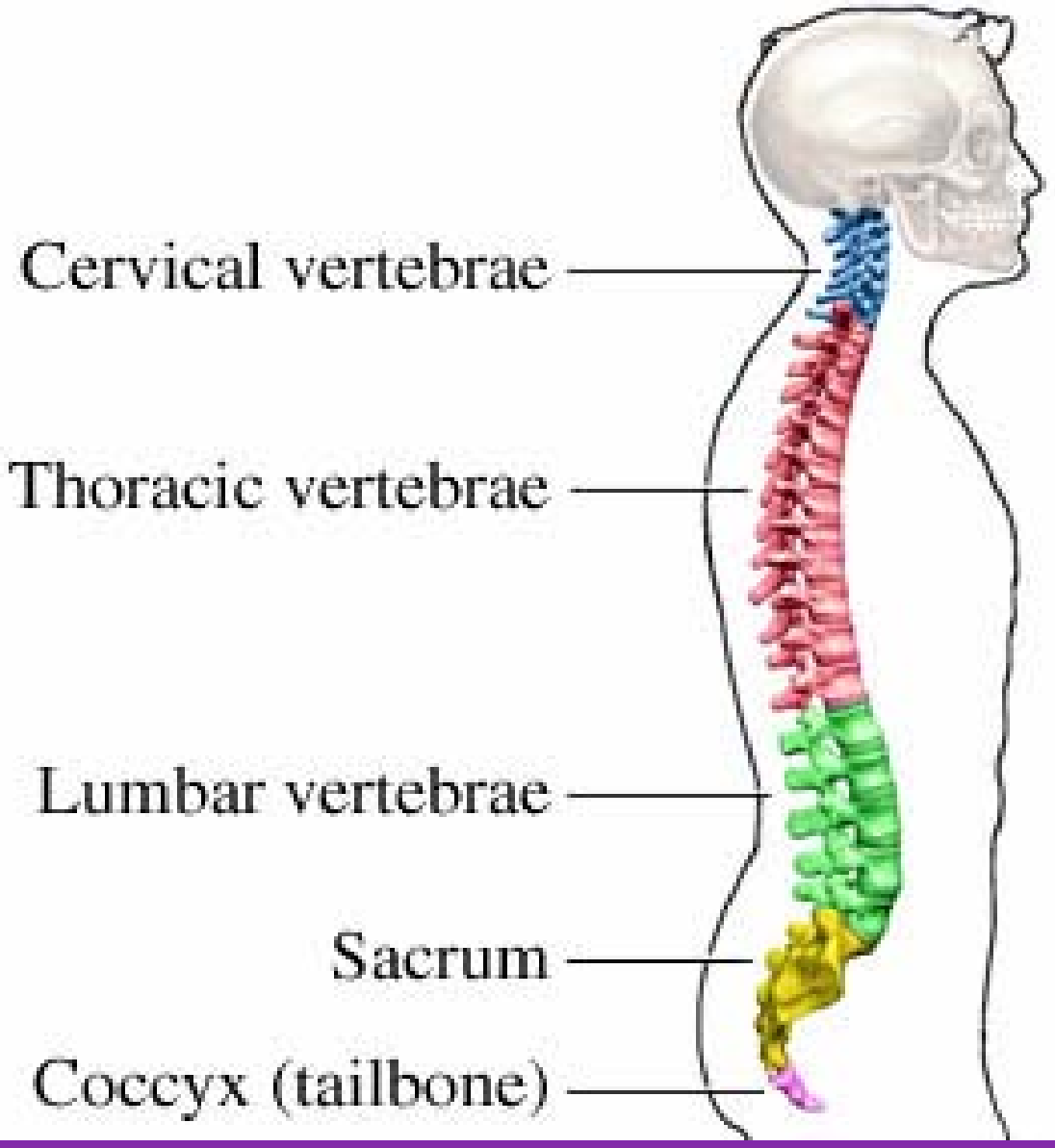
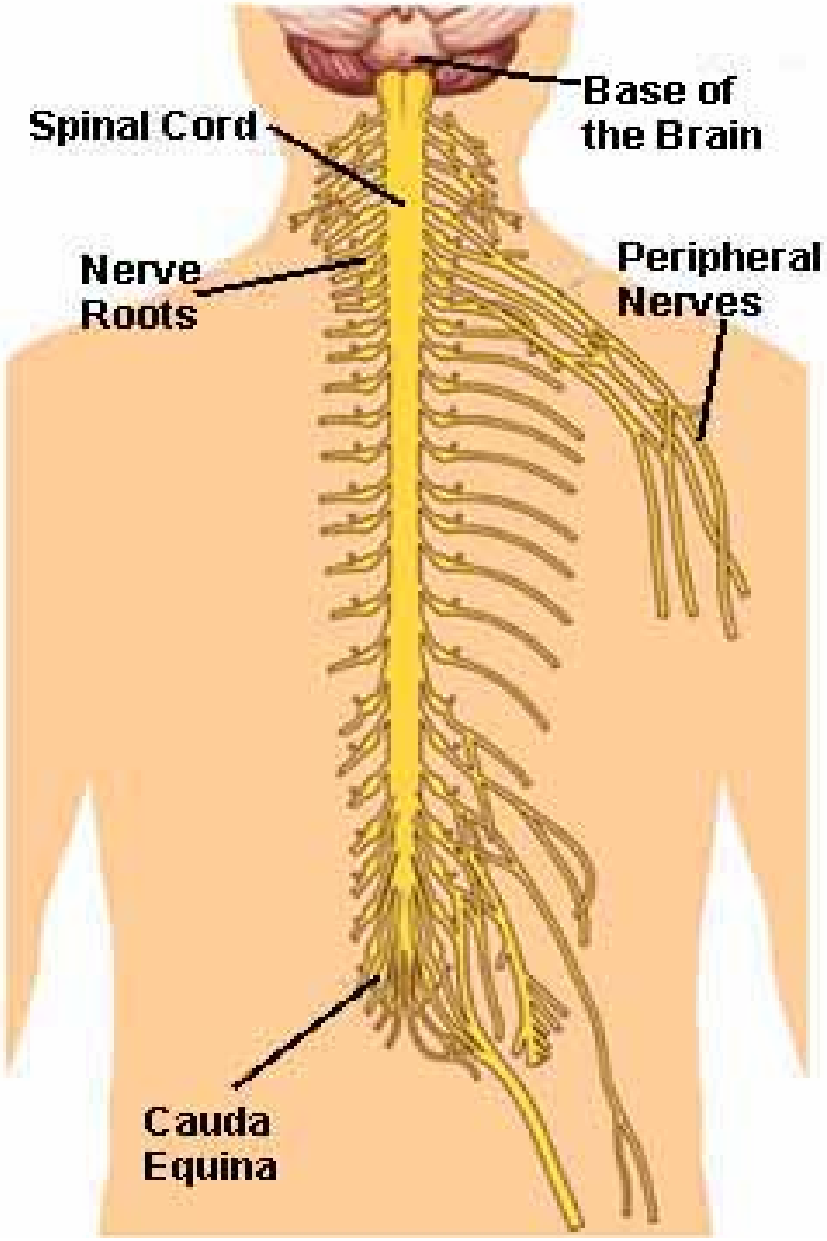
# Cervical Spine

- 7 Cervical Vertebrae - AKA The Neck
- 8 Cervical Nerves - Cervical/Brachial Plexus
- Most Mobile Region - Easily Injured
- Common Injury - Sprain, Strain, Herniated Disc (HNP)
- Symptoms - H/A, Neck/Arm Pain/Numbness
- Orthopedic Tests - Compression, Soto Hall, Distraction, Shoulder Depression, Valsalva
- Signs - Hyporeflexia, Atrophy
  Weakness in Upper Extremities

