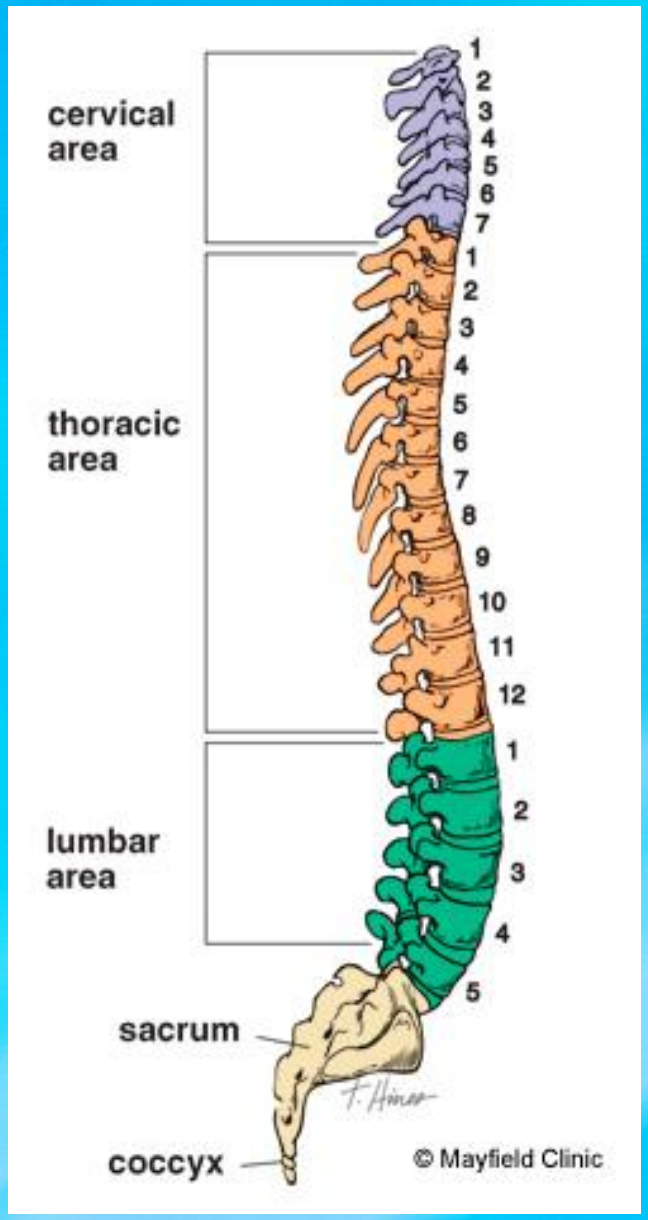

The Spine

Boney Anatomy

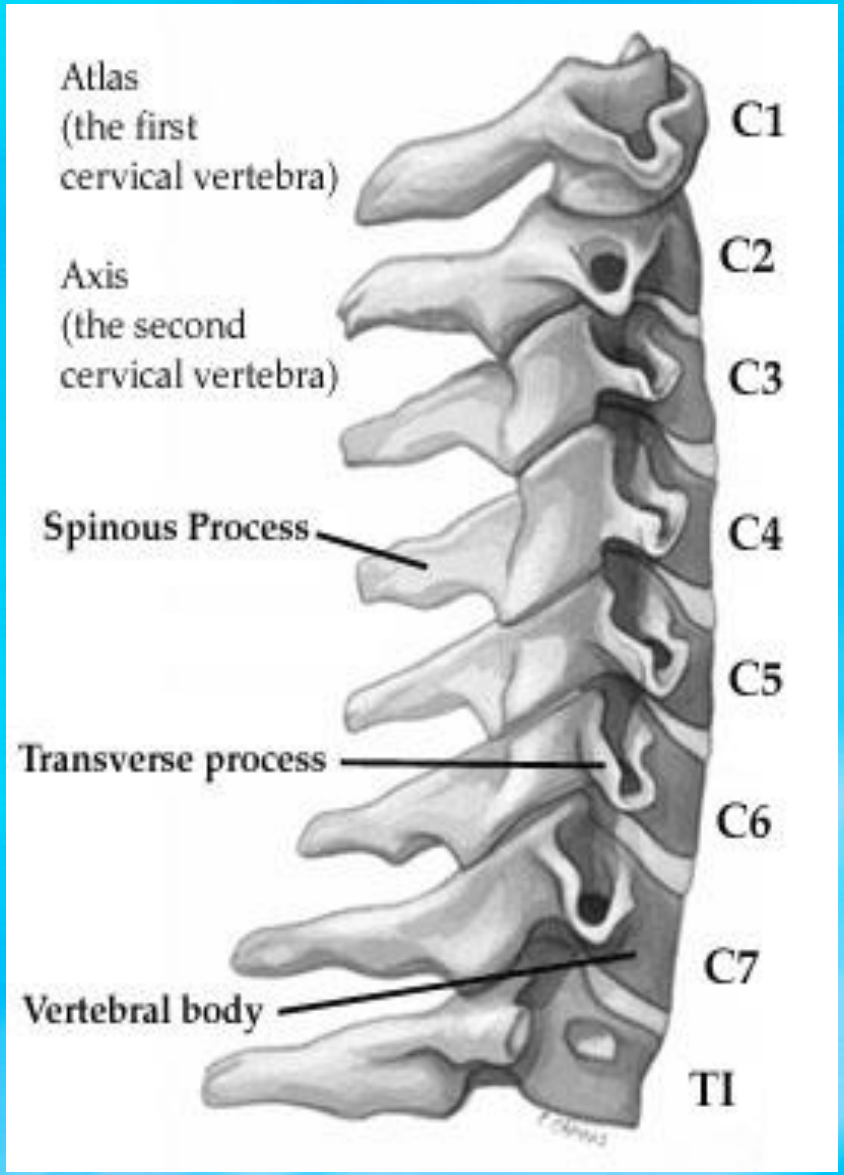
- **<u>Bones</u>**
- **33 *vertebrae* from vertebral column**
  - **7 cervical-** atlas(1) and axis(2),small
  - **12 thoracic-** 1-10 have rib attachment
  - **5 lumbar-** larger
  - **5 sacral-** fused
  - **Coccyx-** 4 fused



Importance of Spine

- Stability
- Protects Spinal Cord
- Protects Nerves
- Allows Movement

- Cervical Spine
  - 7 Vertebrae



Cervical Spine

- Top 7 Vertebrae
- C1-ATLAS Designed like a ring
- Holds the Head

- C2-AXIS Designed for maximum ROM

- C7-”Bump” at the base of neck

Cervical Spine

- Very Mobile

- Most mobile part of the spine

- Flexion
- Extension
- Lateral Flexion
- Rotation

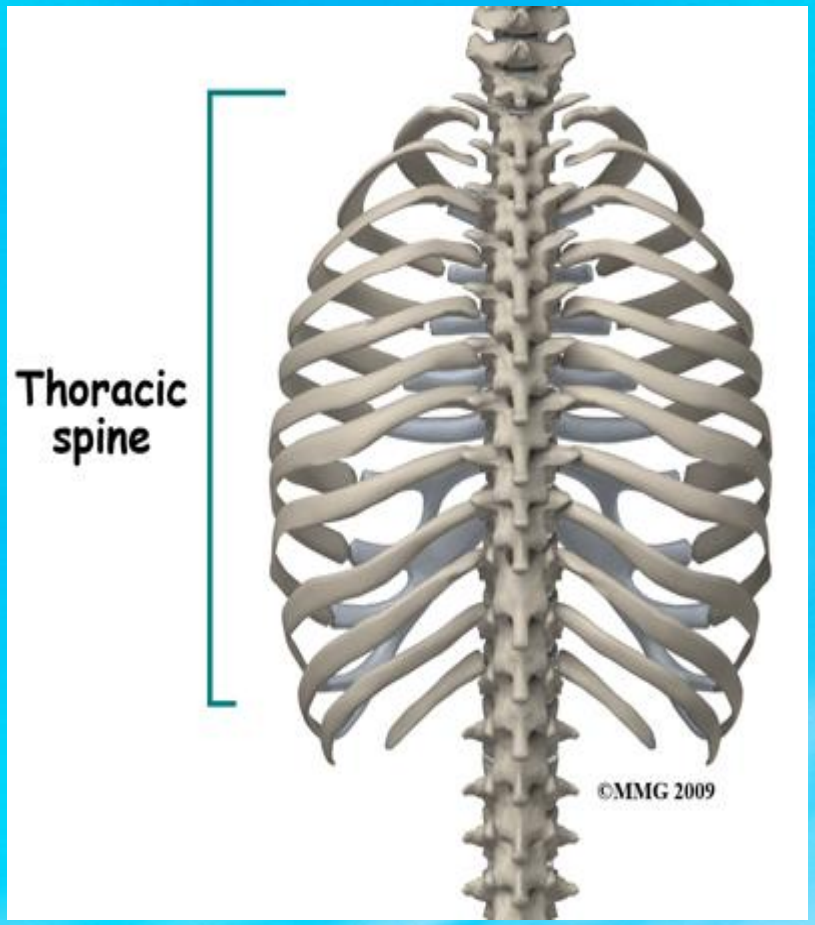
Cervical Spine

- Why is there a “C” shape in the neck?
- Makes for the strongest structure designed to hold weight of head
- Like castles doorways
- Like a bridge support

Thoracic Spine

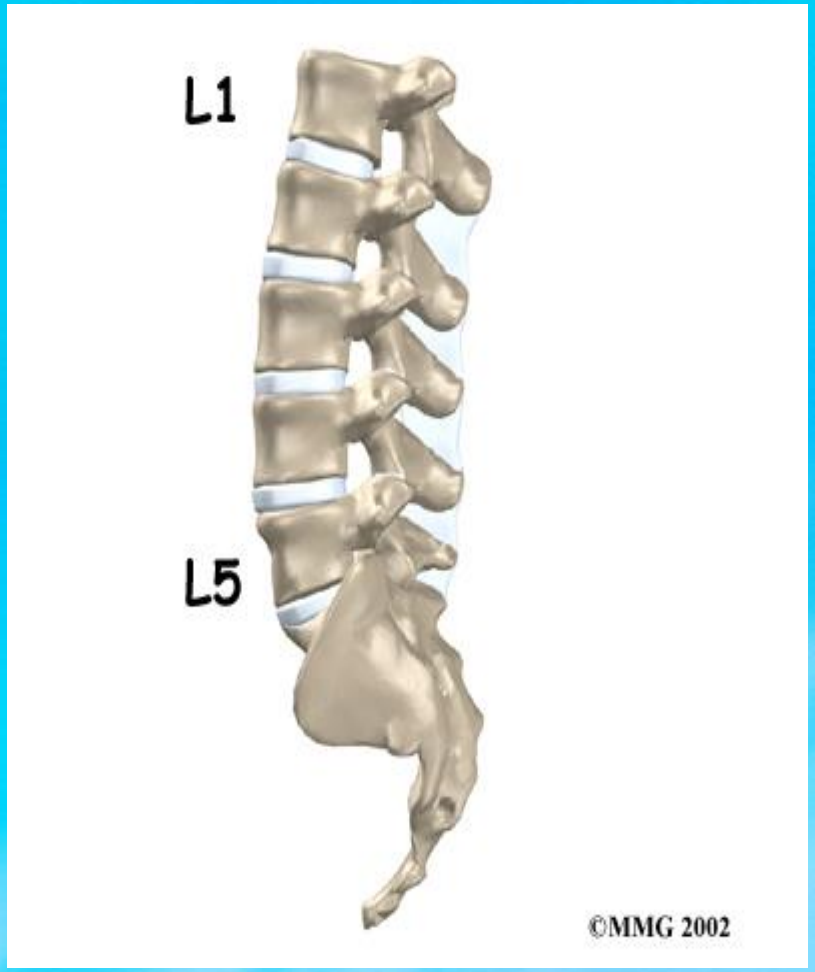
- 12 Vertebrae
- Ribs are attached
- Very little mobility between vertebrae.
- Try to move thoracic spine without moving neck or low back

  You can't
- Do ribs move?
  - They expand when breathing
- Why "C' Shape?

