Spinal Injuries

◈ Incidence and Significance

- 50000 cases per year
- 40-50% involving the cervical spine
- 25% have neurologic deficit
- Age: mostly between 15-24 years
- Gender: mostly males (3:1)

⇨ Sensitive age

◈ Mechanism of Injury

- MVA: 40-55%
- Falls: 20-30%
- Sports: 6-12%
- Others: 12-21%

◈ Anatomy of the Spine

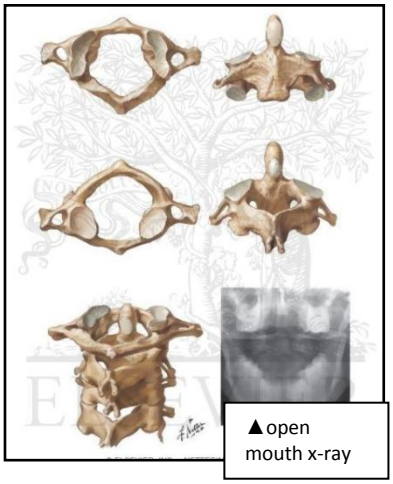
- Bones : vertebrae for protection , bear most of the weight put on yourspine. → NB : the bone has rich blood supply so it heals fast
- Joints : 3 joints :
  - Anteriorly :
    - intervertebral disc: helps absorb pressure and keeps the bones from rubbing against each other. 60-80 % injured.
  - Posteriorly :
    - 2 facet joints
  - Joint give the movement of spine :
    - Flexion .
    - Extension
    - Ateral bending
    - Rotation
- Ligament :
  - Supraspinatous.
  - Infraspinatous.
  - **Legamentum Flavum. (the Most Important)**
  - Ant. Longitudenal Ligament.
  - Post. Longitudenal Ligament .
  - Ligament is IMP. In maintain the flexibility of spine. If injured the x-ray will be normal .

NB : Ligaments has poor blood supply so it will heal slowly

- Muscles: all spinalis muscle .

◈ Cervical Anatomy:

- C1 & C2
  - **C1**:
    - no vertebra. Body
    - Composed of Ant.&Post.arch.
  - **C2**:
    - have Ant. Projection is: Odentoid process significant in stability of C1 & C2
  - open mouth x-ray , we see the C1 &C2 and their articulation..


▲open mouth x-ray

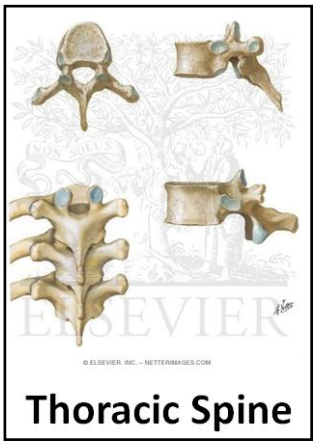
- C3-C7
  - **C3-C7** are same .
    - Has body +2 Lat.masses (facet joints) .
    - We differ it from the thoracic by Spinal process.


Cervical anatomy: C3-C7

NB : the spinal artery which give blood supply to the brain run close to C2 to C6

◈ Thoracic Spine

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

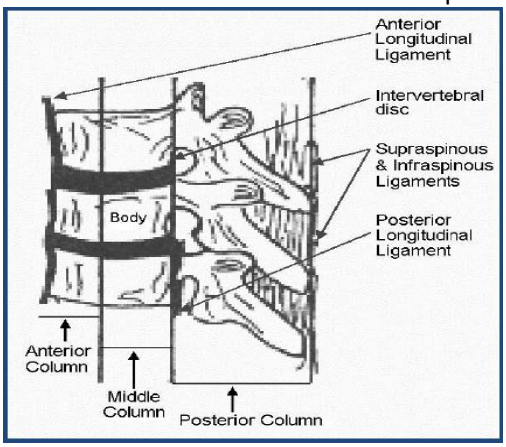

Thoracic Spine

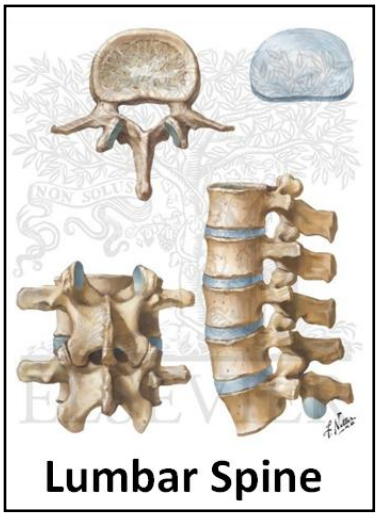
NB : the thorasic spine has limited movement so IT's REARLY injured (MCQ)

◈ Lumbar Spine

- More IMP.
- Lowest mobile segment .
- Most of ligament .
- More fracture.
- All joint here Ant +Post.
- Most of movement.

