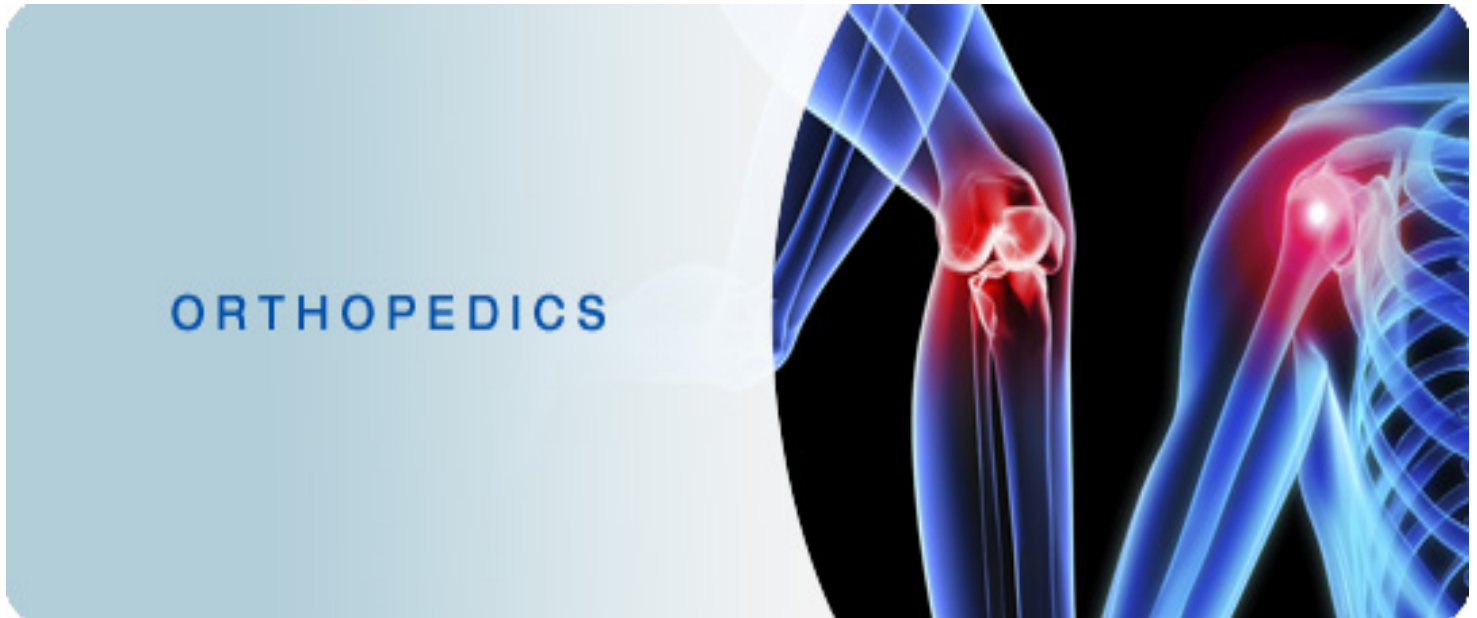


Isn't it funny how someone can say "I believe in Allah" but still follow the Satan who by the way also, "believes" in Allah...

430 ORTHOPEDICS TEAM



Lecture: Spinal Injuries.

Team Members:

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Team Leader:

Ayedah Al-Ruhaimi.

- The slides were provided by the doctor.
- Important notes in **Red**.
- 429 group A team in **Orange**.
- Doctor's notes in **Green**.
- Copied slides in **Black**.