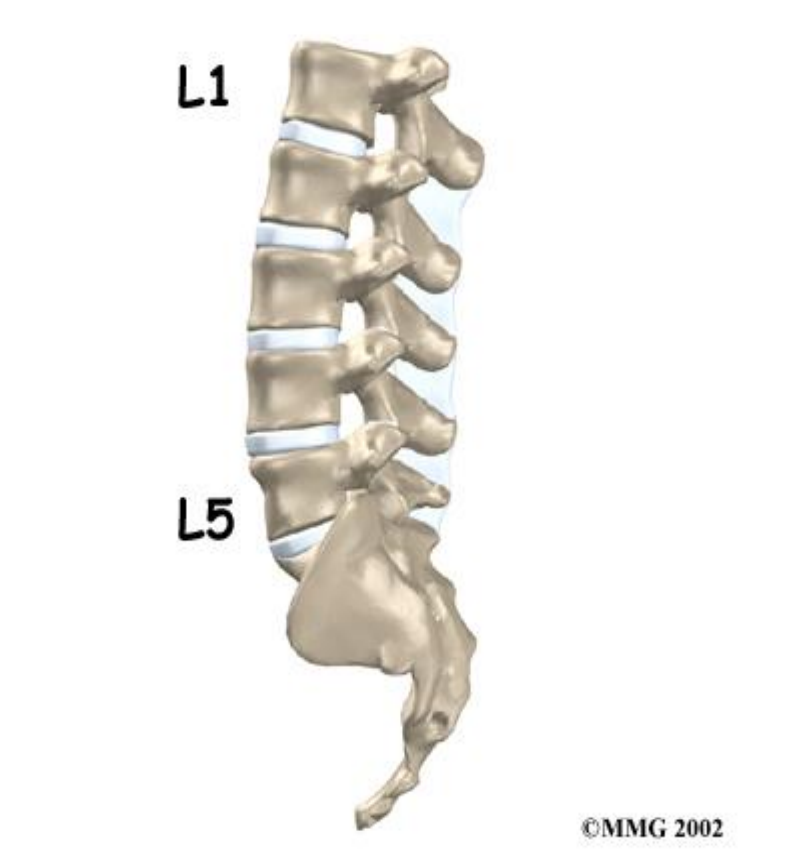


Lumbar Spine

- 5 Lumbar Vertebrae
- Why “C” Shape?
- Largest Vertebrae
- Why the largest?
- Very Mobile



- Lumbar spine problems usually caused by
- Repetitive movements
- Heavy Loads
- Weak Core



Spine

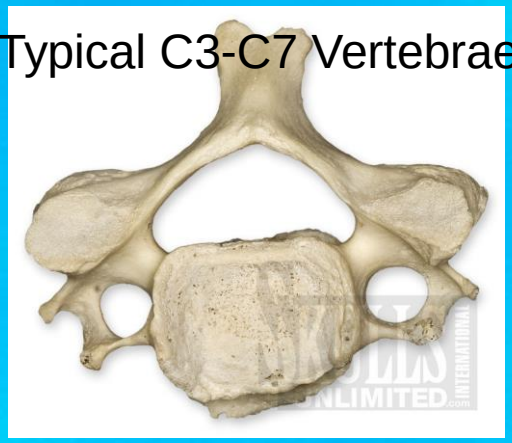
- Most spinal problems overall are caused by muscle imbalance
- Usually too tight or too loose
- Tight muscles need to be stretched
- Loose muscles need to be strengthened
- Need to develop core strength and keep flexibility of core

