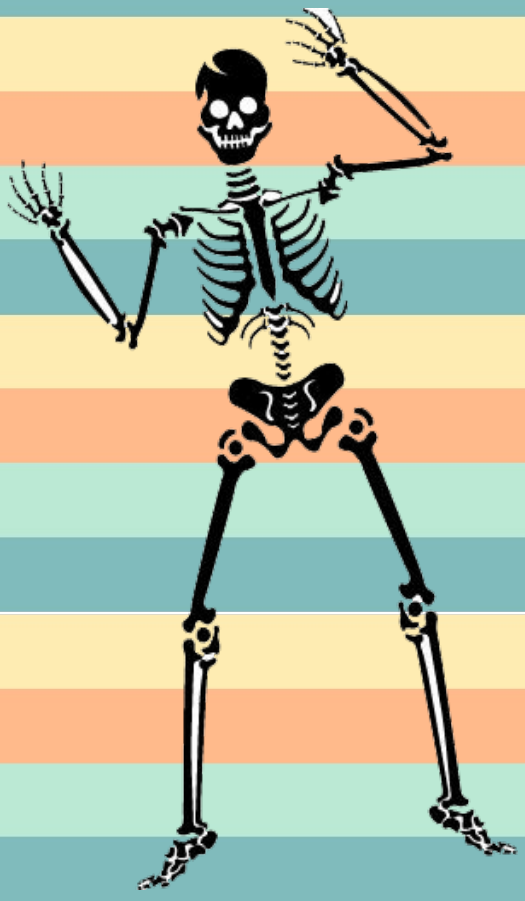
436 Teams

Radiology Teams 436

Imaging of Musculoskeletal system

Objectives

1. Understanding basics of image formation and anatomical landmarks.
2. Developing system of analyzing findings.
3. “Where to look & What to look for”.
4. Recognizing imaging features axial spondyloarthritis.



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Color Coding

Important | Notes | Extra

Editing File

Image of Musculoskeletal system

- Conventional Radiography → Cornerstone. The basic and the most important modality in evaluating musculoskeletal system whether trauma, neoplastic, inflammatory ,haematological disease or arthritis.
- Computed Tomography → Useful in evaluating bone texture. Give more details like bones' cortex ...etc
- Magnetic resonance imaging → Useful to detect earliest change in bone marrow and soft tissue like hyperemic or neoplastic changes and to assess muscles and ligaments.
- Nuclear Medicine → bone scan is very sensitive but is non-specific. It can detect hidden and early changes, it cannot differentiate between inflammatory or neoplastic changes (both will be +) earlier than other modalities.
- Ultrasound → very important to evaluate soft tissues, but its operator dependent.
    - Tendons/ligaments/muscles also by applying doppler we can detect vascularity of the lesion(hyper, hypo…).
    - Detect fluid collections around joints or within muscles.
    - Soft tissue masses and cysts.

"Where to look & What to look for"

- Bone density.
- Bone texture.
- Bone marrow.
- Distortion/displacement of normal structure.
- Articular cortices.
- Soft tissue.

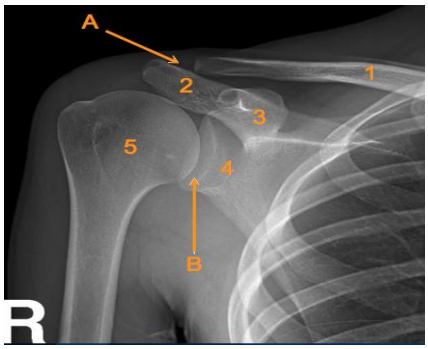
Images of Musculoskeletal system anatomy

