

An artistic illustration of a human spine, showing the vertebrae and intervertebral discs in a stylized, textured manner. The spine is oriented vertically, with the cervical vertebrae at the top and the lumbar vertebrae at the bottom. The illustration is positioned on the left side of the page, with a yellowish-gold background behind the vertebrae.

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.

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

- Stress fractures.

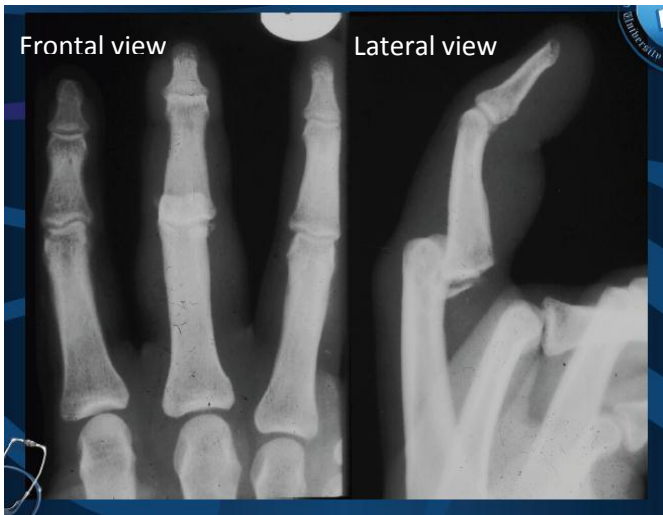
- It is the fracture that occurs in a bone that has been exposed to a repeated minor trauma.
- The bones before the fracture are normal.
- E.g. → the soldiers → they have repeated stress injury while they are walking and exercising (military type of walking)
- These types of fractures are usually thin and lucent line and it appears 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 shaft of the tibia; head of femur or **in the metatarsal bones**.

- Pathological fractures.

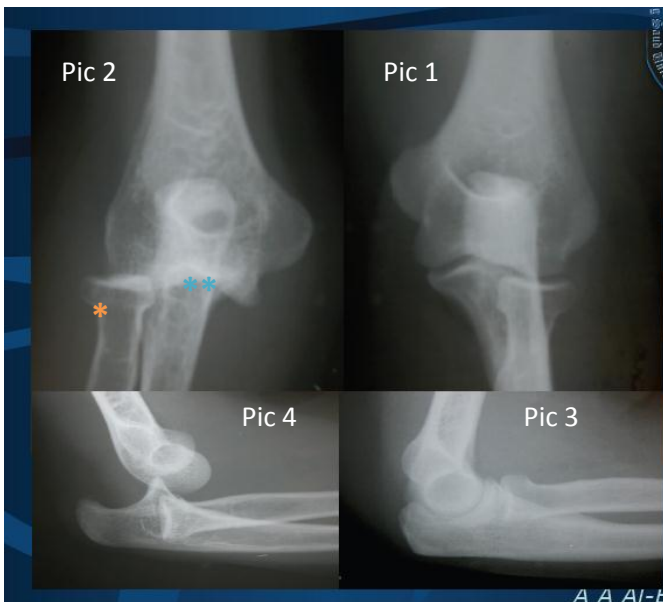
- The bone is abnormal before the fracture.
- Minor trauma may cause this type of fracture.
- E.g. patient has osteoporosis or patient with a neoplastic lesion → the bones will be less consolidated → increase the risk of fracture with minor trauma

❖ Basic Principles In Radiology Of Bone Trauma:

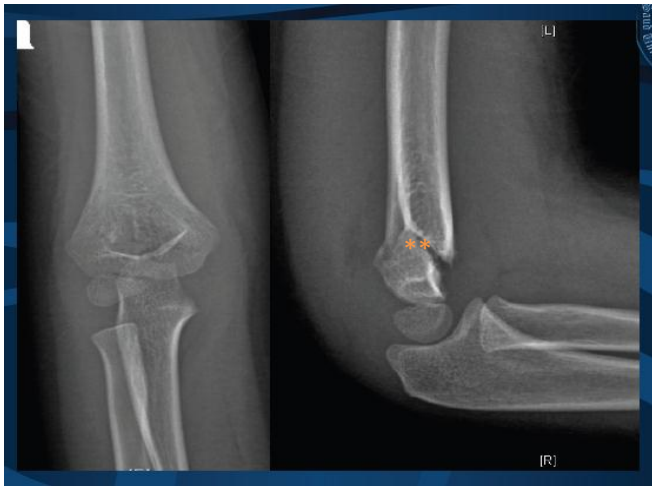
- **Two** perpendicular views.
 - (give us the chance to visualize all the circumferential aspect of the bone)
- Radiograph should include the **joint nearest to the trauma**.
 - (e.g. patient with trauma in the radius or ulnar in the distal portion → it is important to have the wrist joint to be in 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.

