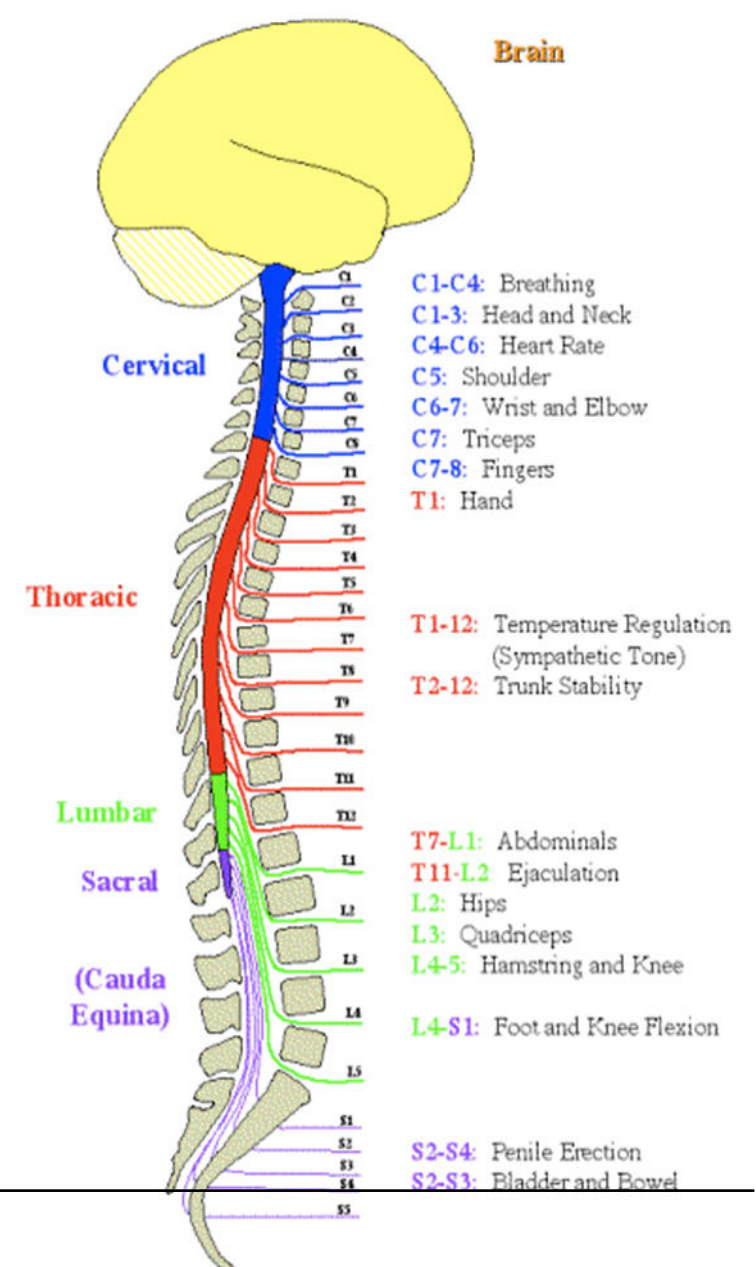


NEUROLOGICAL EXAMINATION OF SPINAL CORD INJURY

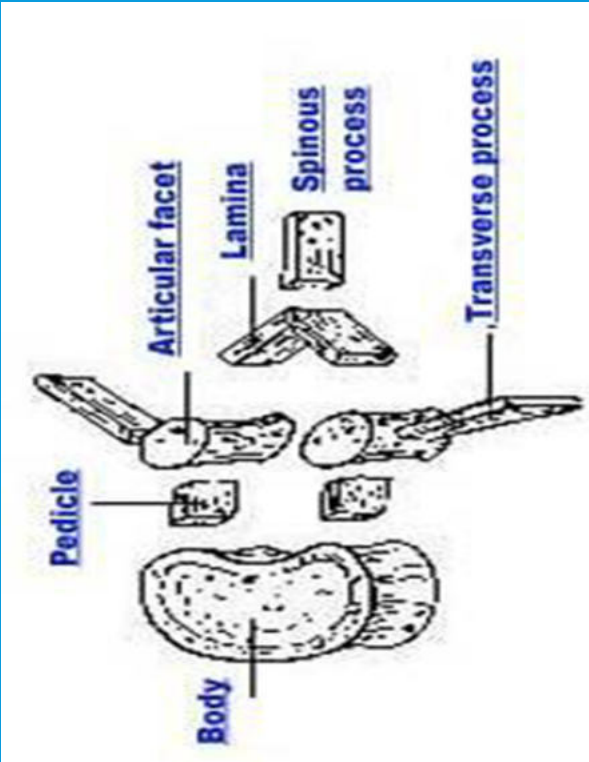
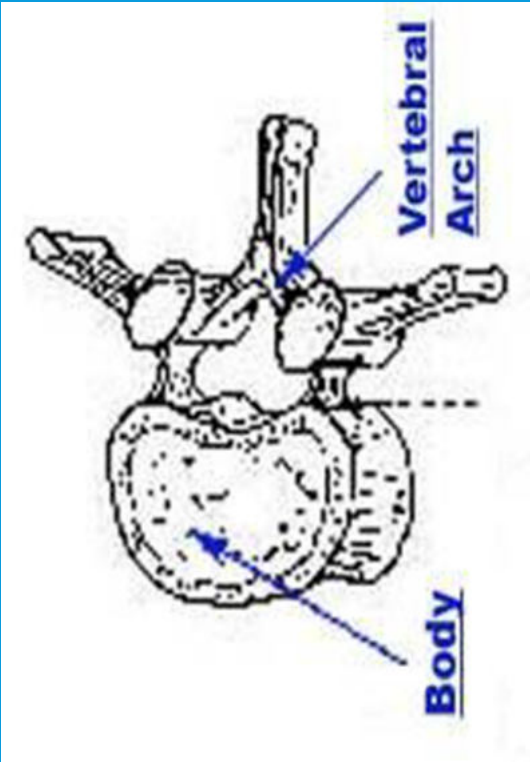
Department Of PMR