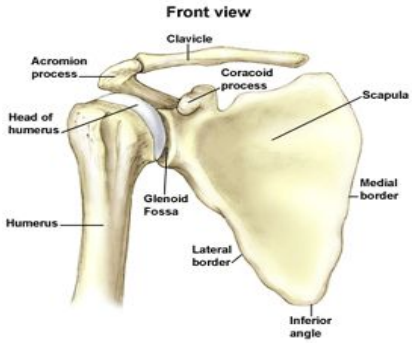
a. Shoulder joint

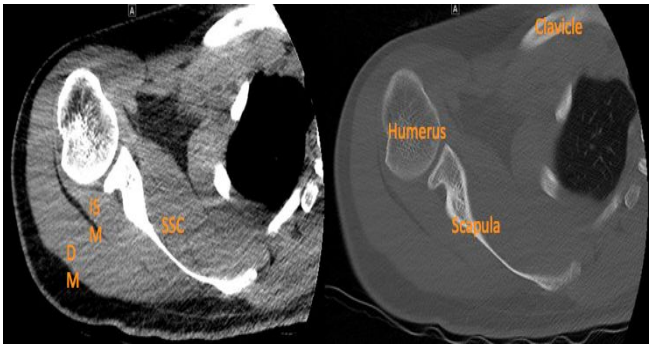
In order to have a clear image of these joint we have to put the patient in slightly oblique position because the glenoid lies obliquely to see the space between the joints.

A) Acromioclavicular joint.
B) Glenohumeral joint.

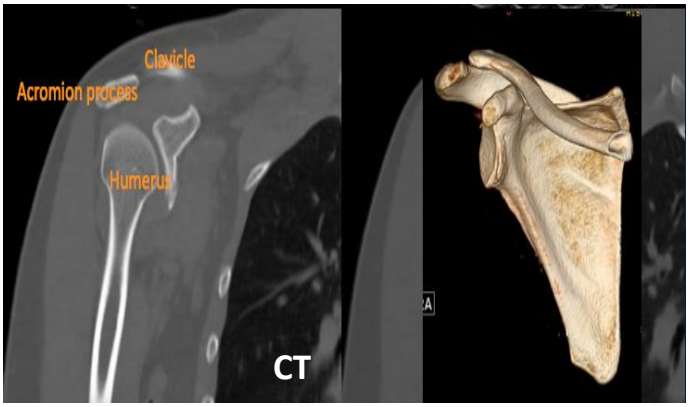
1. Clavicle.
2. Acromion process.
3. Coracoid process.
4. Glenoid process.
5. Humerus.



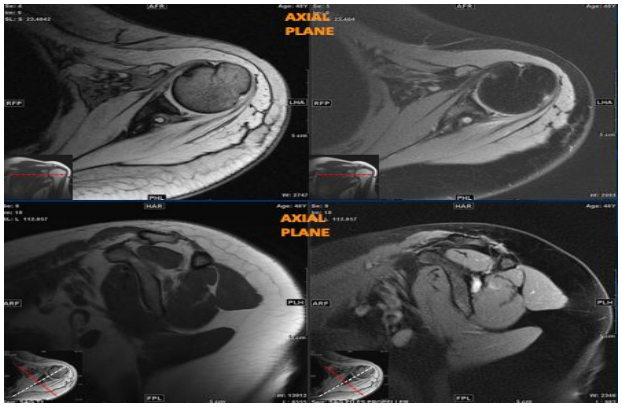


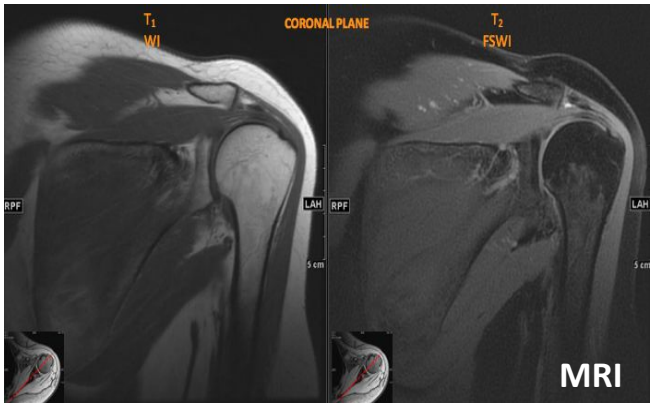


ISM = Infraspinatus muscle.
DM = Deltoid muscle.
SSC = Suprascapularis muscle.