Boney Anatomy of the Spine

C1- ATLAS

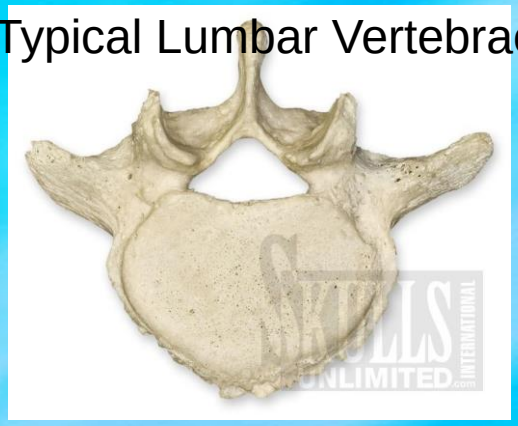
C2- AXIS

Typical C3-C7 Vertebrae

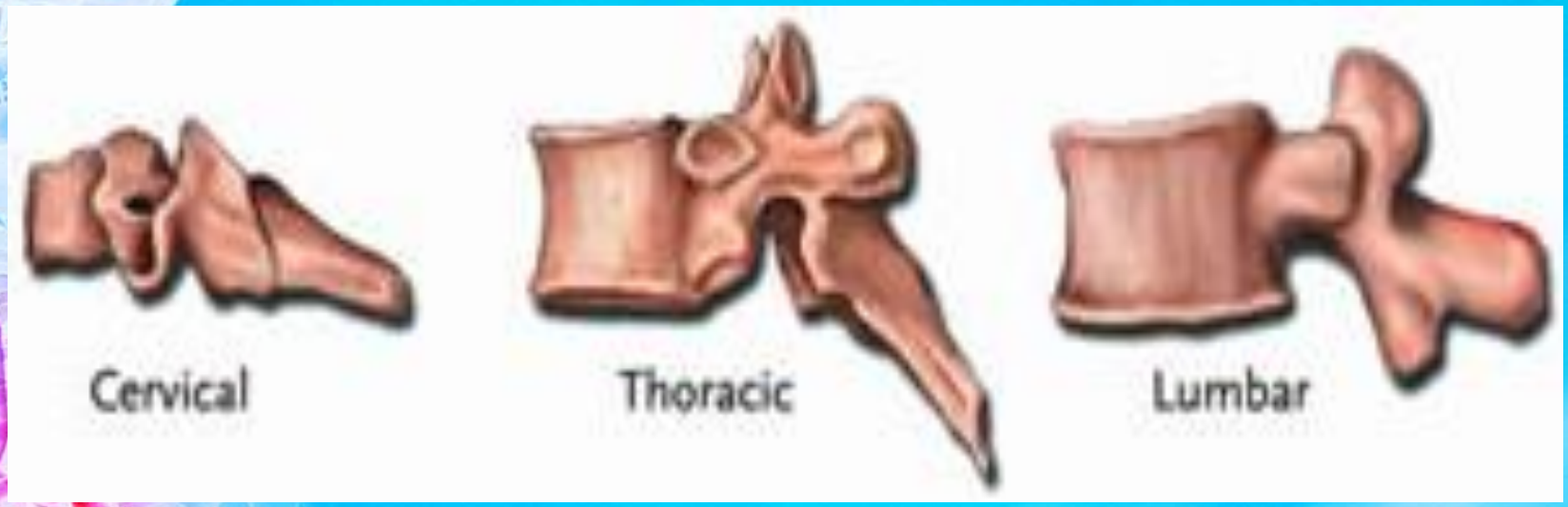


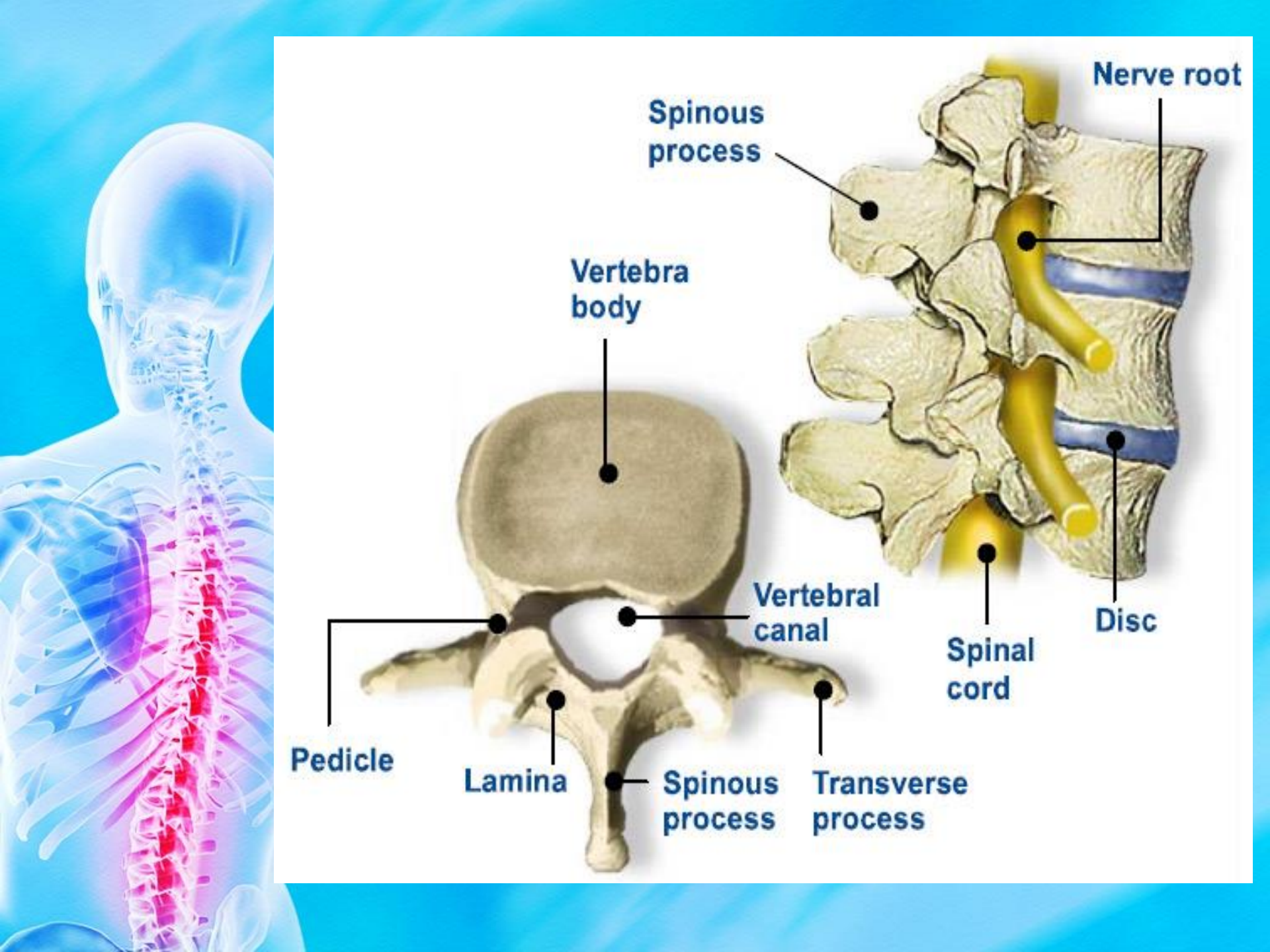
Typical Thoracic Vertebrae

Typical Lumbar Vertebrae



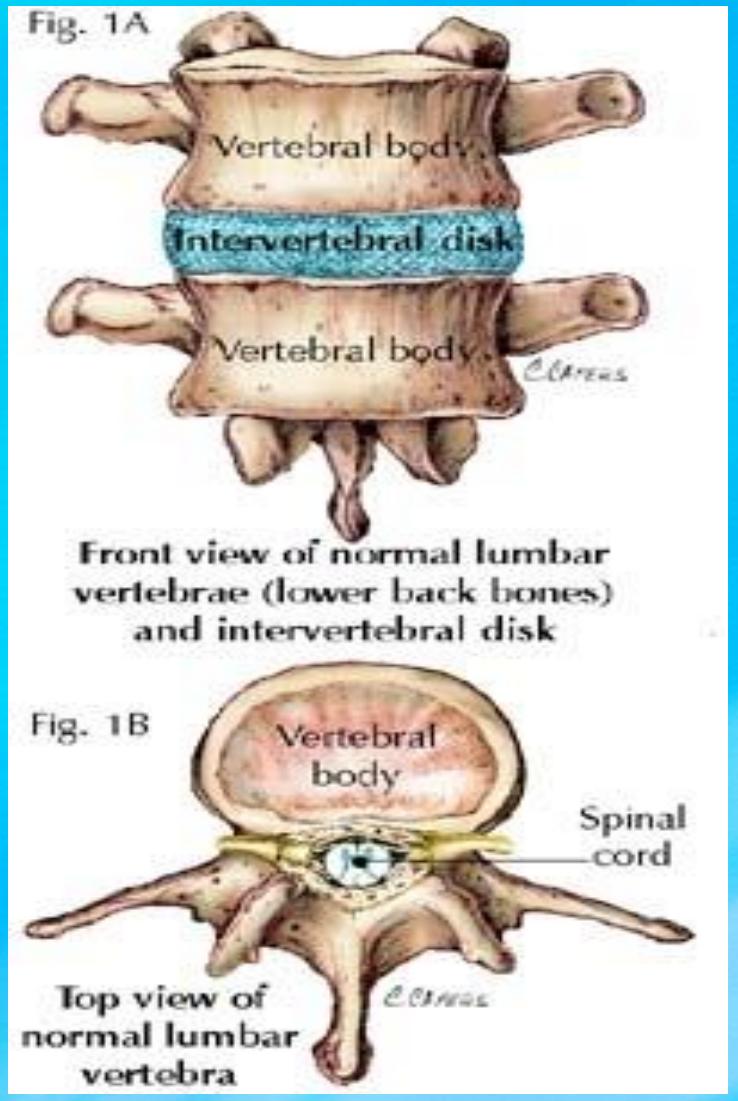
Types of Vertebrae



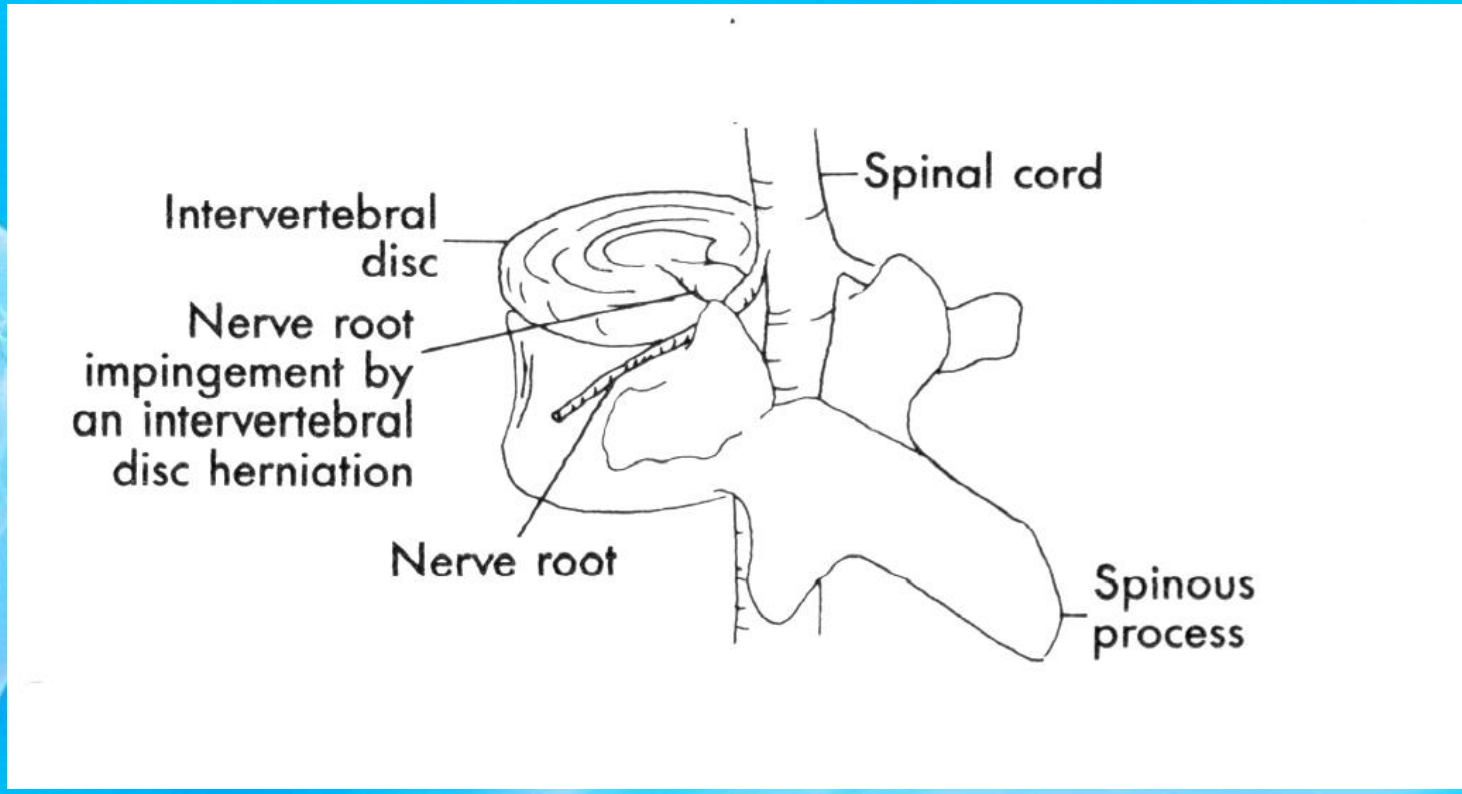

Nerve root
Spinous process
Vertebra body
Vertebral canal
Disc
Spinal cord
Pedicle
Lamina
Spinous process
Transverse process

Numerous muscles and ligaments

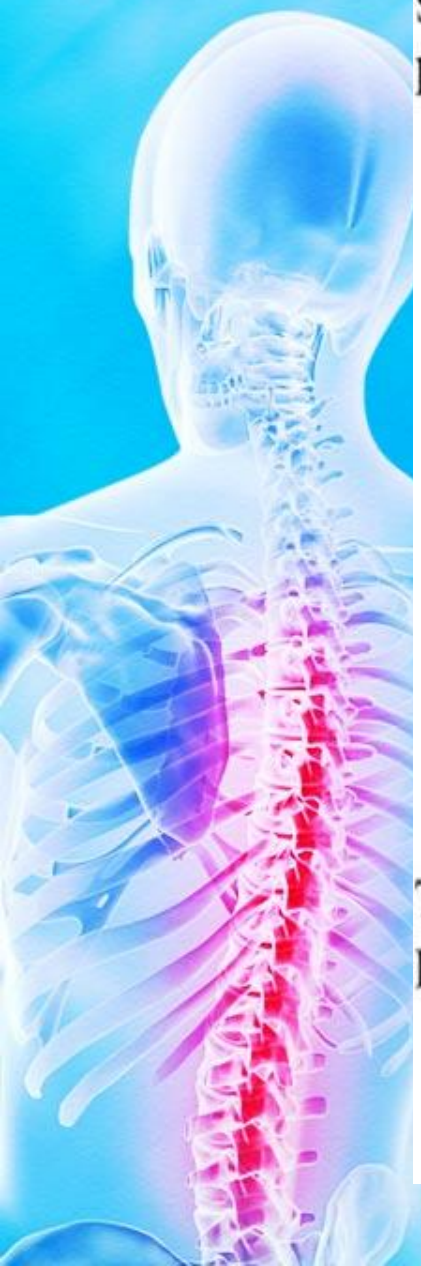
Spinal cord runs directly through middle of each vertebrae

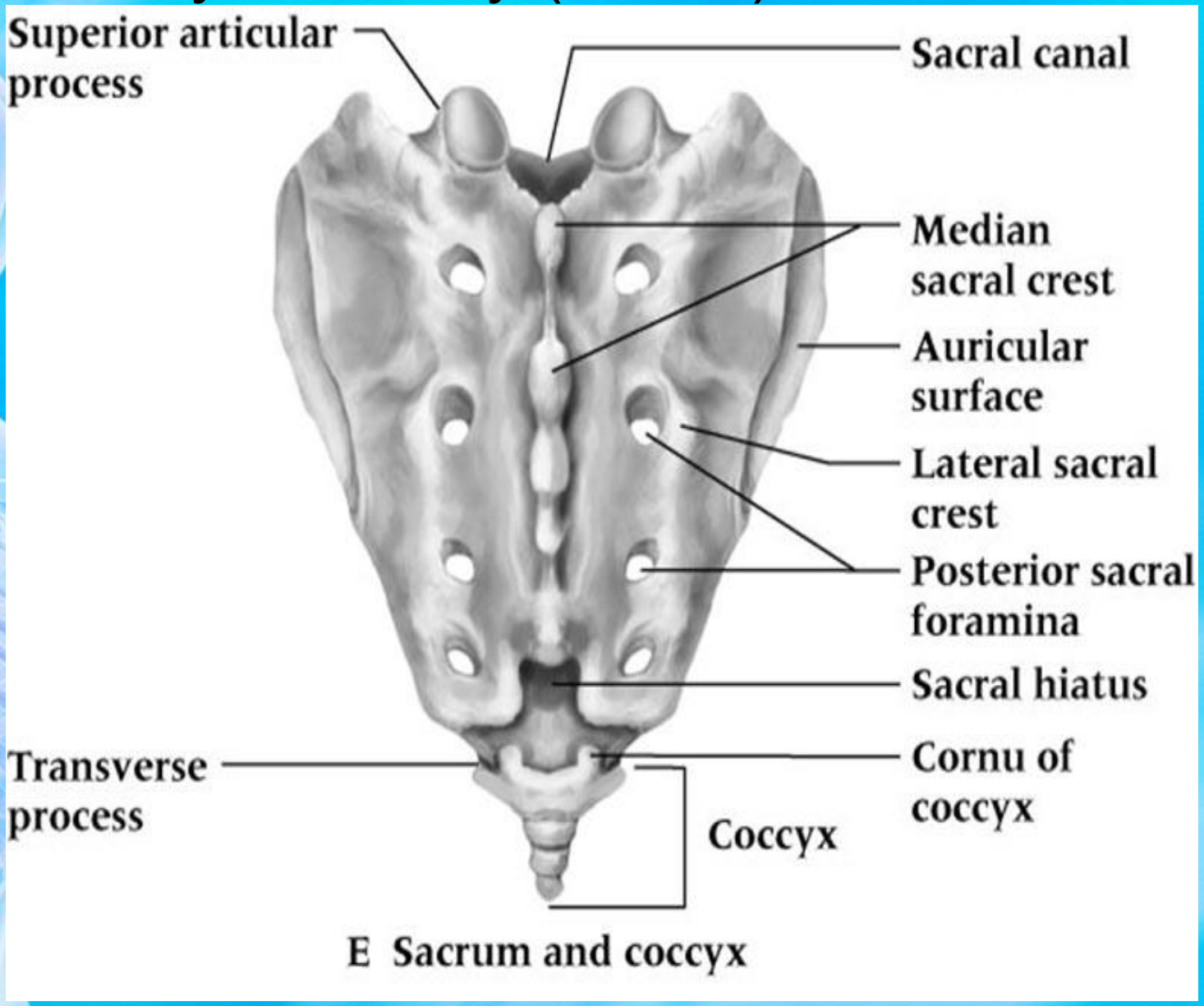


Roots of nerves come out of each vertebrae



Boney Anatomy (cont'd)





