15th Lecture

MED437
King Saud University

RADIOLOGY TEAM 437

Radiological anatomy of the skeletal system

Color Index:

- ✓ Important
- ✓ Notes
- ✓ Extra

Editting File

objectives:

- ➔ Normal radiological anatomic landmarks.
- ➔ System analyzing findings "Where to look & What to look for."
- ➔ Recognize features of certain disease entity.

Sources

Lecturer:
Ahmad Al-BOUKAI
Same 436 lecture Slides:
YES

Done by:

Ahad algrain
Balqees alrajhi
Dawood Ismail

Revised by:

Aseel Badukhon

Lecture outline

1. Image of Musculoskeletal system
2. Image of Musculoskeletal system anatomy
   a. Shoulder joint
   b. Wrist joint
   c. Elbow joint
   d. Hip joint
   e. Knee joint
3. Development and abnormalities of knee joint:
4. Interpretation

In MRI:
we have T1 and T2. T refers to timing.

T1: Fat is bright, it's the regular setting.
Bone is bright and fluid appear black.

T2: Fat is also bright however we change saturation of the picture, by suppressing it.
we call it T2FSAT.
And liquid appear White.

Most common injuries to wrist joints are :
-Scaphoid fracture.
-Lunate dislocation.

Image of Musculoskeletal system

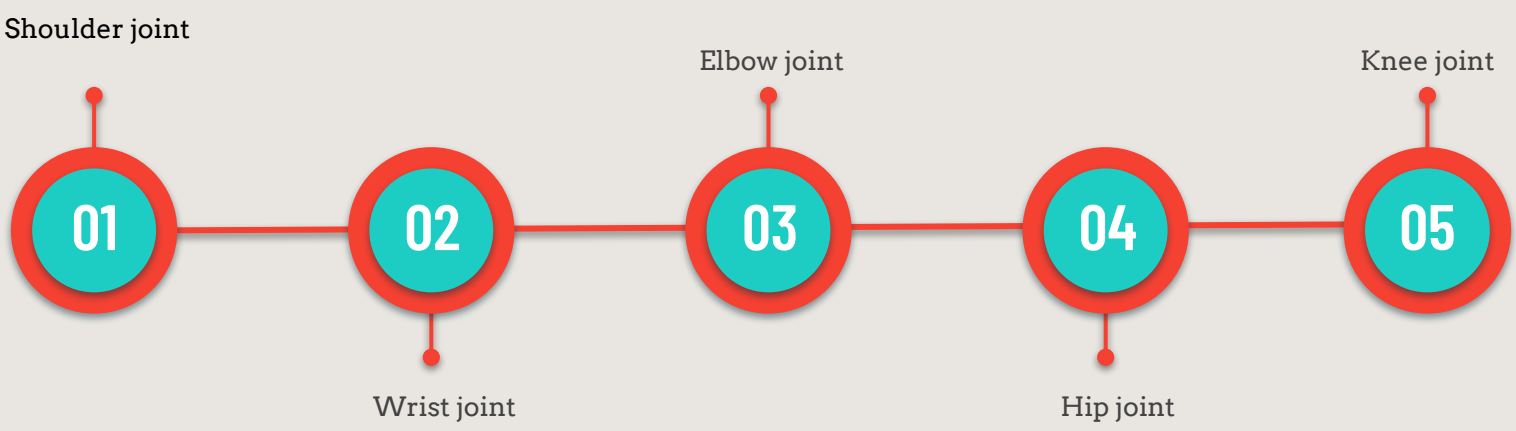
- **Conventional Radiography :** Cornerstone. The basic and the most important modality in evaluating musculoskeletal system whether trauma, neoplastic, inflammatory ,haematological disease or arthritis.
- **Computed Tomography :** Computed Tomography → Useful in evaluating bone texture.
- **Magnetic 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.
- **Ultrasound :**
  - Tendons/ligaments/muscles
  - Detect fluid collections around joints or within muscles.
  - Soft tissue masses and cysts.

Nuclear medicine modality can tell you if there is an abnormality but it won't differentiate and you use it when other modalities failed to locate the abnormality

"Where to look & What to look for":

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

Image of Musculoskeletal system anatomy

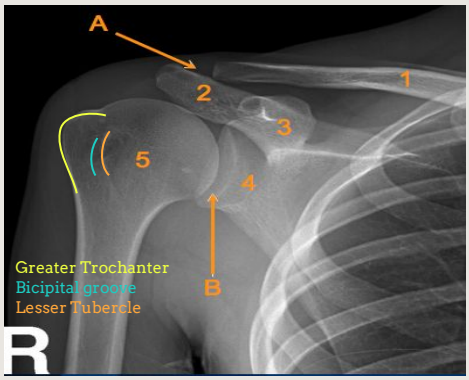


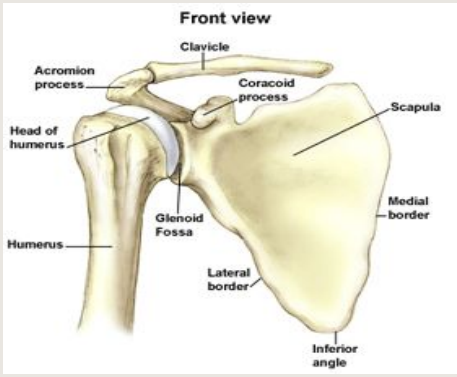
A -Shoulder joint:

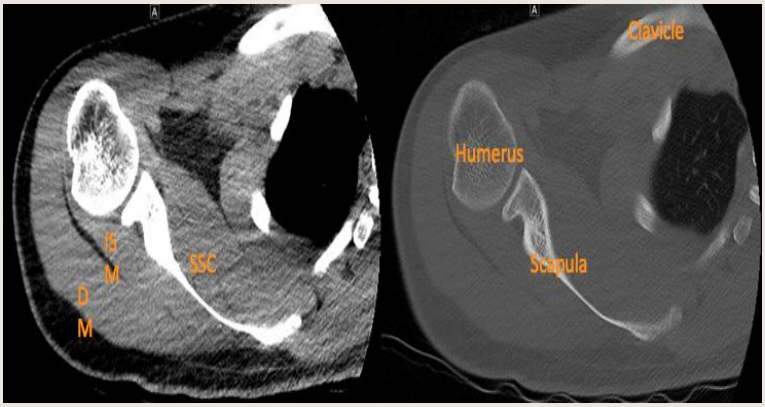
In order to have a clear image of these joint we have to put the patient in slightly oblique . The glenoid lies obliquely to see the space between the joints . 30-45 degrees rotation

A. Acromio-clavicular joint.
B. Gleno-humeral joint (Facet)

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

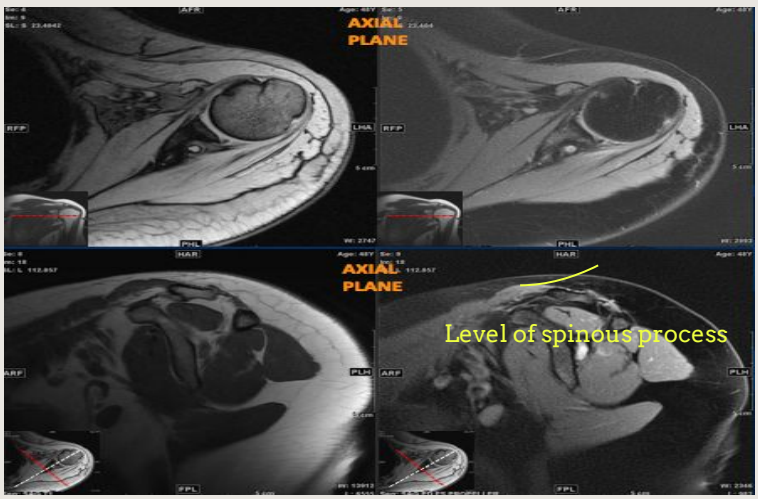




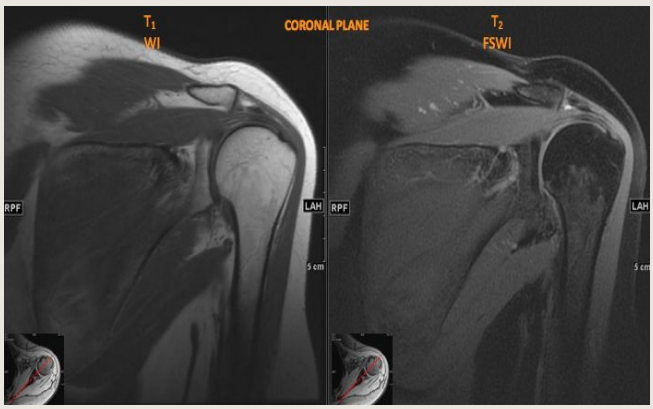


ISM = Infraspinatus muscle.
DM = Deltoid muscle.
SSC = Subscapularis muscle.