It shows axial images and we can modify the image according to our needs whether bone window or soft tissue window and we can takes several sections that construct 3D images (see the scapula) before surgery to give the plan of surgery and gives idea about muscles.



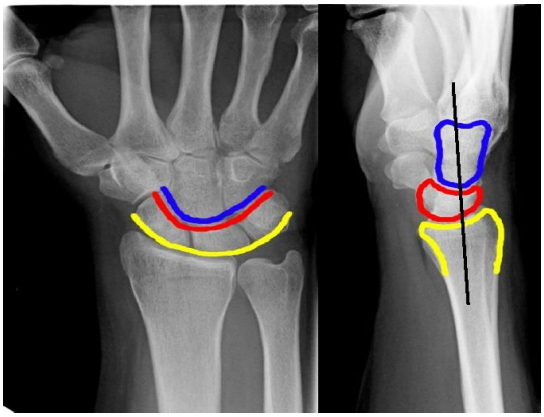


Evaluating the muscle is very important if we have any pathology. The best test for soft tissue is MRI; no radiation, and it has different windows like (T1) which gives an idea about the anatomy and the bone will appears white because of fats. Fluids appear black in T1, but white in T2. If there is injury and edema occurs fat will hide it because both are white in (T1), but suppressing bright signal of fat in (T2), we can detect early changes.

Three carpal arcs should be traced:

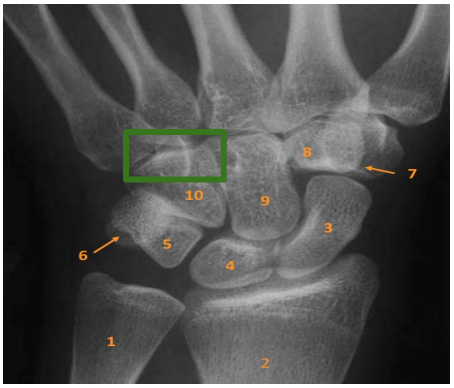
- Along the proximal row of carpal bones; proximal aspect (yellow).
- Along the proximal row of carpal bones; distal aspect (red).
- Along the capitate and hamate proximally (blue).

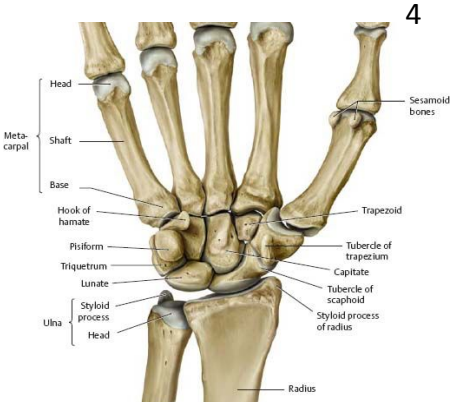
These three lines should remain unbroken.



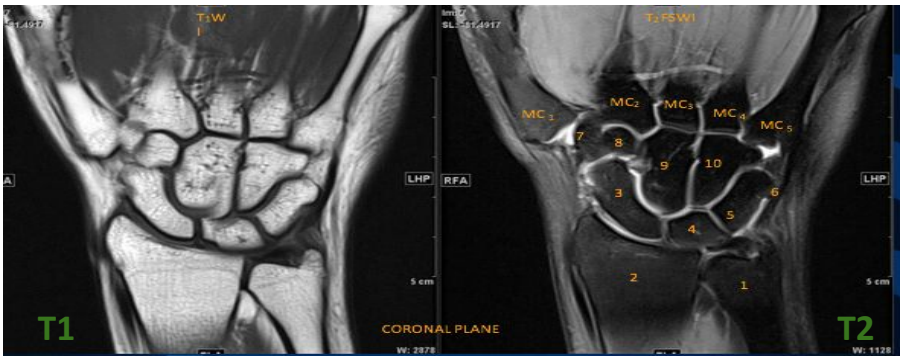
We have the radius زي الطاولة من تحت
وفوقها فيه قاعدة الكوب اللي هو lunate
بعدين الكوب هو الcapitate