ANATOMY OF SPINE

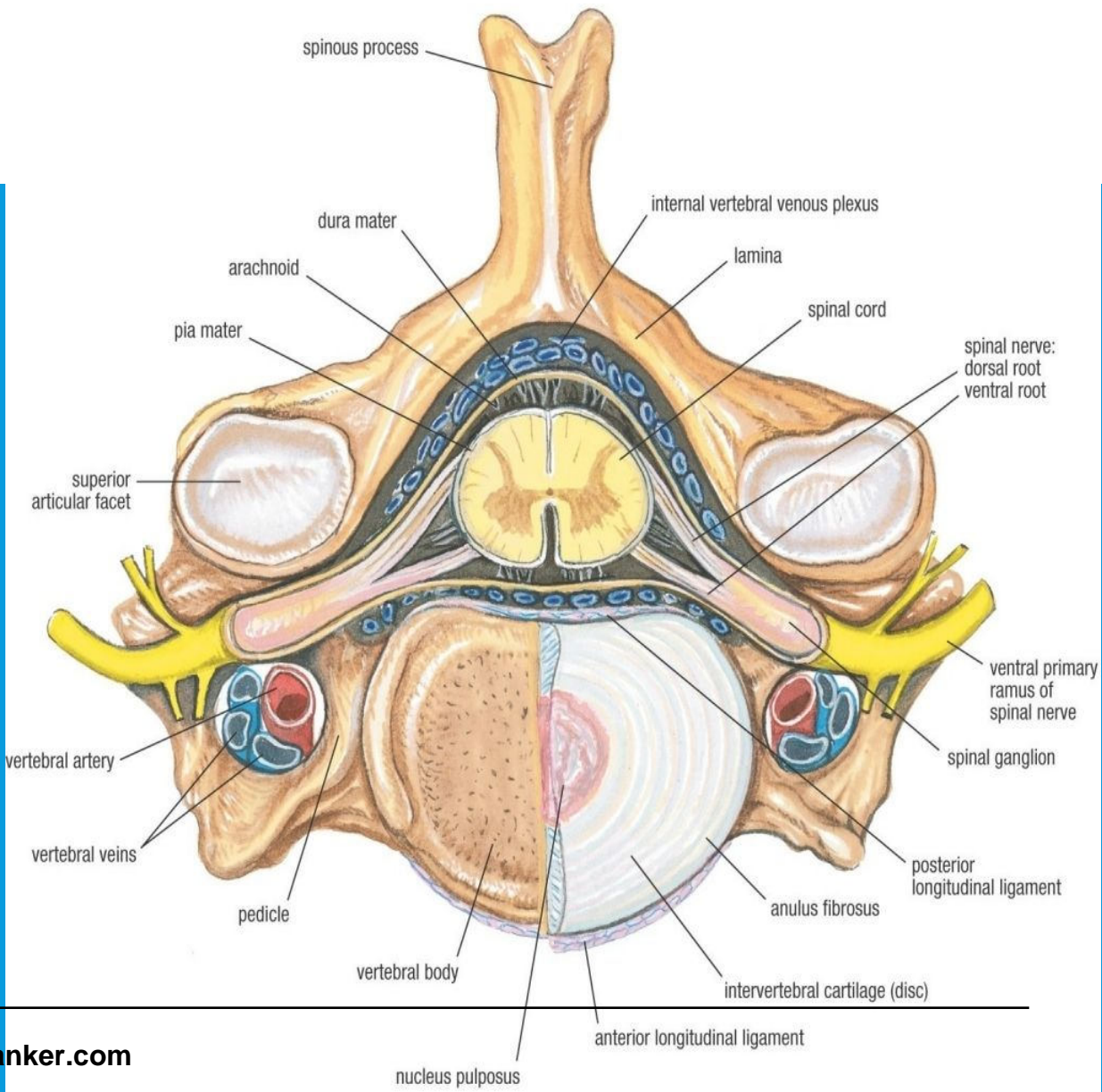
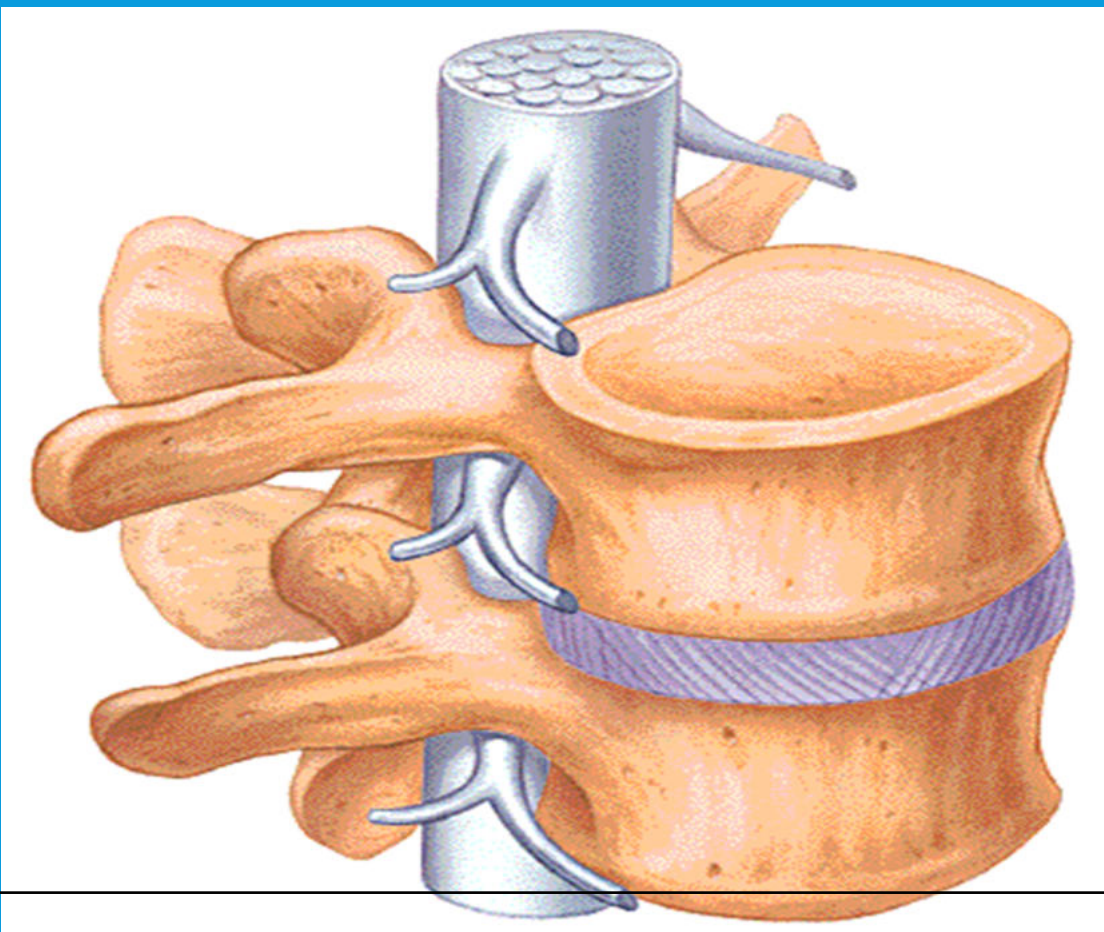
- 7 cervical vertebrae
- 12 thoracic vertebrae
- 5 lumbar vertebrae
- 5 fused sacral vertebrae
- 3-4 small bones comprising the coccyx
- Spinal cord ends as conus medullaris at level of first lumbar vertebra lumbar and sacral nerve roots exit below this and form the cauda equina