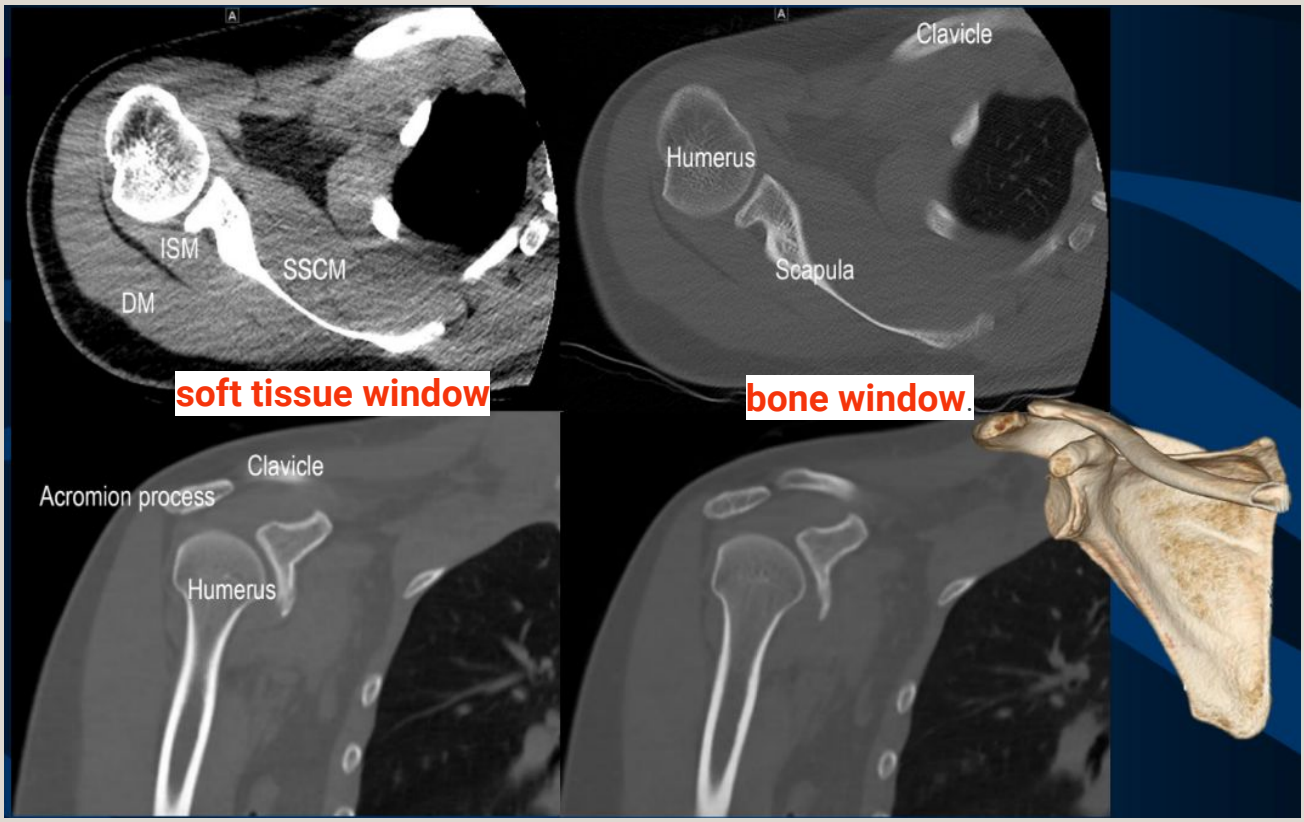
It shows axial images and we can modify the image according to our needs whether bone window or soft tissue window and we can takes several sections that construct 3D images (see the scapula) before surgery to give the plan of surgery and gives idea about muscles.



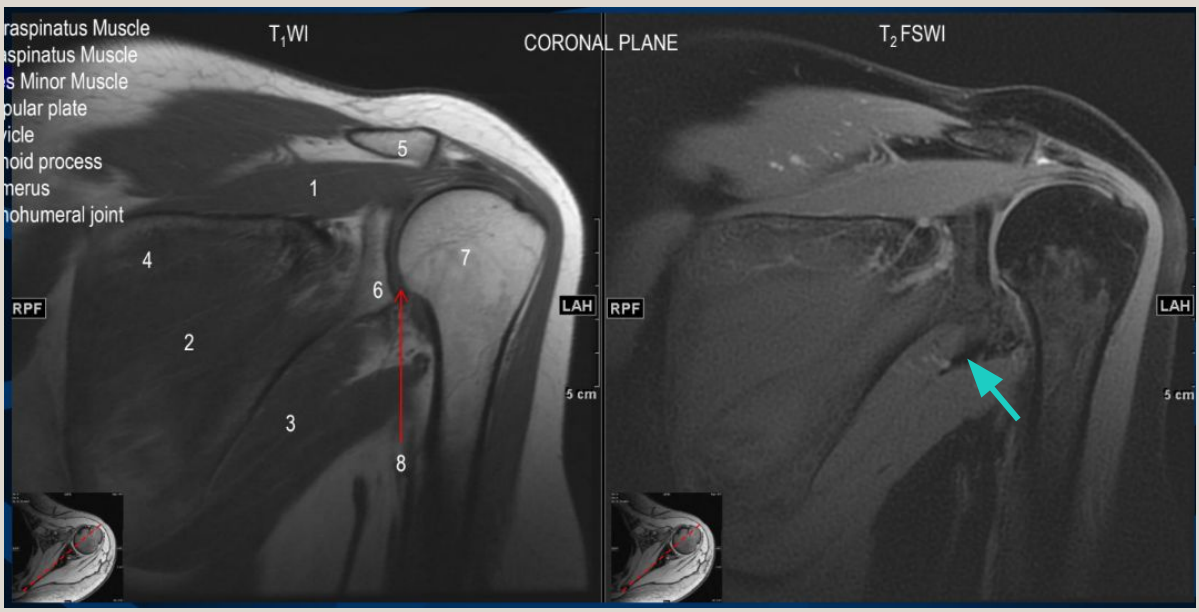
Evaluating the muscle is very important if we have any pathology. The best test for soft tissue is MRI; no radiation, and it has different windows like (T1) which gives an idea about the anatomy and the bone will appears white because of fats. Fluids appear black in T1, but white in T2. If there is injury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