b. Wrist joint





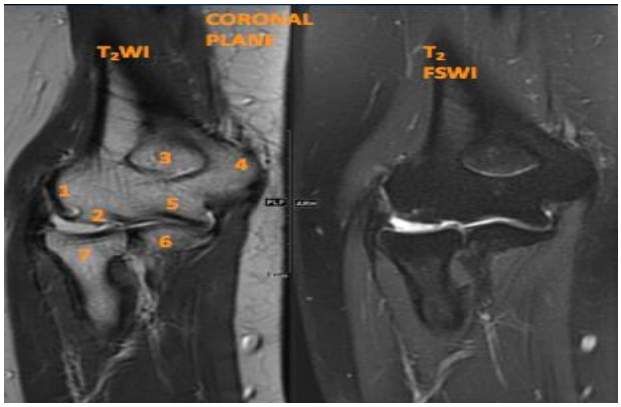
1. Ulna.
2. Radius.
3. Scaphoid.
4. Lunate.
5. Triquetrum.
6. Pisiform.
7. Trapezium.
8. Trapezoid.
9. Capitate.
10. Hamate.

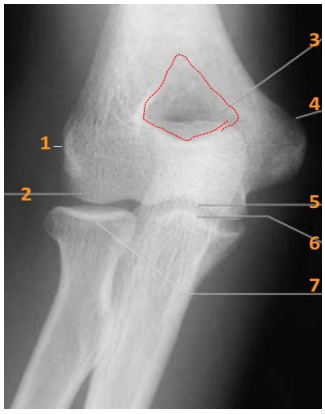


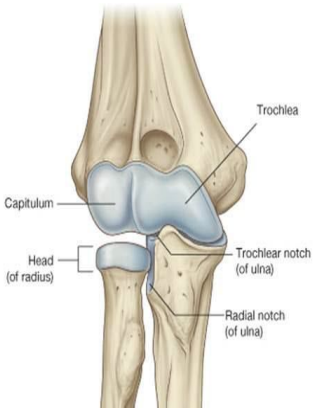
We have 8 carpal bones arranged in 2 rows forming an arch, and we have 7 tarsal bones.
In the hamate there is a rounded structure (hook) if u did the imaging in oblique position so it's not a fracture.

We do MRI to detect early changes in which settings?
In T2 it will show any change within bone marrow. Normally the bone is black, but if there is any pathology it will appears white.
The basic issue here is that we need T1 for basic anatomical landmark and T2 to highlight the early changes within the bone like neoplasm...etc
MRI can detect hidden fractures in x-ray, it also can evaluate the tendons which isn't possible with x-ray and CT.

c. Elbow joint







1. Lateral Epicondyle.
2. Capitulum.
3. Olecranon Fossa.
4. Medial Epicondyle.
5. Trochlea.
6. Coronoid Process.
7. Radius Head.

Here it's very important to differentiate medial and lateral sides, from the eminence that u could feel it medially and its related to medial epicondyle and mild curvature related to the lateral epicondyle (its above the condyle that's why they name it epicondyle) The ulna has 2 processes the short one is coronoid and the large one is olecranon which goes posterior to the olecranon fossa of distal humerus.

d. Hip joint One of most important joints, it has 3 dimensional direction (superior, inferior, anterior, posterior).