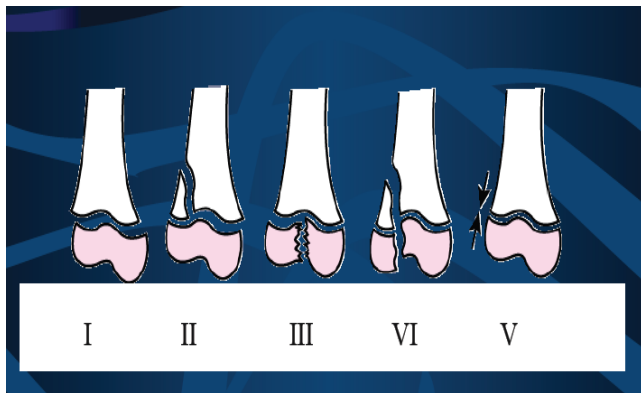


- **Picture 1** → normal articulation of elbow joints in the frontal view.
- **Picture 2** → the **radius *** has been displaced laterally → so there is a dislocation of the radius. Also, the **joint **** is not seen here.
- **Picture 3** → normal elbow joint in the lateral view.
- **Picture 4** → the 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.

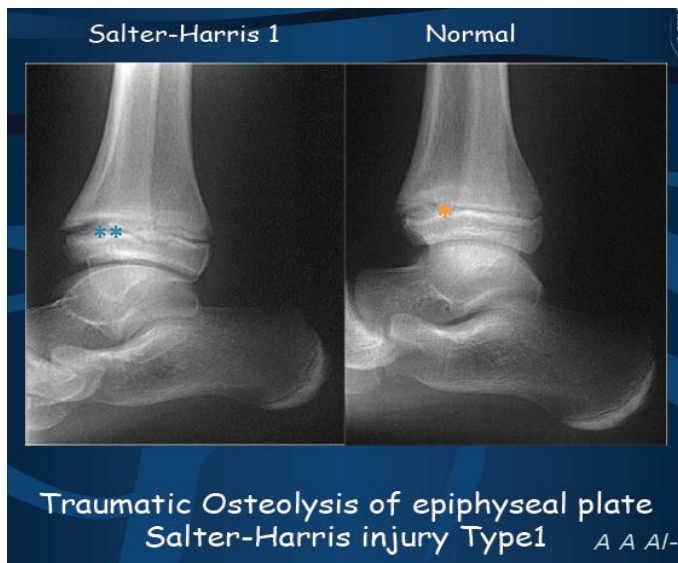
❖ **Salter-Harris Injuries:** (it is a pediatric age group fracture --> occurs at the epiphyseal plate level --> it has 5 subtypes).



- **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***.



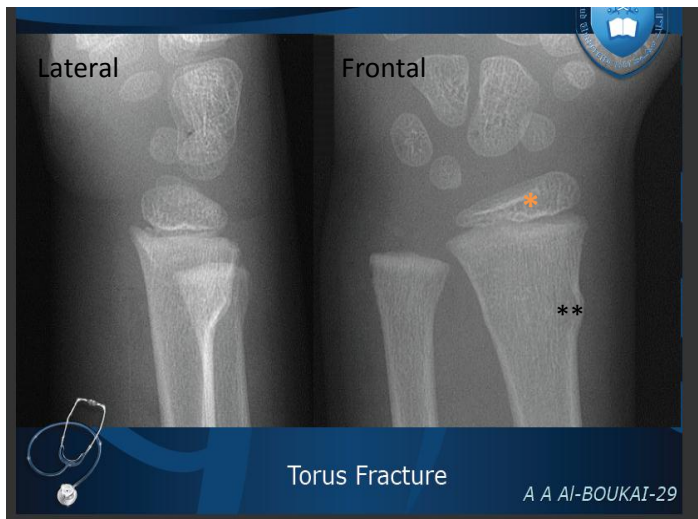
- Lateral view of the ankle joints for the previous pediatric patient.
- The **growth plate*** of the left ankle joint.
- **Widening of the growth plate**** of the right abnormal joint.
- **The history will help you to differentiate between the normal joint and the type 5 fracture.**
- In this case the 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 type 2 fracture