ANATOMY OF SPINE

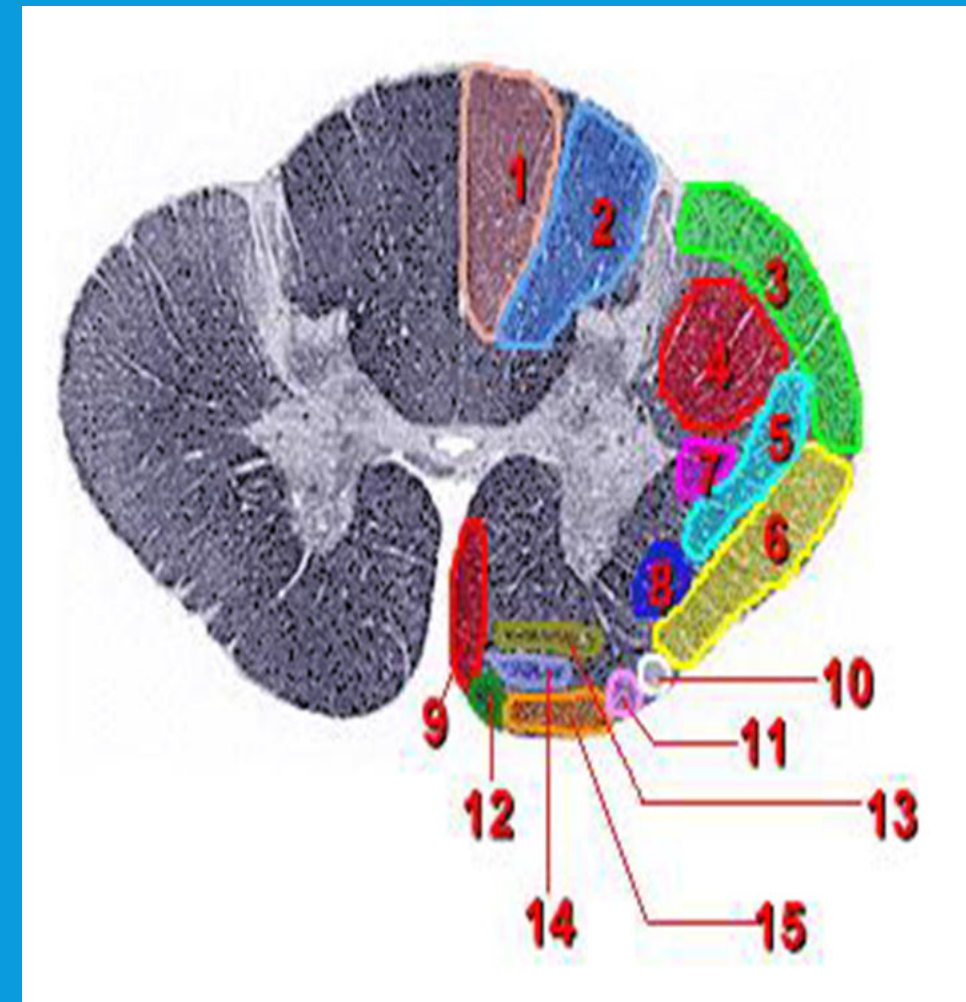


ANATOMY OF SPINE



NEUROANATOMY

- 1&2 Posterior Columns: convey Ipsilateral information about two Point discrimination, proprioception And vibratory sense
- 5 Lateral Spinothalamic Tract: carries Pain and Temperature Information From contralateral extremity
- 4 Lateral Corticospinal Tract: Carries Motor Information from Contralateral Brain to Ipsilateral Extremity

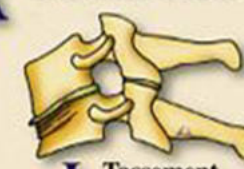


MECHANISMS OF INJURY

- Compression
- Flexion Injury
- Extension Injury
- Rotation

CLASSIFICATION OF LOWER CERVICAL SPINE INJURIES

A COMPRESSION INJURIES



I. Tassement antérieur



II. Comminutive fracture



III. "Tear drop" fracture

B FLEXION-EXTENSION-DISTRACTION INJURIES



I. Entorse "moyenne"



II. Entorse grave



III. Luxation fracture biarticulaire

C ROTATION INJURIES



I. Fracture uniaarticulaire (E.U.A.)



II. Fracture-séparation du massif articulaire (F.S.M.A.)



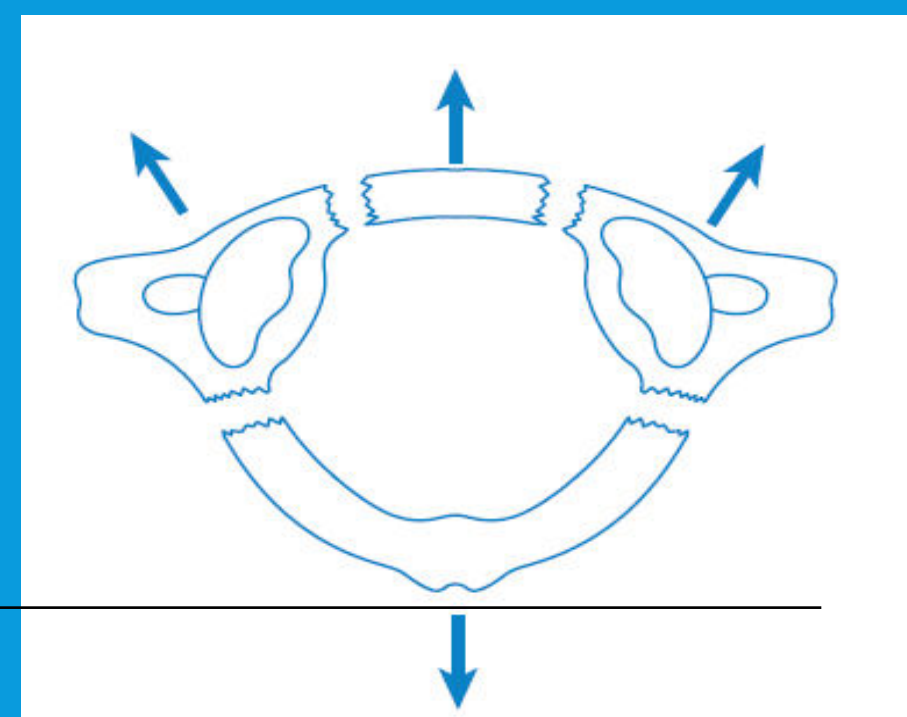
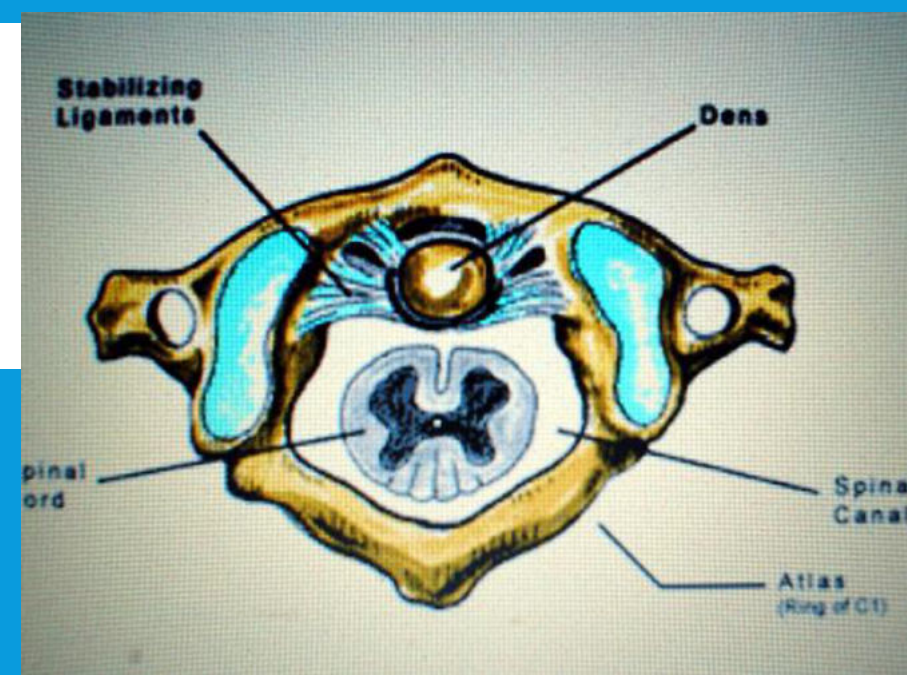
III. Luxation uniaarticulaire (L.U.A.)