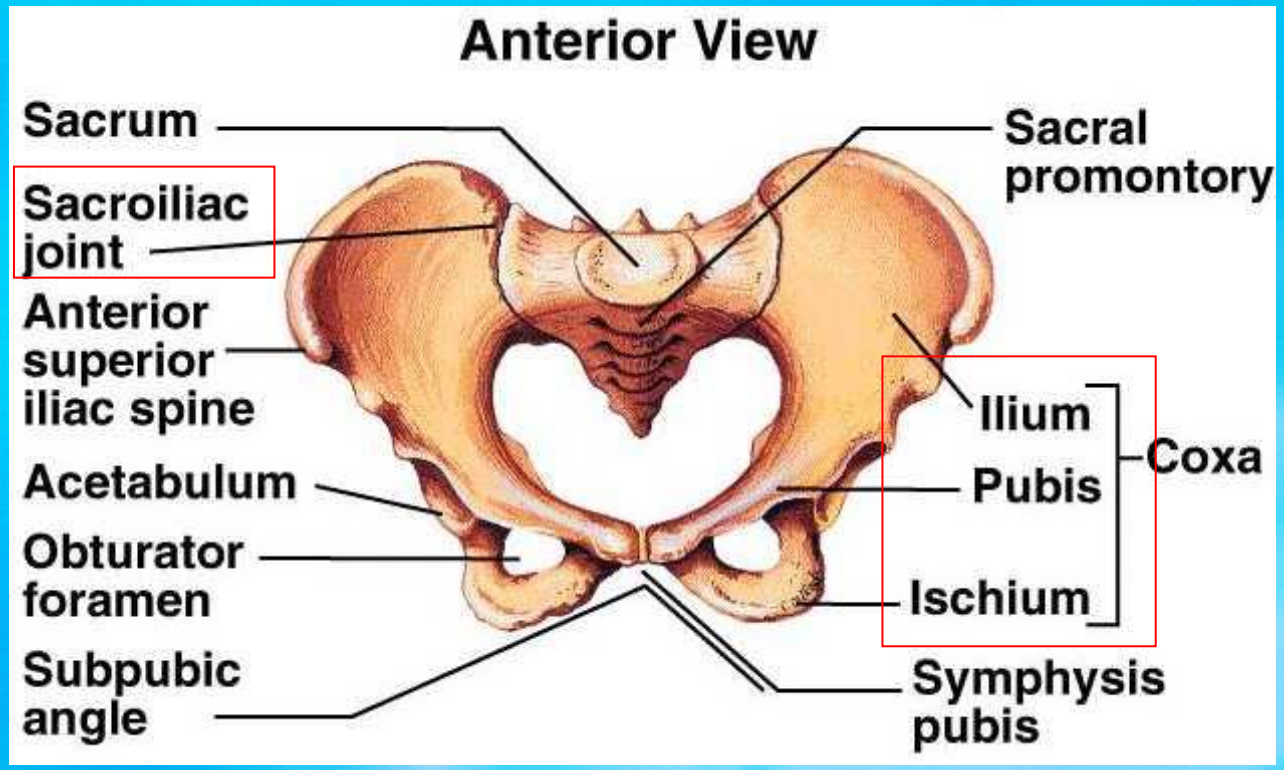
E Sacrum and coccyx

Sacral spine/Pelvis Anatomy

- **Applied Anatomy**
  - Pelvic girdle: structural base of support
  - Formed by ilium, ischium, pubis
  - Acetabulum accepts femoral head
  - The SI jt is formed by the sacrum and the iliac
  - Coccyx: 4 fused bones- muscle attachment

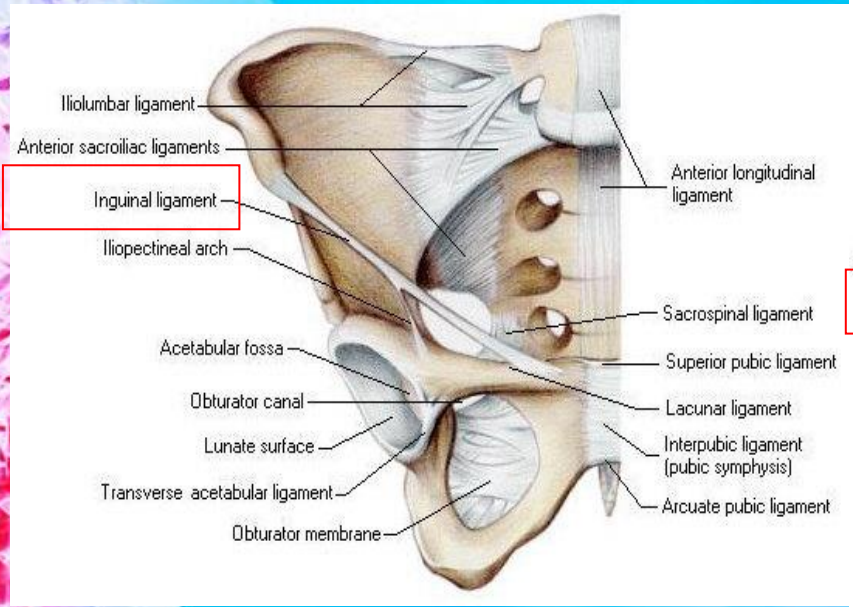
Boney Anatomy of the Pelvic Girdle and SI Joint

- Bones

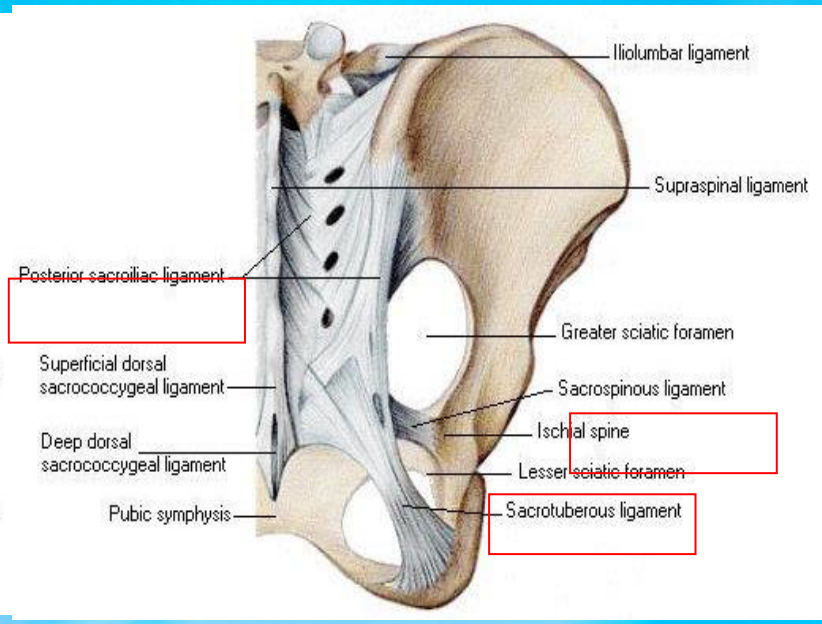


Sacroiliac (SI) Joint

- **Ligaments** (*extremely strong*!)
  - Anterior, posterior, & interosseous
  - Sacrotuberous lig.
  - Sacrospinous ligs.



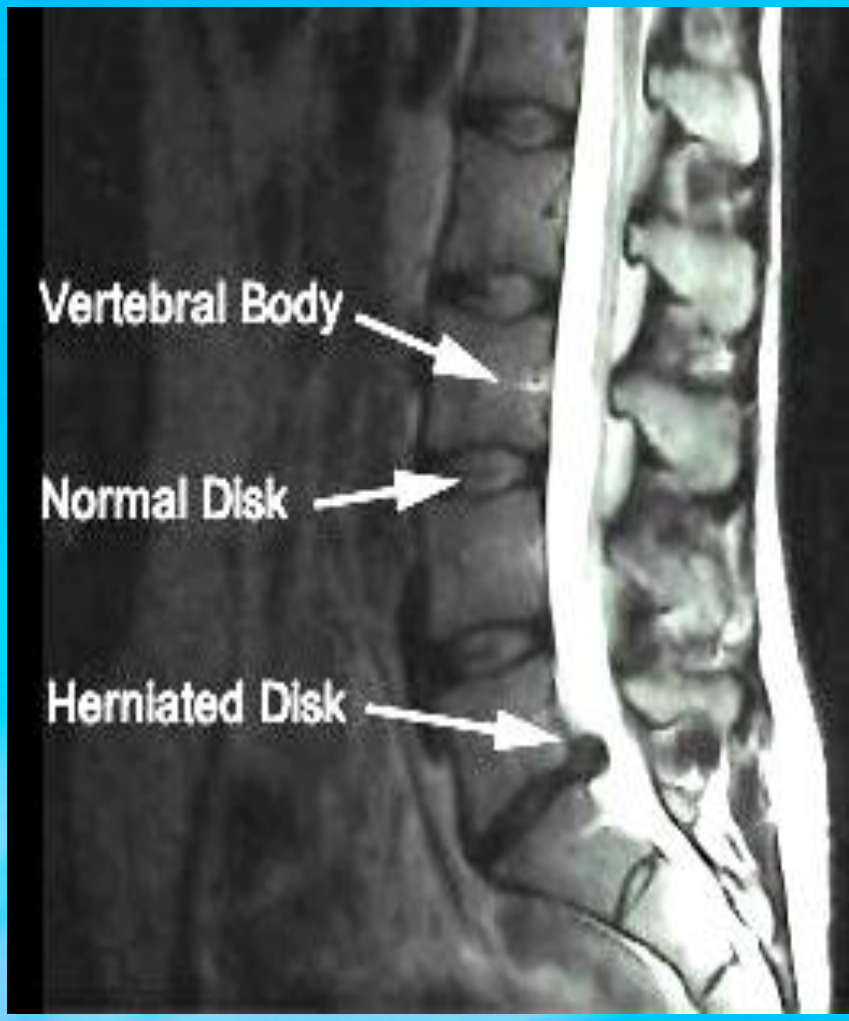
ANTERIOR VIEW



POSTERIOR VIEW

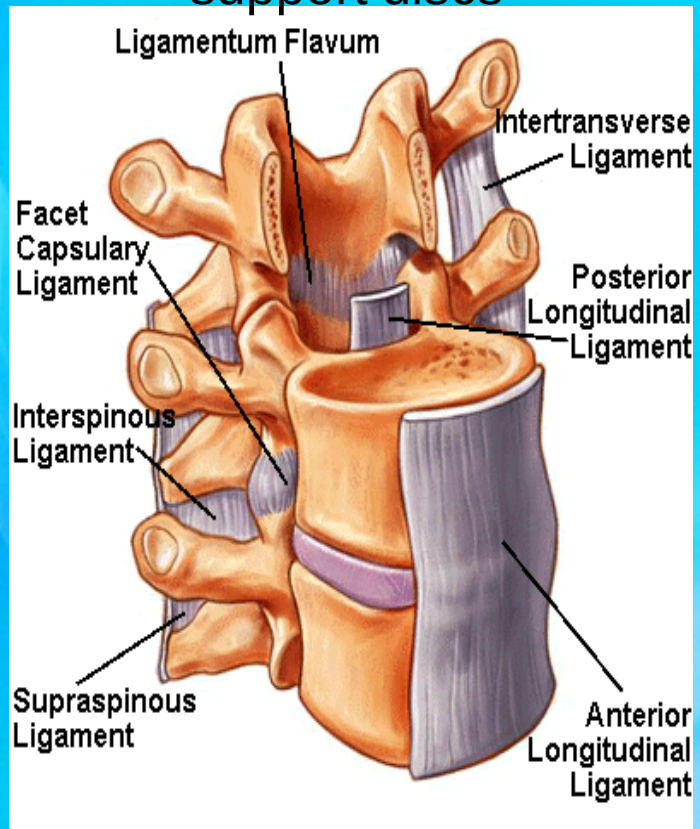
Good Spine Health

- Stretching in AM
- Eat Right
- Calcium!!
- Prevent Osteoporosis
- Work Out
- Increases Bone Density



