

Spinal Trauma

Source : Dr.Fadi El Haddadi

- Vertebral column fractures are common but they are usually missed due to ATLS system ; because spine is reached in the secondary survey. And in the secondary survey, usually there is other more severe injuries other than the spine
- In high energy trauma you should expect spinal injury until proven otherwise, especially if the patient is comatosed. If the patient is conscious ask him\her about back pain and examine him\her.
- As in spinal disorders, kyphosis is stable, but lordosis is unstable.
- Most fractures happen in the junctional areas (transition between kyphosis and lordosis; cervicothoracic and thoracolumbar → T10-L2 are the most common site → 65%), T11-12 are the most unstable site in the spine → increased risk of fracture
- In Males more than the females.
- Suspect spinal fracture in comatosed pt and in major trauma
- Major consequence → paralysis.
- Fractures can be due to:
 - **High** energy trauma: more in young age, examples (RTA, falling down, gun shot)
 - **Low** energy trauma: more in elderly, examples (weak bone due to osteoporosis with small trauma)
- Approach (hx+ physical + investigation) :
 - **History:**
 - Mechanism of injury → you should ask about the details of RTA : if the patient was in a car or pedestrian (more severe), type of car (old or new, large or small), front seater (affected more) or back seater (less affected), model of the car (to know about the seatbelt and airbags), ask about the status of the other people who was involved in the accident, type of car that hit the driver
 - When approach in ABCDE, “ D=Disability”, ask about weakness, numbness, paresthesia in UL+LL
 - **Physical examination:**
 - inspection: look for bruises, hematoma and deformities, if open fracture look for wound
 - palpation: tenderness or crepitations (find the area of maximum tenderness to orient the x-ray imaging). Then order a spine x-ray where the point of maximum tenderness at the center of the x-ray

In secondary survey (physical examination from head to toe) translation and rotation are **CONTRAINDICATED**, you should move the patient **AS ONE PIECE**, at least 3 people should hold the **head, trunk and pelvis** (one at each site), if a fourth person was found let him hold the **lower limb**

Investigations:

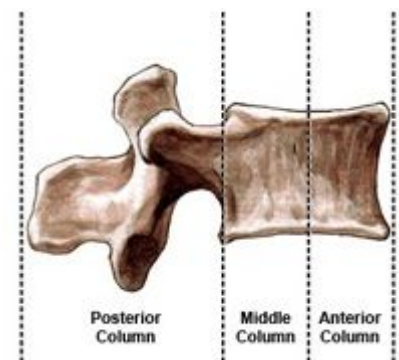
- Order a spine x-ray where the point of maximum tenderness at the middle of the x-ray
- If there is fracture → do **WHOLE** spine x-ray. Pain makes people change their positions (as a reflex), so that it will cause energy to go to another place causing another fracture, it is not necessary for both fractures to be from the same type, they can be from different types.

25% of patients have non-contiguous fracture, so , if you find a fracture in the initial focused x-ray → do a WHOLE spine x-ray.

- Vertebral column fractures are mostly (but not always) diagnosed by x-ray, but you can use CT scan too.
- CT scan → needs 10 minutes, specific for bone lesions
- MRI → needs more time, sensitive but not specific, used for soft tissue injury.
- If there is no back pain or tenderness, no neurological deficit, and the pt is conscious and oriented → DO NOT do x-ray or CT
- If the pt is unconscious → do x-ray then CT → because you can't know if there is pain or tenderness.
- Bone does not cause pain , pain comes from the periosteum
- The aim is to know if there is fracture or not and if the fracture is stable or not.
- When you look to the x-ray, in both views AP and lateral views, we look for:
 1. The **size** of vertebra: normally the size of vertebra increases while going down the spine, so if you find a vertebra smaller than the one above it, this means a fracture
 2. The **alignment**: if you find a change in the alignment of vertebra this indicated displaced fracture
 3. Is there a fracture displacement.

Spinal cord (from lateral view) is divided into 3 columns “**denis classification**”:

- **Anterior column**: anterior half of vertebral body, anterior longitudinal ligament, anterior portion of annulus fibrosus
- **Middle column**: posterior half of vertebral body, posterior longitudinal ligament, posterior aspect of annulus fibrosus
- **Posterior column**: the facet joint, the neural arch, ligamentum flavum, interspinous ligament



Major and minor fractures:

- 1- **Major**: part of vertebral body, pedicles or laminae
- 2- **Minor**: ligamentous injury or spinous process fracture

Stable and unstable fractures:

1. Stable fractures:

- stability means the ability to withstand with normal physiological load (eg: standing, walking,...) with no pain and no neurological deficit.
- ONLY one column of vertebra is affected
- Treatment is conservative

2. Unstable fractures:

- normal physiological load will cause pain or neurological deficit
- 2 columns or more are affected
- Treatment is surgery