COMPRESSION INJURY

- Vertebral body fracture
- Disc herniation
- Epidural hematoma
- Displacement of posterior wall of the vertebral body

JEFFERSON FRACTURE

- A comminuted fracture of the ring of C1.
- Compression of base of skull against C1
- Results in cracking the ring of C1
- Best seen on open mouth x-ray



ATLANTOAXIAL AND DENS FRACTURES

- The result of hyperflexion or hyperextension injuries
- 8% of Dens Fractures associated with C1 fractures

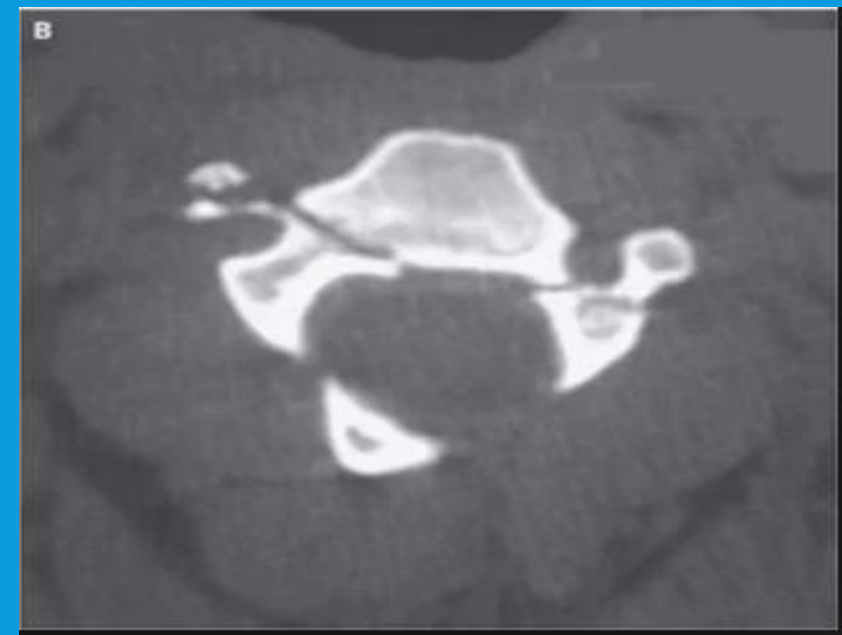
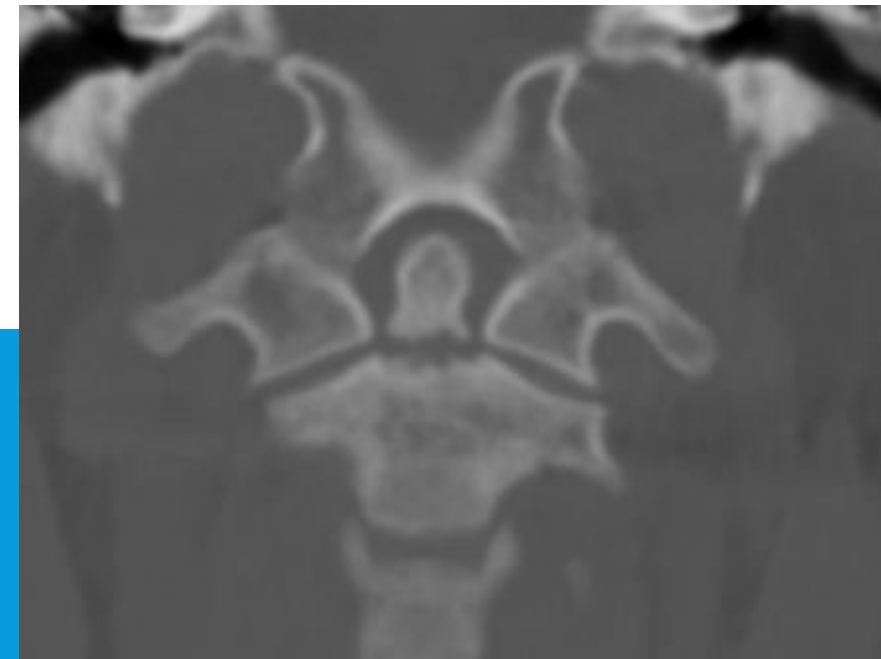
C2 Fractures

Dens Fracture :

- Hyperflexion Injury

Hangman Fracture :

- Hyperextension Injury
- Traumatic spondylolisthesis of the axis
- Bilateral fractures through the pars interarticularis of the axis