Ligamentous Anatomy

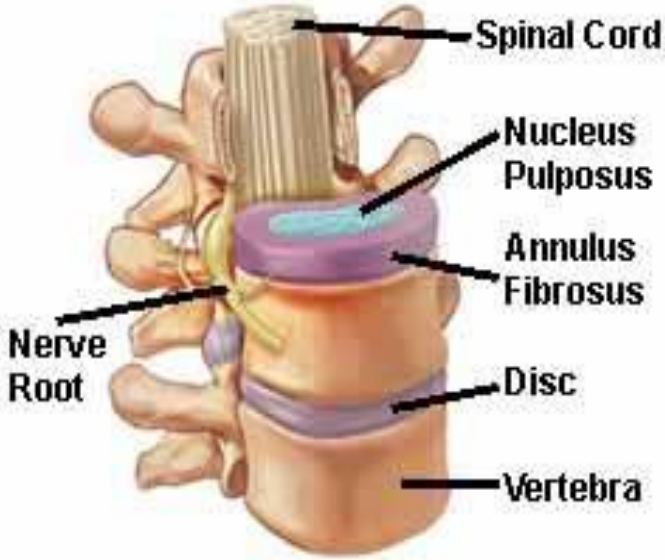
- **Ligaments**
  - Connect bodies of vertebrae and help support discs



- Anterior and Posterior Longitudinal
- Ligamentum Flavum
- Interspinous Ligaments
- Supraspinous Ligaments
- Intertransverse Ligaments

Intervertebral Disc Anatomy

- **Discs**
  - Annulus Fibrosus
    - Dense, strong network of fibers
    - Thicker Ant. Than Post.
  - Nucleus Pulposus
    - 60-80% water
    - Gel like substance in center of disc
    - Dehydrate through day and re-hydrate at night
    - Dehydrate with age – we get shorter!
    - Act as shock absorber and allows movement between segments
    - “Cushion” between bodies of each vertebrae

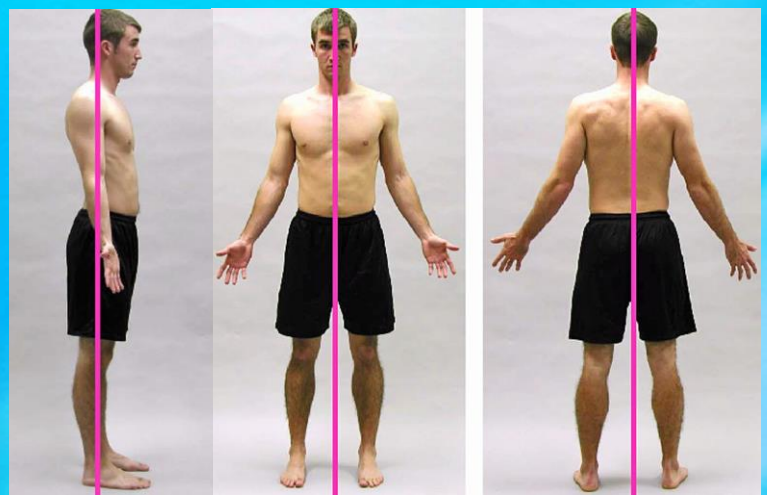


Spinal Evaluation and Assessment

- **<u>History</u>**
  - **Mechanism?**
    - Flex.? Ext.? Landing? Hit someone or someone hit you?
  - **Previous injury?**
    - Car wrecks? Back Problems? Training Regimen?
  - **Unusual sensations?**
    - *pain description*: tingling, burning, numbness?;
    - *pain patterns*- localized in neck, down arm, into buttocks or feet?
    - Loss of strength?
    - Trouble sitting, standing, sleeping?

Spinal Evaluation and Assessment

- **<u>Inspection /Observation</u>**
  - **Posture?- observed from all views**
    - Leaning to side? Head? Scoliosis?
  - **Differences between anatomical landmarks?**
    - Spinous Processes? Level of PSIS/ASIS? Shoulder Ht.? Iliac crests?
  - **Musculature?**
    - Check **<u>BILATERALLY</u>!**



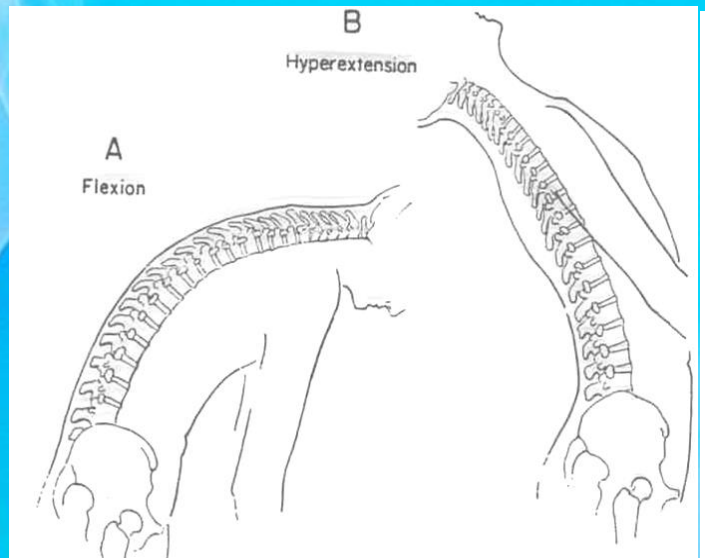
Spinal Curvatures

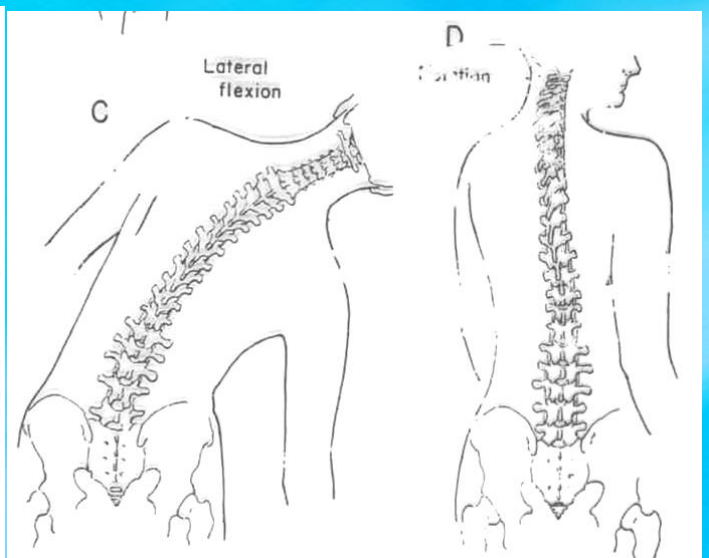
Spinal Evaluation and Assessment

- **<u>Palpation</u>**
  - **Spinous Processes?**
    - Step-off deformity, pain
  - **Transverse Processes-cervical?**
  - **ASIS? PSIS? Iliac Crest?**
  - **Musculature?**
    - spasm

Spinal Evaluation and Assessment

- **<u>Special Tests / Functional Tests</u>**
- **ROM (4)**
  - Flexion, Extension, Rotation, Lateral Bending (L and R)
  - Active, Passive, Resisted
  - Manual Muscle Testing





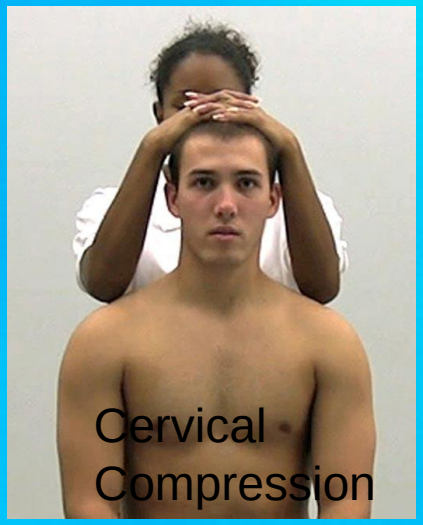
Spinal Evaluation and Assessment

- **<u>Special Tests / Functional Tests</u>**
- **Neurological**
  - Cervical Myotomes- upper extremity
    - **C1-C2 – nodding**
    - **C3 – ear to shoulder**
    - **C4 – shoulder shrugs**
    - **C5 – arm abduction**
    - **C6 – elbow flexion, wrist extension**
    - **C7 – elbow extension, wrist flexion**
    - **C8 – thumb extension, ulnar deviation**
    - **T1 – finger abduction, adduction**

Spinal Evaluation and Assessment

- **Neurological** (cont'd.)
  - Resisted Myotomes- Lower Extremity
    - **L1-2 = hip flexion**
    - **L3 = knee extension**
    - **L4 = ankle dorsiflexion**
    - **L5 = big toe extension**
    - **S1 = ankle plantar flexion or standing toe raise**
    - **S2 = knee flexion**

Spinal Evaluation and Assessment



- **<u>Specific Special Tests</u>**
  - **Cervical Spine**
    - Brachial plexus traction test – plexus trauma
    - Shoulder abduction test – disc or NR trauma
    - Cervical distraction test – facet jt, NR trauma
    - Spurling's or Cervical compression test – NR trauma
    - Vertebral artery test – occluded artery from concussion

Spinal Evaluation and Assessment

- **<u>Specific Special Tests</u>** (cont'd.)
  - **Disc Injury**
    - Valsalva test
    - Milgram test
    - Kernig's test
    - Straight leg raise (SLR)
    - Well SLR
    - Slump test
    - Femoral N. stretch test
    - Brudzinski's test
    - Bowstring (Cram) test

Slump

Spinal Evaluation and Assessment

- **<u>Specific Special Tests</u>** (cont'd.)
  - **Facet Joint Injury**
    - Spring test
    - Quadrant test (Kemps)

Spring

  - **Spondylolysis / Spondylolysthesis**
    - Single leg stance test
    - Stork Standing

Stork

Spinal Evaluation and Assessment

- **<u>More Specific Special Tests</u>**
  - **SI Joint Injury**
    - SI compression/distraction test
    - FABER test
    - Gaenslen's test
    - Long sit test
    - Trendelenburg
    - Thomas Test
  - **Malingering**
    - Hoover test