- Classification is important in management, prognosis and it is a way of communication between doctors
- The key of this classification is **the middle column**, because it can't be affected (fracture) alone, as there is no spine movement that can fracture the middle column alone.. so, if the middle column was affected this means it is 100% unstable fractures.
- if the middle column wasn't affected this is mostly a stable fracture (but not in all cases, so look for the other columns)
- 1 column affected → stable → conservative Tx
- 2 or more columns affected → unstable → surgery

- **Wedge compression fracture:**

- Mechanism of injury: flexion
- If the compression was **less** than 50% of the body of the vertebra (in relation to the vertebra above and below) It is usually stable fracture (mostly in Ant. column) treated conservatively, but later on may present with chronic back pain in which surgery is done.
- If the compression was **more** than 50% of the body of the vertebra (in relation to the vertebra above and below) this means in addition to the compression, the posterior column is affected (ligamentous injury or spinous process fracture) → compression and distraction injury → (Ant. +post. column) → those patients need surgery
- If ligamentous injury is suspected → do MRI
- Associated with osteoporosis



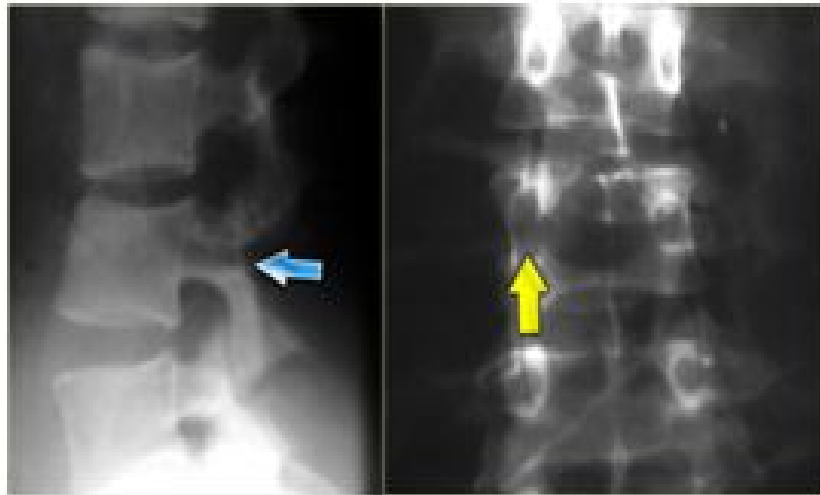
- **Burst fracture or Axial compression:**

- Mechanism of injury: axial loading
- Mostly seen in: falling from height on their feet (while standing), paratroopers (تسبب اصابة جسيمة --الجسيم, المظليين)
 - (على المطبات بسرعة عالية)
- Gravity line : from base of skull, C7, T12, sacroiliac joint (bilaterally), femur head, medial condyle of femur and tibia, calcaneus
- Axial loading can cause fractures at any point on the gravity line.
- Base of skull fracture will present with many signs , one of them is raccoon eyes which is a late presentation
- assume you have a patient fell on his feet from the 4th floor, if you find a severe fractures in calcaneus and medial condyle of femur and tibia you don't expect to have other severe fractures in the upper points, but if you only find simple calcaneus fracture you should search for other fractures along the points of gravity line.
- It is unstable (mostly in Ant. +Post. columns) fracture so it needs surgery
- It can cause paralysis if the pt is moved
- It might cause 3 columns fracture → more severe neurological deficit.

- **Seatbelt fracture (chance fracture) :**

- Mechanism of injury: flexion-distraction
- Most dangerous as it is Commonly and easily missed; because it is not always detected by x-ray
- The patient has all signs and symptoms of fracture (back pain, tenderness, crepitations). Do x-ray, if fracture can't be seen→ do CT scan, if you can't see it → do MRI.

- It's impossible to have signs of fracture without having a fracture.
- DON'T discharge this patient until you do CT and MRI and confirm that there is no fracture
- If there is symptoms of fracture (pain , tenderness, decreased ROM) with no x-ray changes → mostly it's a Seatbelt fracture
- It is unstable fracture where 3 columns are affected, so surgery is the treatment
- If the seatbelt was at the level of the disc, the fracture will be in the bone(vertebra), but If the seatbelt was at the level of the vertebra, the fracture will be in the disc (can ONLY be detected by MRI)
- Occurs mostly in old cars which has a type of seat belt only on the abdomen with no lateral belt (shoulder belt)→ with acceleration and deceleration injury this can cause this type of fracture
- To decrease the risk of this type of fracture →
 - The use of new seat belt → lateral belt → lateral belt(shoulder belt)
 - Air bags



- **Displaced fracture:**

- The patient is presented with paralysis
- It is unstable fracture, needs surgery to prevent chronic back pain NOT to return the spinal cord function because the patient is already paralyzed.
- Dislocation : loss of articulation , if its partial → subluxation
- If we consider the disc a joint we can apply the previous terminology on this type of fracture