# SPINAL ANATOMY

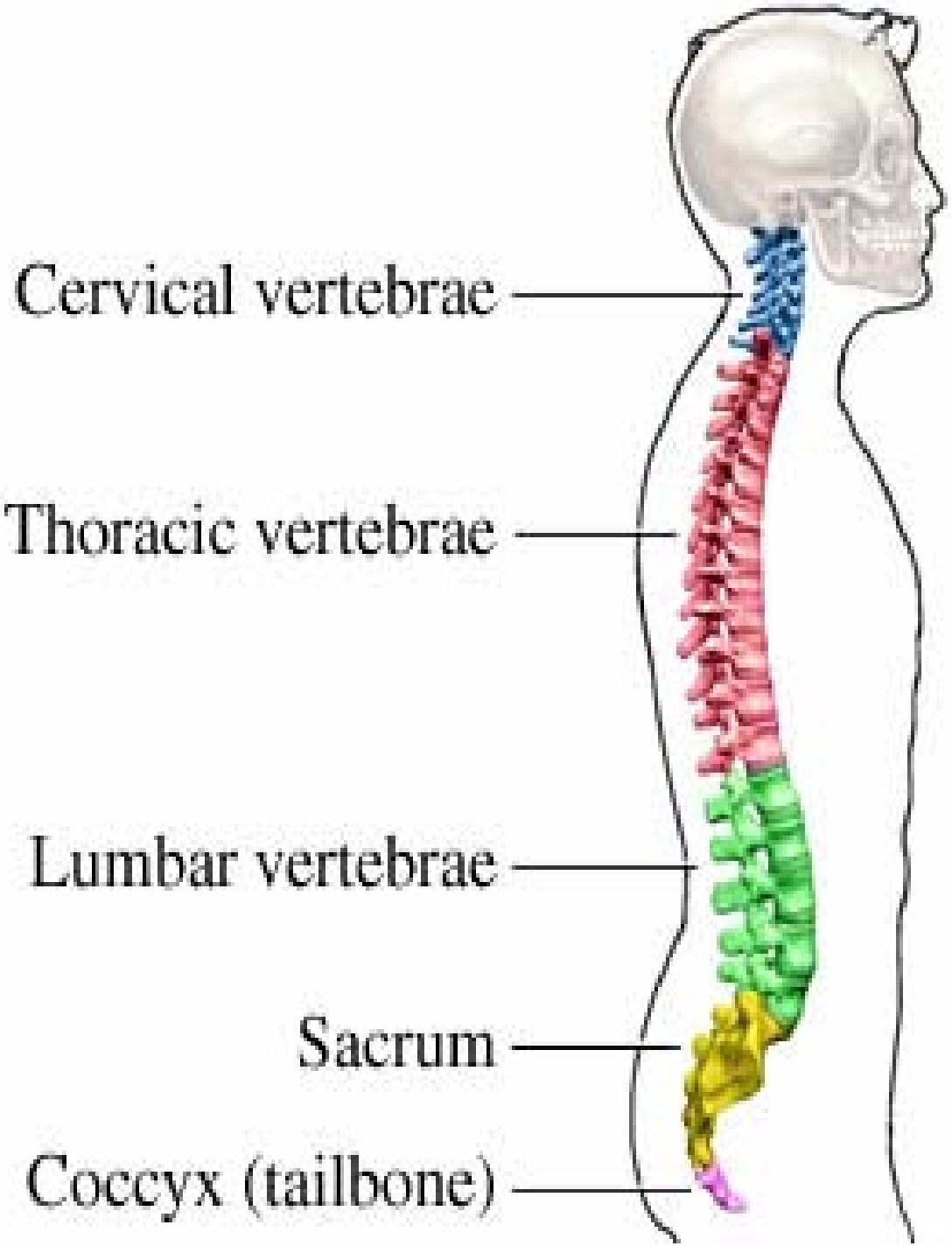


# Spinal Cord and Nerve Structures

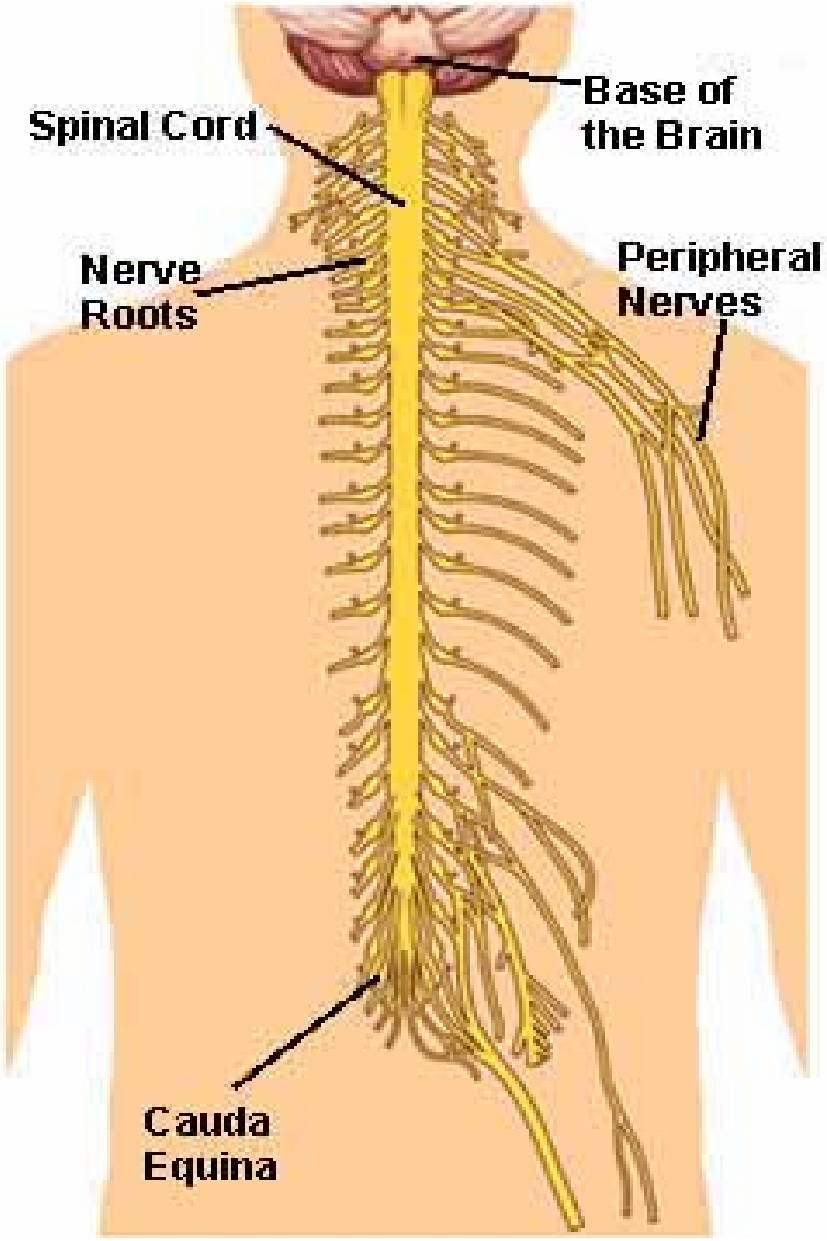


# Thoracic Spine

- 12 Thoracic Vertebrae - AKA Dorsal Spine
- 12 Thoracic Nerves - Between the Ribs
- Least Mobile Region - Less Injured
- Injuries - Dorsalgia, Fx Ribs
- Orthopedic Tests – None
- Signs - Fx on X-Ray,
  Bruised Sternum, Dyspnea

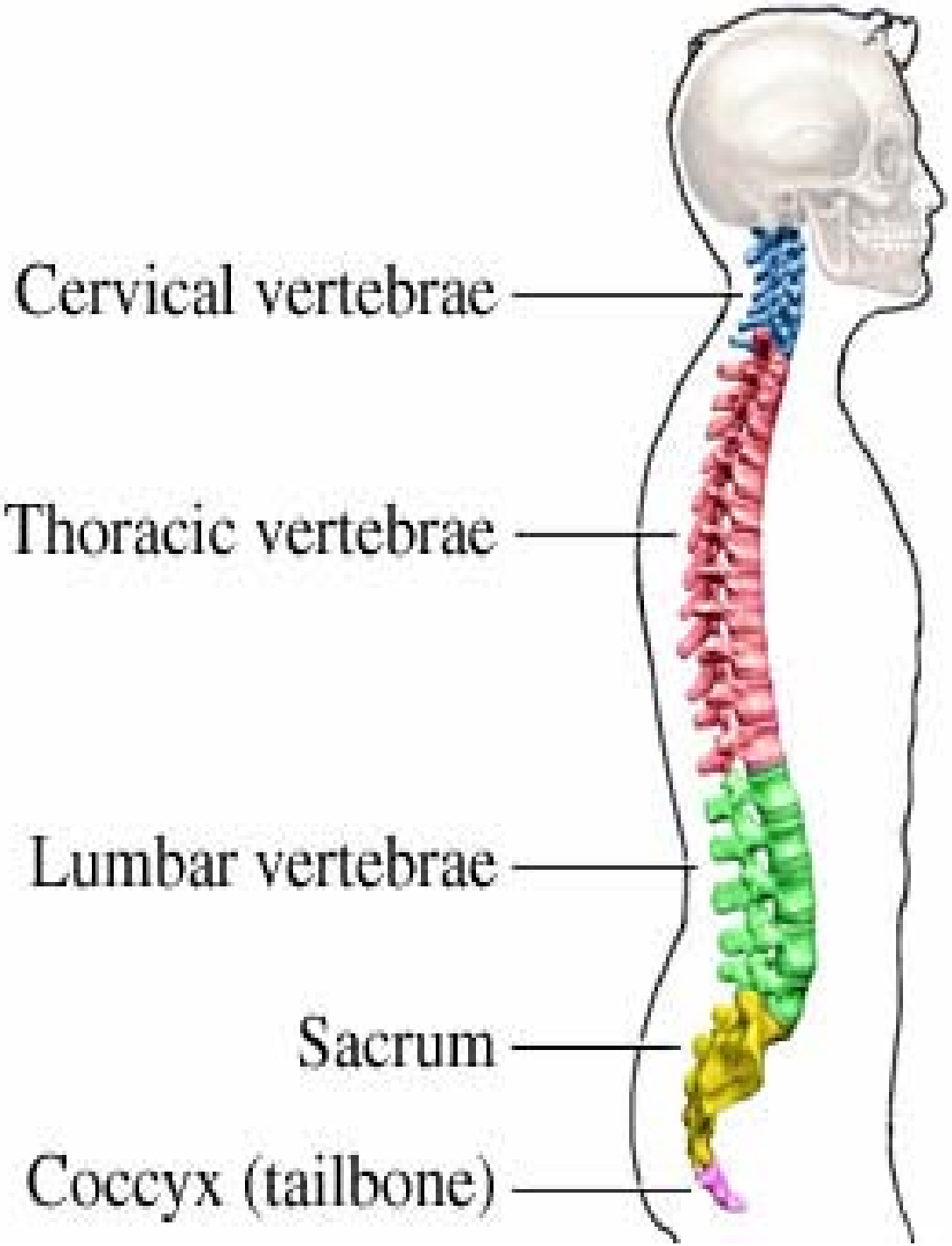

Cervical vertebrae
Thoracic vertebrae
Lumbar vertebrae
Sacrum
Coccyx (tailbone)

# Spinal Cord and Nerve Structures

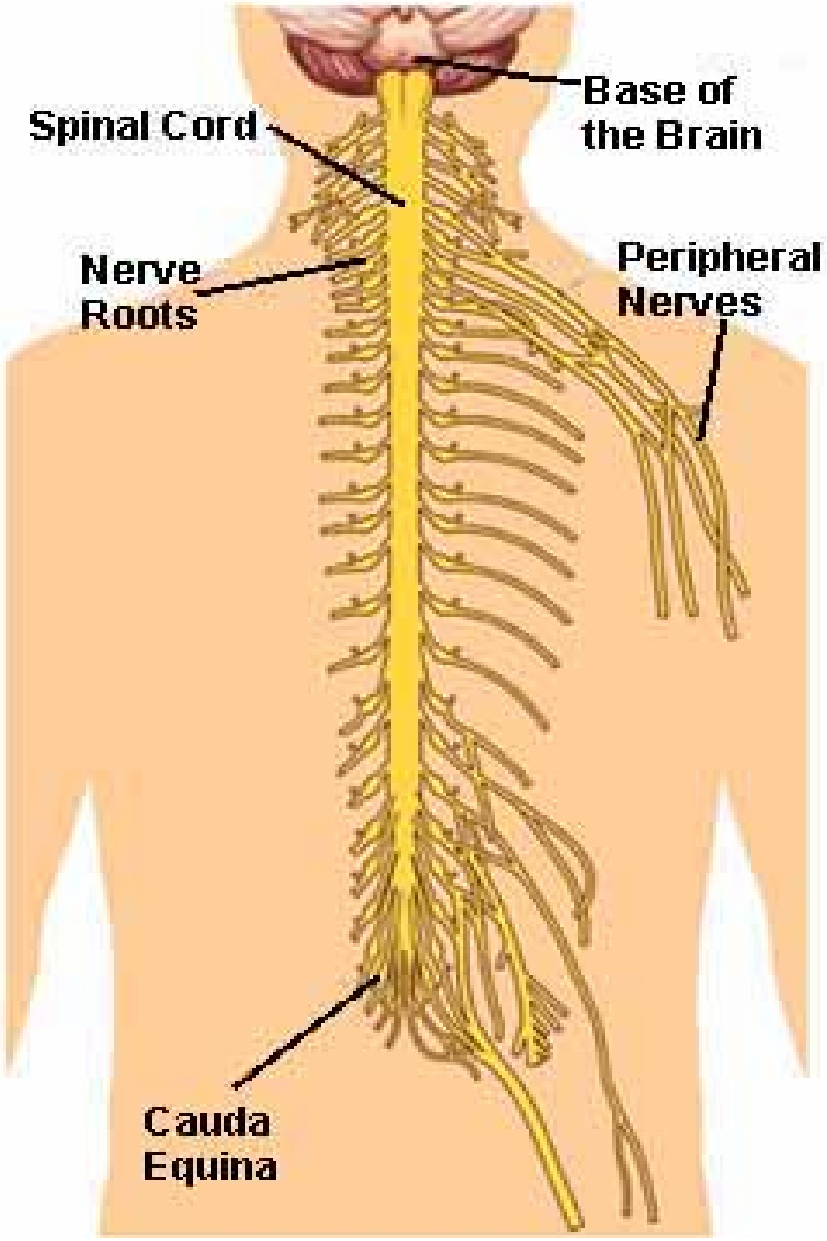


# Lumbar & Sacral Spine

- 5 Lumbar Vertebrae, 5 Fused Sacral Vert. - The Low Back
- 5 Lumbar Nerves - Lumbar Plexus
- 5 Sacral Nerves - Sacral Plexus
- Weight Bearing - Easily Injured
- Common Injury - HNP, Sprain & Strain
- Symptoms - LBP, Sciatica
- Signs - Hyporeflexia, Atrophy
  Weakness in Lower Extremities
- Orthopedic Tests - SLR, WLR, Kemp's, Ely's


Cervical vertebrae
Thoracic vertebrae
Lumbar vertebrae
Sacrum
Coccyx (tailbone)

# Spinal Cord and Nerve Structures



# Diagnostic Testing

X-RAY

MRI

EMG/NCV

# X-Rays

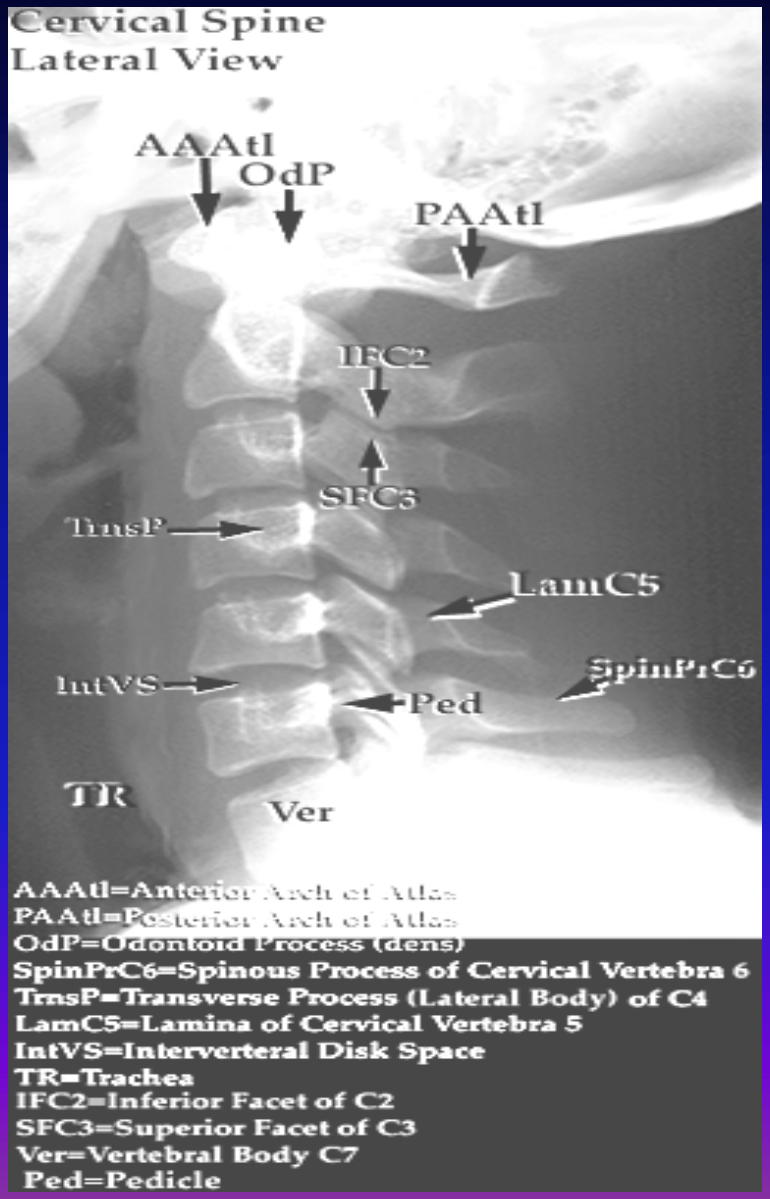
Rule Out

- Fractures
- Dislocations
- Osteoarthritis
- Spondylolisthesis
- Bone Tumors
- Infections

