



## Lecture (10)

# Bone Fractures

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### Resources:

- Lecture by dr.AlBoukai
- Diagnostic imaging book

# Musculoskeletal Radiological Trauma

## ❖ Terminology In Bone Trauma:

### - Dislocation vs. Subluxation.

- Dislocation → complete displacement (separation) between the articulations of the bones (joints). There is a disruption of the alignment between the 2 bones
- Subluxation → partial displacement (separation) of the joints. The 2 bones are in the same alignment.

### - Closed vs. Opened fractures.

- Closed → the skin is intact → no risk for superadded infection.
- Open → the skin is not intact → risk for superadded infection.

### - Greenstick vs. Torus fractures. vs. Physeal injuries.

- All the 3 types occur in pediatric age group → because the bones (the cortex of the bones) are still not consolidated → leading to a specific pattern of injury.

### - Stress fractures.

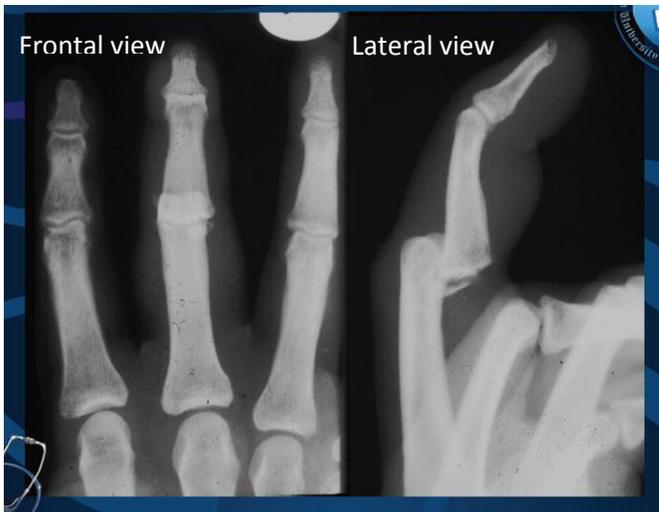
- It is the fracture that occurs in a bone that has been exposed to a repeated minor trauma.
- The bones before the fracture are normal.
- E.g. → the soldiers → they have repeated stress injury while they are walking and exercising (military type of walking)
- These types of fractures are usually thin and lucent lines and they appear as a transverse line
- If you see an oblique line → it is less likely to be a stress fracture.
- Since it is a **thin and lucent line** → it is **important that we look for it**
- Usually it occurs in the shaft of the tibia; head of femur or **in the metatarsal bones**.

### - Pathological fractures.

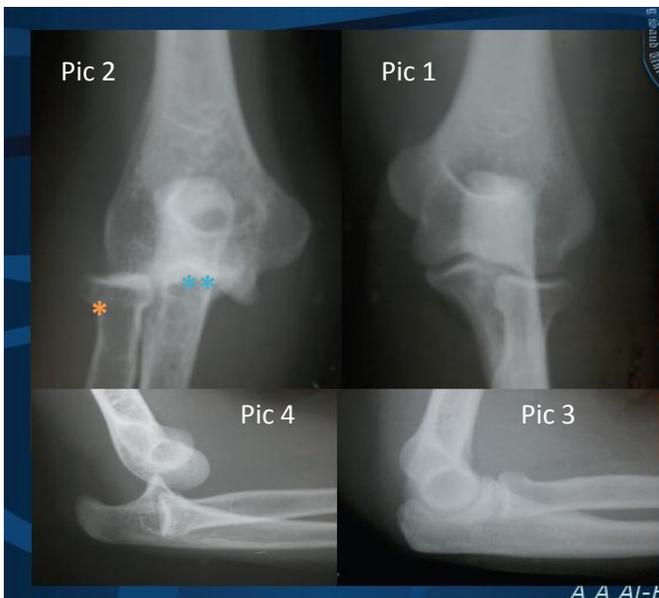
- The bone is abnormal before the fracture.
- Minor trauma may cause this type of fracture.
- E.g. patient has osteoporosis or patient with a neoplastic lesion → the bones will be less consolidated → increase the risk of fracture with minor trauma