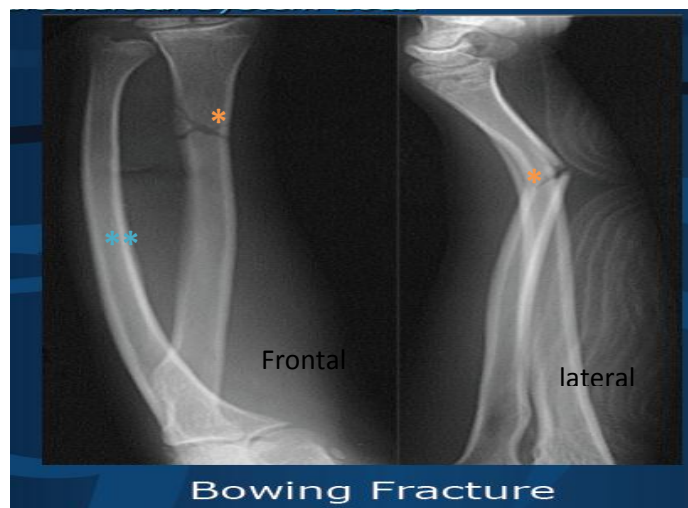
- By comparing the length of the finger between the 2 hands, we will see that the middle right finger is shortened.
- The **growth plate***(at the base of proximal phalanges of the middle finger) is not seen here.
- Type 5 fracture.
- If this injury has been discovered earlier, the management will prevent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

55 years old patient limping with hip pain

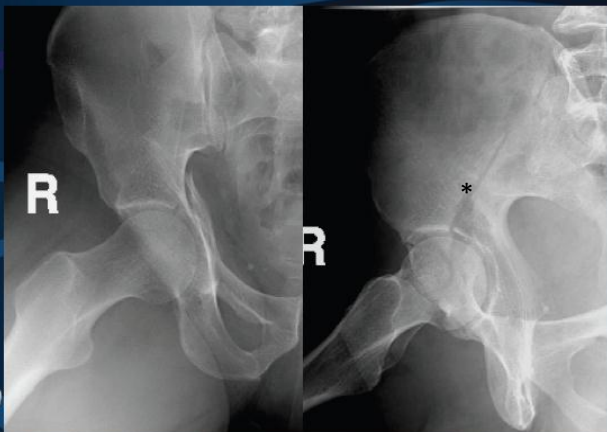


Supra-acetabular fracture

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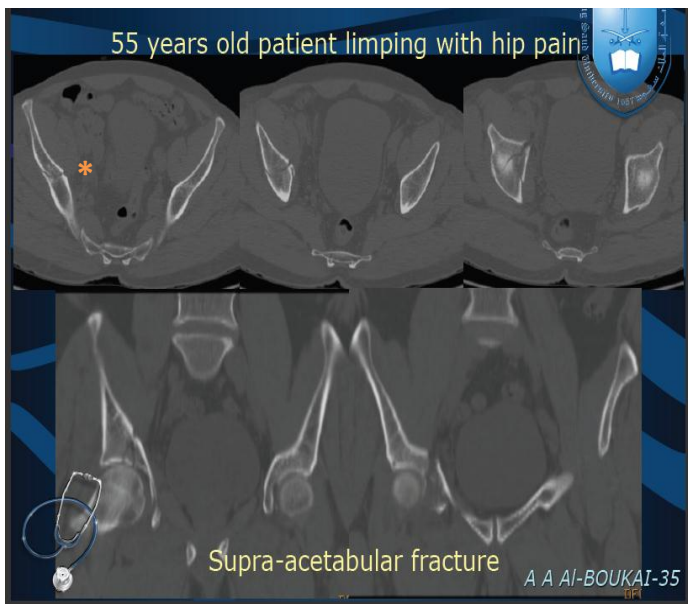
- Patient with history of road traffic accident (RTA) presented with pain in the right hip joint.
- Fracture of the right iliac bone → we can see whit dense disrupted line in the right iliac bone*.