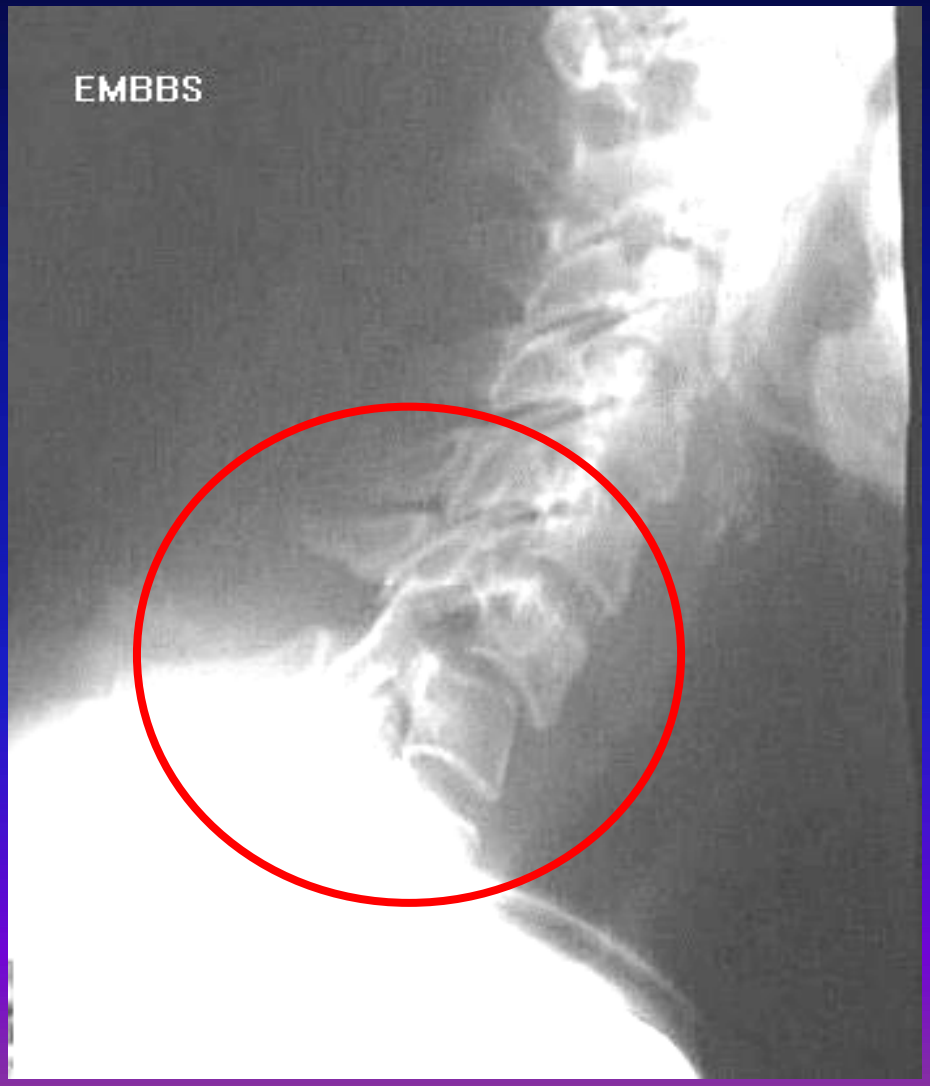
# Fractures

- A pop or snap felt or heard at the time of the injury.
- Mild to severe pain
- Severe swelling and bruising (often, but not always).
- An unstable joint (feels wobbly or loose).
- A grating sound or feeling.
- A bulge (sometimes) at the site of a complete tear.
- A change in sensation, such as numbness or tingling.
- *Evidence of a broken bone on X-Rays

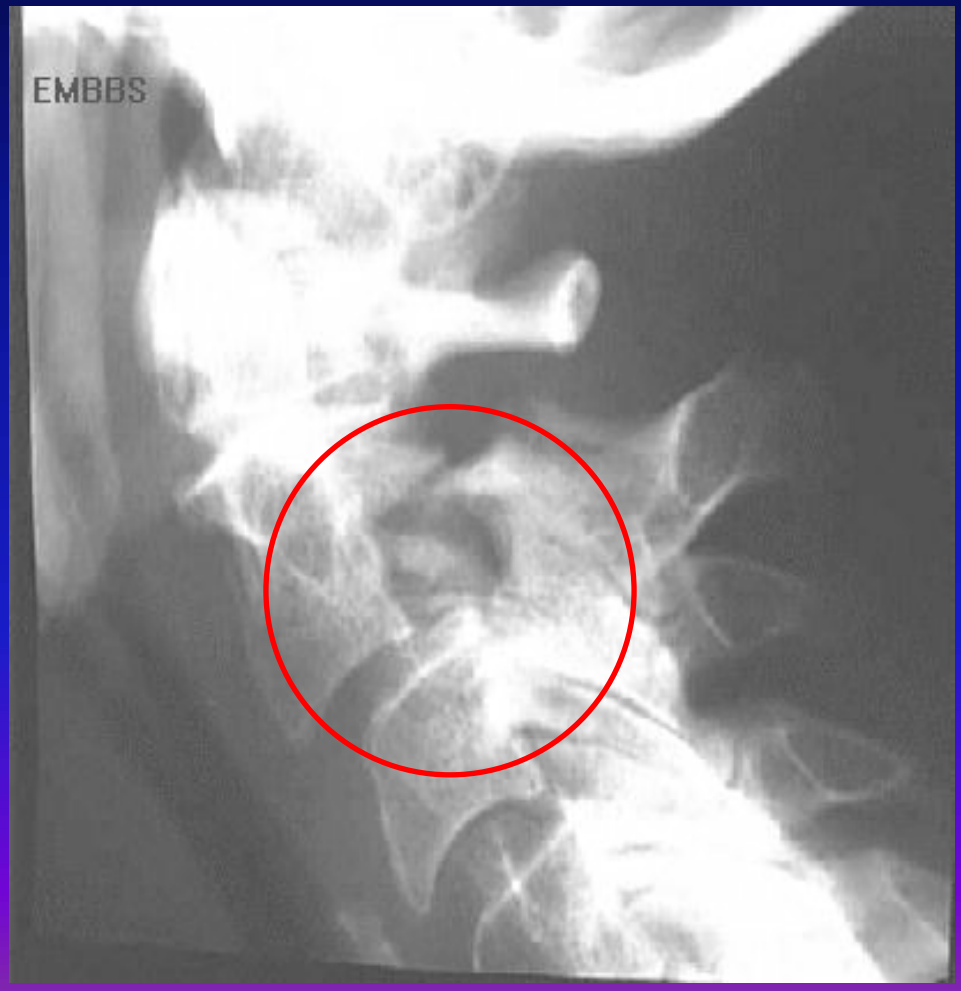
# Normal Cervical Spine X-Ray



# C6-C7 Vertebral Dislocation



# C2-C3 Fracture/Dislocation

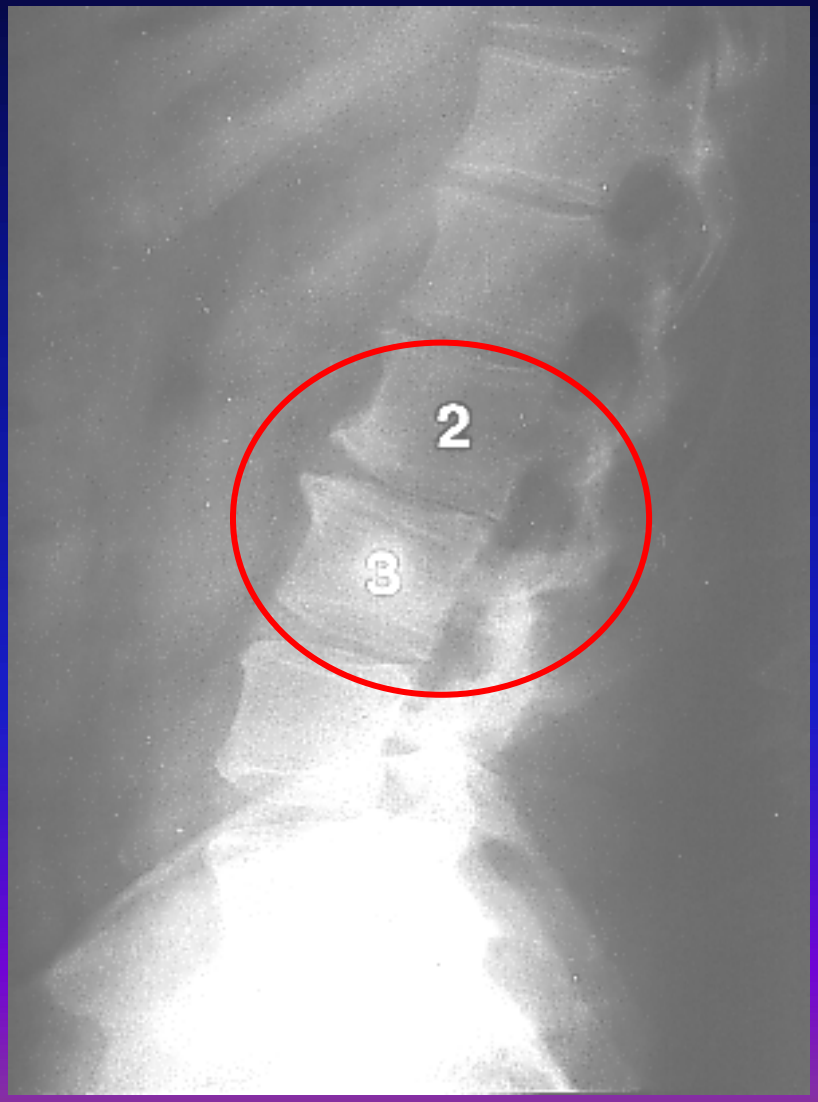


# Skull Fracture X-Ray

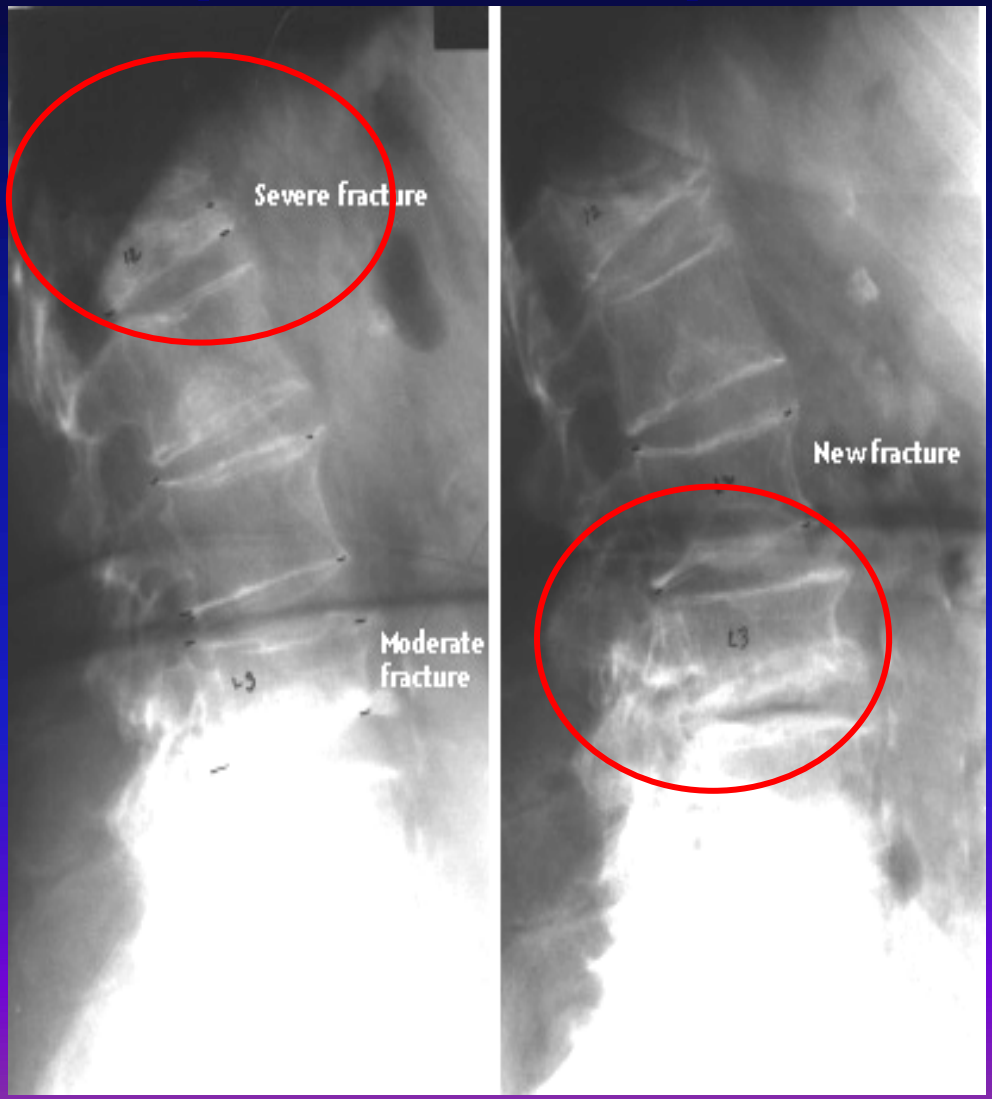
# Normal Elbow (X-Ray)