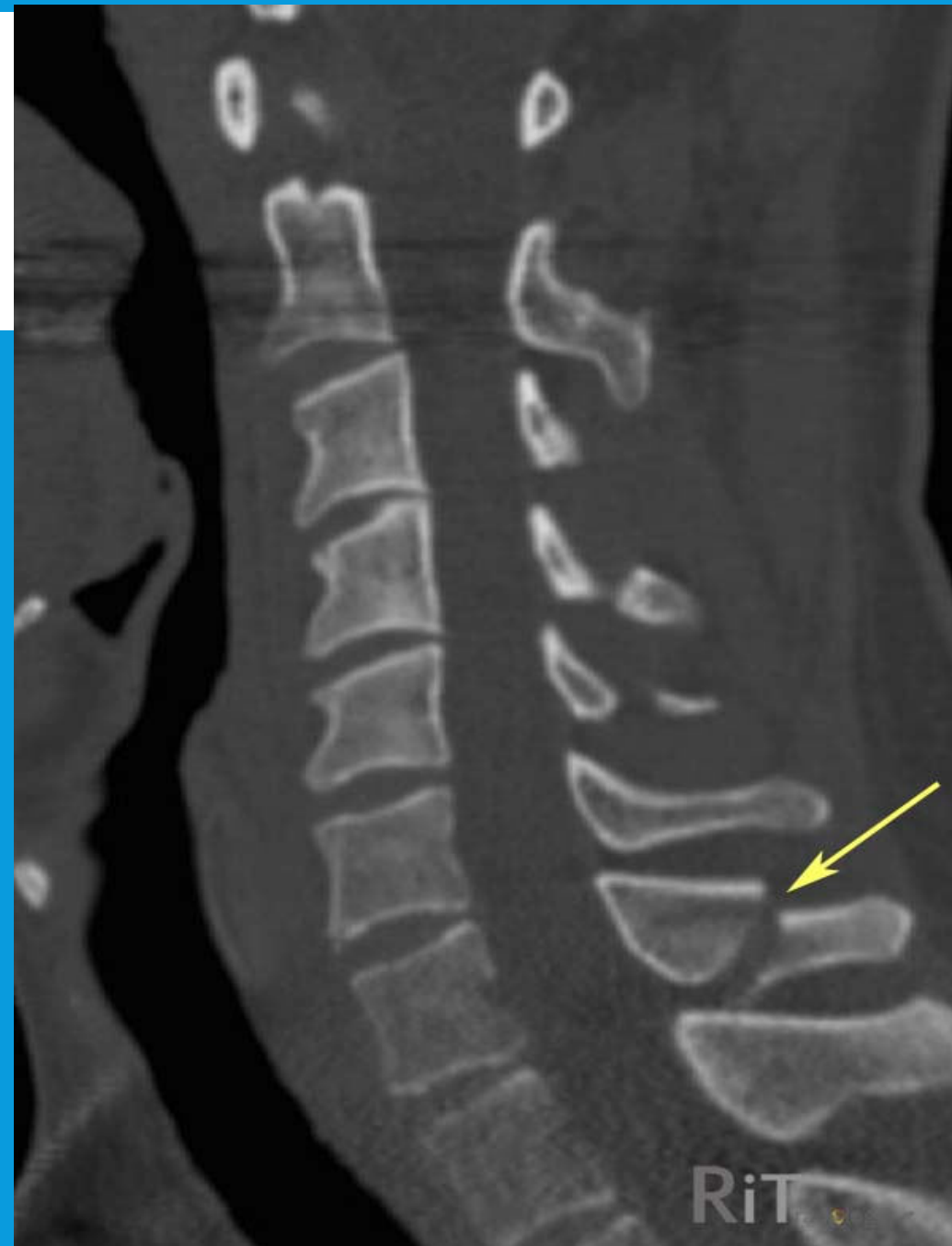
FLEXION TEARDROP FRACTURE

- Hyperflexion of the subaxial cervical spine
- Retropulsion of the larger portion of a vertebral body into the spinal canal, detached from an anterior fragment (teardrop)
- Often associated with an anterior cord syndrome.



CLAY-SHOVELER'S FRACTURE

- Avulsion fracture of the spinous process of C6, C7, or T1.
- It is not typically associated with neurologic injury.



THORACOLUMBAR TRAUMA

- ☐ Mechanism of injury
- Compression
- Distraction
- Rotation

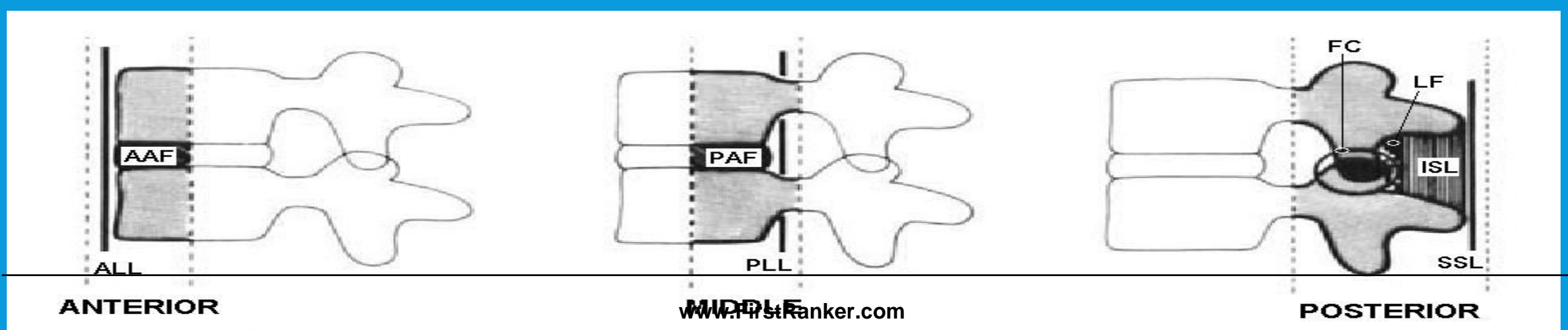
CHANCE FRACTURE

- Failure of all three columns due to flexion-distraction
- Falls from a height
- Strikes part of the torso on an immovable object
- Injury pattern most likely to cause SCI



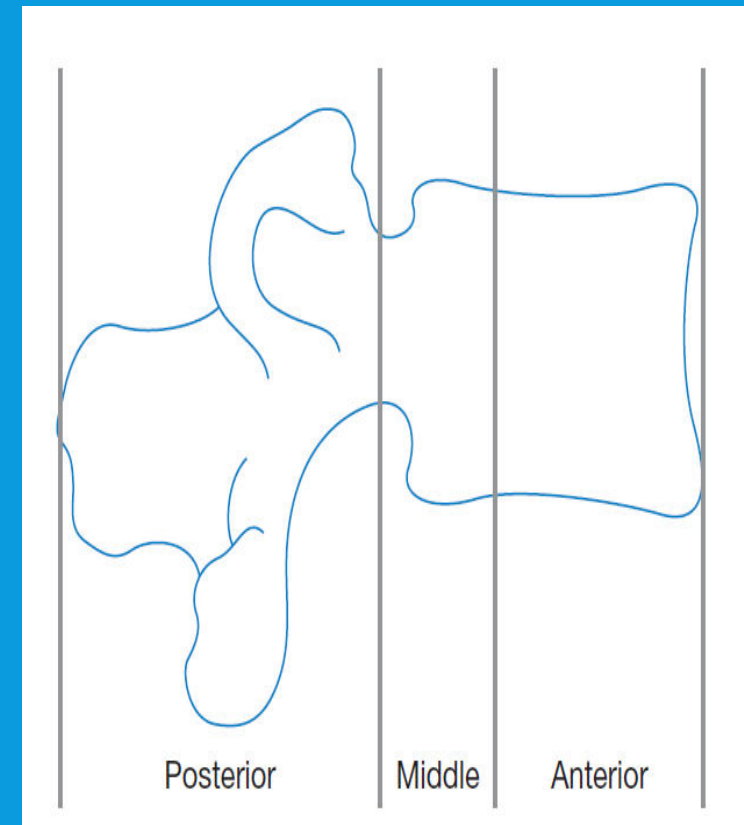
THE THREE-COLUMN CONCEPT OF SPINAL ANATOMY

- The anterior column: ALL + anterior portion of the vertebral body + anterior portion of the disk.
- The middle column: posterior portion of the vertebral body + the posterior portion of the disk + PLL
- The posterior column: the pedicles facet joints + laminae + supraspinous ligament, interspinous ligament + facet joint capsule + ligamentum flavum.