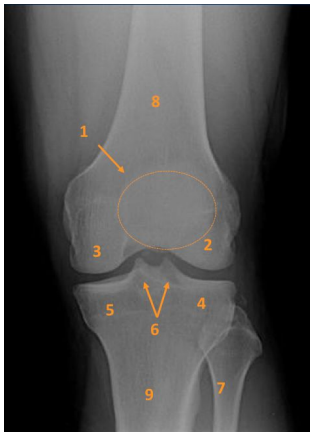
A) Sacroiliac Joint.
B) Symphysis Pubis.

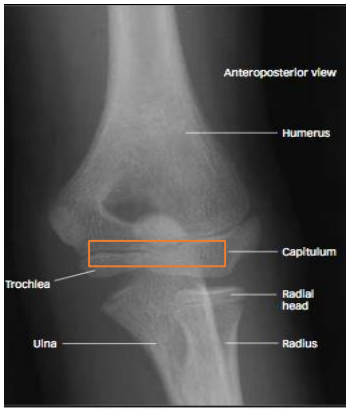
1. Superior Anterior Iliac Spine.
2. Inferior Anterior Iliac Spine.
3. Femur Head structures forming the joint: (the acetabular fossa of iliac bone + femur head).
4. Femur Neck has 2 emenance (trochanters).
5. Greater Trochanter.
6. Lesser Trochanter.
7. Ischium.
8. Superior Pubic Ramus.

in pediatrics the pelvic bone is made of three parts.

e. Knee joint

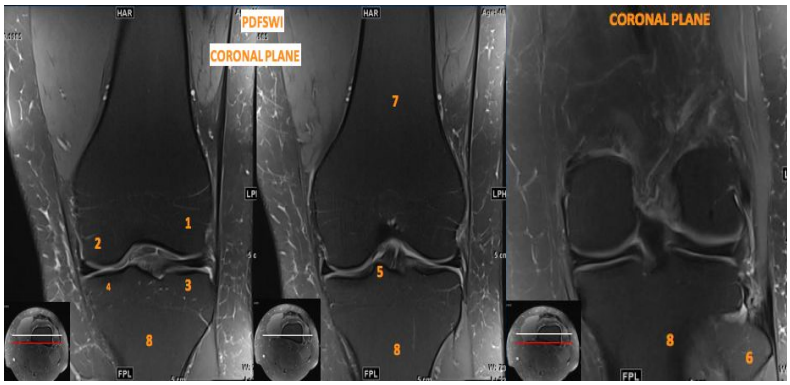
1. Patella Rounded structure.
2. Lateral condyle.
3. Medial condyle.
4. Lateral tibial plateau.
5. Medial tibial plateau.
6. Tibial eminence.
7. Fibula.
8. Femur.
9. Tibia.





A 5 year old child **An 11 year old child** **An Adult**

it's important to differentiate between the joint of different age groups, normally we have the shaft, metaphysis and the epiphyseal center which is responsible of growth in children this will be cartilaginous matrix which will appear black, it isn't ossified yet.

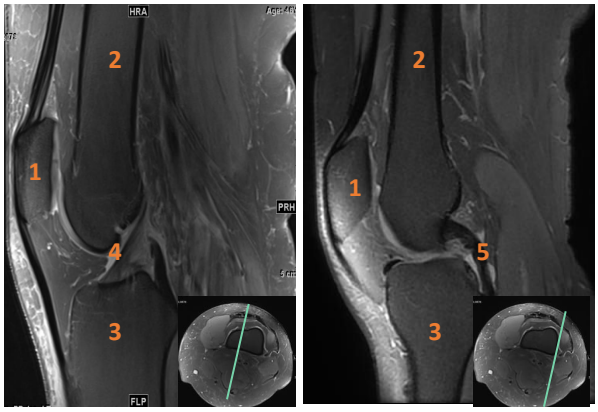


MRI (Coronal plane)

1. Lateral condyle.
2. Medial condyle.
3. Lateral tibial plateau.
4. Medial tibial plateau.
5. Tibial eminence.
6. Fibula.
7. Femur.
8. Tibia.