FABER

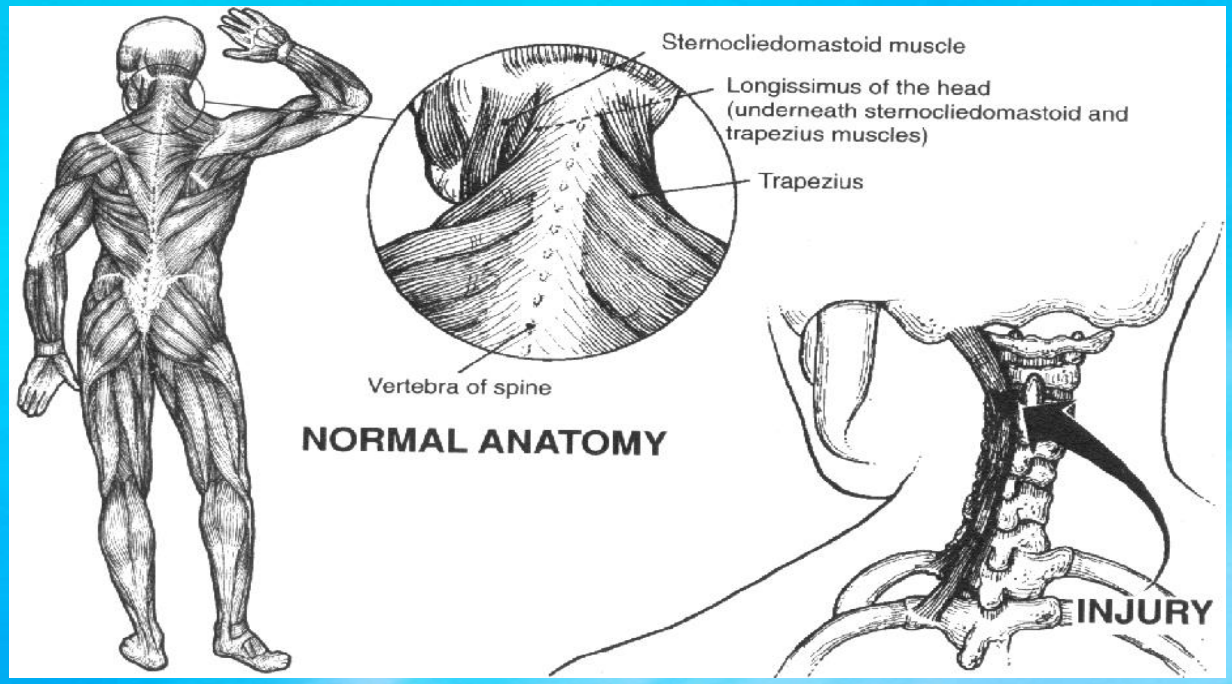
Prevention of Neck Injuries:

Strengthening program

- Increase flexibility
- Teach proper technique
- Athlete has to have a state of readiness when playing

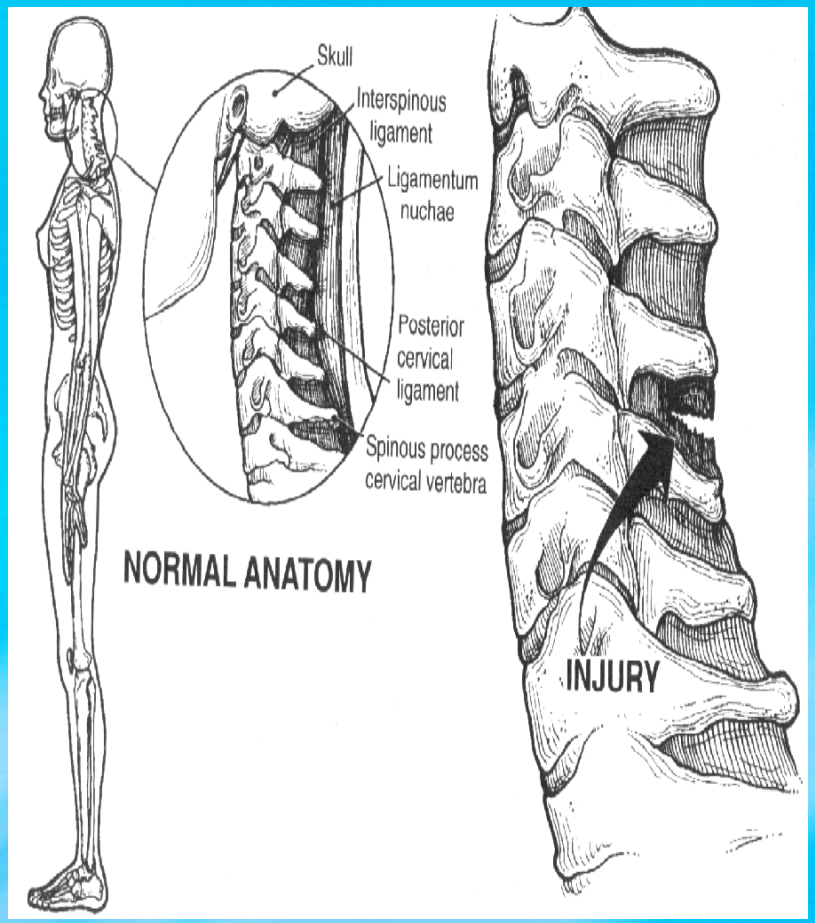
Injuries to Neck

- Strain: muscle injury due to heads sudden forced flexion, extension, or rotation
  a)Signs/Symptoms: localized pain, point tenderness, restricted motion, muscle guarding from pain is common



Sprain: A cervical sprain can occur from the same mechanism as a strain but usually results from a more violent motion. Head snaps suddenly while unprepared. Frequently muscle strains occur with ligament sprains

a) Sprain displays all the signs of a strained neck, but the symptoms persist longer



Fracture: Usually caused by axial loading of the cervical vertebrae from a force to the top of the head combined with flexion of the neck. Must be aware of non-displacement fractures

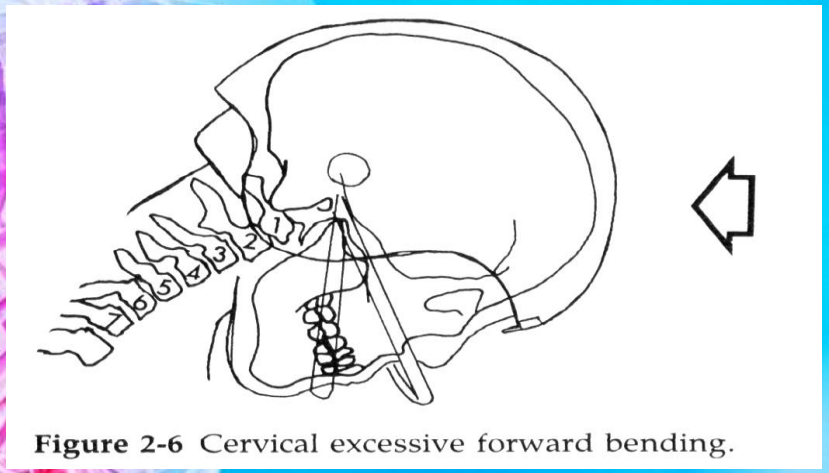
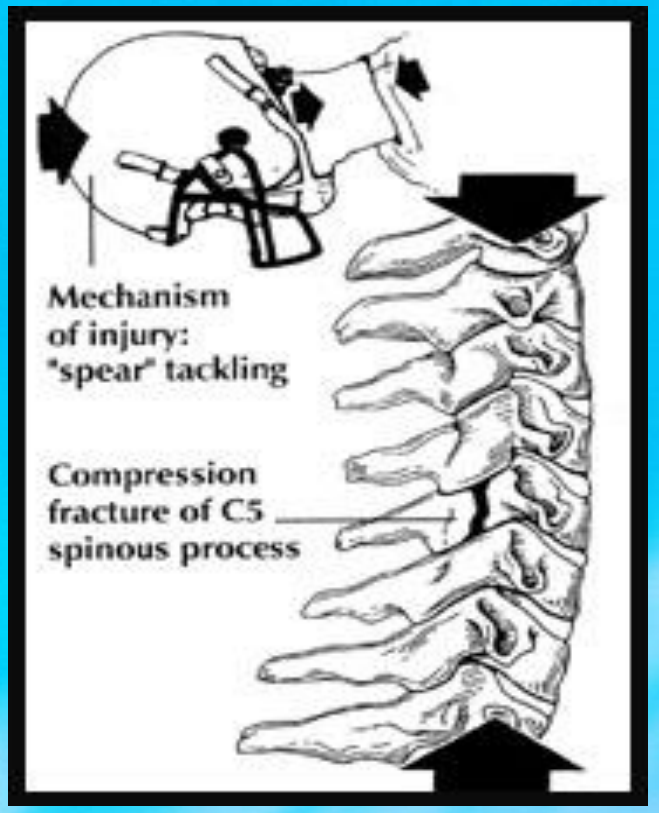


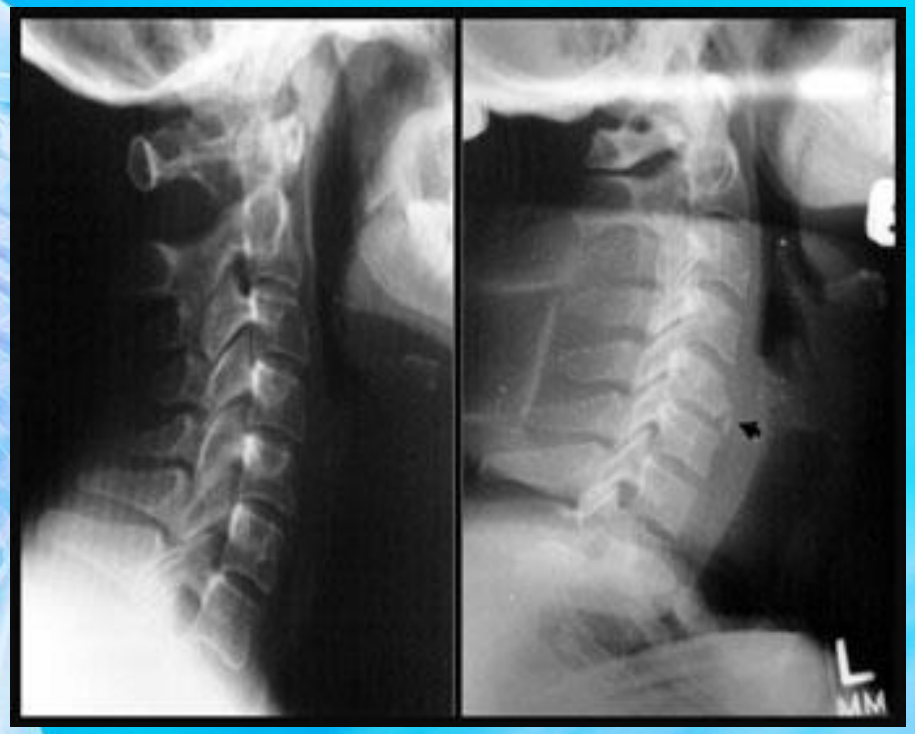
Figure 2-6 Cervical excessive forward bending.