### ❖ Basic Principles In Radiology Of Bone Trauma:

- **Two** perpendicular views.
  - ( give us the chance to visualize all the circumferential aspect of the bone)
- Radiograph should include the **joint nearest to the trauma**.
  - (e.g. patient with trauma in the radius or ulnar in the distal portion → it is important to have the wrist joint to be in the image that you have taken as there is a possibility to injure the carpal bones or the wrist joint.)
- The **paired bone** concept.
  - (e.g. arm is a paired bone, it has ulnar bone and radius bone)
  - The injured bone will be shortened and the other bone will be exposed to more stress and therefore, the second one will be either fractured or dislocated.
- The weakest link concept (Adult vs. Children).
  - The soft tissue structures (muscles/ ligaments/ tendons) in **Adults**. (e.g. the football players, they usually have ligaments injury either the cruciate ligaments or collateral ligaments)
  - The Physeal plate (growth plate) in **Children**.
- Comparison films



- **In the frontal view** → the middle finger → loss of joint articulation → indicating that there is a dislocation → in order to clarify this dislocation → you need a lateral view.
- **In the lateral view** → there is a clear dislocation and fracture of the middle finger.

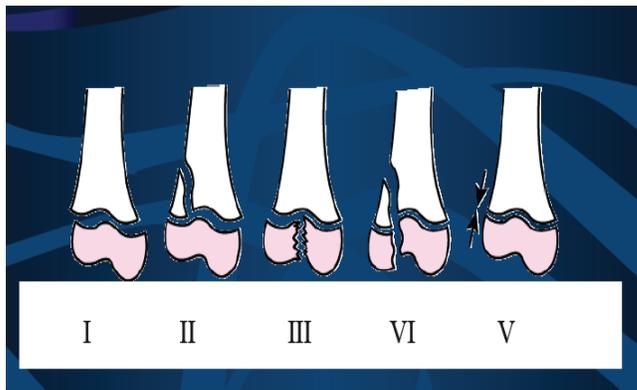


- **Picture 1** → normal articulation of elbow joints in the frontal view.
- **Picture 2** → the **radius \*** has been displaced laterally → so there is a dislocation of the radius. Also, the **joint \*\*** is not seen here.
- **Picture 3** → normal elbow joint in the lateral view.
- **Picture 4** → the distal part of humerus has been displaced laterally and dislocated.
- So, in the frontal view we could visualize only the dislocation of radius but in the lateral view we were able to visualize the humerus dislocation.



- This is elbow joint for a **pediatric** patient → because the **epiphyseal plate** is seen here.
- Frontal view → it looks normal elbow joint.
- Lateral view → there is a fracture within the distal part of the **humerus\*\***.
- This fracture might be completely missed in the frontal view.

❖ **Salter-Harris Injuries:** (it is a pediatric age group fracture --> occurs at the epiphyseal plate level --> it has 5 subtypes).



- **Type 1** → only separation of the 2 bones at the epiphyseal plate.
- **Type 2** → separation of the 2 bones with metaphyseal corner fracture. (**Most frequent type**).
- **Type 3** → separation with fracture involving the epiphysis
- **Type 4** → separation with fracture at the metaphyseal corner and epiphysis.
- **Type 5** → the 2 bones are impacted → due to vertical force → leading to retardation of the growth → because it's leads to premature closure of the growth plate. (**It is the worst type**).



- Pediatric right and left ankle joints → because the epiphyseal plate is seen in the normal left ankle joint.
- In the right ankle joint → the epiphyseal plate is **separated\***.



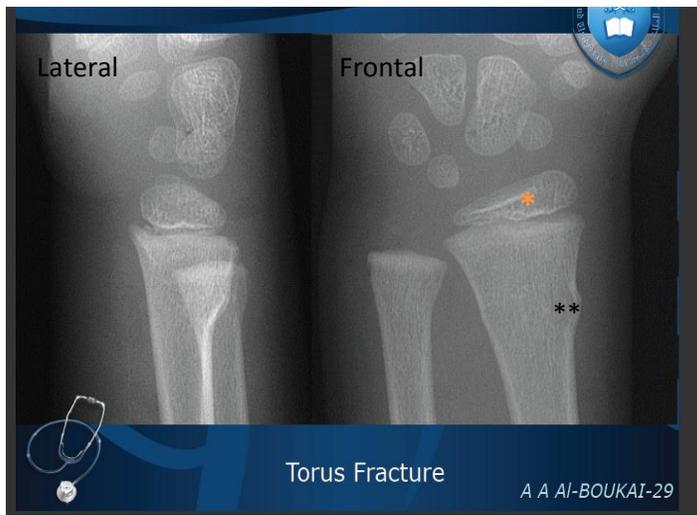
- Lateral view of the ankle joints for the previous pediatric patient.
- The **growth plate\*** of the left ankle joint.
- **Widening of the growth plate\*\*** of the right abnormal joint.
- **The history will help you to differentiate between the normal joint and the type 5 fracture.**
- In this case the patient came complaining of an injury of the right joint so, when we took the left joint image, it can't be type 5 fracture because the patient dose not complain of it.
- We took an image for both the right and left joint to compare between them