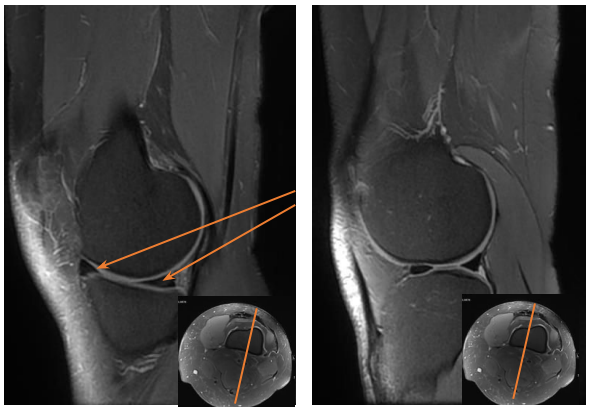
fibula can be used to differentiate between lateral and medial sides, but in a section the doesn't show the fibula, the larger condyle is the medial one.

MRI (Sagittal plane-midpart)



1. Patella.
2. Femur.
3. Tibia.
4. ACL (anterior cruciate ligament).
5. PCL (posterior cruciate ligament).

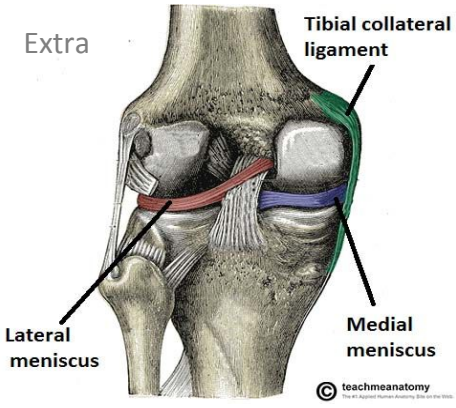
MRI (Sagittal plane-Medial and lateral)

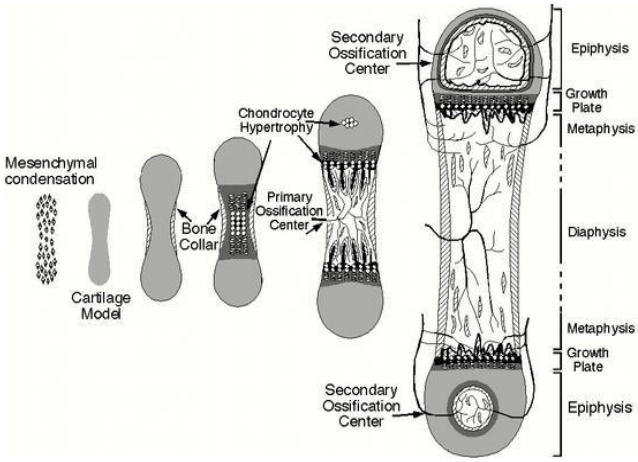


Normal medial Meniscus **Normal lateral Meniscus**

Arrows: Normal outline of the meniscus is bow tie with homogeneous low signal (two opposing triangular horns)