- The Three columns مهم جدا
  - Ant. Column >Ant. part of body
  - Middle column > Post. Part of body
  - Post. Column > Pidcle + Lamina+ Spinal process.



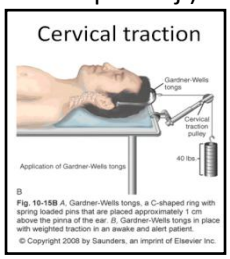

Lumbar Spine

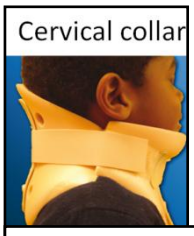
- FROM these colums we can devide the injury of the spine to :
- Stable injury :
  - one column only
  - (e.g. wedge #in Ant. Column)
  - not required treatment or conservative only

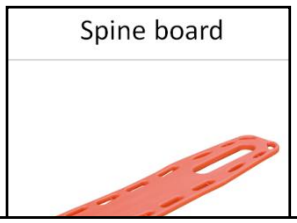
- Unstable injury:
  - 2 or more column .
  - need intervention (surgery , etc..)

◈ Assessment of the spine injured pt.

- Immobilization(by cervical colar)*[Prevent bleeding, pain…]* then but the pt, on Spine board and strap him then apply cervical traction → (NB : in children we use spine board with opening due to the head size)
- History:
  - Mechanism of injury(high or low energy)
  - Head injuries (high incidence of cervical spine inj.)
  - Seat belt injury
- Physical examination
  - Inspection, palpation
  - Neurologic examination

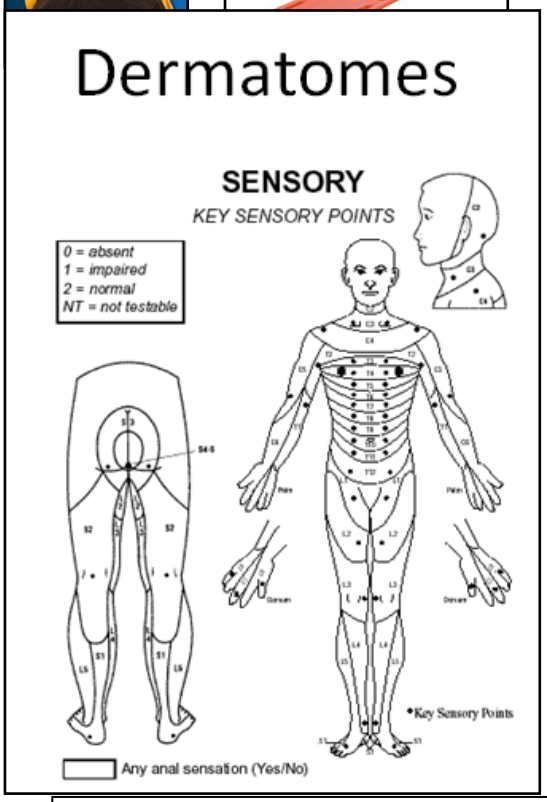






◈ Neurologic examination مهم جدا

- **Spinal cord syndromes :**
  - Complete SCI (spinal cord injury)
    - **Intially** Flaccid paralysis below level of injury
    - May involve diaphragm if injury above C5 (remember the root of the diaphram come from C3 to C5)
    - Sympathetic tone lost if fracture above T6(bradycardia + hypotension) → NB : parasympathatic will not affected because it comes from the vegus nerve and then in spinal injury it will work without inhibition
    - Bilateral effect.
  - Incomplete SCI: Good prognosis for recovery
    - Central cord syndrome مهمه
      - Upper limb > lower limb deficit.(espicialy in hand)
      - NB : this dz occure in pt, with conginital spinal stenosis So in case of compression the center which control the upper limbs will get affected
    - Brown-Sequard syndrome
      - Also called: cord hemi-section (by bone fragment ...)
      - Remember : motor tract cross in the upper levels while the sensory tracts cross at the site of innervations
      - In this syndrome the pt, will loss motor in one side and sensory in the other side Although this syndrome has good prognosis



