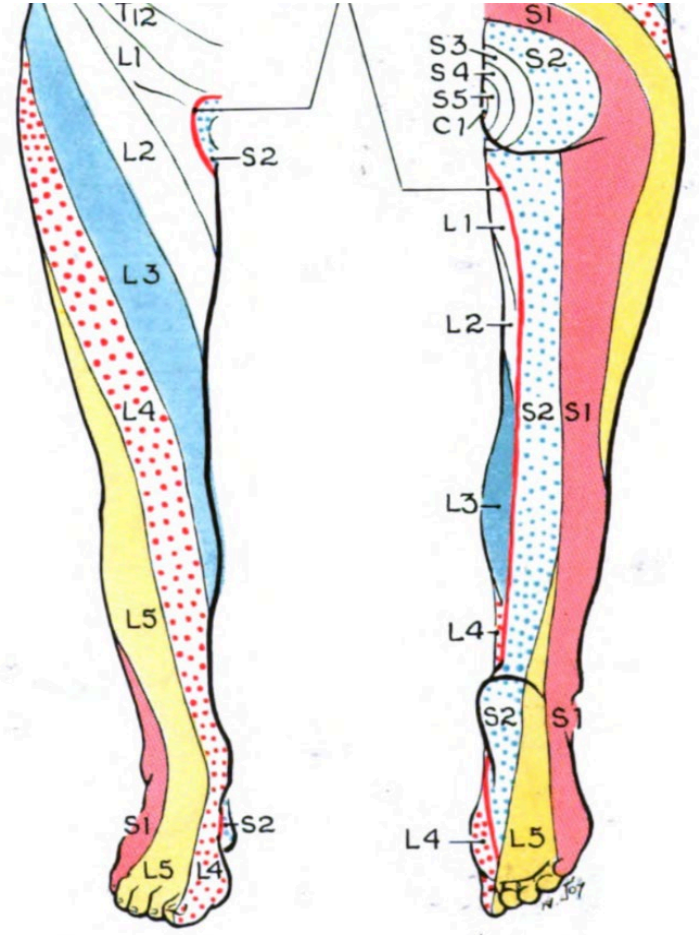


COMMON PATHOLOGIES-LUMBAR

Right L5-S1 disc herniation



L5 radiculopathy



RED FLAGS

Metastatic spine tumor

Myelomyelacia

RED FLAGS

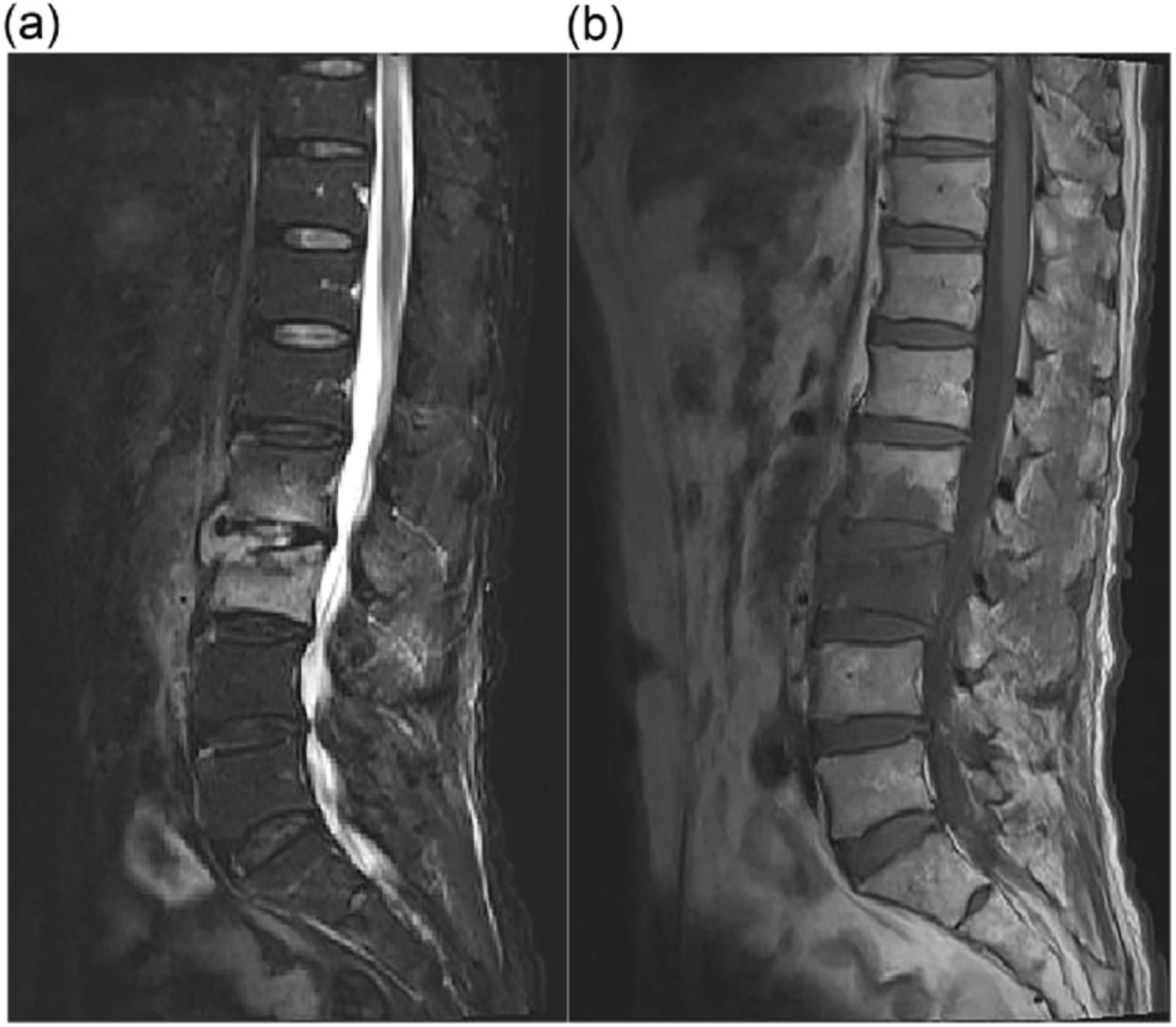
Foot Drop

Definition:
Inability to dorsiflex the foot due to weakness or paralysis of the anterior leg muscles.
Often presents with steppage gait and toe dragging.

COMMON CAUSES & DIFFERENTIAL DIAGNOSIS

🧠 **Neurological** Stroke Multiple sclerosis (MS) Amyotrophic lateral sclerosis (ALS) Spinal cord injury Lumbar radiculopathy (L4–L5)	🔌 **Peripheral Neuropathy** Peroneal nerve injury (most common) Diabetic neuropathy Charcot-Marie-Tooth disease