❖ Epidemiology:

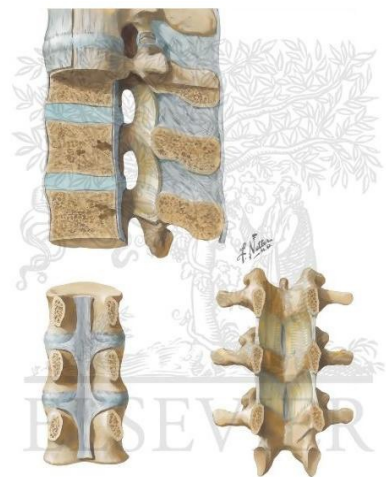
- 50000 cases per year.
- 11000 new spinal cord injuries.
- 15-20% multiple non-contiguous levels.
- 10% involving the cervical spine.
- **90% involving thoraco-lumbar spine.**
- 25% have neurologic deficit.
- Age: mostly between 15-24 years.
- Gender: mostly males (4:1).

❖ Mechanism of Injury:

- **High energy trauma** such as an MVA or fall from a height or a horse.
 - **MVA: 40-55% (most common).**
 - Falls: 20-30%
 - Sports: 6-12%
 - Others: 12-21%.
- **Low energy trauma in a high risk patient** (e.g. a patient with known spinal canal compromise such as ankylosing spondylitis, Osteoporosis or metastatic vertebral lesions)
- Penetrating trauma from gunshot or knives

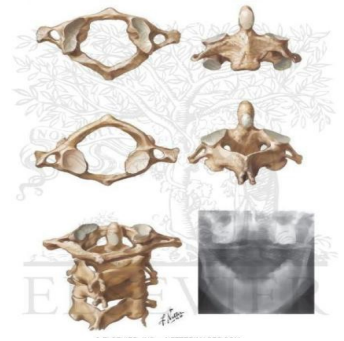
❖ Anatomy of the Spine: ((429))

- Bones: vertebrae for protection bear most of the weight put on your spine.
- Joints: 3 joints:
 - Interiorly :
 - inter-vertebral disc: helps absorb pressure and keeps the bones from rubbing against each other. 60-80 % injured.
 - Posterior :
 - 2 facet joints
 - Joint give the movement of spine :
 - Flexion.
 - Extension
 - Lateral bending
 - Rotation
- Ligament :
 - Supraspinatous.
 - Infraspinaous.
 - Legamentum Flavum. (**the Most Important**)
 - Ant. Longitudinal Ligament.
 - Post. Longitudinal Ligament.
 - **Ligament is IMP.** In maintain the flexibility of spine. If injured the x-ray will be normal.
- Muscles: all spinalis muscle



❖ Cervical Anatomy:

- **C1 & C2** (50% of rotation occurs BTW C1 & C2 and then 5% at each level). (50% of flexion and extension occurs BTW C1 and cranium)
 - **C1:**
 - No vertebra. Body
 - Composed of Ant. & Post .arch.
 - **C2:**
 - Have Ant. Projection is: Odontoid process significant in stability of C1 & C2.
 - **Open mouth x-ray (MCQ)**, we see the C1 &C2 and their articulation.
- **C3-C7**
 - **C3-C7** is same.
 - Have body +2 Lat. masses (facet joints).
 - We differentiate it from the thoracic by Spinal process.



Cervical anatomy: C3-C7

❖ Thoracic Spine

- Articulate with ribs by body and spinal process (downward).

❖ Lumbar Spine

- More IMP.
- Lowest mobile segment.
- Most of ligament.
- More fracture.
- All joint here Ant +Post.
- Most of movement.
- **The Three columns (imp)**
 - Ant. Column >Ant. part of body
 - Middle column > Post. Part of body
 - Post. Column > Pedicle + Lamina+ Spinal process.
- **Stable injury :**
 - One column only
 - (e.g. Wedge #in Ant. Column)
 - Not required treatment or conservative only.
- **Unstable injury:**
 - **2 or more column.**
 - Need intervention (surgery, etc.)