# Fractured Humerus (X-Ray)

# OA at L2-L3 (Deg Disc Disease)



# Lumbar Spine Compression Fx's



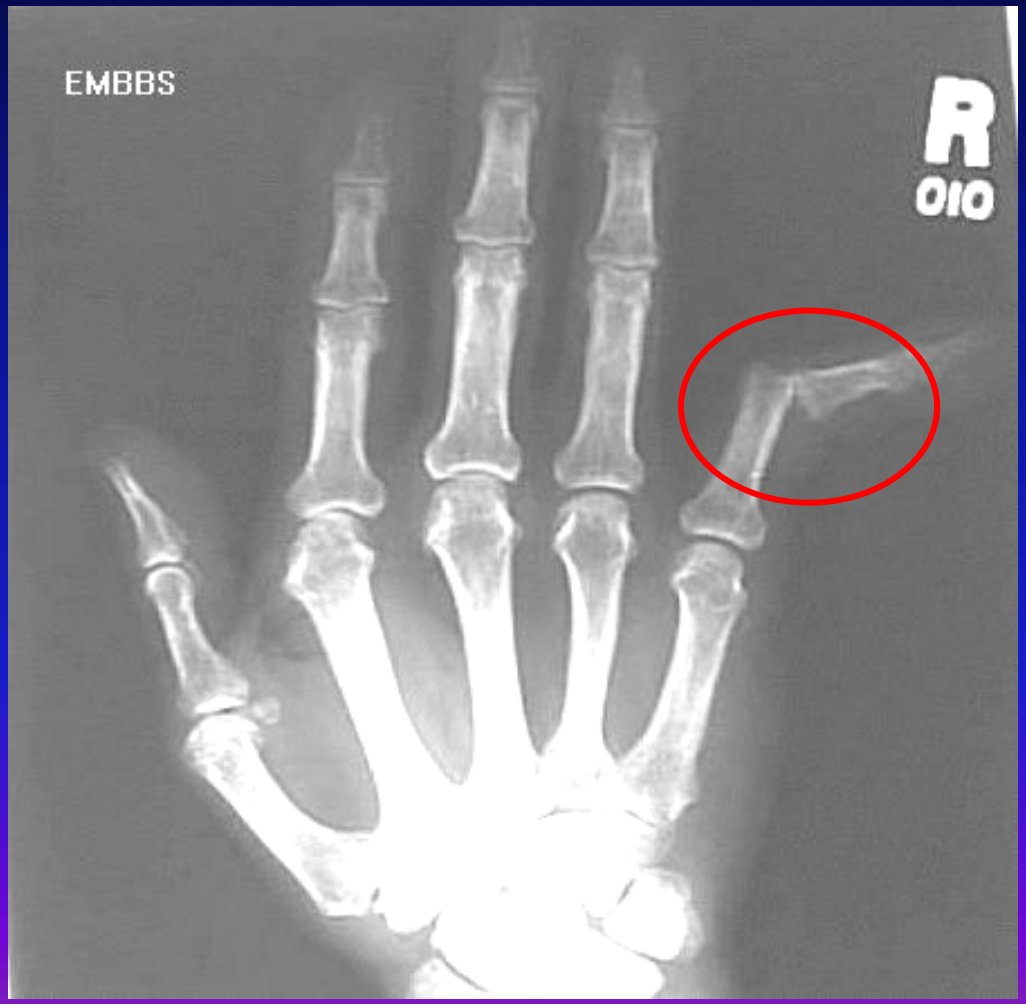
# Fibula Fracture X-Ray

# Tibia Fibular Fracture

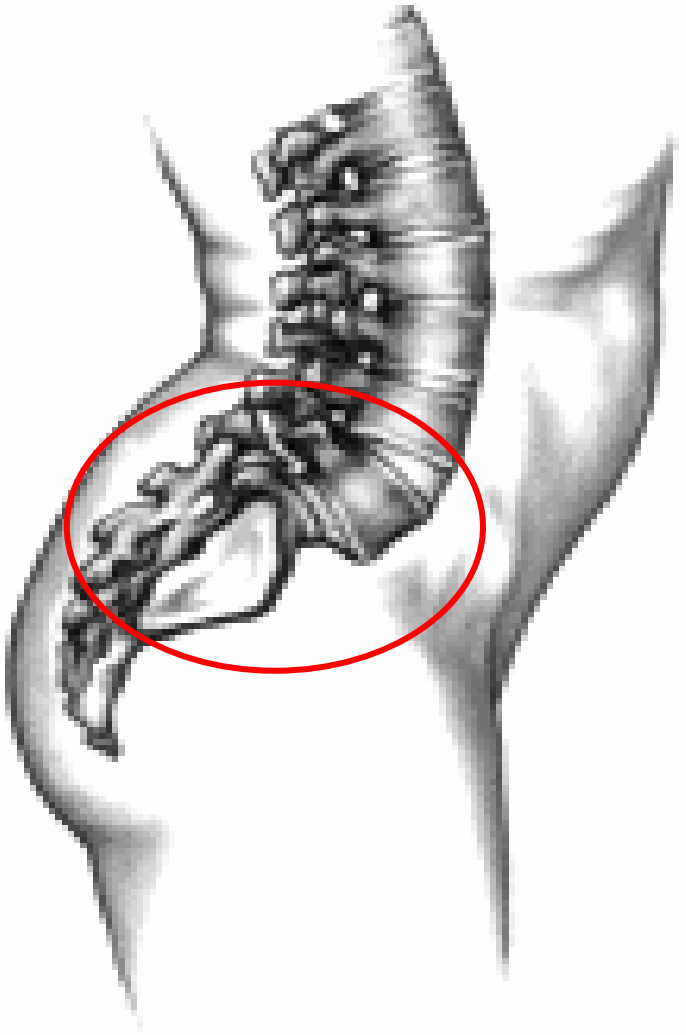
# Pelvic Fracture X-Ray

# Patella Fracture/Dislocation X-Ray

# Finger Dislocation X-Ray



# Spondylolisthesis



# MRI

Herniated Disc (HNP)

- Posterior
- Anterior
- Lateral

Bulging Disc

- Clinical Significance ?

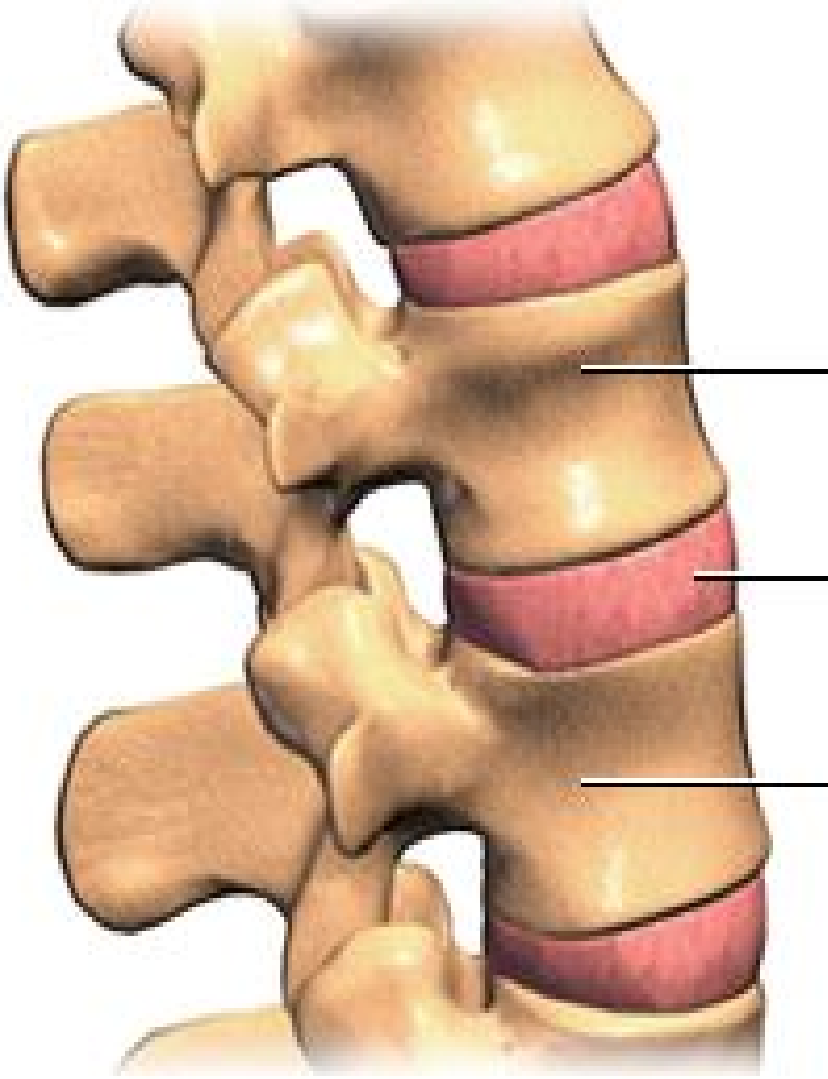
Sequestered (Prolapsed)

- Surgery Required

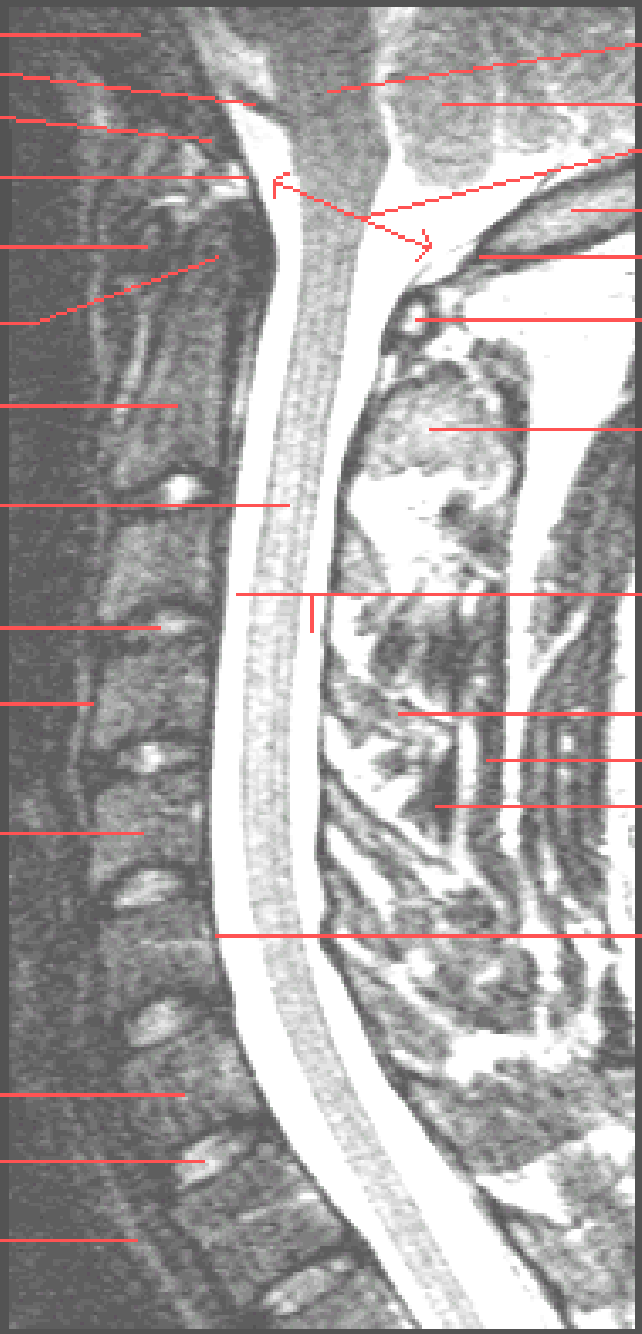
Spinal Stenosis

Foraminal Stenosis

- Surgery Required
- Pre-Existing


Vertebral body
Intervertebral disc
Vertebral body

# Slice 1/7



Basilar part of occipital bone
Vertebral a.
Basion
Cruciform lig. of atlas and tectorial membrane
Anterior arch of atlas
Odontoid process (axis)
Vertebral body of axis
Spinal cord
C3-C4 intervertebral disc
Anterior longitudinal lig.
C5 vertebral body
C7 vertebral body
C7-T1 intervertebral disc
Esophagus

Brainstem
Cerebellum
Foramen magnum
Squama of occipital bone
Opisthion
Posterior arch of atlas
Spinous process (axis)
Subarachnoid space
Spinous process (C4)
Multifidus mm.
Interspinous lig.
Posterior longitudinal lig.