💪 **Musculoskeletal** Muscle/tendon injury Muscular dystrophy Myositis Knee trauma Habitual leg crossing	🌡️ **Systemic** Diabetes mellitus Autoimmune disorders Vitamin deficiencies (e.g., B12) Toxic exposures (e.g., alcohol, chemotherapy)

RED FLAGS



Diskitis / Osteomyelitis

🔬 **Key Laboratory Findings**

- **Elevated ESR (Erythrocyte Sedimentation Rate)**
- **Elevated Procalcitonin**
- **Elevated CRP (C-Reactive Protein)**

These are the **most consistent abnormalities** in cases of diskitis.

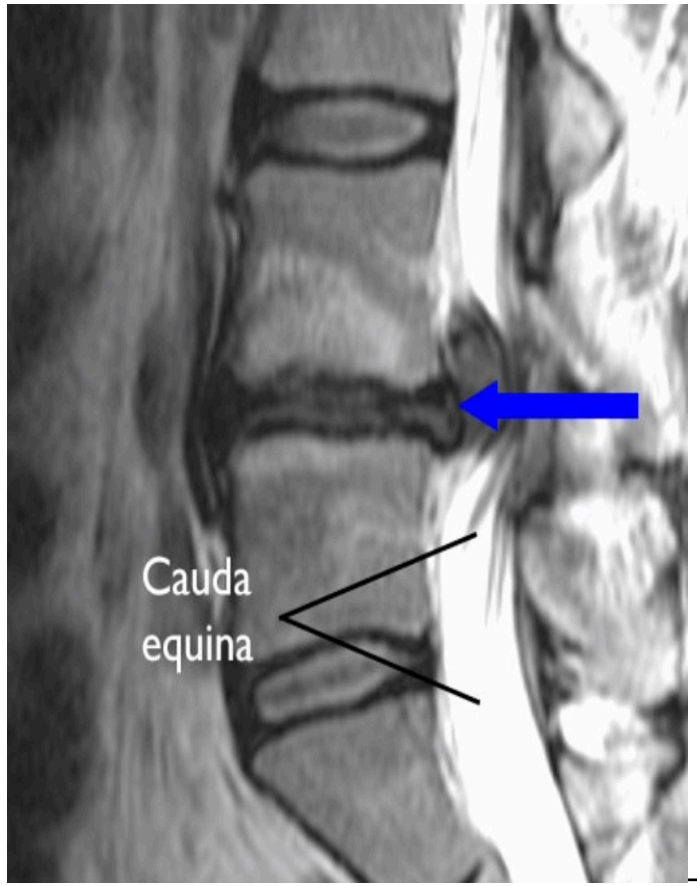
🧪 **Additional Diagnostics**

- **Blood Cultures** – to identify causative organisms.

- **CT-Guided Aspiration** – via **Interventional Radiology** for precise sampling.