CT Scan of the shoulder joint



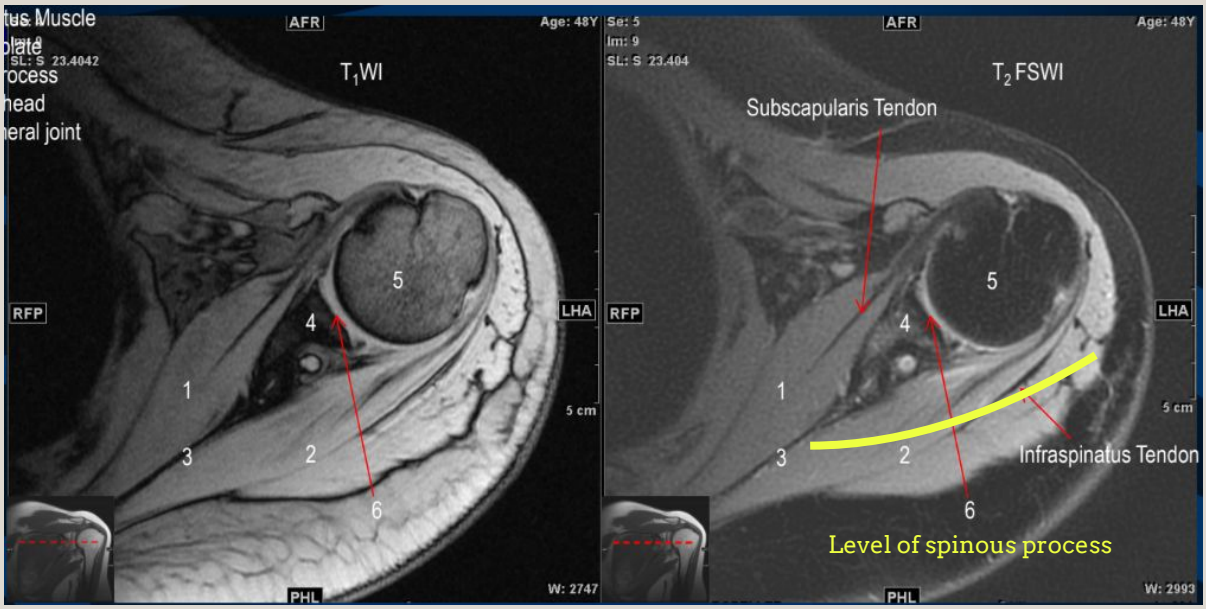
MRI of the shoulder joint



1- Supraspinatus Muscle
2- Infraspinatus Muscle
3- Teres Minor Muscle
4- Scapular plate
5- Clavicle
6- Glenoid process
7- Humerus
8- Glenohumeral joint

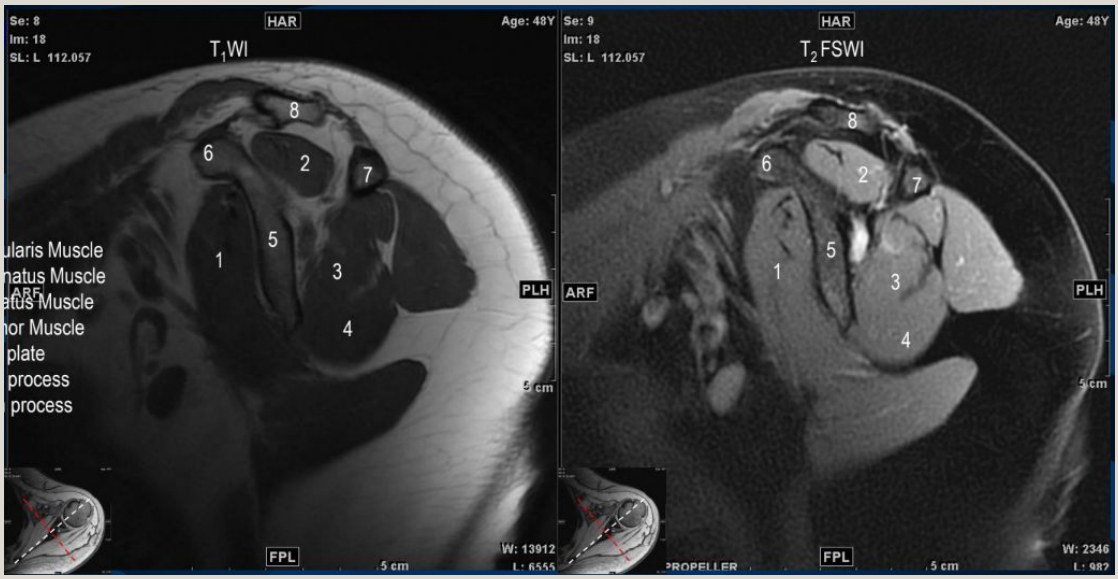
Normal Tendon

MRI of the shoulder joint



1- Subscapularis Muscle AXIAL PLANE
2- Infraspinatus Muscle
3- Scapular plate
4- Glenoid process
5- Humeral head
6- Glenohumeral joint