D. Signs/Symptoms of a fracture:

- Neck point tenderness and restricted movement
- Cervical muscle spasm
- Cervical pain and pain in the chest and extremities
- Numbness in trunk or limbs
- Weakness or paralysis in limbs or trunk
- Loss of bladder or bowel control

Management: see handout

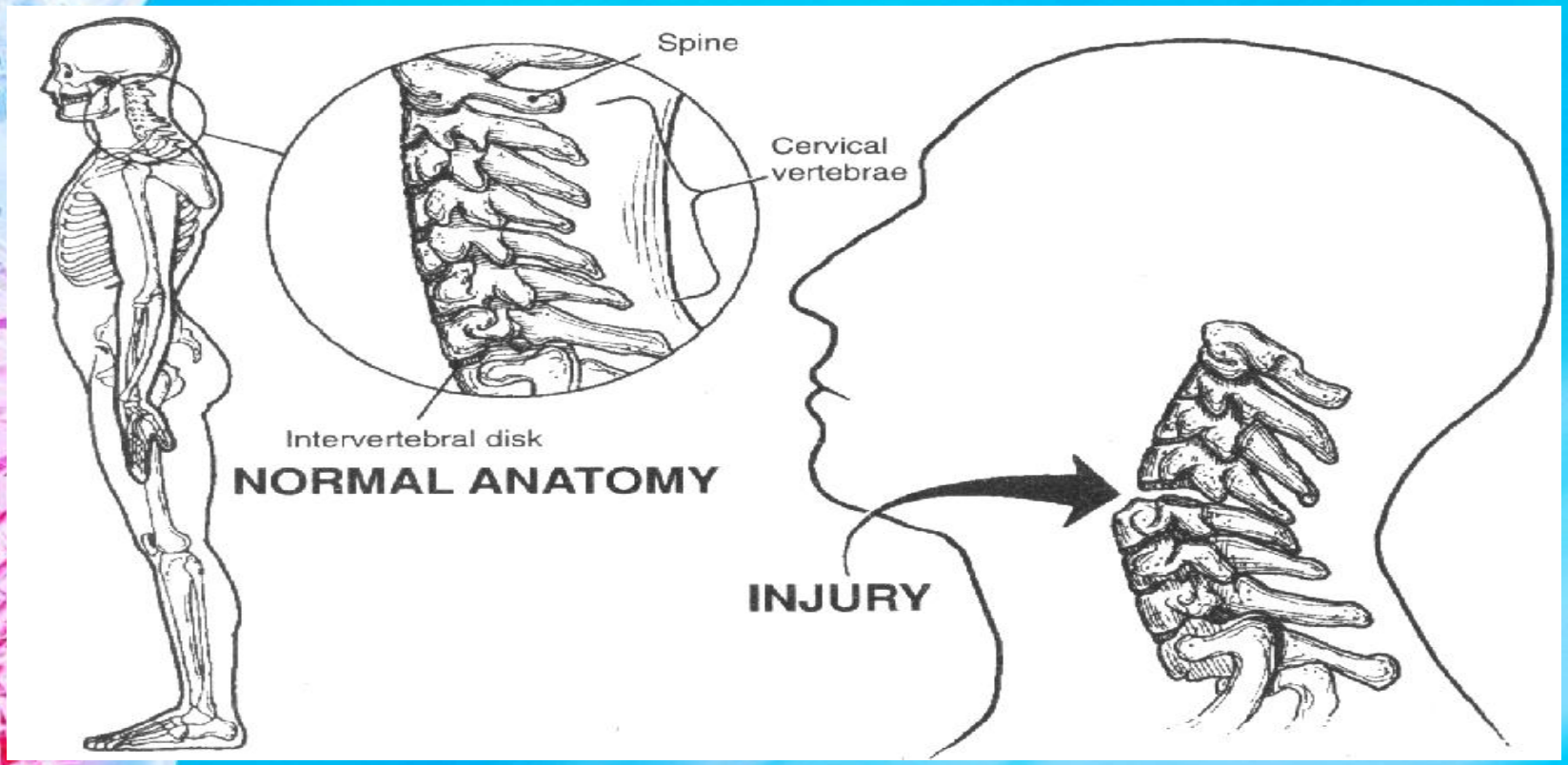


Fractures/Dislocations

- Mechanism:
  - Generally an axial load w/ some degree of flexion
- S/S:
  - Neck point tenderness, restricted motion, cervical muscle spasm, pain, numbness/weakness in the trunk and or limbs
- Management:
  - **First and foremost- rule out a cervical fracture!**
  - Splint/spine board and refer-get X-rays.
  - If you cannot rule out a fracture, do NOT do ROM other special tests.

Cervical Dislocations: occur more frequently in sports than cervical fractures. Result from axial loading or violent flexion and rotation of the head.

a) Signs/Symptoms: Same as a fracture, greater likelihood of causing injury to the spinal cord



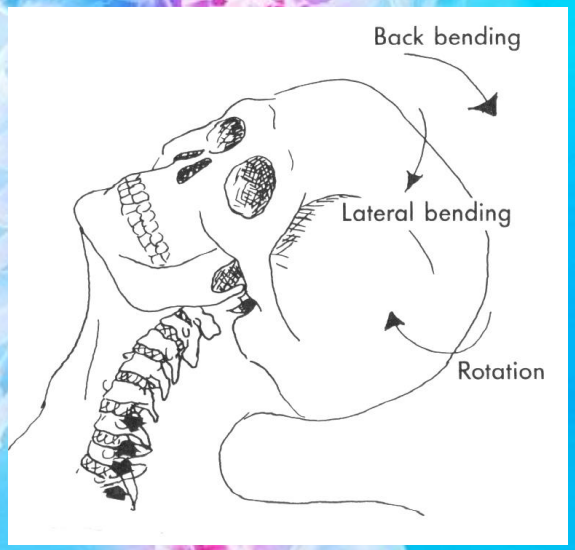
Spinal Cord Shock:

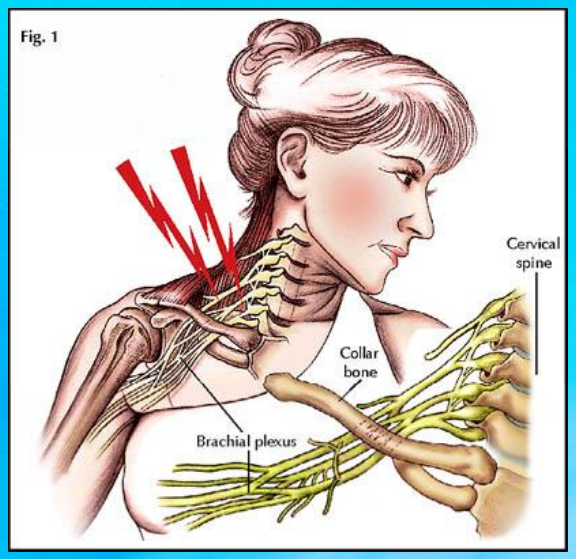
A mild contusion of the spinal cord. athlete has all the signs of a spinal cord injury but after a short while all these signs leave, athlete is able to move freely and has no other symptoms other than a sore neck.

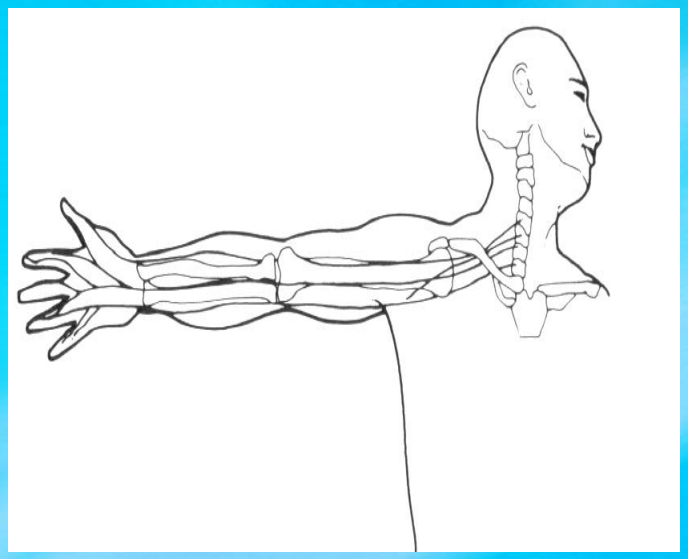
Cervical Nerve Stretch Syndrome (**Stinger/Burner**): Injury to the brachial plexus due to stretching or compression

a) Signs/Symptoms: burning sensation, numbness and tingling, and pain extending from the shoulder down to the hand, with some loss of function of the arm and hand that lasts for several minutes

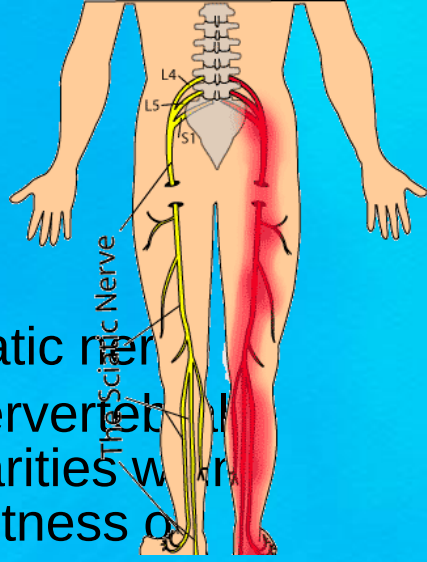
b) Return to play: may return when asymptomatic, repeated stingers may result in permanent damage







- **Contusions**
  - Mechanism:
    - Significant impact or direct blow to the back
  - S/S:
    - Pain, swelling, muscle spasm and pt tenderness
  - Management:
    - RICE, ice massage combined with gradual stretching, Ultrasound is effective for deep muscle



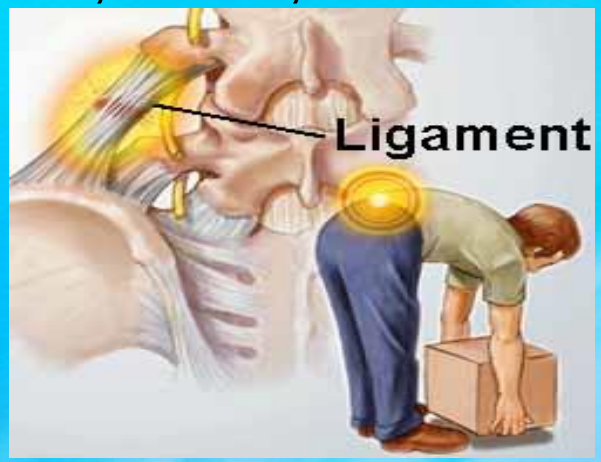
- **Sciatica**
  - Mechanism:
    - Inflammatory condition of the sciatic nerve
    - Nerve root compression from intervertebral disk protrusion, structural irregularities within the intervertebral foramina or tightness of the piriformis muscle
  - S/S:
    - Arises abruptly or gradually; produces sharp shooting pain, tingling and numbness
    - Sensitive to palpation while straight leg raises intensify the pain
  - Management:
    - Rest, treat the cause of inflammation, traction if disk protrusion is suspected