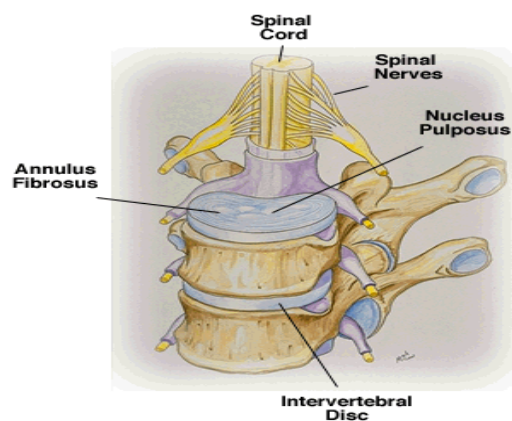
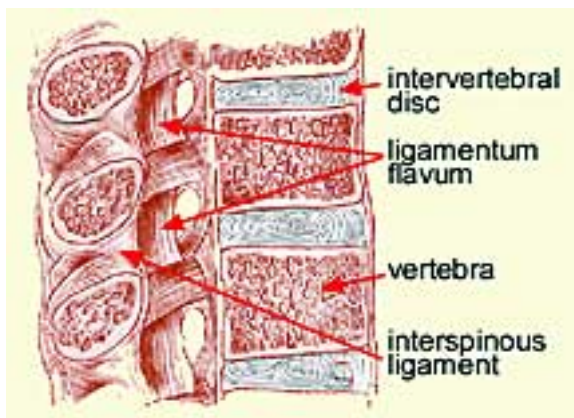
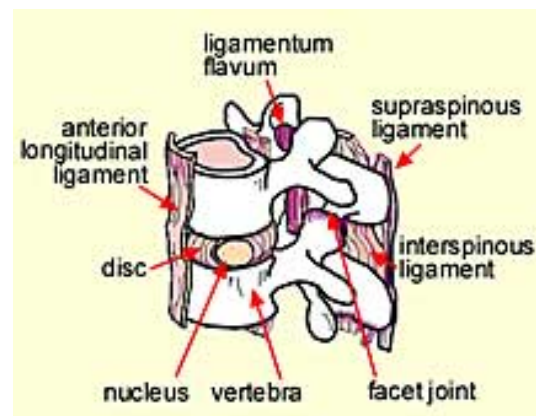
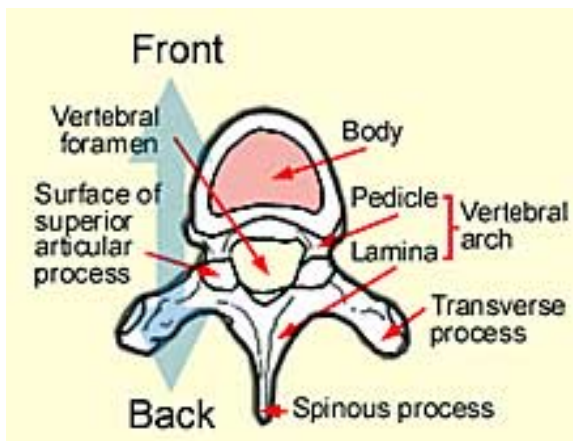
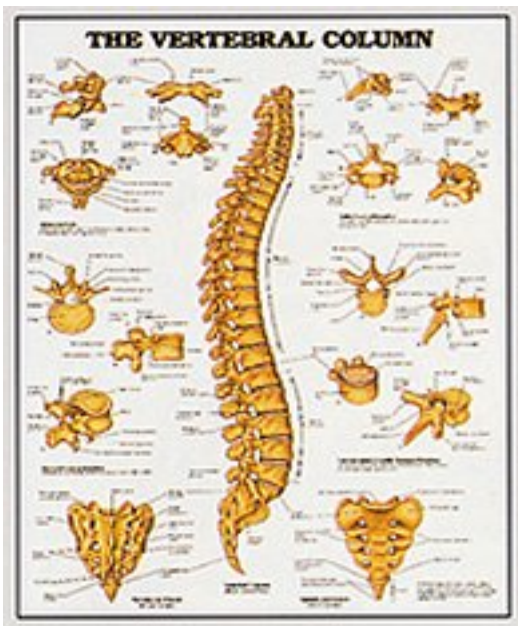