Slice 3/5

Aorta

L3 vertebral body

Left common iliac a.

Left common iliac v.

Spinal canal

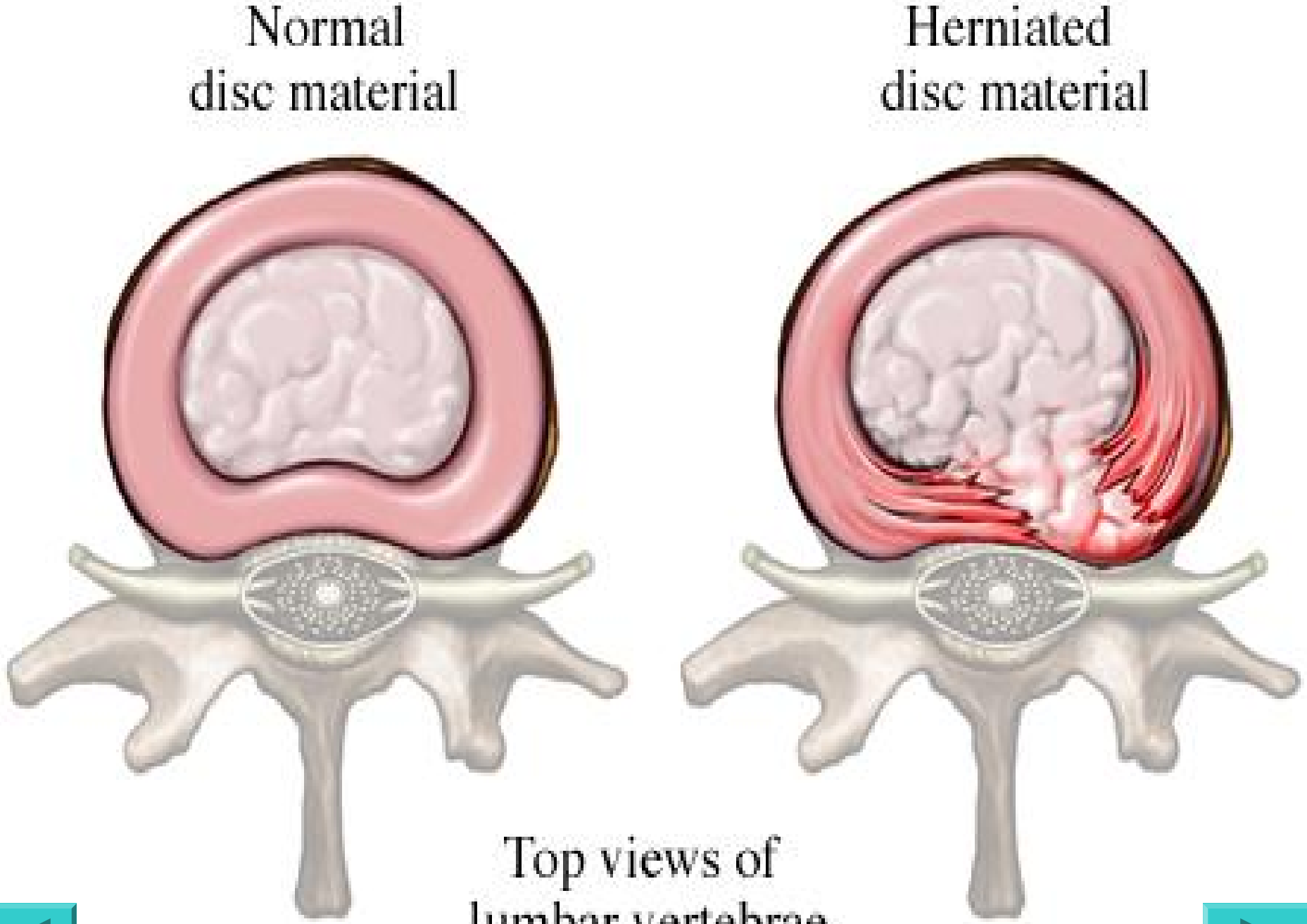
L2-L3 intervertebral disk

Articular processes

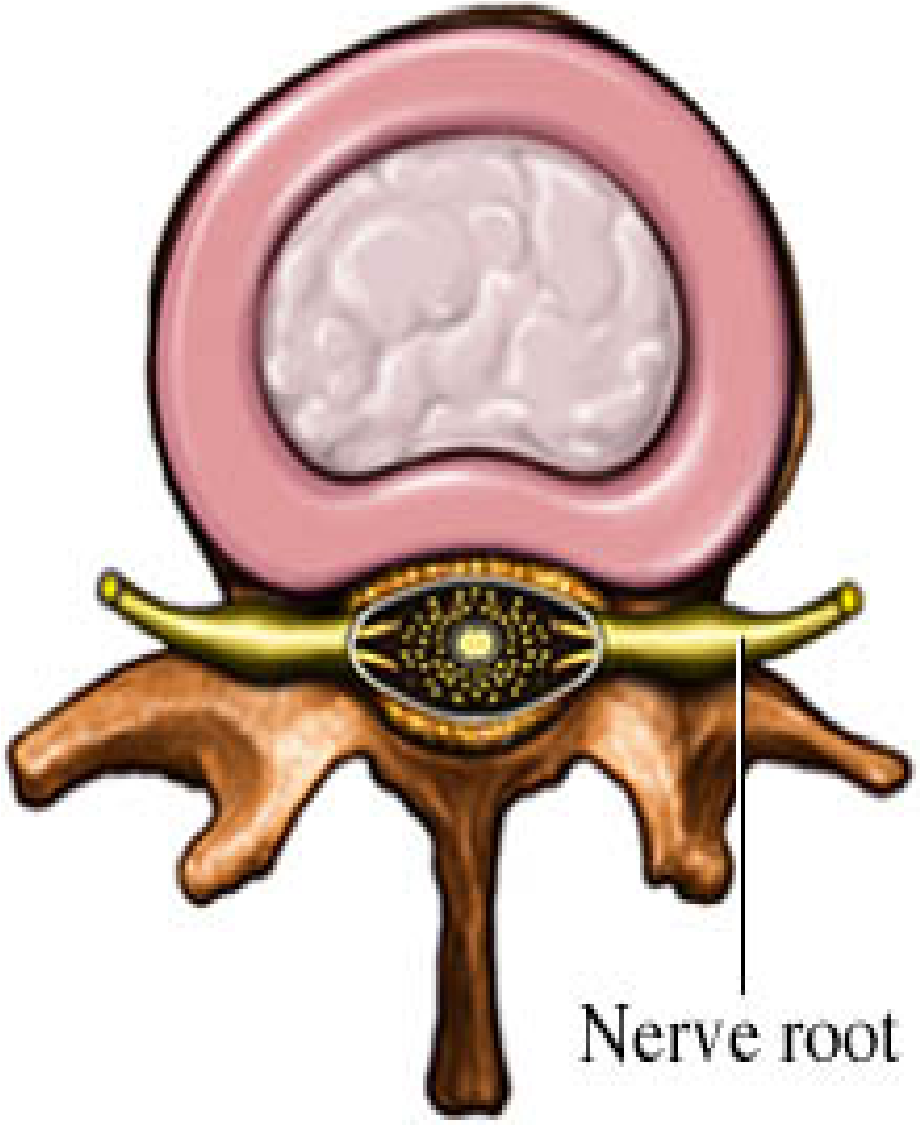
Ligamentum flavum

L5-S1 intervertebral disk

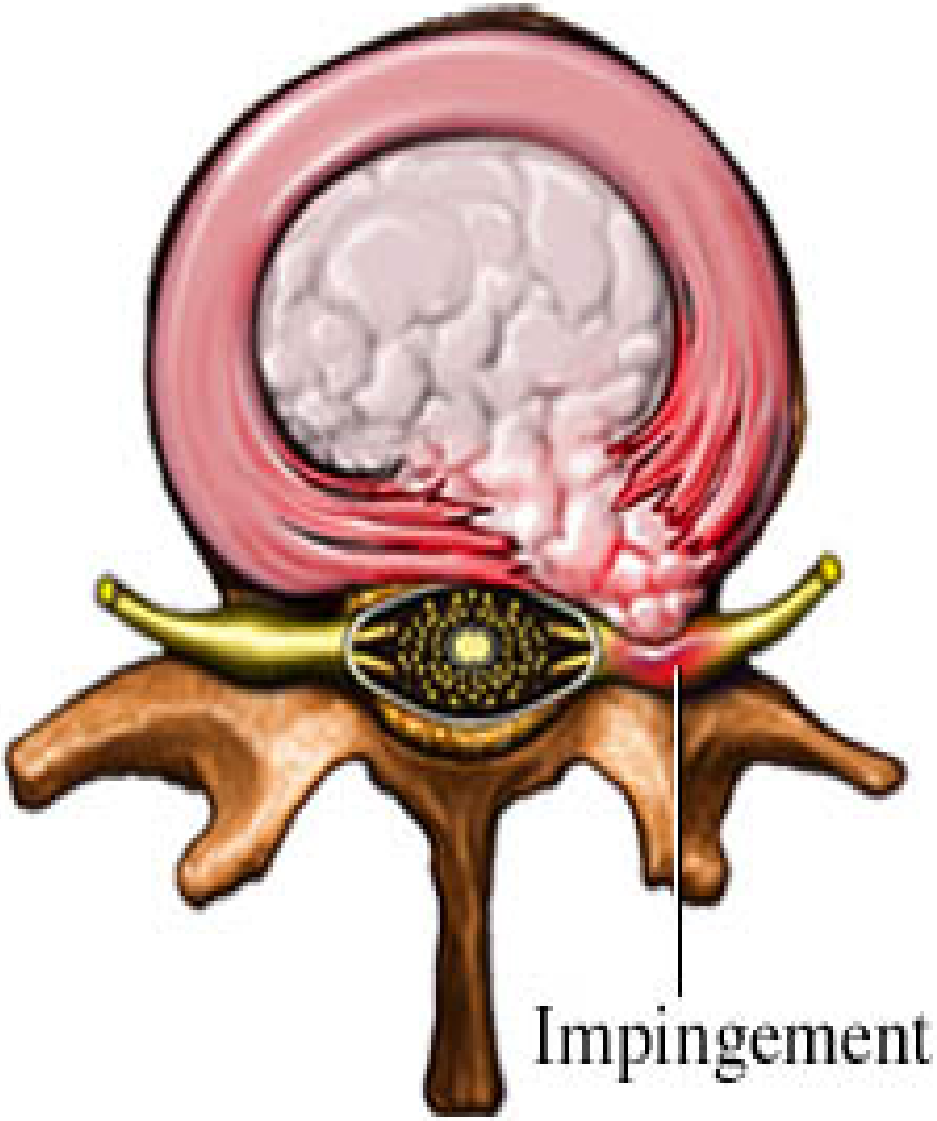
Rectum

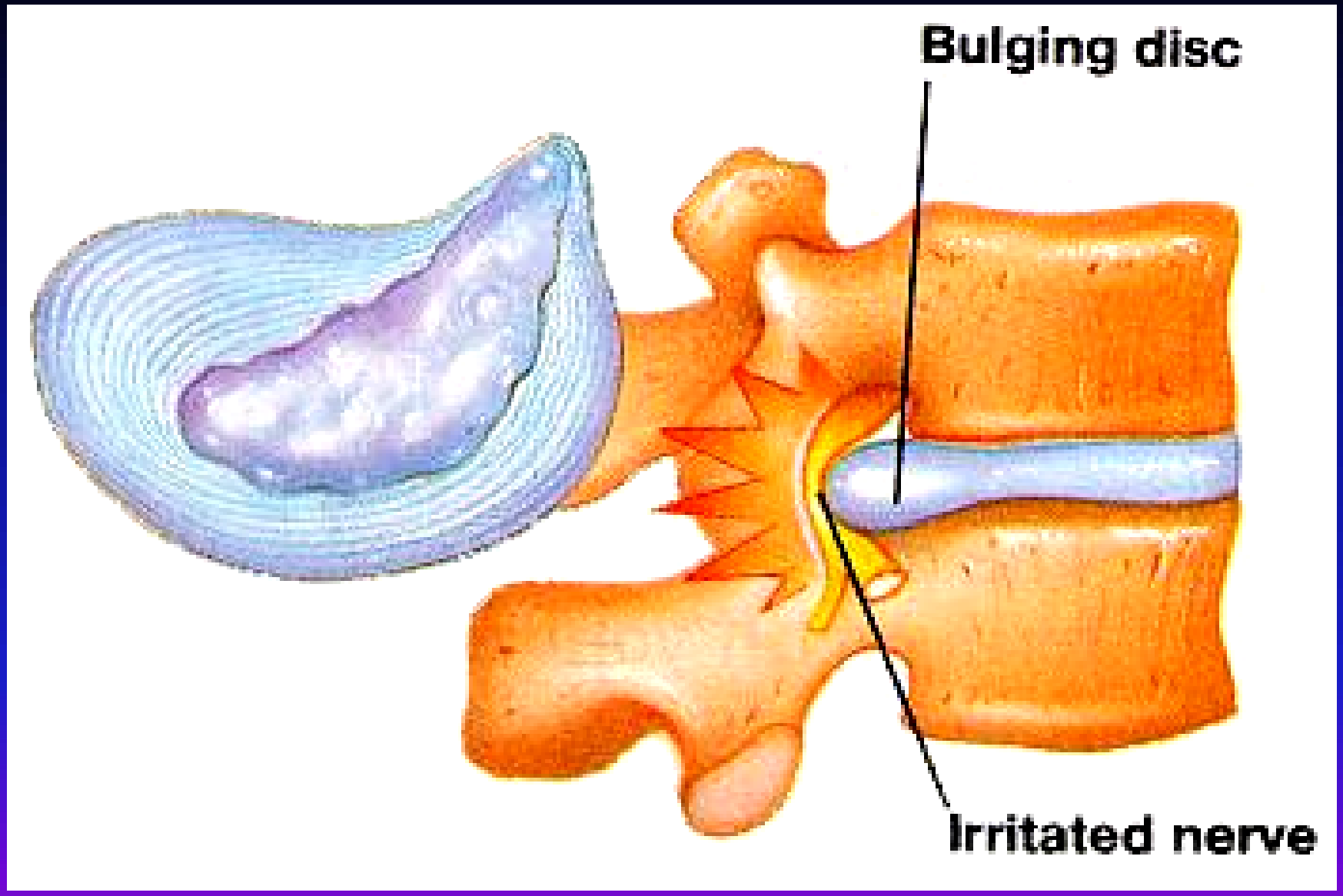

Normal
disc material
Herniated
disc material
Top views of
lumbar vertebrae

Normal disc



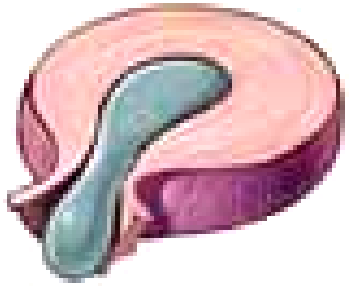

Herniated disc




Bulging disc
Irritated nerve

Disc Degeneration

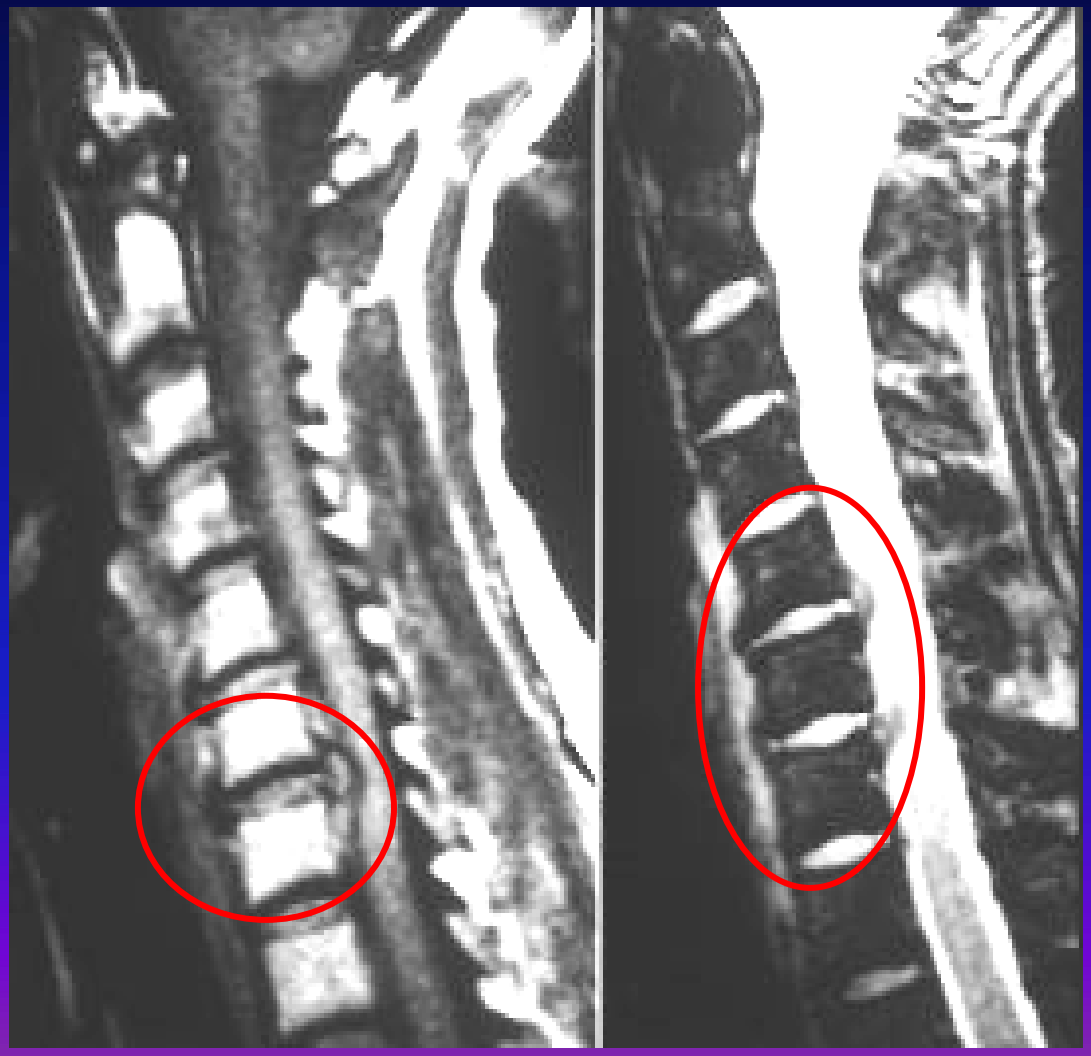
Prolapse



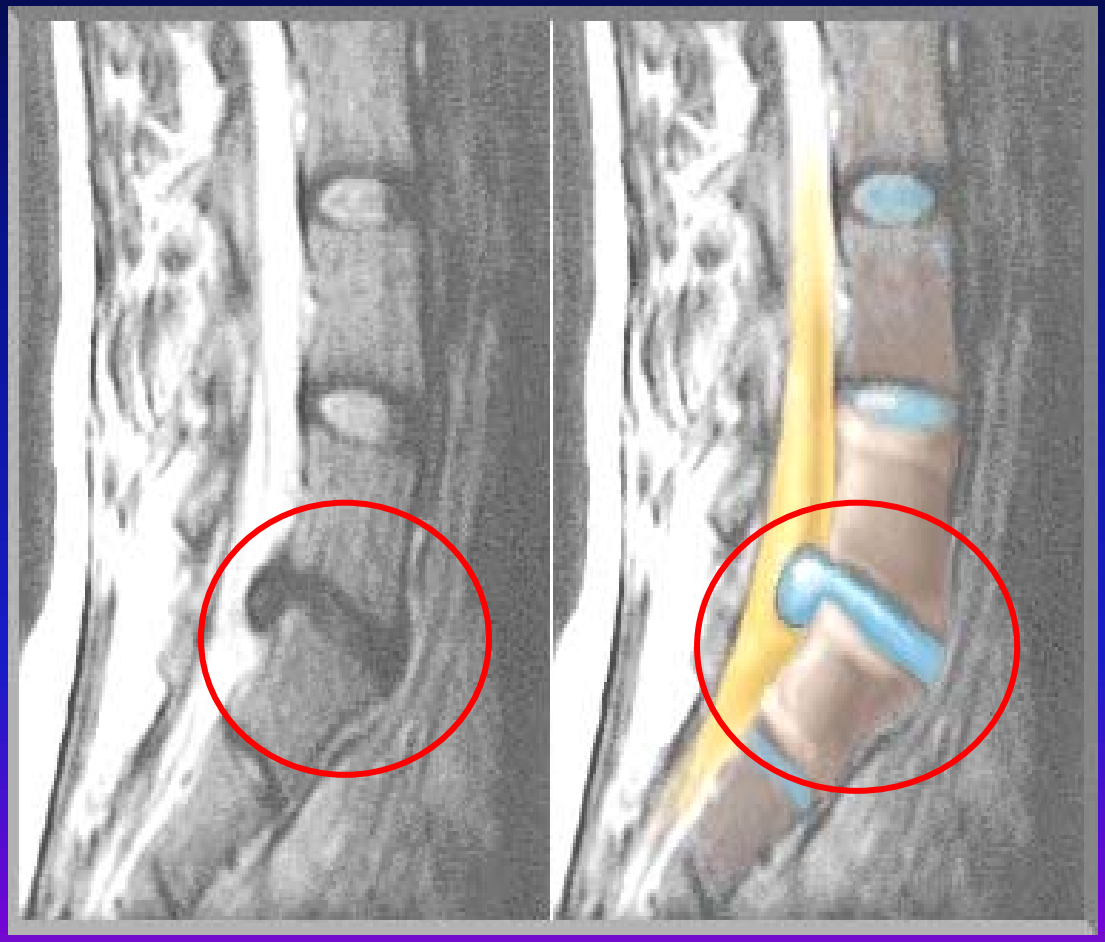
Extrusion

Sequestration

# Cervical Herniated Disc (MRI)

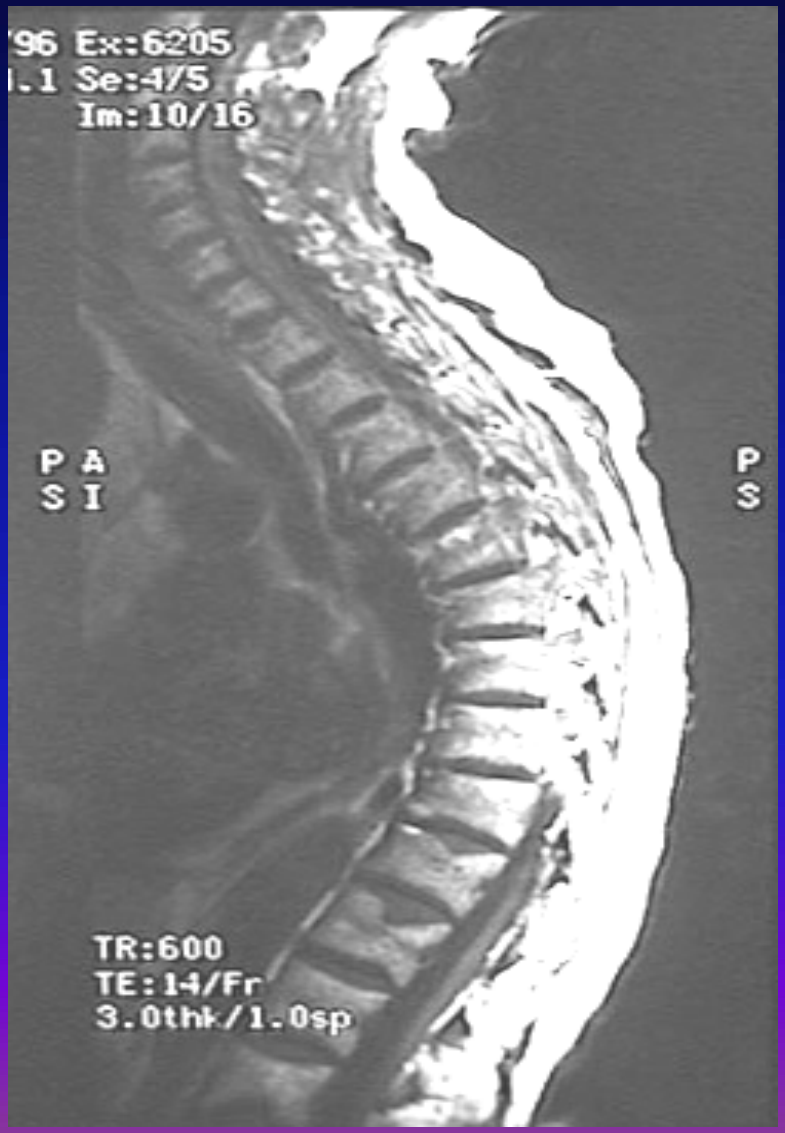


# Lumbar Herniated Disc (MRI)



# Cervical Spinal Stenosis (MRI)

# Thoracic Spine Compression Fx MRI



# EMG (Electromyography)

Needle Insertion

Diagnosis of Myopathy

Diagnosis of Radiculopathy

Symptom = Muscle Weakness

Sign = Atrophy

Silent at Rest = Normal

Fibrillations/Fasiculations at rest = Pathology

Electromyography (EMG) is done to:

Help diagnose diseases that damage muscle tissue, nerves, or the junctions between nerve and muscle (neuromuscular junctions). These disorders include a herniated disc, amyotrophic lateral sclerosis (ALS), or myasthenia gravis (MG).
Evaluate the cause of weakness, paralysis, involuntary muscle twitching, or other symptoms. Problems in a muscle, the nerves supplying a muscle, the spinal cord, or the area of the brain that controls a muscle can all cause these kinds of symptoms.