Low Back Strain

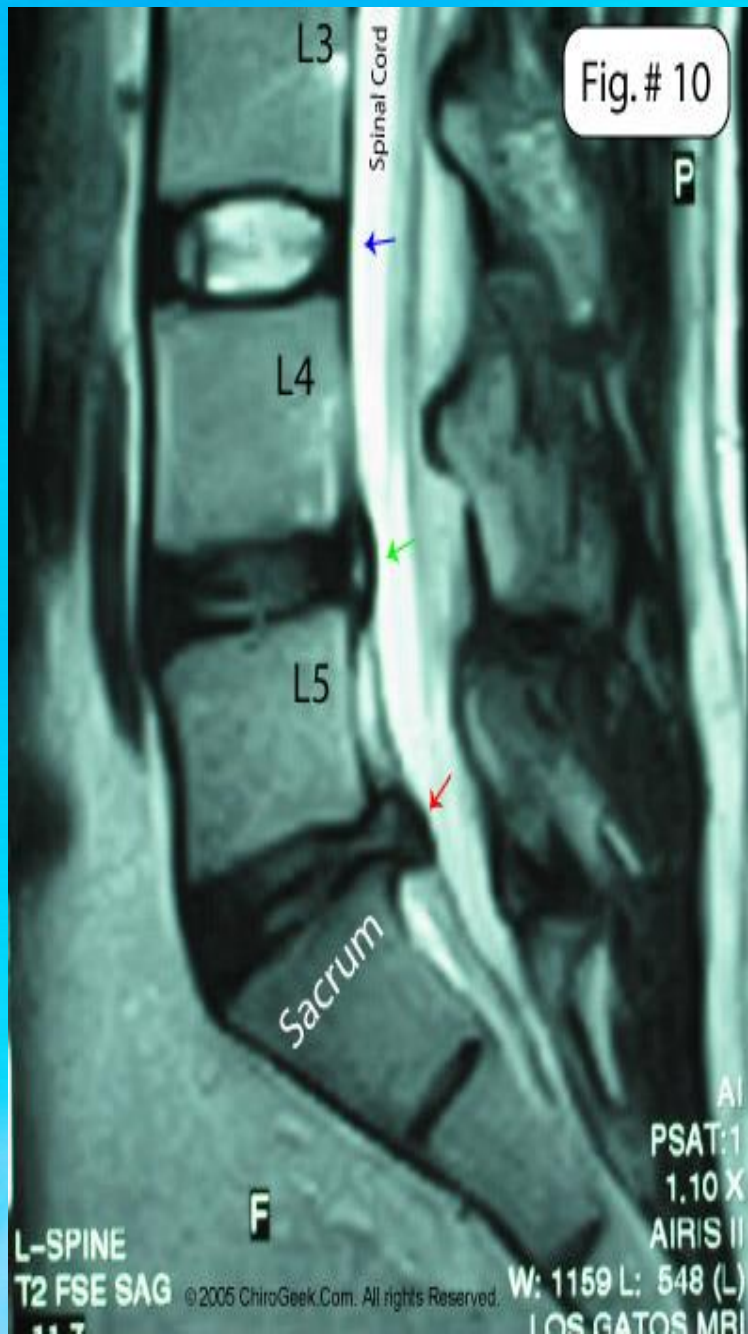
- Mechanism:
  - Occurs with sudden movement or lifting too much
  - Associated with muscle spasm / tightness
  - Presents as other muscles strains do
- S/S:
  - Localized pn, pt tenderness, restricted motion, pn w/ ext./flex.
- Management:
  - RICE, brace, monitor spasm

Low Back Sprains

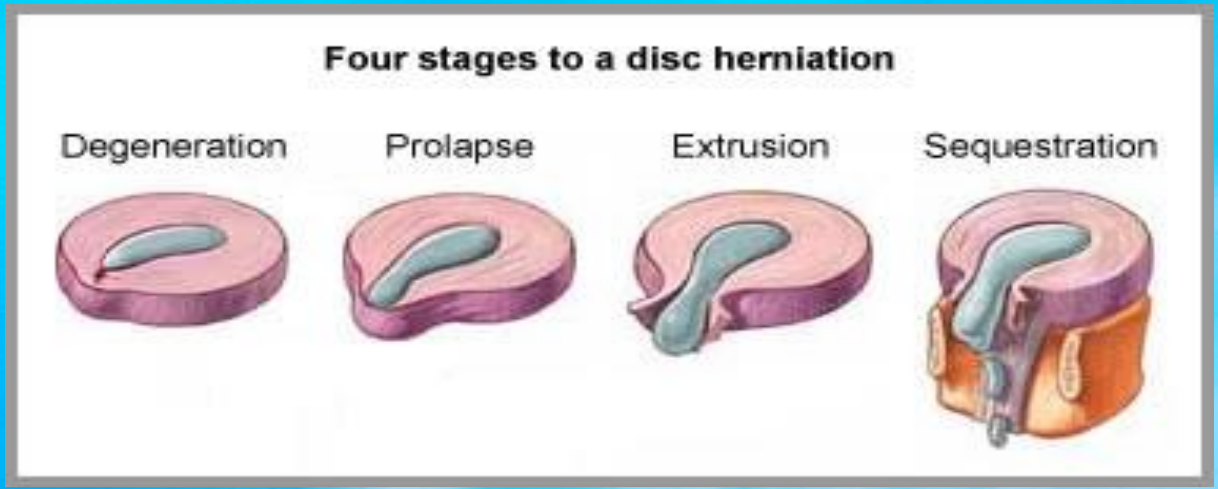
- Mechanism:
  - commonly from ext./flex. and combined with more violent motions; *"felt a pop"* or sudden snap
- S/S:
  - Localized pt tenderness (lateral to and over the spinous process), muscle spasm, decreased ROM, will last longer than a strain
- Management:
  - RICE, brace, rule out a fracture



- **Disc Herniations**
  - Mechanism:
    - Involves repetitive loading (flexion) during contact sports and similar cause to a sprain
    - Nucleus pulposus herniates through annulus fibrosis and press against spinal cord/nerve roots.(C5-7, L4,L5-most common)
  - S/S:
    - Pn and stiffness, radiating pn, sensory or reflex loss
  - Management:
    - Rest, immobilization, and modalities, surgery?



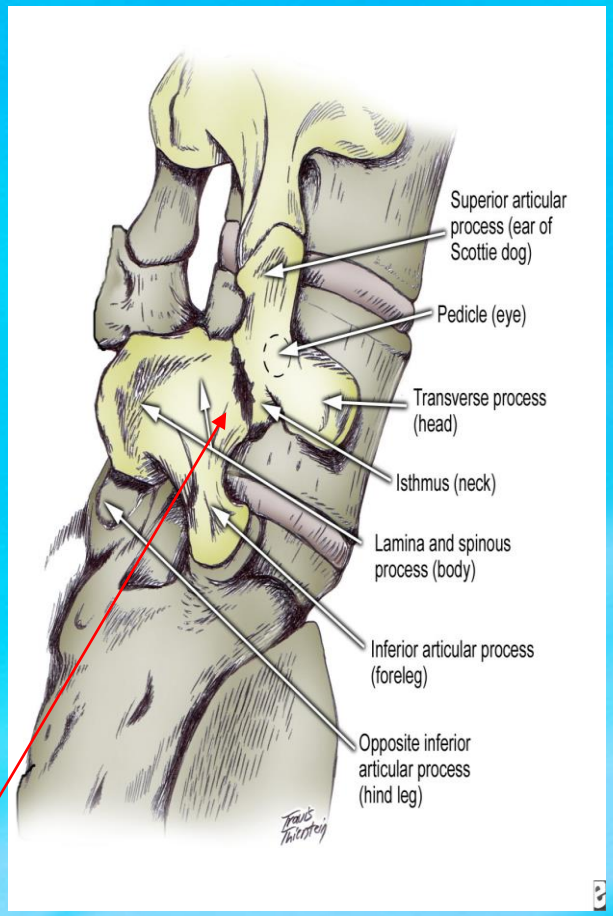
- **4 Types of Herniation**
  - **Degeneration** – little nucleus involvement, but centralized back pain
  - **Bulge/Prolapse** – nucleus migration without peripheral disc deformation
  - **Extrusion**– peripheral disc bulge from nucleus migration that pushes out
  - **Herniation or sequestration** – nucleus material squirts out of disc and stays outside



- **Facet Joint Dysfunction**
  - Mechanism:
    - Commonly injured with extension mech. or rotation
    - Repetitive stress through movement
    - Can impinge nerve roots exiting spinal column when inflamed
  - S/S:
    - Pain may *decrease* with increased activity with localized pn
    - Similar to sprain/strain
  - Management:
    - Ice, avoid irritating positions, modalities

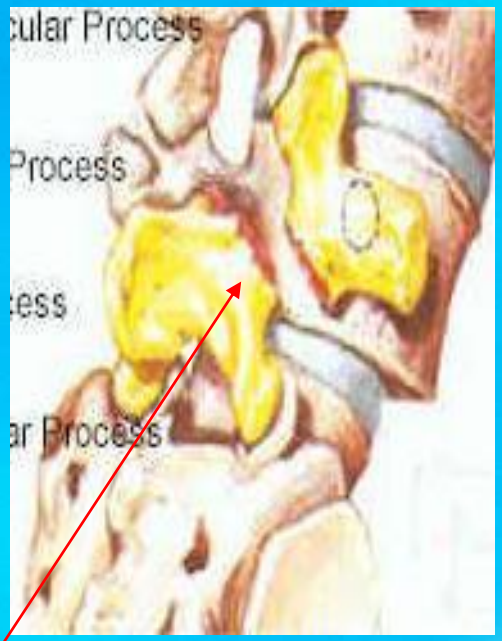
Spine Pathology

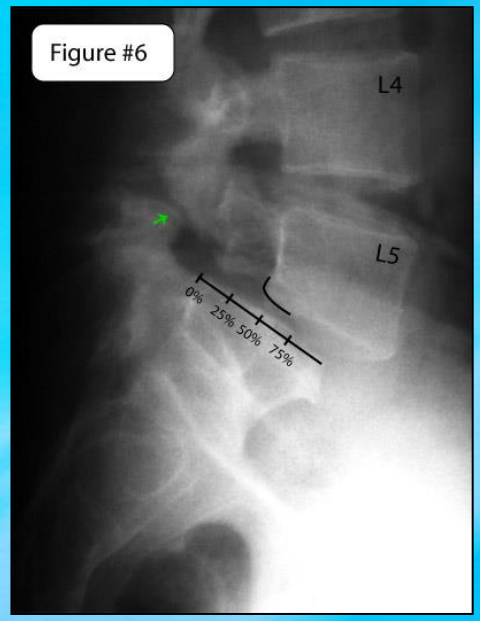
- **Spondy's**
  - *Spodylolysis*
    - Degeneration of vertebrae because of congenital weakness-(stress fracture of PARS)
    - PARS: part of the lamina located between superior and inferior facets
    - "Collared Scotty Dog" deformity



Spine Pathology

- **Spondy's**
  - *Spondylolisthesis*
    - slipping of one vertebrae on another located either above or below
    - Often associated with a progression of spondylolysis
    - "Decapitated Scotty Dog" deformity





Spine Pathology

- **Spondy's**
  - Mechanism:
    - Can be caused by genetics-born with thin vertebral bone
    - Overuse and repeated ext. or stress on back (gymnasts, divers, FB lineman)
    - From degenerative diseases such as cerebral palsy
  - S/S:
    - Pt tenderness, persistent/inc. pn and stiffness (in ext.), need to change positions frequently
  - Management:
    - X-ray, bracing, rest, exercises to strengthen core

Sacroiliac Joint Dysfunction

- **Sacroiliac Sprain**
  - Mechanism:
    - Result of twisting, falls backward, steps too far down, heavy landings on one leg, bending forward with knees locked during lifting
    - Causes irritation and stretching of sacrotuberous or sacrospinous ligaments and possible anterior or posterior rotation of pelvic bones
  - S/S:
    - Palpable pain and tenderness, Pelvic asymmetries, measurable leg length deformities, restricted movement during trunk flexion
    - Pain may radiate posteriorly, laterally, or anteriorly down the thigh and may even be located in the groin
    - Increased pain w/ unilateral stance
    - Movement from sit to stand will create pain
    - Sitting is usually comfortable
  - Management:
    - Modalities, bracing, strengthening exercises

Sacroiliac Joint Dysfunction

- **Coccyx Injuries**
  - Mechanism:
    - Generally the result of a direct impact which may be caused by forcibly sitting down, falling, or being kicked by an opponent
  - S/S:
    - Pain is often prolonged and at times chronic
  - Management:
    - X-rays/rectal exam may be required to determine the extent of the injury
    - Analgesics and a ring seat to relieve pressure while sitting
    - May require protective padding to prevent further injury

QUESTIONS????

END OF NECK INJURIES