Thoracic Spine

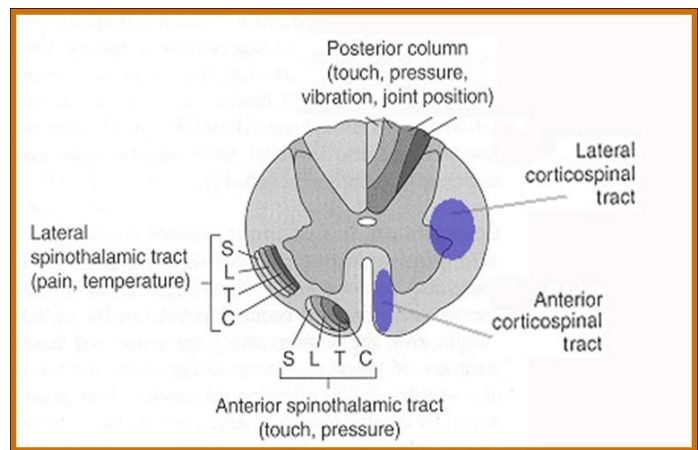
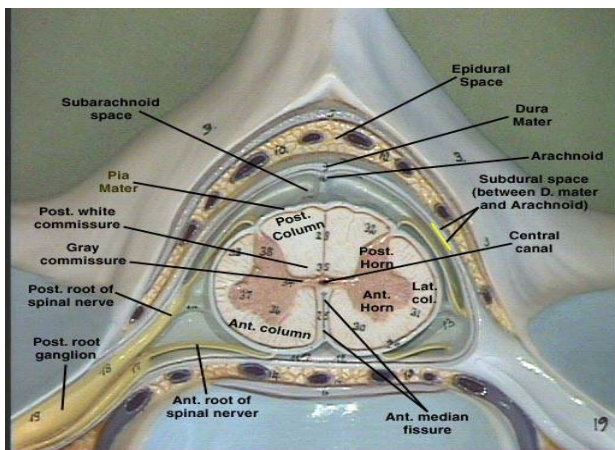


Lumbar Spine

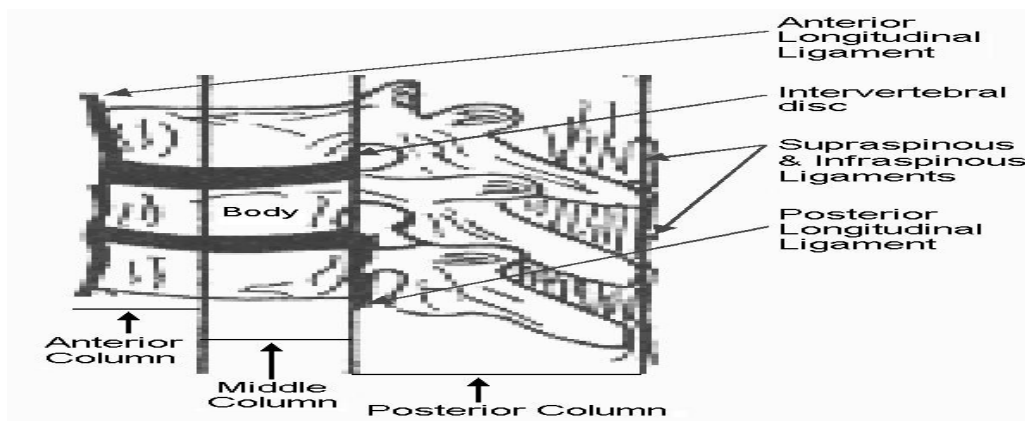
❖ Spinal Column:



❖ Spinal Cord:



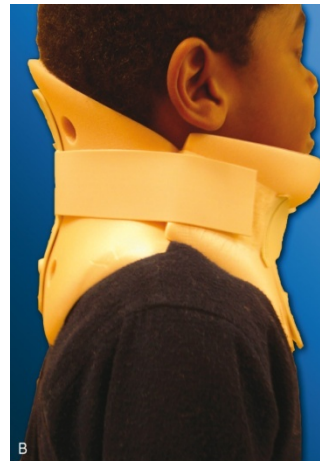
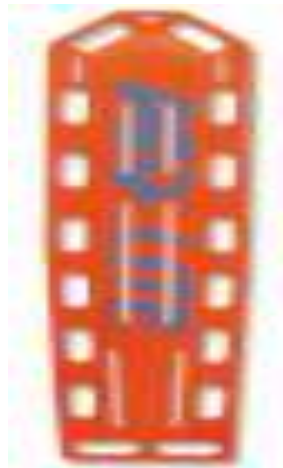
❖ The Three columns:



❖ Assessment:

- In cases of trauma, ABCDE's must be assessed first and treated appropriately (MCQ)
- Patients should be examined with spinal collar until spinal pathology is excluded.
- Careful log rolling keeping the head, neck and pelvis in line should be done to examine the spine properly.
 - Immobilization (by cervical collar only for 2 hrs for the sake of transportation only)
 - History:
 - Mechanism of injury (high or low energy)
 - compression, flexion, extension, distraction
 - Other injuries (head injuries with high incidence of cervical spine injury)
 - **Seat belt**
 - Other causalities. (presence of other passengers and their clinical situation)

- Physical examination:
 - Inspection, palpation.
- Neurologic examination → (Muscle Test, Sensory exam, light touch, Sharp dull discrimination, Vibration sense, Proprioception and two-point discrimination and Reflexes).



❖ Asia Score: Brief Trauma Neurologic Survey:

Patient Name _____ Date/Time of Exam _____

Examiner Name _____

ASIA **STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY** **ISC**

MOTOR
KEY MUSCLES (working on reverse side)

	R	L
C5	<input type="checkbox"/>	<input type="checkbox"/>
C6	<input type="checkbox"/>	<input type="checkbox"/>
C7	<input type="checkbox"/>	<input type="checkbox"/>
C8	<input type="checkbox"/>	<input type="checkbox"/>
T1	<input type="checkbox"/>	<input type="checkbox"/>

UPPER LIMB TOTAL (MAXIMUM) (25) (25) (50)

Comments:

LOWER LIMB

	R	L
L2	<input type="checkbox"/>	<input type="checkbox"/>
L3	<input type="checkbox"/>	<input type="checkbox"/>
L4	<input type="checkbox"/>	<input type="checkbox"/>
L5	<input type="checkbox"/>	<input type="checkbox"/>
S1	<input type="checkbox"/>	<input type="checkbox"/>

Voluntary anal contraction (Yes/No) ☐ ☐

LOWER LIMB TOTAL (MAXIMUM) (25) (25) (50)

SENSORY
KEY SENSORY POINTS

0 = absent
1 = impaired
2 = normal
NT = not testable

LIGHT TOUCH

	R	L
C2		
C3		
C4		
C5		
C6		
C7		
C8		
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		
L1		
L2		
L3		
L4		
L5		
S1		
S2		
S3		
S4		

PIN PRICK

	R	L
C2		
C3		
C4		
C5		
C6		
C7		
C8		
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		
L1		
L2		
L3		
L4		
L5		
S1		
S2		
S3		
S4		

Any anal sensation (Yes/No) ☐ ☐

PIN PRICK SCORE (MAX: 112)

LIGHT TOUCH SCORE (MAX: 112)

NEUROLOGICAL LEVEL
The most caudal segment with sensory deficits

COMPLETE OR INCOMPLETE?
Incomplete - Any sensory or motor function is preserved

ASIA IMPAIRMENT SCALE

ZONE OF PARTIAL PRESERVATION
Partial sensory or motor preservation

Key Sensory Points

❖ Level of Cord Injury determines level of function: (imp)

ASIA IMPAIRMENT SCALE	
<input type="checkbox"/> A = Complete:	No motor or sensory function is preserved in the sacral segments S4-S5.
<input type="checkbox"/> B = Incomplete:	Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.
<input type="checkbox"/> C = Incomplete:	Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3.
<input type="checkbox"/> D = Incomplete:	Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more.
<input type="checkbox"/> E = Normal:	motor and sensory function are normal