55 years old patient limping with hip pain



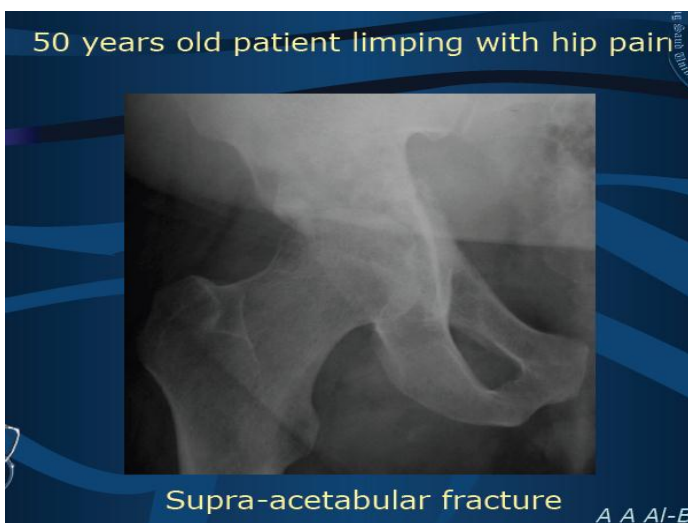
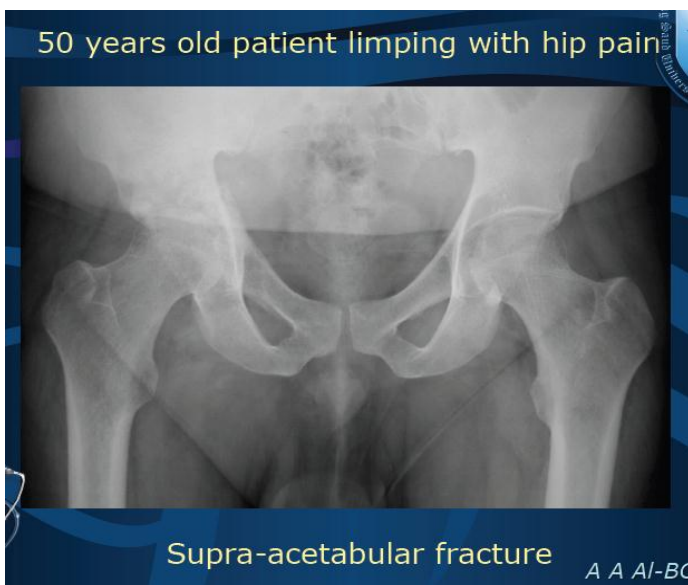
Supra-acetabular fracture

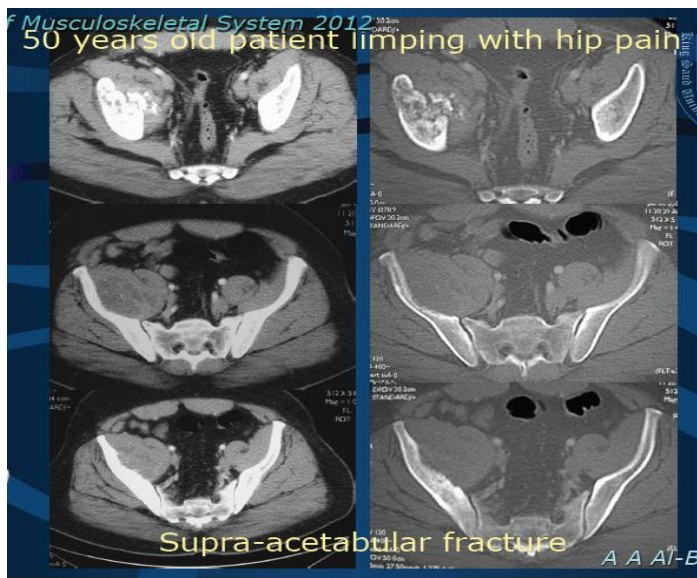
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- The **fracture*** of the right iliac bone for the previous patient.

- 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.