النقاط السوداء هي مكان الاختبار- مهمه بالاوسكي

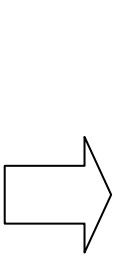
- Conus medullaris syndrome
  - Mixture of UMN and LMN deficits.
  - Not common .
  - NB : it can recover completely
- Cauda-Equina syndrome
  - Urinary retention, bowel incontinence and saddle anasthesia → SO always Check PR (rectal ex) in cases of Emergency (MCQ)

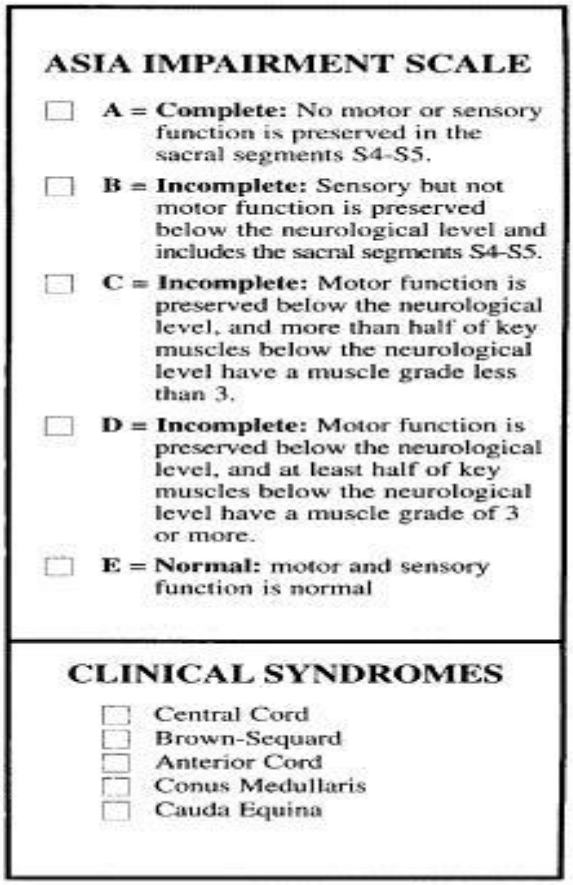
- Usually due to large central disc herniation rather than fracture
- Nerve root deficit:
  - LMN
- Spinal Shock
  - Intially the pt present with Transient loss of spinal reflexes and Flacidity
  - Lasts 24-72 hours
  - Recovery **may** begin immediately
  - Loss of the Bladder function :**Urinary Retention**
  - Characterised by **Flaccid paralysis**
- Neurogenic shock
  - Reduced tissue perfusion due to loss of sympathetic outflow مهمه and un-apposed vagal tone
  - Peripheral vasodilatation
  - Rx.: fluid resuscitation (MCQ) مهمه

◈ Imaging

- X-rays : → (NB : advantage over the other test : it can give dynamic views)
  - Cervical: 3 views
    - AP, lateral and open mouth
  - Thoraco-lumbar: 2 views
    - AP & lateral
  - Flexion-Extension views
- CT: → (NB : advantage over the other test :can get small details)
  - best for bony anatomy
- MRI:
  - best to evaluate soft tissue مهمه

IMP classification :
It is used to diffrentialte between the comlete and incomplete spinal injuries
Also it gives an idea about the prognosis
NB :
A : has the worse prognosis
D : has the best prognosis





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 :
The Closer the patient to normal (E) the better prognosis

- Function of the Ligaments:

1- Anterior Ligaments: will prevent hyperextension
2- Posterior Ligaments: will prevent HyperFlexion

- There is No Faced Joints in the Cervical Spines !
- The columns of the Lumbar Spine: 1st and 2nd
- **IN the examination there is no Active Or Passive ROM (apply for any Trauma patient**)
- **Why we stabilize the patient with a Cervical collar and a board ?**
  → If there is a cervical Fracture, and it is unstable, movement of the patient without stabilizing spine will lead to hyperextension and spinal Injury

In Examination:

- You Exam both Front and back
- For CaudaEquina Syndrome: Preform PR and Sensation to that area (around it)
- Sacral Segment:
  If there is a complete injury, sacral segment is spared with a normal PR and sensation, it is agood indication that the patient may recover from this!