- **Irregular outline\*** in the epiphyseal plate and **slightly separated.**
- In the lateral view → there is a **soft tissue swelling\*\*** → indicating that there was a trauma to the wrist joint.
- Separation at the metaphysic level.
- This is tvpe 2 fracture



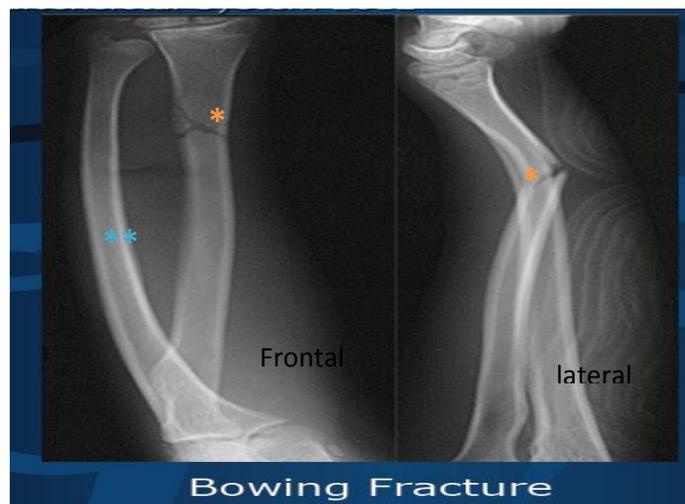
- By comparing the length of the finger between the 2 hands, we will see that the middle right finger is shortened.
- The **growth plate\***(at the base of proximal phalanges of the middle finger) is not seen here.
- Type 5 fracture.
- If this injury has been discovered earlier, the management will prevent the shortening of the finger.



- Pediatric wrist joint → because we can see the **growth plate\***.
- Puckling of the cortex\*\* → this is called a torus fracture.
- We call it torus fracture because the lesion is all over the circumferential surface of the cylindrical bone.



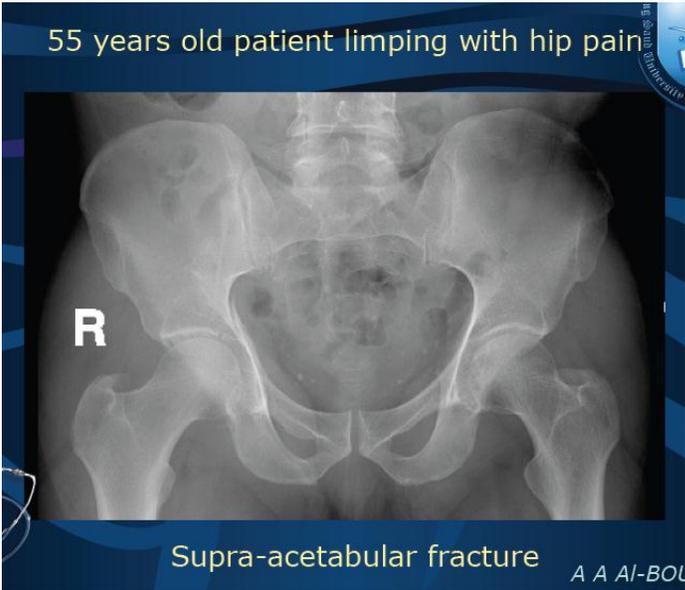
- **Greenstick \***fracture is a pending fracture.
- When there is pending force over the bone, the fibers of the cortex will disrupt from one side and preserved from the other side.