STABLE Vs UNSTABLE FRACTURE

- When the integrity of the middle and either the anterior or the posterior column is affected, the spine is likely to be unstable.
- ☐ The columns can be affected by:
 - Fracture
 - Ligamentous disruption
 - Gunshot wounds
- Because of the nature of the injury, can affect more than one column and the spine can still remain stable.
- SCI can occur without obvious radiographic findings.

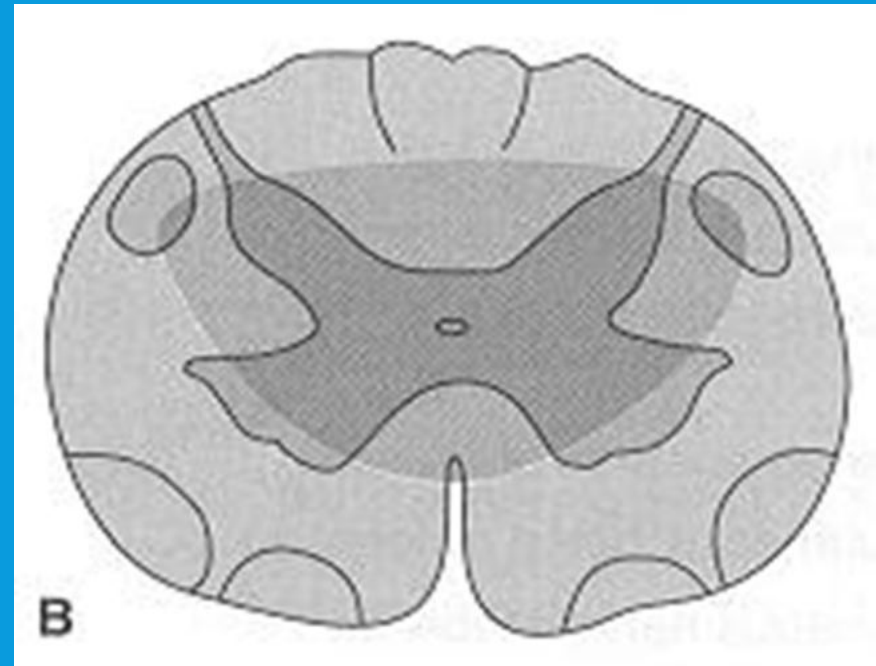


CLINICAL SYNDROMES AFTER INCOMPLETE SPINAL CORD INJURY

- Central Cord Syndrome
- Brown-Sequard Syndrome
- Anterior Cord Syndrome
- Conus Medullaris Syndrome
- Cauda Equina Syndrome

CENTRAL CORD SYNDROME

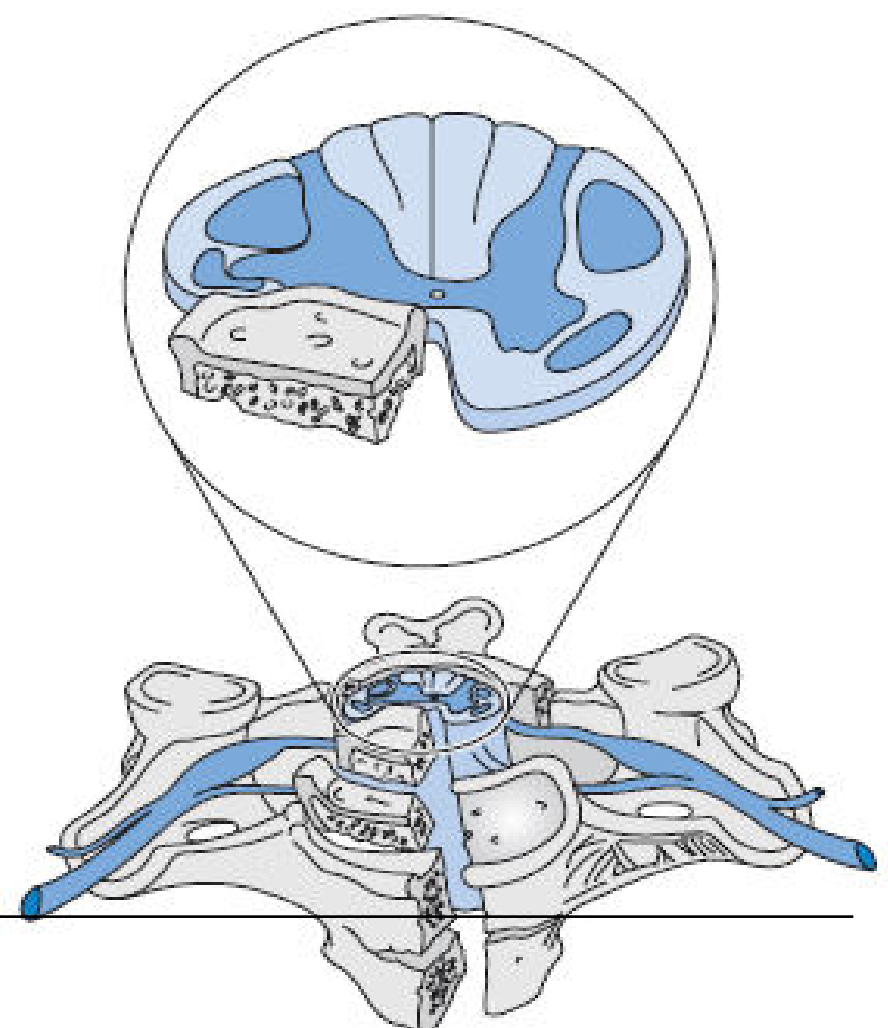
- Motor>Sensory Loss
- Upper>Lower Extremity Loss
- Distal >Proximal Muscle Weakness
- Classically occurs with hyperextension injuries of the cervical spine