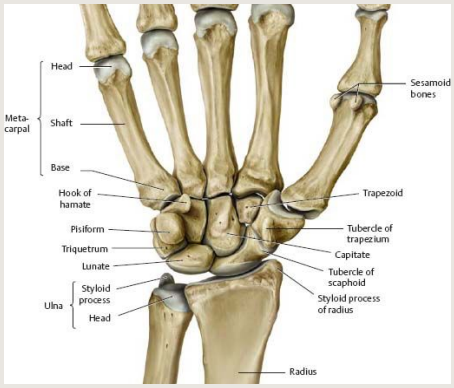
MRI of the rotator cuff muscles

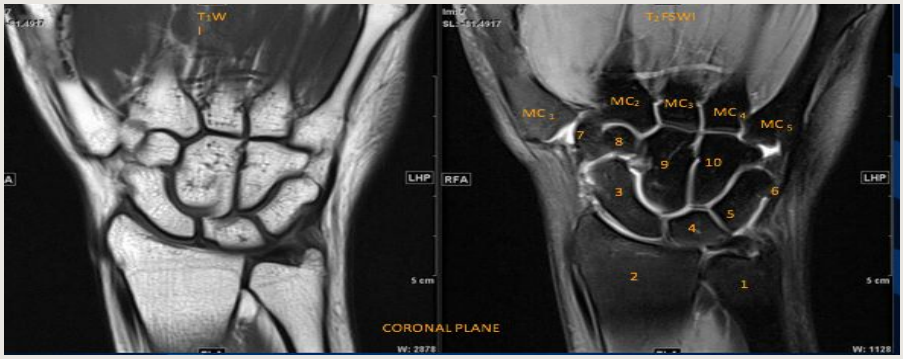


Subscapularis Muscle
2- Supraspinatus Muscle
3- Infraspinatus Muscle
4- Teres Minor Muscle
5- Scapular plate
6- Coracoid process
7- Acromion process
8- Clavicle

B- Wrist joint:

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



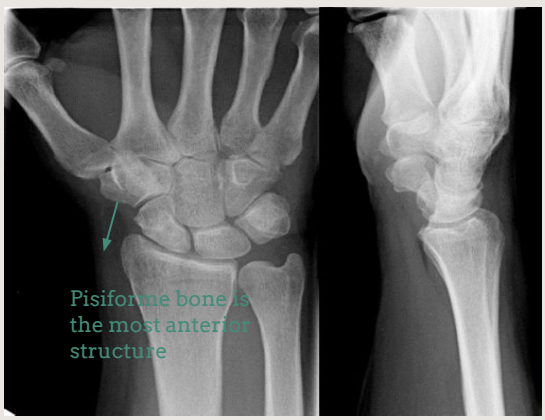


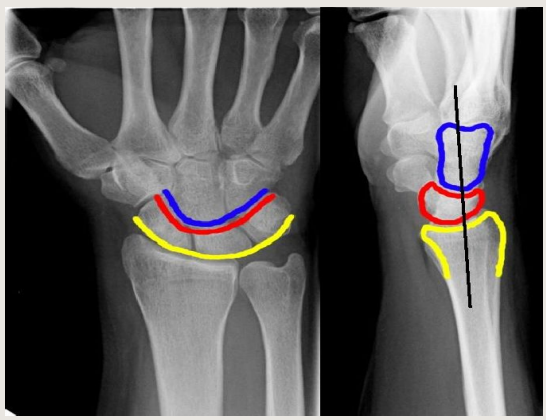
We have 8 carpal bones arranged in 2 rows forming an arch, and we have 7 tarsal bones.
In the hamate there is a rounded structure (hook) if u did the imaging in oblique position so it's not a fracture.

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.

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).