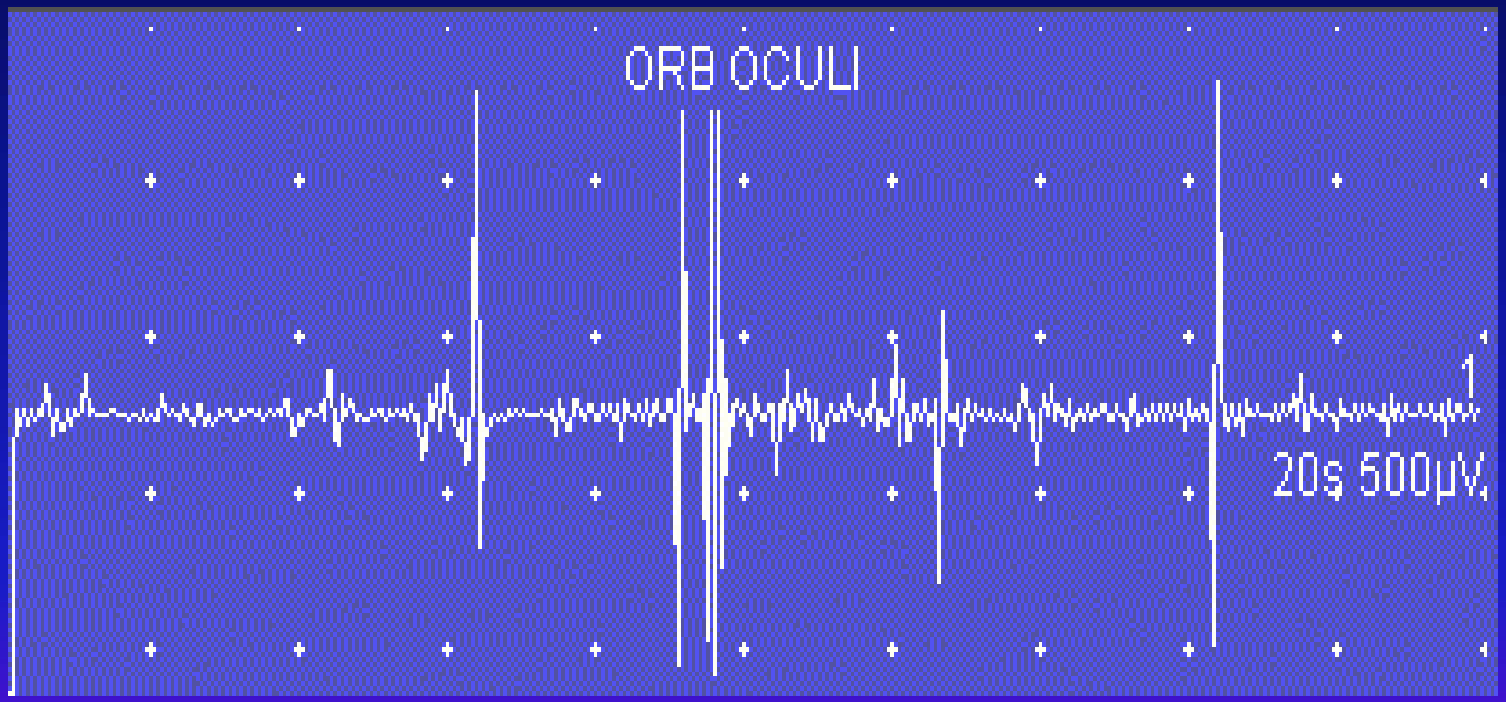
Nerve conduction studies are done to:

Detect and evaluate damage to the peripheral nervous system (which includes all the nerves that lead away from the brain and spinal cord and the smaller nerves that branch out from those nerves). Nerve conduction studies are often used to help diagnose carpal tunnel syndrome or Guillain-Barré syndrome.
Identify the cause of abnormal sensations, such as numbness, tingling, or pain.

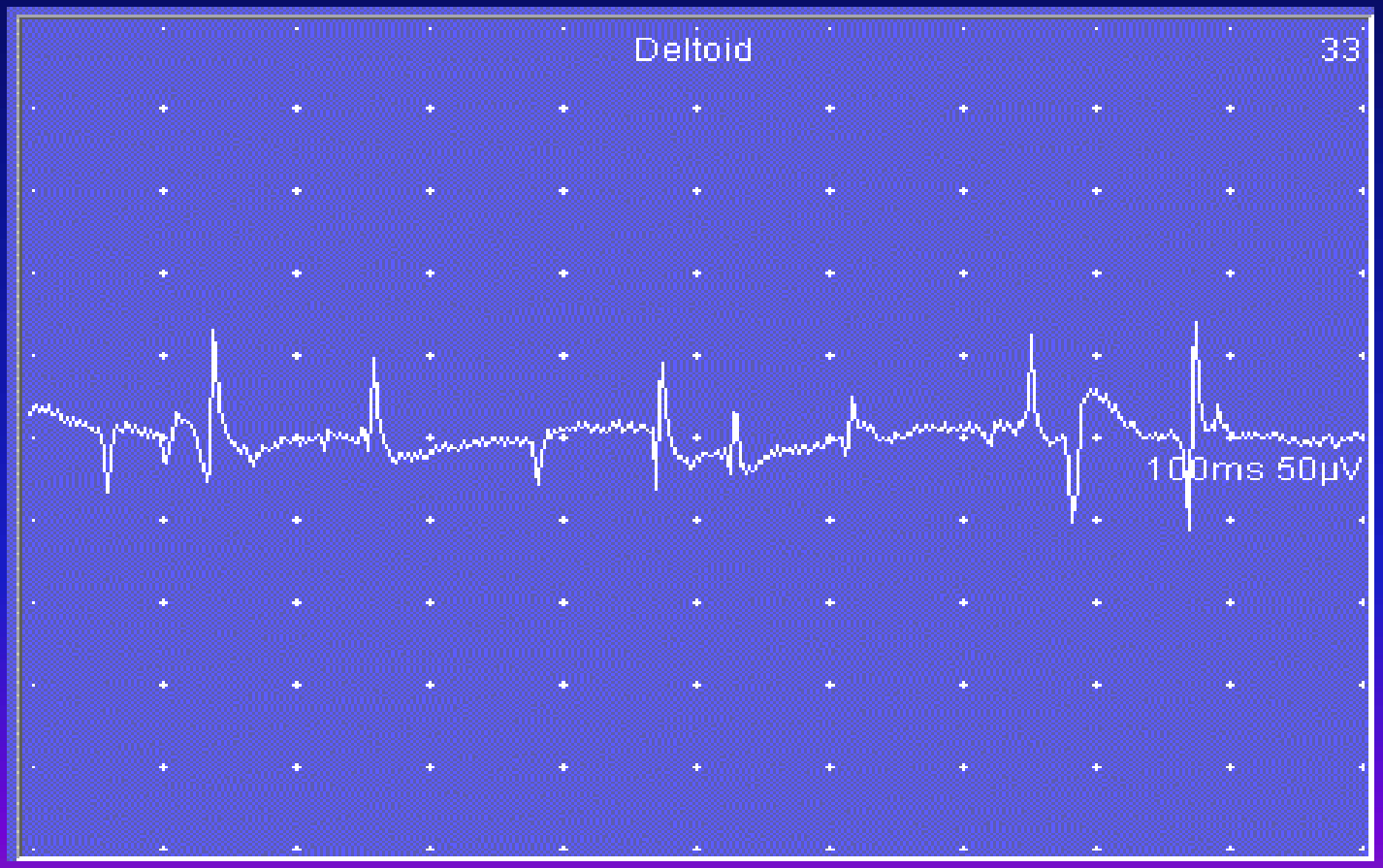
# Electromyography Trace (EMG)

# Normal EMG (Insertional Activity)

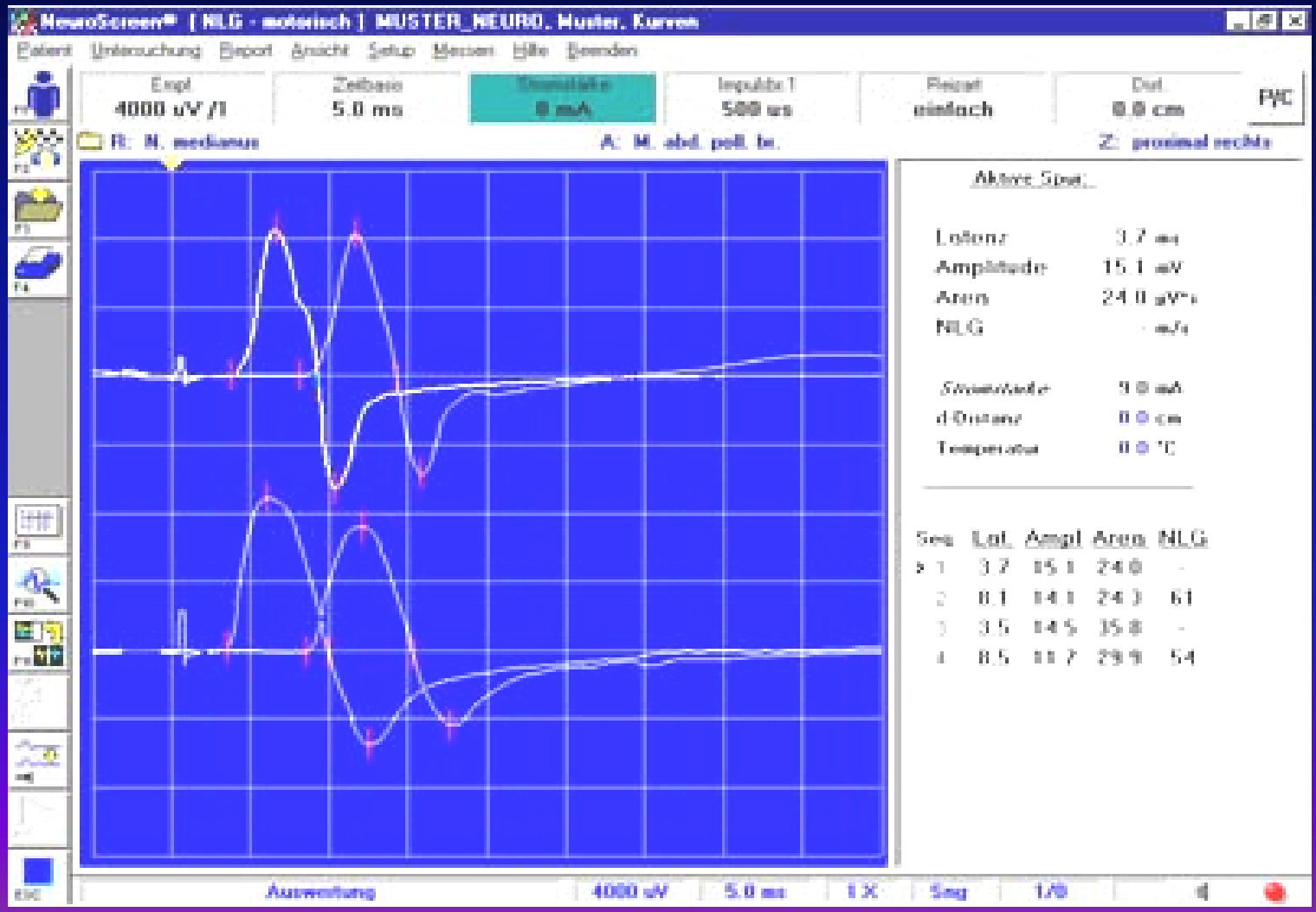
# Orbicularis Oculi Fasiculation



# Deltoid Muscle Fibrillation



# Nerve Conduction Velocity (NCV)



Definition:
SER is a procedure that provides a measure of function in the peripheral nervous system and the large fiber sensory tracts in the central nervous system.

Procedure:
Peripheral nerves are stimulated in the arms and legs. Responses run up the spinal cord to the brainstem and brain where they are recorded over the scalp.

Indications:
SER testing is useful in the following conditions:

Multiple sclerosis and other demyelinating diseases.