BROWN-SEQUARD LESION

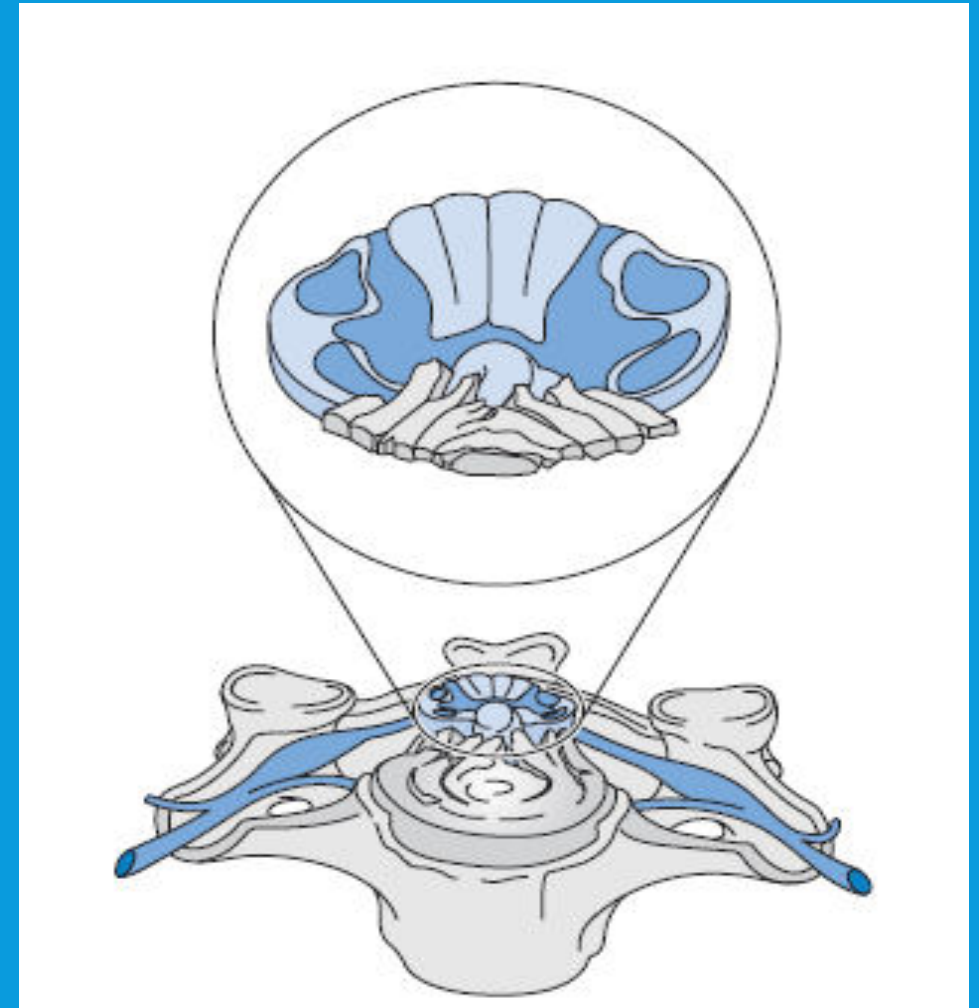
□ A burst fracture with posterior displacement of bone fragments compresses one side of the spinal cord.

- Loss of Ipsilateral Proprioception, Light Touch and Motor Function
- Loss of Contralateral Pain and Temperature Sensation
- Due to hemisection of the cord due to penetrating injury
- Incomplete lesions most common



ANTERIOR CORD SYNDROME

- ❑ A large disk herniation compresses the anterior aspect of the spinal cord, leaving the dorsal columns intact.
- Loss of Motor function, Pain and Temperature Sensation
- Preservation of Light touch, Vibratory Sensation and Proprioception

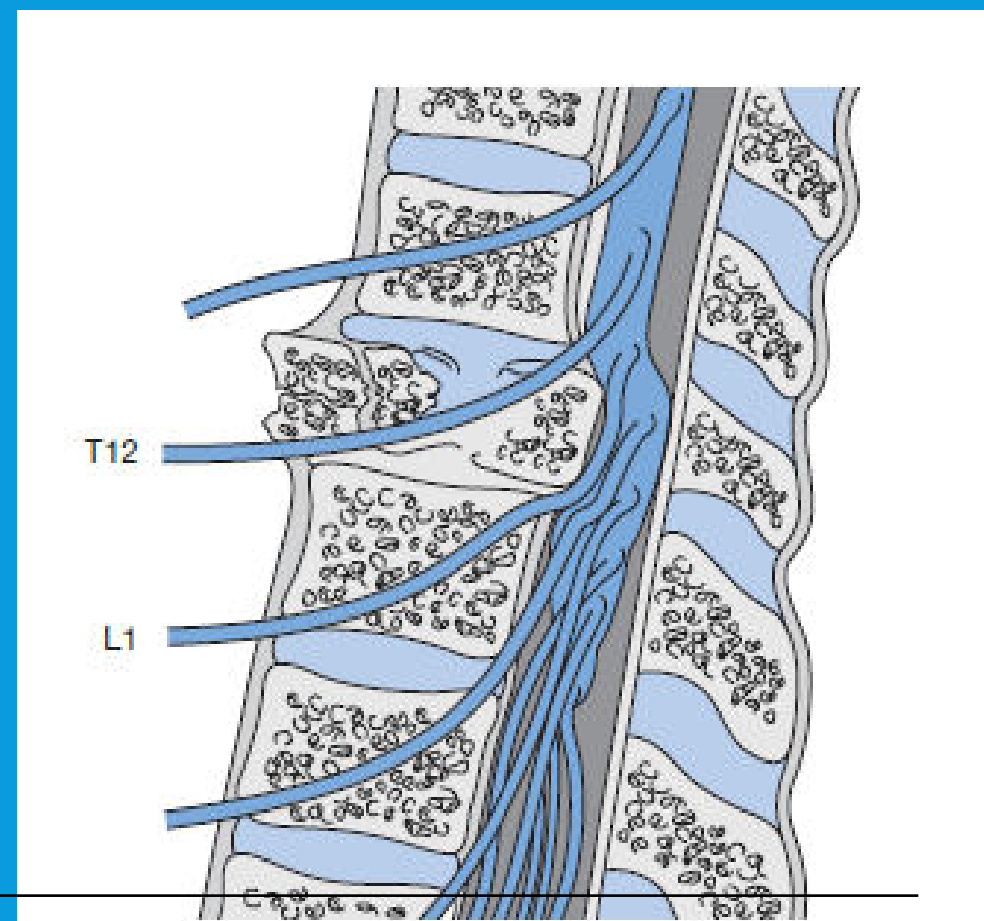


CONUS MEDULLARIS SYNDROME

A burst fracture of with posterior displacement of bone fragments compresses the conus medullaris.