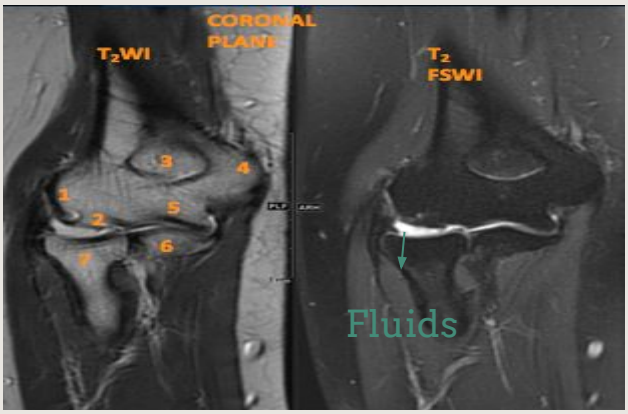


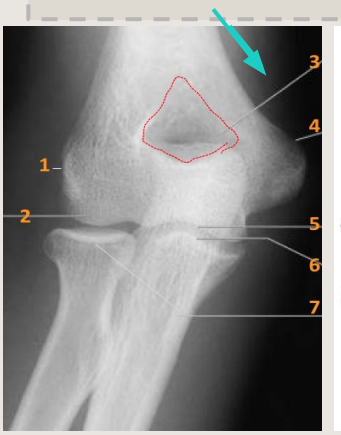


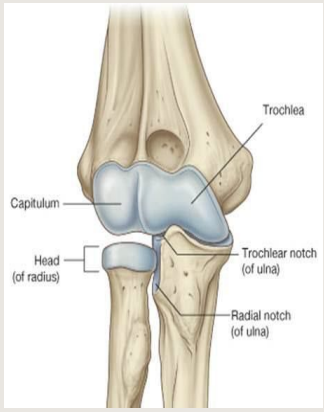
-These lines should be unbroken (Parallel).
-We have the radius زي الطاولة من تحت
وفوقها فيه قاعدة الكوب اللي هو lunate
بعدين الكوب هو الcapitate

C- Elbow joint:

3 is dark which indicates lower density but this is normal in this area



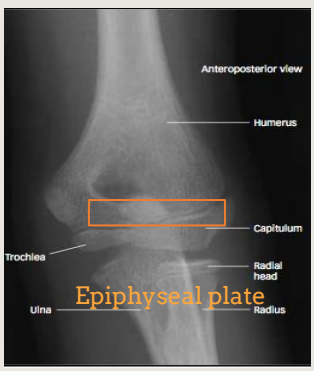




1. Lateral Epicondyle.
2. Capitulum
3. Olécranon Fossa
4. Medial Epicondyle
5. Trochlea
6. Coronoid Process
7. Radius Head

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.

A 5 year old child

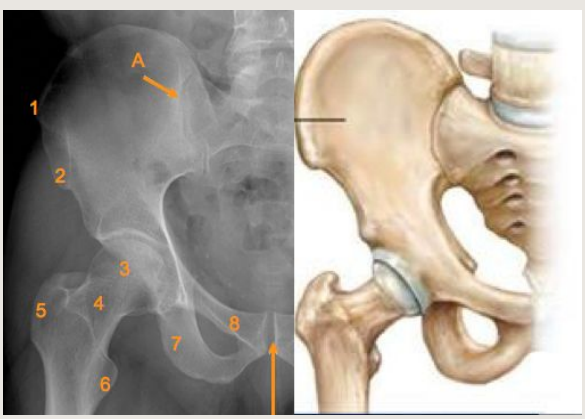


An 11 year old child

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.

D- Hip joint:



1. Superior Anterior Iliac Spine.
2. Inferior Anterior Iliac Spine.
3. Femur Head
4. Femur Neck
5. Greater Trochanter.
6. Lesser Trochanter.
7. Ischium
8. Superior Pubic Ramus.

D- Hip joint:

A. Sacroiliac joint.
B. Symphysis Pubis.

Pediatric Patient. femur epiphysis not connected yet.

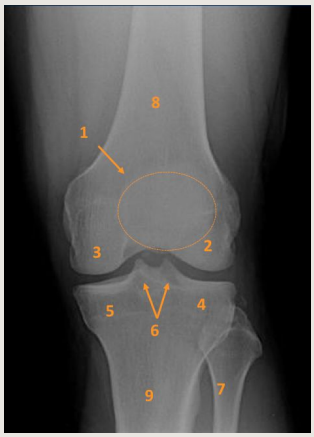
-Femur neck has 2 eminences (Trochanters).

-Femur Head structures forming the joint: (the acetabular fossa of iliac bone + femur head).

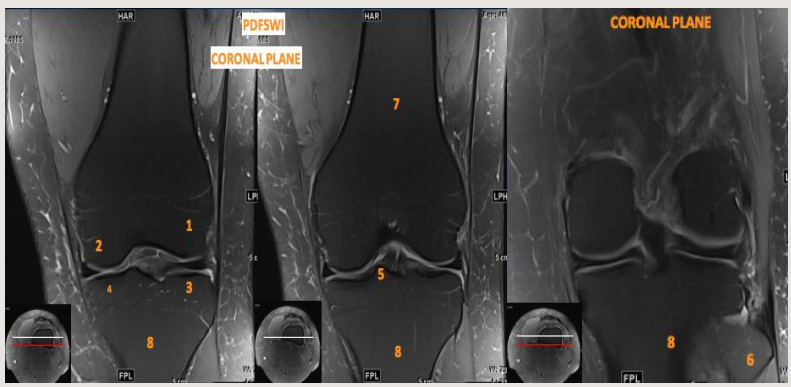
-in pediatrics the pelvic bone is made of three parts.