CLINICAL SYNDROMES	
<input type="checkbox"/>	Central Cord
<input type="checkbox"/>	Brown-Sequard
<input type="checkbox"/>	Anterior Cord
<input type="checkbox"/>	Conus Medullaris
<input type="checkbox"/>	Cauda Equina

Notes:

- You can palpate for Gaps and steps in the spine C7 called: Cervical Prominence
- So, If there is a gap; you felt C1 then the other one below it deep (not at the same level) then it is → Steps → spondylotheiasis
- Gaps: you will feel one spine then below it space then another Spine → could be due to a rupture if the ligaments .
- **ASIA Scale: (American Spine injury association)**
- **The Closer the patient to normal (E) the better prognosis.**
(E → excellent)

❖ Prognosis for Recovery of spinal Cord Injury:

- Poor prognosis for recovery if:
 - Pt arrives in shock.
 - Pt cannot breath.
 - Pt has a complete injury.

❖ Severity of neurologic deficit

- **Complete spinal cord injury:**
 - Flaccid paralysis below level of injury.
 - May involve diaphragm if injury above C5.
 - Sympathetic tone lost if fracture above T6.
- **Incomplete**
 - Any sensation?
 - Sacral sparing?
 - **Central cord syndrome:**
 - Characterized by disproportionately (UL>LL).
 - Mechanism: hyper-extension.
 - Occur with or without fractures.
 - Recovery: **50% regaining function.**
 - Prognosis is fair.
 - **Anterior cord syndrome:**
 - Characterized by loss of corticospinal and spinothalamic tract with preserved posterior column.
 - Mechanism: ischemia or infarction to spinal cord.
 - Common injury.
 - Recovery: 10%.



- Prognosis is good if progressive recovery within 24hrs, absent SS (sacral sensation) after 24hrs portends a poor outcome
- **Brown-Sequard syndrome:**
 - Characterized by hemi-cord injury with ipsilateral paralysis, loss of Proprioception and fine touch, and contra lateral temperature and pain loss.
 - Prognosis is good, with over 90% regaining of bowel and bladder function and ambulatory capacity.
- **Conus Medullaris syndrome:**
 - Seen in T12-L1 injuries.
 - Loss of voluntary bowel and bladder control with preserved lumbar root function.
 - Uncommon as pure lesion (mixed conus-cauda).
- **Cauda Equine syndrome: (imp)**
 - Saddle anesthesia, urinary retention and stool incontinence (perform PR and sensation to that area)
 - Usually due to large central disc hernia ion rather than fracture.
- **Nerve root deficit: LMN**

❖ **Spinal Shock:**

- Transient loss of spinal reflexes.
- Lasts 24-72 hours (recovery may begin immediately)
(Perform bulb-cavernous reflex (squeezing the glans of penis in male or clitoris in female) → contraction of anus)

❖ **Neurogenic shock:**

- Reduced tissue perfusion due to loss of sympathetic outflow and unopposed vagal tone.
- Peripheral vasodilatation (hypotension and bradycardia).
- Rx: fluid resuscitation and vasopressors. (vasopressors are much more impotent than fluid resuscitation)

❖ **Imaging:**

- X-rays:
 - Cervical: 3 views.
 - AP, lateral and open mouth.
 - Thoraco-lumbar: 2 views.
 - AP & lateral.
 - Flexion-Extension views.
- CT: best for bony anatomy.
- MRI: best to evaluate soft tissue

❖ Management of Spinal Injuries:

- Depends on: (MCQ)
 - Level of injury.
 - Degree and morphology of injury: STABILITY
 - Presence of neurologic deficit.
 - Other factors.