RED FLAGS

Caudal Equina Syndrome



Symptoms of Cauda Equina Syndrome

- Urinary retention
- Urinary and/or fecal incontinence.
- “Saddle anesthesia”
- Weakness or paralysis of usually more than one nerve root.
- Pain in the back and/or legs

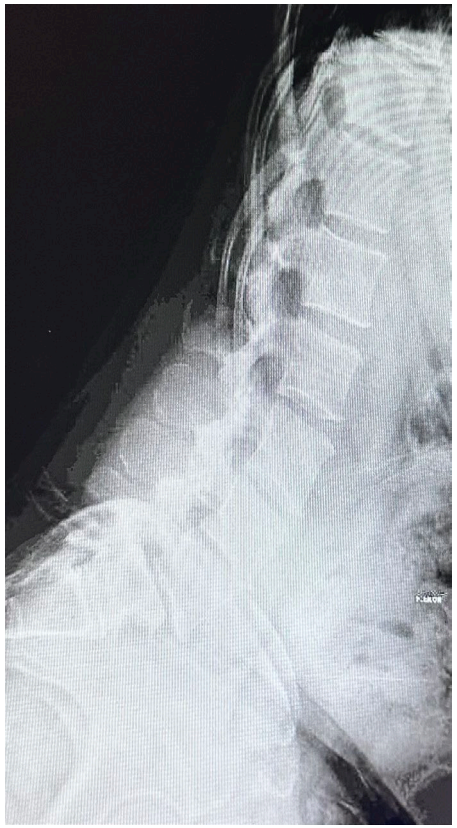
Key Labs for Initial Evaluation of Spine Disease

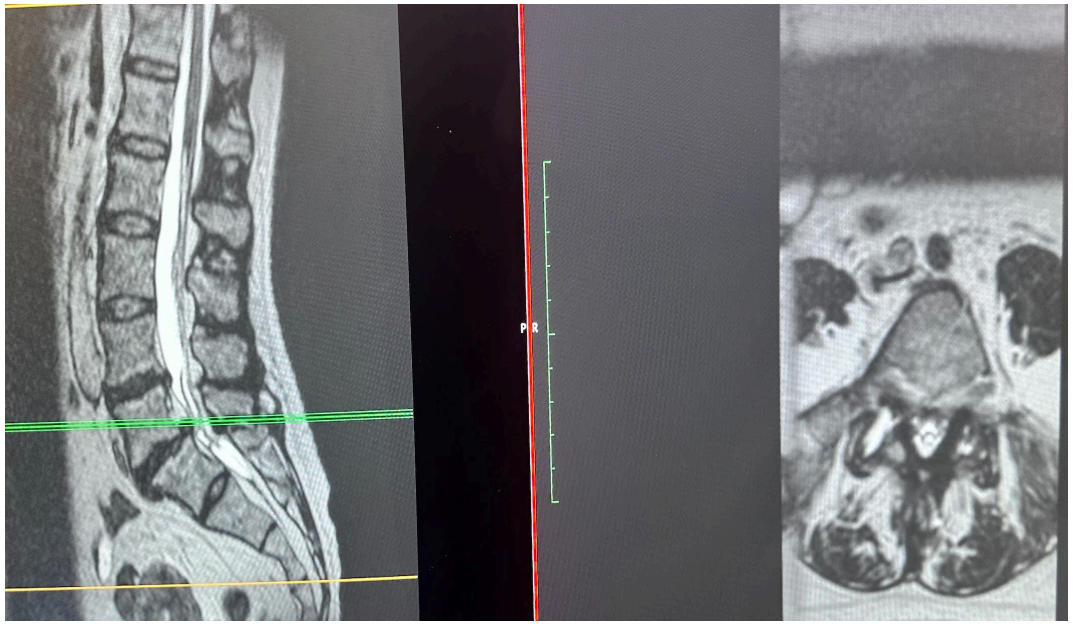
Lab Test	Purpose / Interpretation
 CBC	Detects infection, anemia, or systemic inflammation
 CMP	Assesses metabolic and organ function (liver, kidney, electrolytes)
 CRP / ESR Procalcitonin	Markers of inflammation or infection; elevated in systemic or localized pathology
 ANA / RF	Screens for autoimmune disorders (e.g., lupus, rheumatoid arthritis)
 HLA-B27	Associated with seronegative spondyloarthropathies (e.g., ankylosing spondylitis)

- **59-year-old female** with a **2-year history of bilateral lower extremity pain**, more pronounced on the **right side**, accompanied by **progressive right lower extremity weakness**.

Previous treatments include:

- Physical Therapy
- Medrol Dosepak
- Naproxen
- Robaxin
- Epidural Steroid Injection (ESI)
- Facet Joint Injections





- 71-year-old female referred for second opinion
- Inability to walk due to weakness
- Sensation intact
- Hyperreflexia in lower extremities (LE)
- Normal reflexes in upper extremities (UE)
- Excellent strength in UE
- Bladder and bowel function intact
- Reports neck and mid-back pain at onset
- No lower back pain

TAKE HOME

A thorough history and Physical Examination is critically important in guiding the diagnosis and management of patients with spine disorders.

THANK YOU!

REFERENCES

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3. Dermatomal Map: https://dermatomemap.com/tag/dermatomal-distribution-map-shingles/
4. Examples of Disc Problems: Degenerative Disc Disease — Adams Health Center