Degenerative diseases

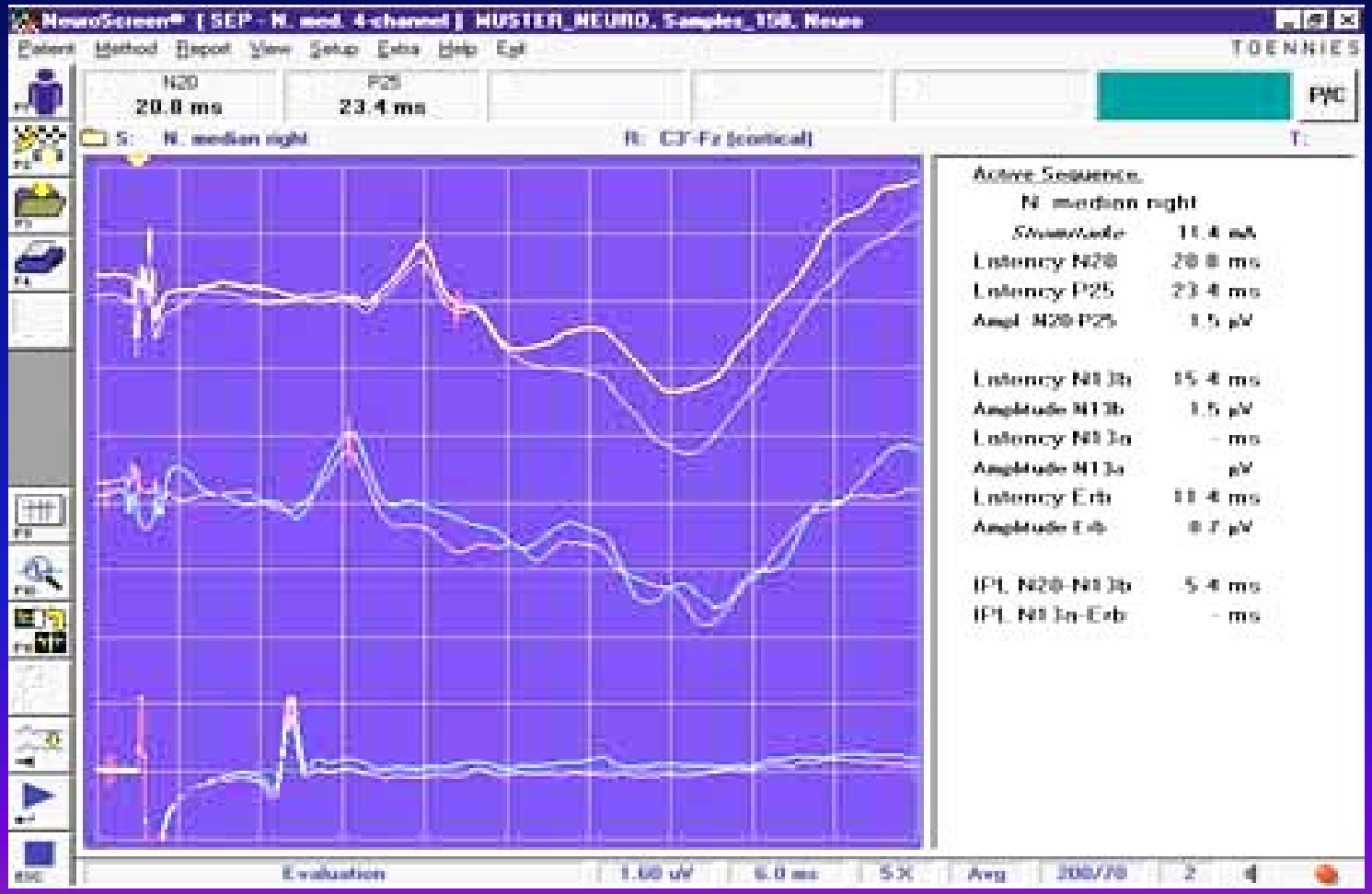
Peripheral nerve lesions

Brachial plexus and cervical root trauma

Plexopathies and radiculopathies

Spinal cord trauma

# Somatosensory Evoked Potential (SSEP)



# Soft Tissue Injuries Due to MVA

- Cervical Spine Sprain/Strain – Whiplash
- Thoracic Spine Sprain/Strain – Dorsalgia
- Lumbar Spine Sprain/Strain – Lumbalgia
- Shoulder Sprain/Strain
- Knee Sprain/Strain
- Wrist Sprain/Strain

# Sprain

Sprains are injuries to the tough ropelike fibers (ligaments) that connect bone to bone. If you have a severe sprain, your symptoms may not be much different from those you would have with a broken bone. Health professionals rank sprains by degree of severity.

A first-degree sprain stretches the ligaments but does not tear them. Signs and symptoms may include:

- Mild to moderate swelling and pain.
- A stable joint that does not feel loose or wobbly.
- Normal movement.

A second-degree sprain partially tears the ligaments. Signs and symptoms may include:

- A pop or snap felt or heard at the time of the injury.
- Moderate to severe pain and swelling.
- Restricted movement.
- Bruising.

A third-degree sprain completely tears the ligaments. Signs and symptoms may include:

- A pop or snap felt or heard at the time of the injury.
- Mild to severe pain (pain is sometimes less in a complete tear than in a partial tear).
- Severe swelling and bruising (often, but not always).
- An unstable joint (feels wobbly or loose).
- A grating sound or feeling.
- A bulge (sometimes) at the site of a complete tear.
- A change in sensation, such as numbness or tingling.

A minor sprain in a healthy person may heal in a few days to a few weeks. A severe sprain can take several months to heal and may never heal completely, resulting in long-term pain, limited movement, deformity and instability of the joint, and repeated injuries.

First aid for a sprain includes rest (immobilization), ice, compression, and elevation. While a minor sprain will often heal well with home treatment, a moderate to severe sprain may require medical treatment, such as a cast or splint, physical therapy, medication, or surgery.

# Muscle strain

A muscle strain, also known as a pulled muscle, may be minor (such as an overstretched muscle) or severe (such as a torn muscle or tendon). Strains are caused by overstretching muscles.

Symptoms of a muscle strain can vary, depending on how severe the strain is, and may include:

- Pain and tenderness that is worse with movement.
- Swelling and bruising.
- Normal or limited muscle movement.
- A bulge or deformity at the site of a complete tear.

Recovery time for a muscle strain can vary, depending on a person's age and health and the type and severity of the strain. While a minor strain often heals well with home treatment, a severe strain may require medical treatment. If a severe strain is not treated, a person may have long-term pain, limited movement, and deformity.

# Head Injury, Age 4 and Older

## Concussion (traumatic brain injury)

A concussion occurs when the head sustains a hard blow and the impact jars or shakes the brain inside the skull. The rapid movement interrupts the brain's normal activities. Although there may be cuts or bruises on the head or face, there may be no other signs of a brain injury.

Symptoms of a concussion usually include any of the following changes in the person's level of consciousness, such as:

- Brief loss of consciousness.
- Inability to remember what happened immediately before and after the injury (amnesia).
- Confusion.
- Asking the same question over and over.
- Dizziness, vertigo, lightheadedness, or unsteadiness that prevents standing or walking.
- Blurred or double vision.
- Ringing in the ears (tinnitus).
- In a small child, increased fussiness or lack of energy.

Symptoms of concussion can be mild to severe, depending on the severity of the injury. If the injury is more serious, symptoms will usually develop within the first 24 hours after the accident. Symptoms may last for days, weeks, or even months following the injury.

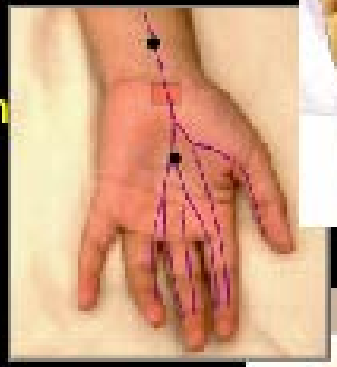
# Sensory Nerve Conduction Studies

EMG on CD Series: Volume III

Author: Sanjeev D. Nandedkar, Ph.D.

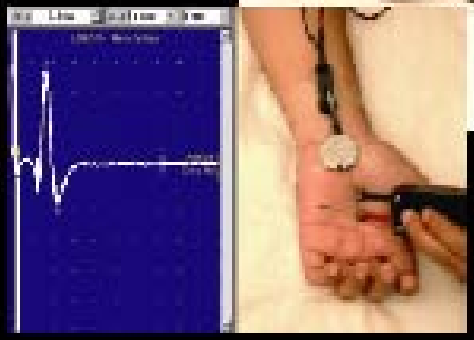
Parts I - IV

*Editor: Sanjeev D. Nandedkar, Ph.D.*



**I. Tutorial**
**II. Nerves of Hand and Forearm**
**III. CTS Testing**
**IV. Nerves of Leg and Foot**

*Recording Techniques (Videos)*
*Reference Values*
*Clinical Utility*
*Quiz*
*Ready to print Book*

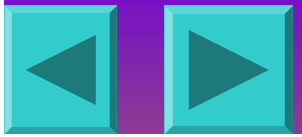


## Types of head injuries

Serious head injuries may involve injuries to the brain. Head injuries are classified as either open or closed.

Open head injuries involve a fracture or penetration of the bones of the skull, which can injure the brain and allow dirt or bacteria to come in contact with the brain. Open head injuries are emergencies and require immediate medical care.

Closed head injuries do not penetrate the bones of the skull. Closed head injuries occur when the head sustains a hard blow and the impact jars or shakes the brain within the skull. The rapid movement of the brain within the skull can cause bruising, swelling, or tearing of the brain tissue. It also can stretch, pull apart, or tear nerves or blood vessels, causing bleeding within or around the brain. If the skull has been fractured, the bones do not move (called a nondisplaced fracture). Closed head injuries can be more difficult to identify because there may not be visible signs of injury, such as bleeding or deformity.



Both open and closed head injuries may result in:

A concussion.

A brain bruise (contusion). If the injury was caused by a strong force, a brain contusion or bleeding within or around the brain may occur.

Bleeding within or around the brain, which can be a life-threatening injury. Initial symptoms of this type of injury may be the same as those of a concussion. More serious symptoms usually develop within 24 hours after the injury. In rare cases, if the bleeding is slow, symptoms will take longer to develop.

Dx Testing:

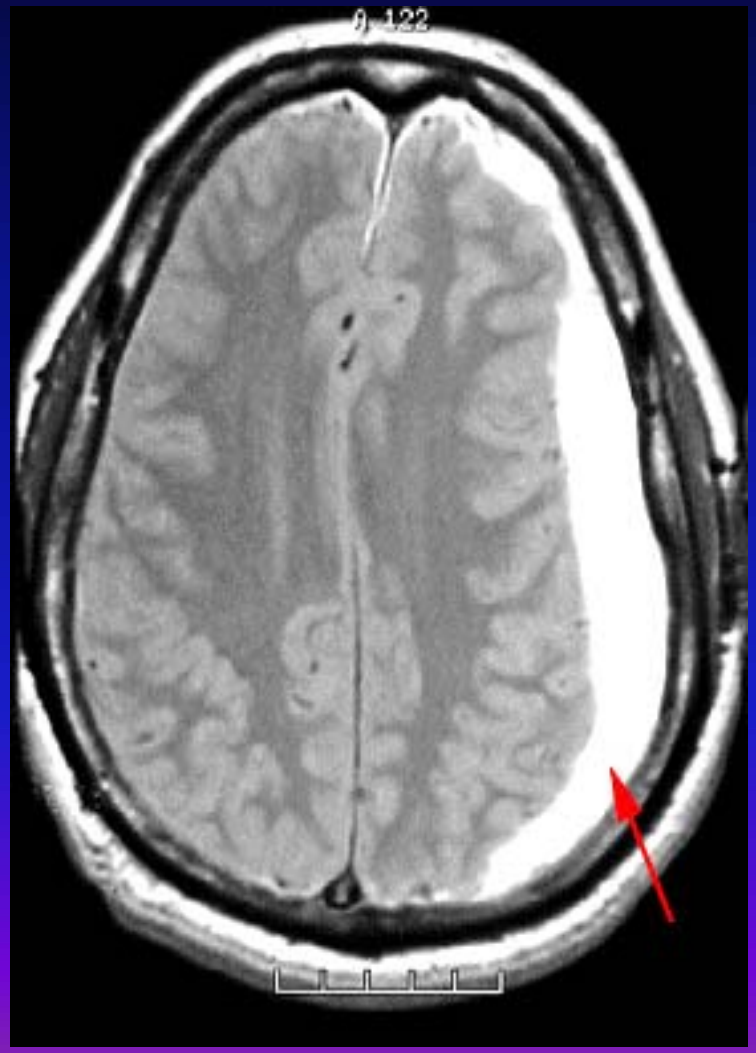
Skull X-Ray to R/O Fracture

CT or MRI to R/O Subdural Hematoma

If Positive – Craniotomy (Surgery) to Evacuate Hematoma

# Brainstem Auditory Evoked Response (BAER)

# Subdural Hematoma on MRI



# Indisputable Signs of Traumatic Injuries

- Fracture on X-Ray, MRI or CT scan
- Dislocation on X-Ray, MRI or CT scan
- Abnormal Reflexes
  Hyporeflexia
  Hypereflexia
  Positive Babinsky
- Muscular Atrophy
- Severe Swelling and Ecchymosis (Bruising)
- Severe Lacerations

If none of the above are present, it is a soft-tissue injury

# P M & R Opinion on EMG/NCV/SSEP

According to the recommendations published by **Physical Medicine and Rehabilitation Clinics of North America May 1998,** "the strict indications for neurodiagnostic studies ordered in patients with less than 8 weeks of treatment **were fever, chills, weight loss, tumor, infection, high energy trauma, cauda equina syndrome, severe motor deficit, long tract signs, or progressive neurologic loss**."