❖ Some general rules:

- **Stable** injuries are usually treated conservatively.
- **Unstable** injuries usually require surgery.
- **Neurologic compression** requires decompression

❑ Specific Injuries:

❖ Cervical spine fractures

- Descriptive: depends on mechanism of injury.
 - Flexion/extension.
 - Compression/distraction.
 - Shear.
- Presence of Subluxation/dislocation
- SCI:
 - High fracture results in quadriplegia.
 - Low fracture results in paraplegia. (C6 , C7 or C7, T1)



❖ Thoraco-Lumbar fractures:

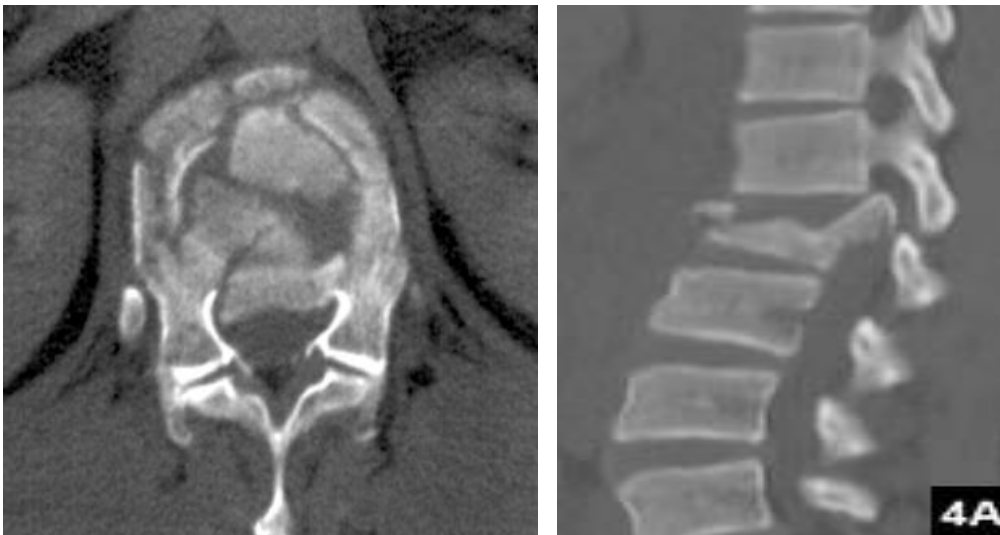
- Spinal cord terminates at L1/2 disc in adult (L2/3 in a child).
- 50% of injuries occur at Thoraco-lumbar junction.
- Common fractures:
 - Wedge fracture (flexion/compression).
 - Burst (compression).
 - Chance (flexion/distraction).

❖ Wedge fracture:



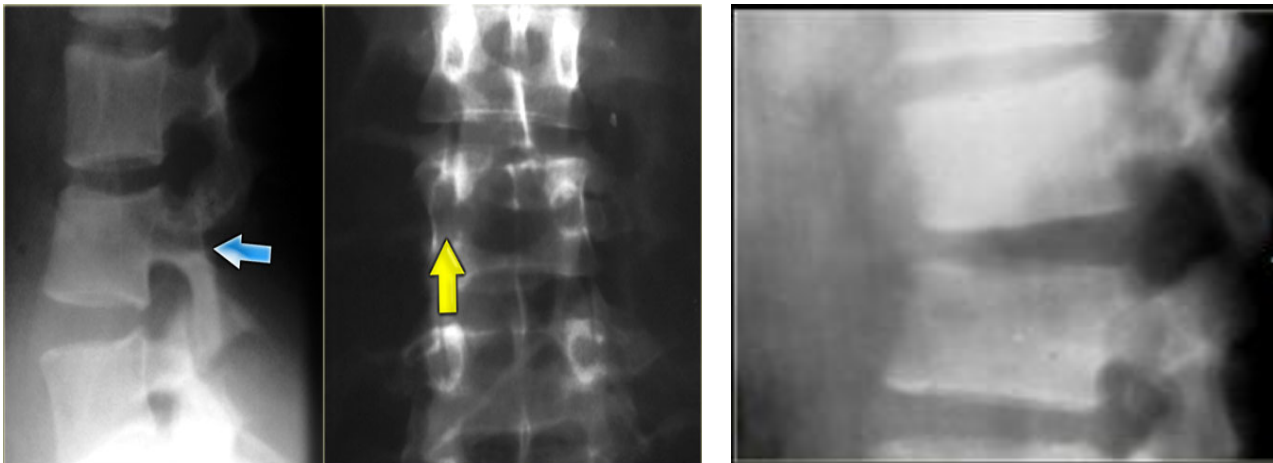
- The distance BTW spinal process is equal → meaning it is stable injury → managed conservative.