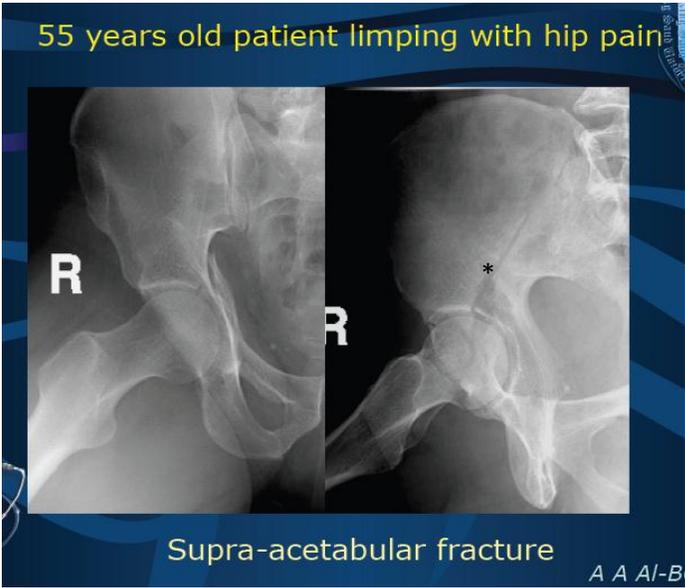
- **Angulated radius\*** fracture → leading to shortening of the fractured bone and **curving\*\*** of the other bone.
- The curvature is called bowing fracture.
- It is a pediatric age group fracture.
- This case applies the concept of paired bones



- Angulated fracture of the ulnar.
- The radius is bowing and **dislocated\***



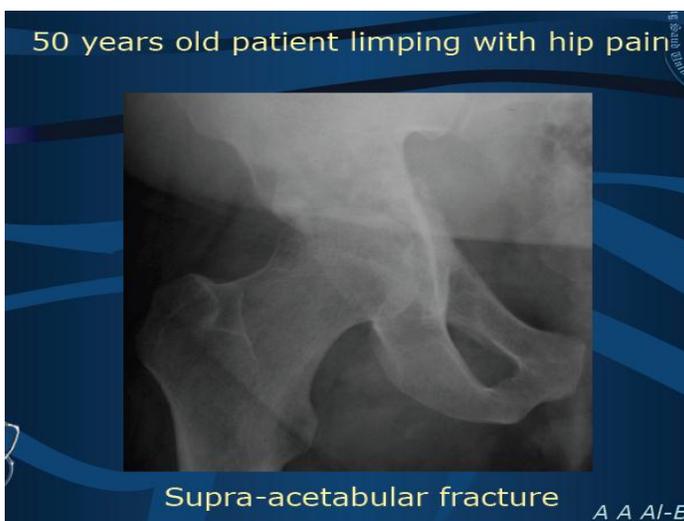
- Patient with history of road traffic accident (RTA) presented with pain in the right hip joint.
- Fracture of the right iliac bone → we can see whit dense disrupted line in the right iliac bone\*.

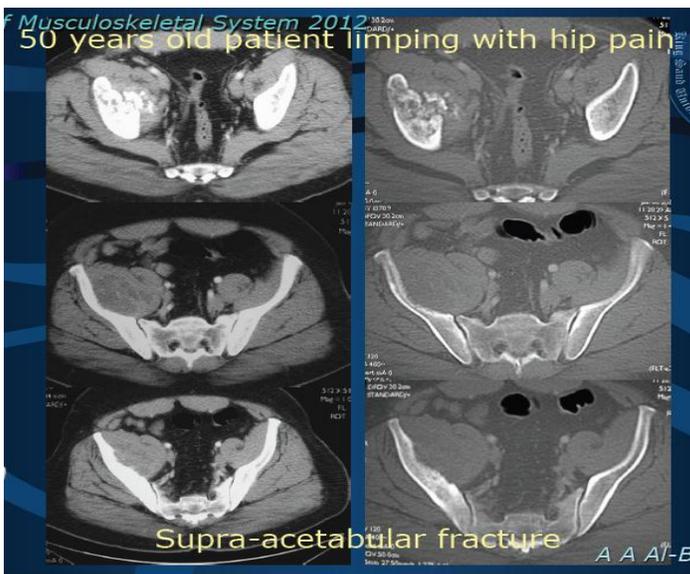




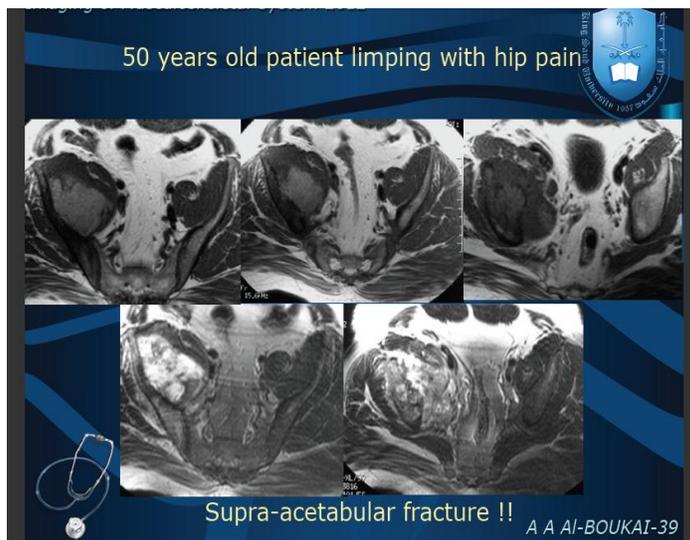
- The fracture\* of the right iliac bone for the previous patient.