- NeuroPraxia: Loss of Function, Better Prognosis
- Neurotmesis: Nerve Inside damaged but Neural sheath is intact
- Axonotmesis: Complete Cut, Worst prognosis

- **For CaudaEquina Syndrome:**

1- Red Flag
2- Ask the Patient if he can feels his bladder; can you empty it? (L4 L5, S1)
3- Not issue of tissue Profusion, so Fluids only you give to the patient (Issue of Neurological Function)

- UMNL:
- Patient will have Hyperflexia, Hypertoniaand Rigidity. But in spinal Cord injuries the patient is in the first 24-72 Hours will be flacced and No Reflexes (temporal state) due to SPINAL SHOCK

- Synapses of reflexes:
  By Removal of the cortex responsible Injury

◈ Management of Spinal Injuries

- Depends on:
  - Level of injury (thoracic spin inj. Mostly by consevative , cervical injuries need ventelation)
  - Degree and morphology of injury
  - Presence of neurologic deficit
  - Other factors . If the p.t has another injury we can called it (p.t factor)
- Some general rules: مهم جدا – سؤال
  - Stable injuries are usually treated conservatively
  - Unstable injuries usually require surgery
  - Neurologic compression requires decompression

NB : 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

Notes:
If there is a shear → really bad trauma
Subluxation: Incomplete (Partial)
Dislocation: Complete

(Subluxation in the Spine called: Spondolytheasis)

- Thoraco-Lumbar (why is it common?) T11- L2

Thoracic Spine is very rigid – have some rotation
Lumbar is very Mobile

- The only part you can feel in the spine is the Spinous Process

CaudaEquina Syndrome (VeryImportant)

•A surgical emergency

•Requires full neurologic examination *including rectal examination for anal tone (MCQ) → do it for all Emg cases*

•Investigations: X-rays initially, but *MRI is mandatory as X-rays are usually unremarkable*

•Treatment: Emergency decompression-usually discectomy- within 24 hours.

Etiology:

- Compression or irritation of Lumbosacral Nerve roots below ConusMedullaris (Below L2 Level)
- Decreased space in the vertebral canal below L2
- Common causes: Herniated Disk or/and Spinal Stenosis, vertebral Fractures, Tumours
- Note: Spinal cord ends at L1-2, Dura ends: S1-2

Clinical Features:

- Usually Acute (develops in less than 24 hours)

1. **Motor (UMN signs)**

- Weakness, Reduced deep tendon reflexes (knee or ankle)

2. **Autonomic:**

- Urinary retention (Or overflow incontinence) and/or Fecal Incontinence due to loss of anal sphincter Tone.

3. **Sensory:**

- Low back pain radiating to legs (sciatica) aggravated by vlasalvaManeuver and by setting: relived by lying down.
- Bilateral sensory loss or pain; depends on the level affected
- Saddle area(S2-S5) anesthesia
- Sexual Dysfunction (Late Finding)

Treatment:

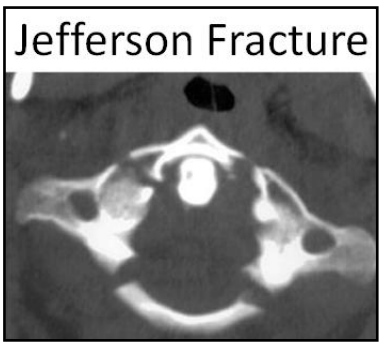
- Urgent Investigation and decompression (< 48 H) to preserve bowel, bladder and sexual function and/or to prevent progression to paraplegia

Prognosis:

- Markedly Improves with surgical decompression

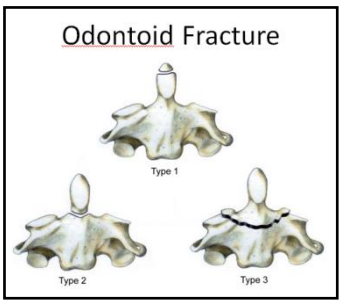
MRI Is the Gold standard Investigation

◈ Specific Injuries



- **C1**
  - **JEFFERSON FRACTURE غير مطلوبه - قراءه فقط**
    - Compression force
    - Stable fracture, Usually treated conservatively
    - Is burst fracture.
    - Tx : we need rigid cervical spine.