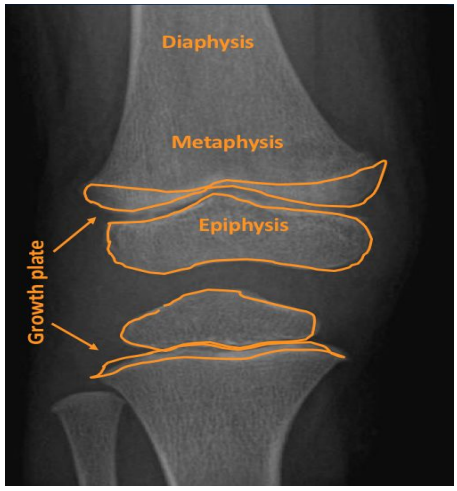
Extra



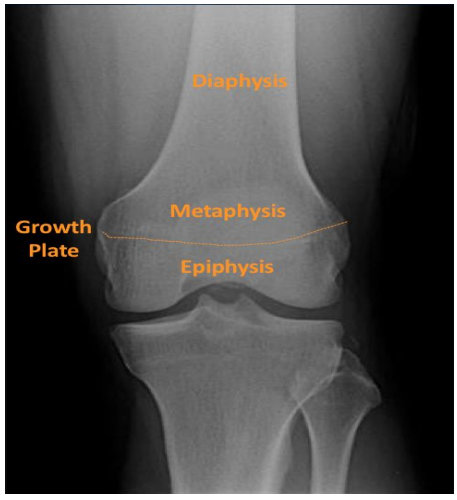


Development and abnormalities of knee joint:

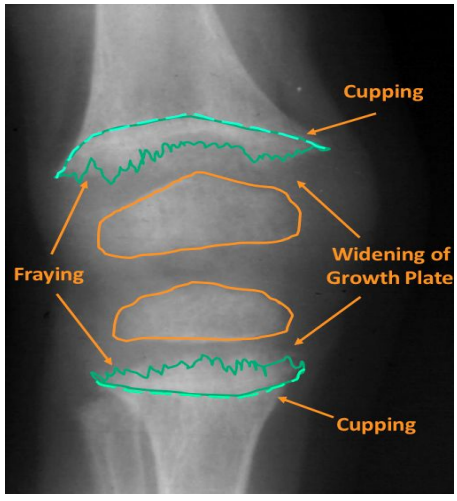
Normal (Pediatric)



Normal (Adult)

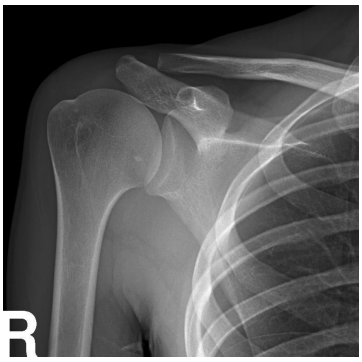


Abnormal (Rickets)

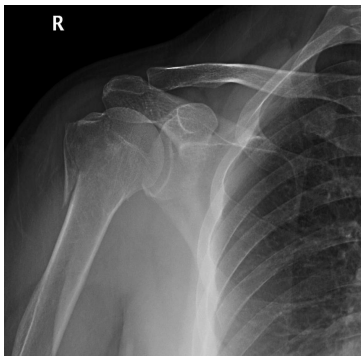


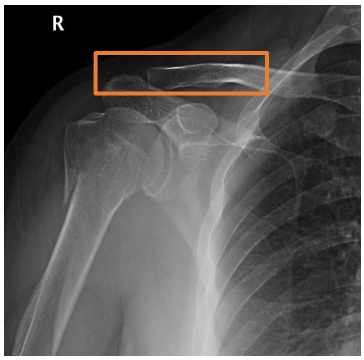
In children you can see growth plate as a black line, it is hyperlucent will defined line that usually present in patient with metabolic disorder (rickets) but in adults it is fused.