❖ Burst fracture:



- Retro-avulsion traction disturbed vertebral body, wide distance BTW pedicles. In the CT there is fragments in the canal
- There is significant kyphosis.
- Unstable fracture → managed by compression or fixation according to neurological deficit.

❖ Chance fracture:



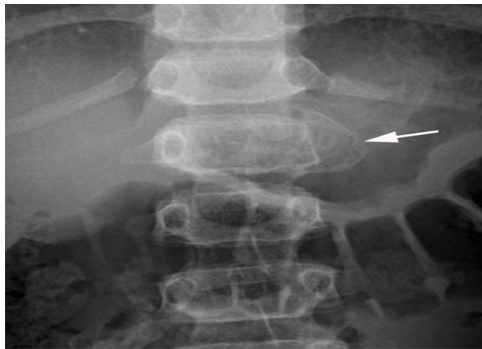
- Chance fracture could be bony chance (in the upper part) or ligaments chance.
- The spinal processes are not aligned.
- There is a space BTW pedicles.
- Unstable → managed surgically

❖ Fracture dislocation:



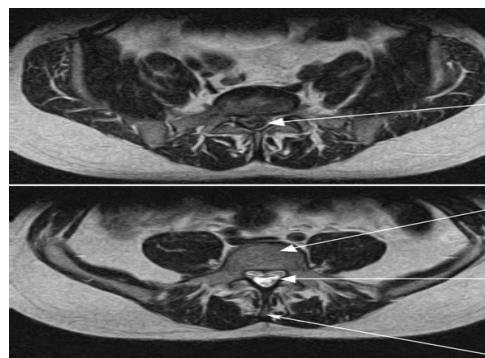
❖ Pathologic fractures:

- Low-energy fractures.
- Osteoporotic is common.
- Usually due to infection or tumor.
- X-rays: “winking owl” sign. (there is a missed pedicle as if it is winking (closed))



❖ Cauda Equine Syndrome:

- A surgical emergency.
- Common cause is herniated disc and spinal stenosis
- Requires full neurologic examination including rectal examination for anal tone.
- **Clinical features** →
 - 1- **Motor (UMN signs):**
 - Weakness, Reduced deep tendon reflexes (knee or ankle).
 - 2- **Autonomic:**
 - Urinary retention, fecal incontinence due to loss of anal sphincter Tone.
 - 3- **Sensory:**
 - ➔ Sciatica (low back pain radiating to legs aggravated by Valsalva maneuver and sitting, relieved by lying down).
 - ➔ Bilateral sensory loss or pain depends on the level affected
 - ➔ Saddle area (S2-S5) anesthesia.
 - ➔ Sexual dysfunction (late presentation)
- Investigations: X-rays initially (just a routine investigation but it will be negative), but **MRI is mandatory (it is the gold standard)** as X-rays are usually unremarkable.
- Treatment: Emergency decompression-usually discectomy and wide laminectomy within 24 hours. (it is not elective procedure)
- Prognosis is markedly improves with surgical decompression.



The only single exam that you would like to do is PR. (MCQs)

Notes //

- Spinal red flags are Cauda Equine, spinal tumors, and Fractures with instability.
- Pediatric pt with cervical injury, the most important complication is scoliosis.
- 90% of injuries occur in thoraco-lumbar spine and 50% of these fractures occur at the thoraco-lumbar junction.