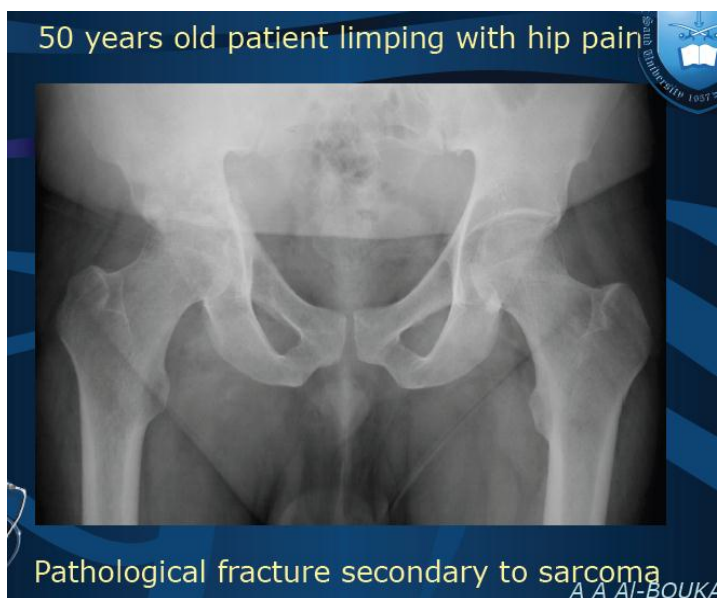


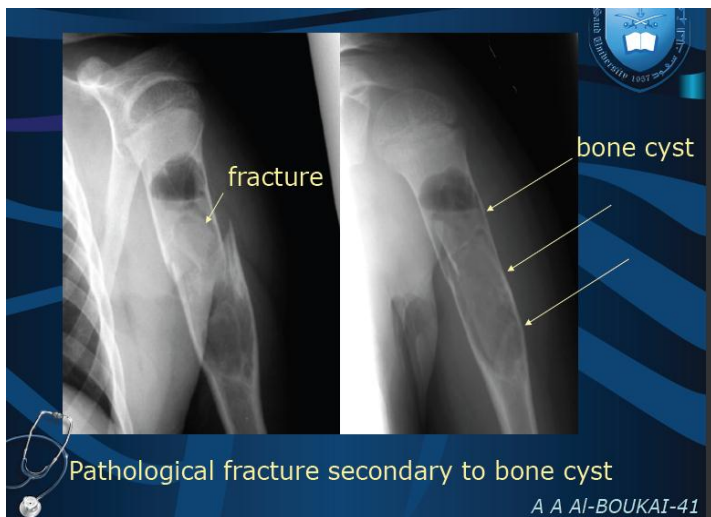


- Ill-defined articular surface of the right → this is alter texture.
- Disrupted cortical outline in the right.
- The fracture here is pieces of bones rather than sharp fracture like the previous patient.
- This type of fracture is called avulsion fracture → the bones are fragments rather than sharp
- 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

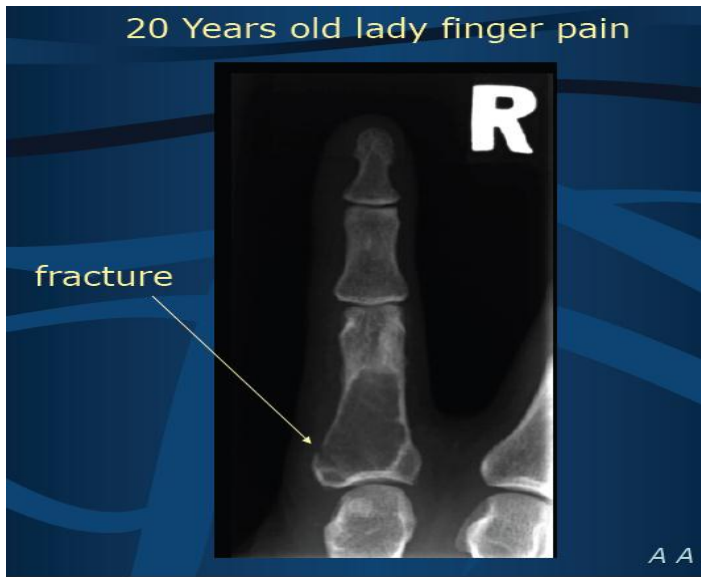


- → if there is blood without history of trauma → suspect malignancy
- → if there is pus → suspect infection
- This case, it is blood due to sarcoma.



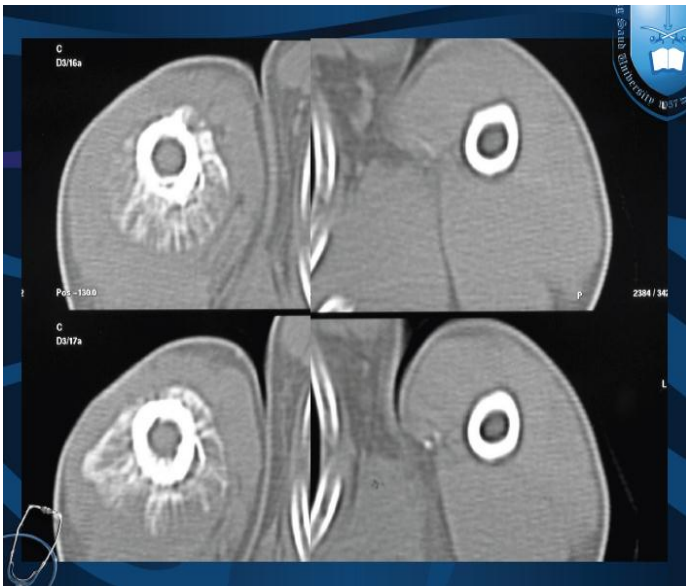


- The fracture here is sharp because of the cyst.
- But if there is malignancy → the fracture will be fuzzy.



- Fuzzy, ill-defined fracture secondary to malignancy.





- 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