Interpretation



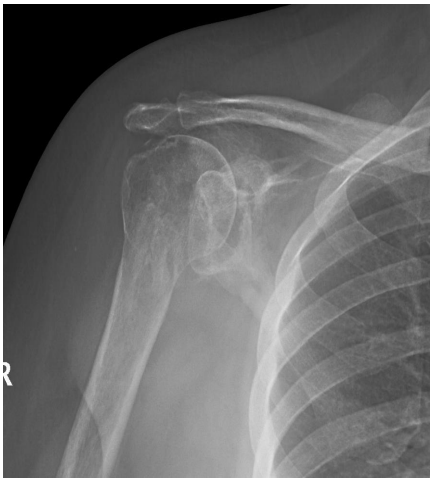
Normal



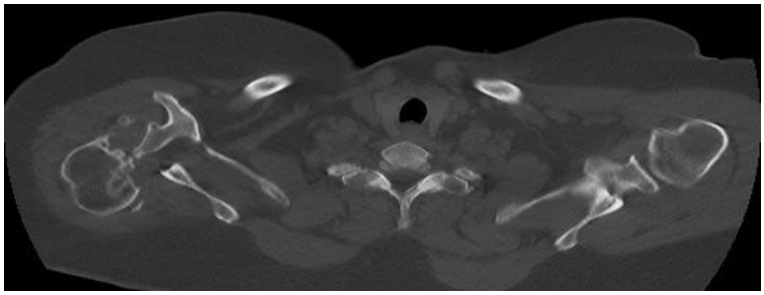


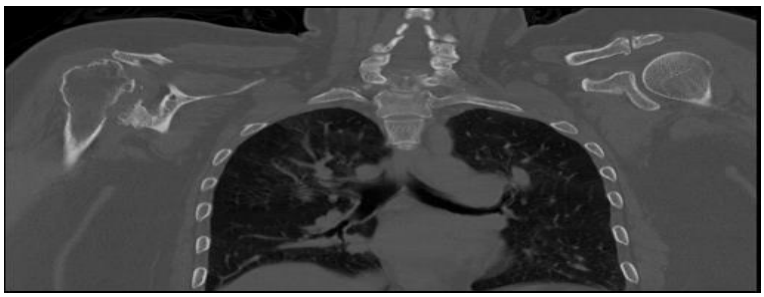
Fracture

a trauma to the shoulder would cause a fracture, if you look to the two right images the fracture is not clear but there are some changes in the texture of the bone.
Indicating pathology: we need another modality to evaluate > CT look below.



Old Fracture & Dislocation





Old Fracture & Dislocation

Normal **Hyperparathyroidism**

The cortex It's not the same in right image, in the left image you can see the trabeculae with smooth outline but the trabeculae in the right image are more of an irregular outline of the cortex. **So what to look for?** cortex, the outline, corticomedullary differentiation, trabecule.

Summary

Radiological modalities in skeletal system	Features
X-Ray	- The most important modality for identifying the pathology. - Cannot evaluate muscles.
CT scan	- Identify the bone details (trabeculae within bone marrow, bone marrow spaces).
MRI	- Can detect early changes by detecting Signal changes in bone marrow, can show the outline of trabeculae (clearly defined or vague). - Outline the anatomy and pathology of adjacent structures. - Better soft tissue characterization (muscles and tendons).
Ultrasound	- Can be used on superficial structures such as small joints to identify changes in muscles tendons and synovial membranes.
Nuclear scan	- Can detect changes earlier than other modalities but can’t determine what is the pathology (sensitive but not specific).

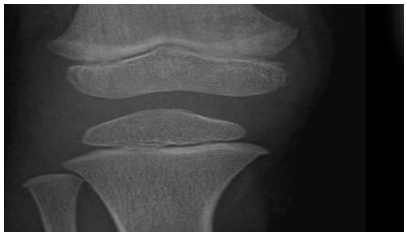
Questions

1) What is the best modality to evaluate muscles and tendons in the shoulder?
A- CT. B- MRI. C- X-ray. D- Nuclear scan.

2) A patient was presented to the ER after RTA with major shoulder trauma complaining of shoulder pain, what will you order initially?
A- CT. B- MRI. C- X-ray. D- Nuclear scan.

3) From the scenario above. The X-ray did not show clear pathology, what will you order next?
A- CT. B- MRI. C- X-ray. D- Nuclear scan.

4) This image show the knee of 5 year old boy, what is your diagnosis?
A- Normal. B- Rickets.
C- Fracture. D- Inflammation.



5) What is the limitation of Nuclear scan?
A- No limitation. B- Operator dependent.
C- It shows no different between inflammation and neoplasms.
D- Expensive.

Answers:
1- B.
2- C.
3- A.
4- A.
5- C.