E- Knee joint:

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

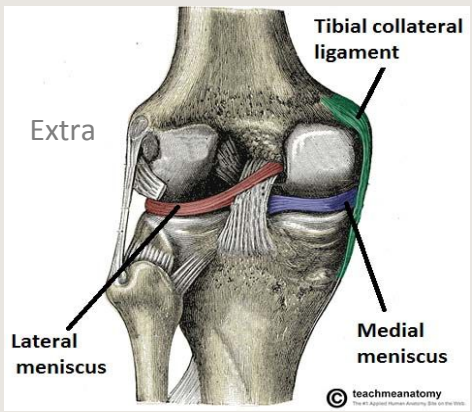


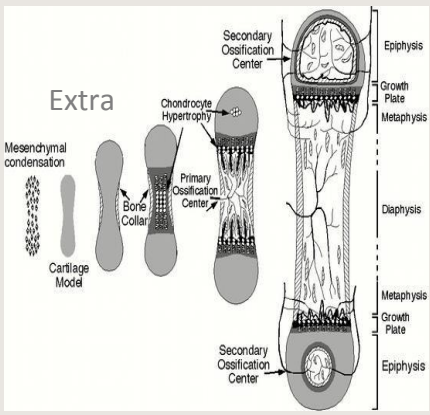
1. Lateral condyle.
2. Medial condyle.
3. Lateral tibial plateau.
4. Medial tibial plateau.
5. Tibial eminence.
6. Fibula.
7. Femur.
8. Tibia.



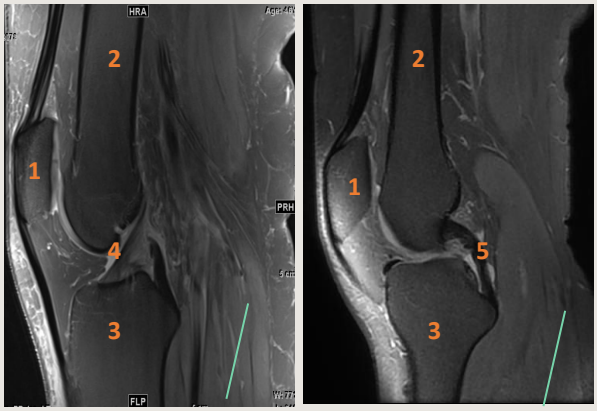
MRI (Coronal plane)

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.



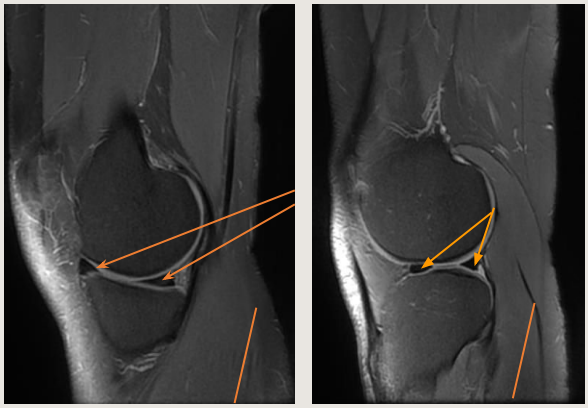


MRI (Sagittal plane-midpart)



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

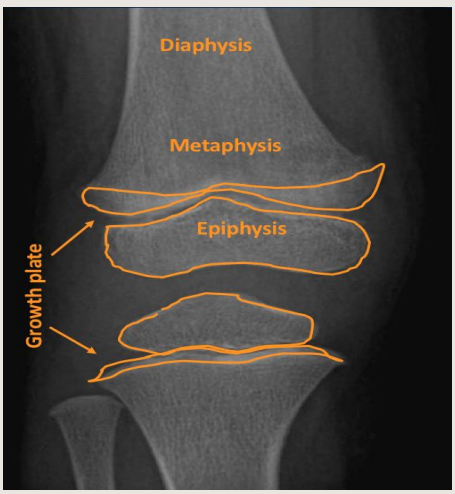
Normal lateral Meniscus

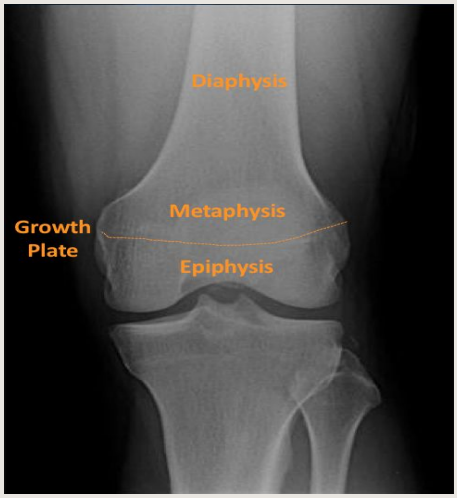
Arrows: Normal outline of the meniscus is bow tie with homogeneous low signal (two opposing triangular horns)

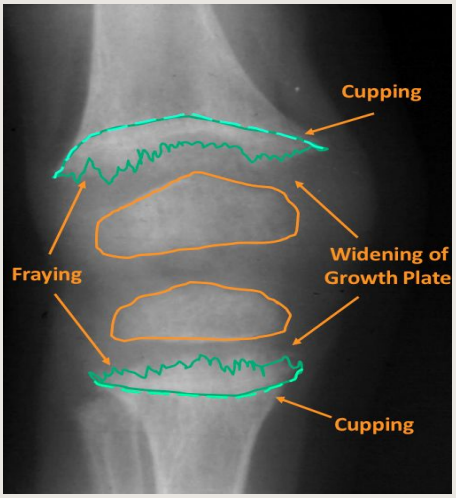
Sagittal plane, when you see medial meniscus. Fibula bone doesn't appear.