- **C2**
  - **ODONTOID FRACTURE غير مطلوبه - قراءه فقط**
    - Management depends on location of fracture.
      - **Fractures of the tip:short** Immobilisation is adequate
      - **Fractures of the base**: will heal well by **adequate** Immobilisation
      - **Fractures at middle** require internal fixation

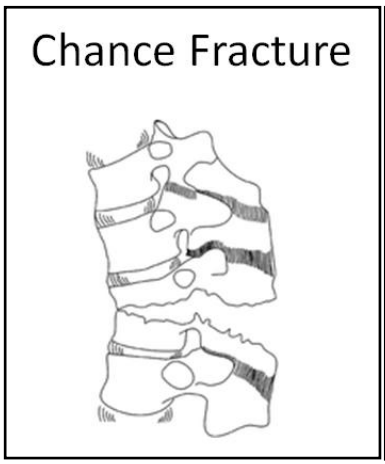


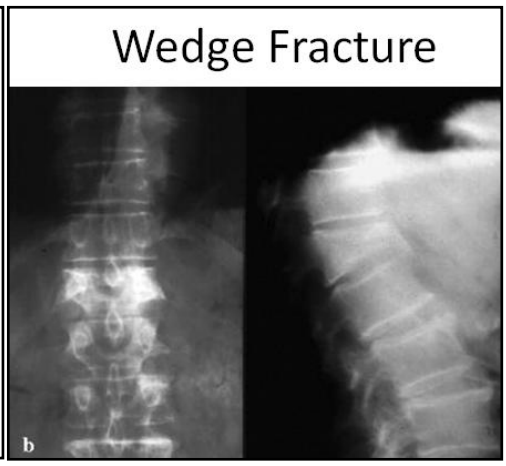
  - **HANGMAN FRACTURE غير مطلوبه - قراءه فقط**
    - Traumatic spondylolisthesis of C2 (#of pars interarticularis)
    - Managment depends on displacment and presence of C2-3 subluxation.
    - IF displaced leads to **immediate** death by compression of Medulla Oblongata, *So, Surgery as fast as possible*

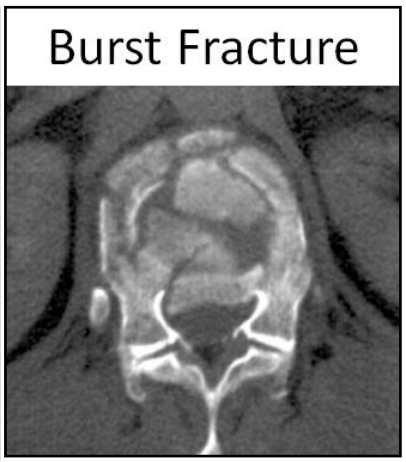
- **C3-7**
  - Descriptive: depends on mechanism of injury
    - Flexion/extension
    - Compression/distraction
    - Shear
  - Presence of subluxation/dislocation
  - SCI (Spinal Cord Injury):
    - high fracture results in quadriplegia
    - Low fracture results in paraplegia
    - At cervical spine (tetraplegia).
    - Below cervical spine (paraplegia).

❖ Thoraco-Lumbar fractures

- NB : most injuries occure at this area because it is the area between the rigid (thoracic) and mobile (lambar)
- 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)**
    - NB : normally the anterioir and posterior vertebral walls are equal → but in this type of fracture either the A or the P wall will compress
    - is a vertebral compression fracture occurring anterior column or middle.
    - In picture , vertebra resembles a wedge.
    - These fractures are more commonly found in the thoracic spine
    - These fractures occur in pt with osteoporosis (MCQ)
    - They are stable and treated conservatively
  - **Burst (compression)**
    - It is compression injury
    - It require surgery sometimes
  - **Chance (flexion/distraction)**
    - It common in old cars accidents where the seat belt hold the abdomen only
    - It caused by sever flexion and traction
    - It is instable and require surgery







◈ Pathologic fractures

- Due to infection or tumor
- Low-energy fractures
- X-rays: “winking owl” sign (MCQ)