- The important of CT here, is that there is a chance that there will be a piece of fracture inside the joint causing pain and limitation of the movement.

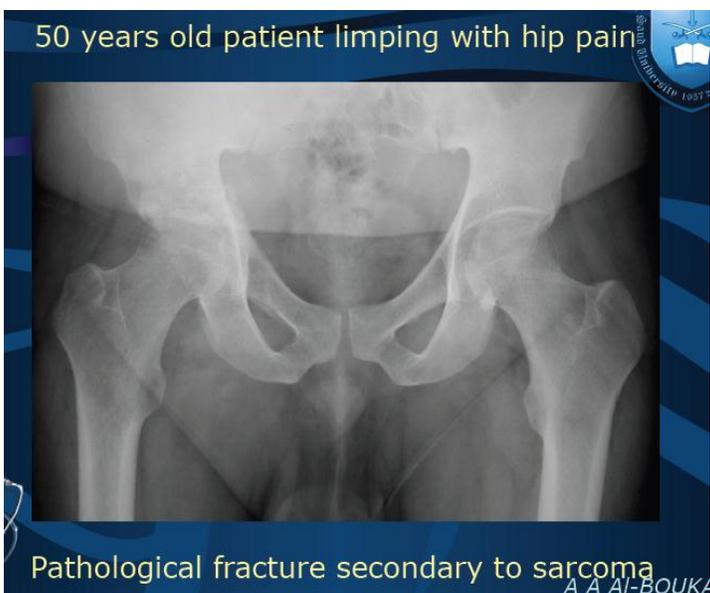


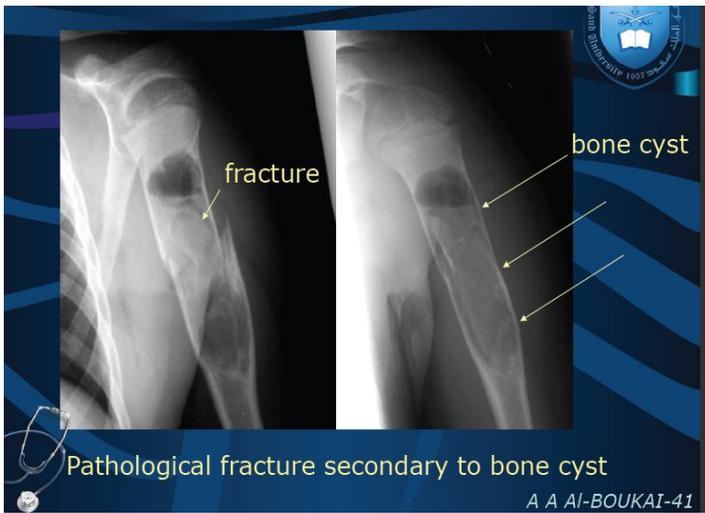


- Ill-defined articular surface of the right → this is alter texture.
- Disrupted cortical outline in the right.
- The fracture here is pieces of bones rather than sharp fracture like the previous patient.
- This type of fracture is called avulsion fracture → the bones are fragments rather than sharp
- There is also a huge soft tissue swelling around the fracture.
- The cause of this type of fracture is pathological not trauma. in this case, the patient is having sarcoma of the bone



- → if there is blood without history of trauma → suspect malignancy
- → if there is pus → suspect infection
- This case, it is blood due to sarcoma.





Pathological fracture secondary to bone cyst

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- The fracture here is sharp because of the cyst.
- But if there is malignancy → the fracture will be fuzzy.



20 Years old lady finger pain

- Fuzzy, ill-defined fracture secondary to malignancy.



Pathological fracture secondary to sarcoma

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- Patient presented with foot pain and he used to go to the work walking.
- In X-ray → normal
- Sesamoid normal bone\*.



- The X-ray was repeated one week later → there is very thin hair line traversing the shaft. ( you can see it around the sesamoid bone)
- So, if you have patient with persistent pain → repeat the X-ray