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.

Development and abnormalities of knee joint:







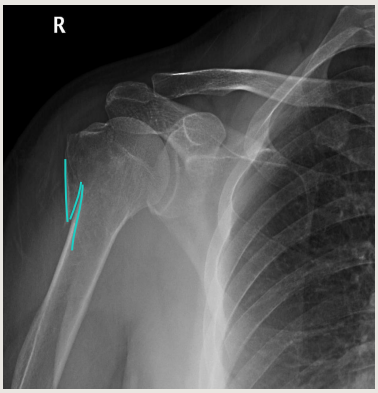
Normal (Pediatric)

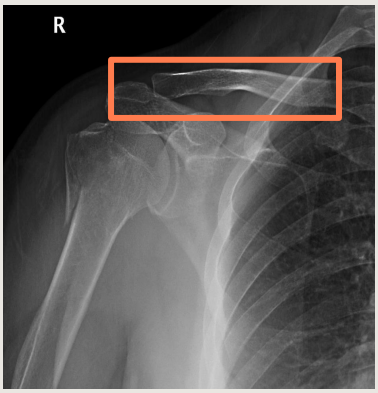
Normal (Adult)

Abnormal (Rickets)

Interpretation

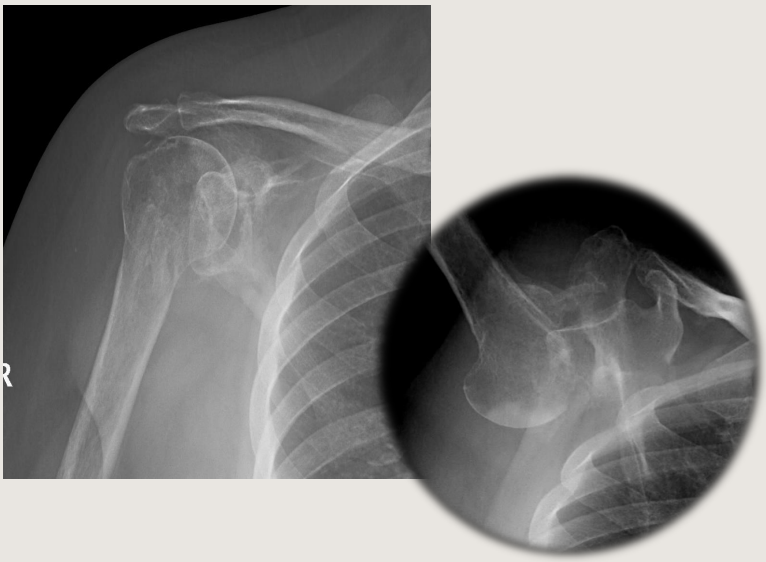
Normal



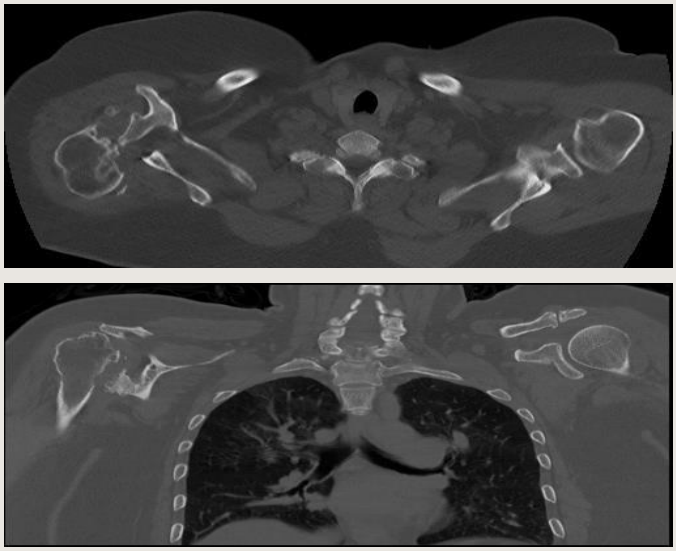


Fracture

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. useful in hyperemia and effusion.
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) Nuclear scan

d) x-ray

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) Nuclear scan

d) x-ray

3.From the scenario above. The X-ray did not show clear pathology, what will you order next?

a) CT

b) MRI

c) Nuclear scan

d) x-ray

This image show the knee of 5 year old boy, what is your diagnosis ?

a) Fracture

b) Rickets

c) Normal

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

1-b. 2-D. 3-A 4-C. 5- C

help us improve with your feedback:

RadiologyRadiology437@gmail.com

We would be happy, if you leave your feedback click Here !

References

✓ Slides
✓ 436 Teamwork

slidesgo

You did it !