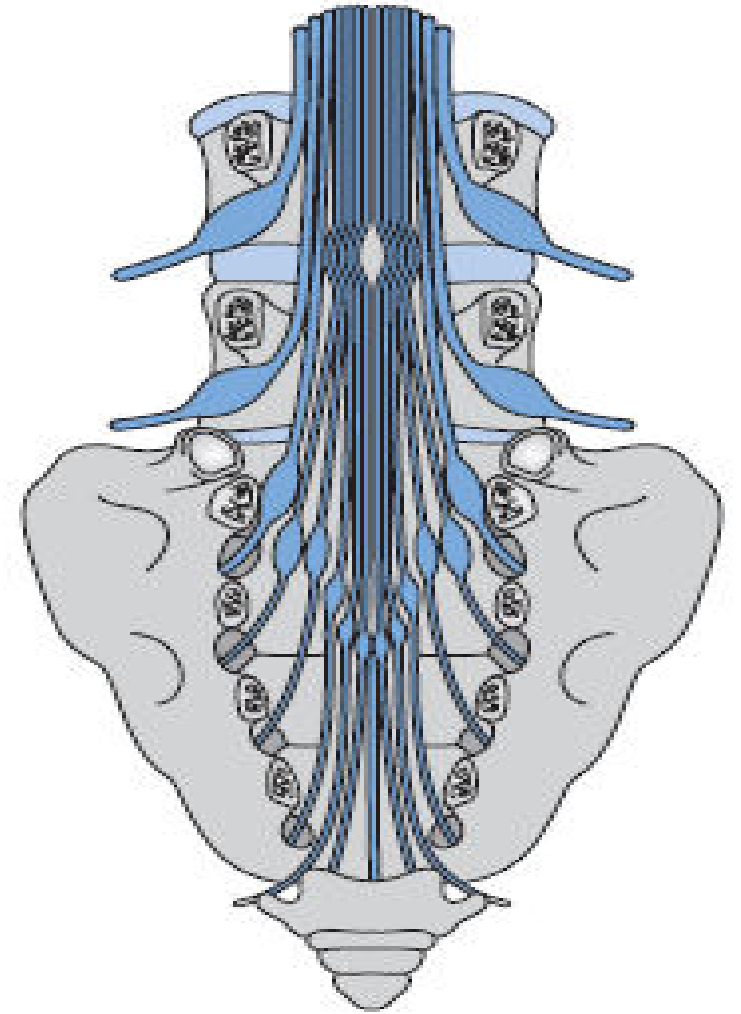
Injury to sacral cord, lumbar nerve roots causing

- Areflexic bladder
- Loss of control of bowels
- Knee jerk reflexes preserved, ankle jerk absent
- Signs similar to cauda equina syndrome except more likely to be bilateral



CAUDA EQUINA SYNDROME

- ❑ A central disk herniation at L4-L5 level compresses the cauda equina.
- Injury to nerve roots and not spinal cord itself
- Muscle weakness and decreased sensation in affected dermatomes
- Decreased bowel and bladder control



CLASSIFICATION OF SPINAL CORD INJURY

Patients are classified according to the ASIA Impairment Scale (AIS)

❑ Combined efforts from

❖ ASIA: American Spinal Injury Association

❖ ISCOS: International Spinal Cord Society

COMPONENTS OF THE TEST

Three Main Parts to the Exam:

- Strength Testing
- Light Touch Sensation
- Pinprick Sensation

Lowest Level of motor control:

- Voluntary Anal Contraction
- Lowest Level of Sensation:
- Deep Anal Pressure

NEUROLOGIC EXAM: DERMATOMES

- | | |
|----------------------------------|--|
| ▪ C ₅ - Deltoid | ▪ T ₁₂ – Symphysis Pubis |
| ▪ C ₆ – Thumb | ▪ L ₄ – Medial aspect of leg |
| ▪ C ₇ – Middle Finger | ▪ L ₅ - Space between first and second toes |
| ▪ C ₈ - Little Finger | ▪ S ₁ – Lateral border of the foot |
| ▪ T ₄ – Nipple | ▪ S ₃ – Ischial Tuberosity |
| ▪ T ₈ – Xiphoid | ▪ S ₄₋₅ – Perianal region |
| ▪ T ₁₀ - Umbilicus | |

- L2 - Hip flexion
- L3 - Knee Extension
- L4 - Ankle dorsiflexion
- L5 - Toe extension
- S1 – Plantar flexion

REV 11/15

Muscle Function Grading

0 = total paralysis

1 = palpable or visible contraction

2 = active movement, full range of motion (ROM) with gravity eliminated

3 = active movement, full ROM against gravity

4 = active movement, full ROM against gravity and moderate resistance in a muscle specific position

5 = (normal) active movement, full ROM against gravity and full resistance in a functional muscle position expected from an otherwise unimpaired person

5* = (normal) active movement, full ROM against gravity and sufficient resistance to be considered normal if identified inhibiting factors (i.e. pain, disuse) were not present

NT = not testable (i.e. due to immobilization, severe pain such that the patient cannot be graded, amputation of limb, or contracture of > 50% of the normal ROM)

Sensory Grading

0 = Absent

1 = Altered, either decreased/impaired sensation or hypersensitivity

2 = Normal

NT = Not testable

ASIA Impairment Scale (AIS)

A = Complete. No sensory or motor function is preserved in the sacral segments S4-5.

B = Sensory Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-5 (light touch or pin prick at S4-5 or deep anal pressure) AND no motor function is preserved more than three levels below the motor level on either side of the body.

C = Motor Incomplete. Motor function is preserved at the most caudal sacral segments for voluntary anal contraction (VAC) OR the patient meets the criteria for sensory incomplete status (sensory function preserved at the most caudal sacral segments (S4-S5) by LT, PP or DAP), and has some sparing of motor function more than three levels below the ipsilateral motor level on either side of the body.
(This includes key or non-key muscle functions to determine motor incomplete status.) For AIS C – less than half of key muscle functions below the single NLI have a muscle grade ≥ 3 .

D = Motor Incomplete. Motor incomplete status as defined above, with at least half (half or more) of key muscle functions below the single NLI having a muscle grade ≥ 3 .

E = Normal. If sensation and motor function as tested with the ISNCSCI are graded as normal in all segments, and the patient had prior deficits, then the AIS grade is E. Someone without an initial SCI does not receive an AIS grade.

Using ND: To document the sensory, motor and NLI levels, the ASIA Impairment Scale grade, and/or the zone of partial preservation (ZPP) when they are unable to be determined based on the examination results.

Steps in Classification

The following order is recommended for determining the classification of individuals with SCI.

1. Determine sensory levels for right and left sides.

The sensory level is the most caudal, intact dermatome for both pin prick and light touch sensation.

2. Determine motor levels for right and left sides.

Defined by the lowest key muscle function that has a grade of at least 3 (on supine testing), providing the key muscle functions represented by segments above that level are judged to be intact (graded as a 5).

Note: in regions where there is no myotome to test, the motor level is presumed to be the same as the sensory level, if testable motor function above that level is also normal.

3. Determine the neurological level of injury (NLI)

This refers to the most caudal segment of the cord with intact sensation and antigravity (3 or more) muscle function strength, provided that there is normal (intact) sensory and motor function rostrally respectively.

The NLI is the most cephalad of the sensory and motor levels determined in steps 1 and 2.

4. Determine whether the injury is Complete or Incomplete.

(i.e. absence or presence of sacral sparing)

*If voluntary anal contraction = **No** AND all S4-5 sensory scores = 0*

*AND deep anal pressure = **No**, then injury is **Complete**.*

*Otherwise, injury is **Incomplete**.*

THANK YOU

www.FirstRanker.com