Al-Mustaqbal University
College of Health and Medical Technologies
Radiological Techniques Department

Magnetic Resonance Imaging

First Semester

Lecture 24 : MRI of shoulder joint

By

Dr. Mohanad Ahmed Sahib
MSc. Ph.D. Radiology technology

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Introduction :

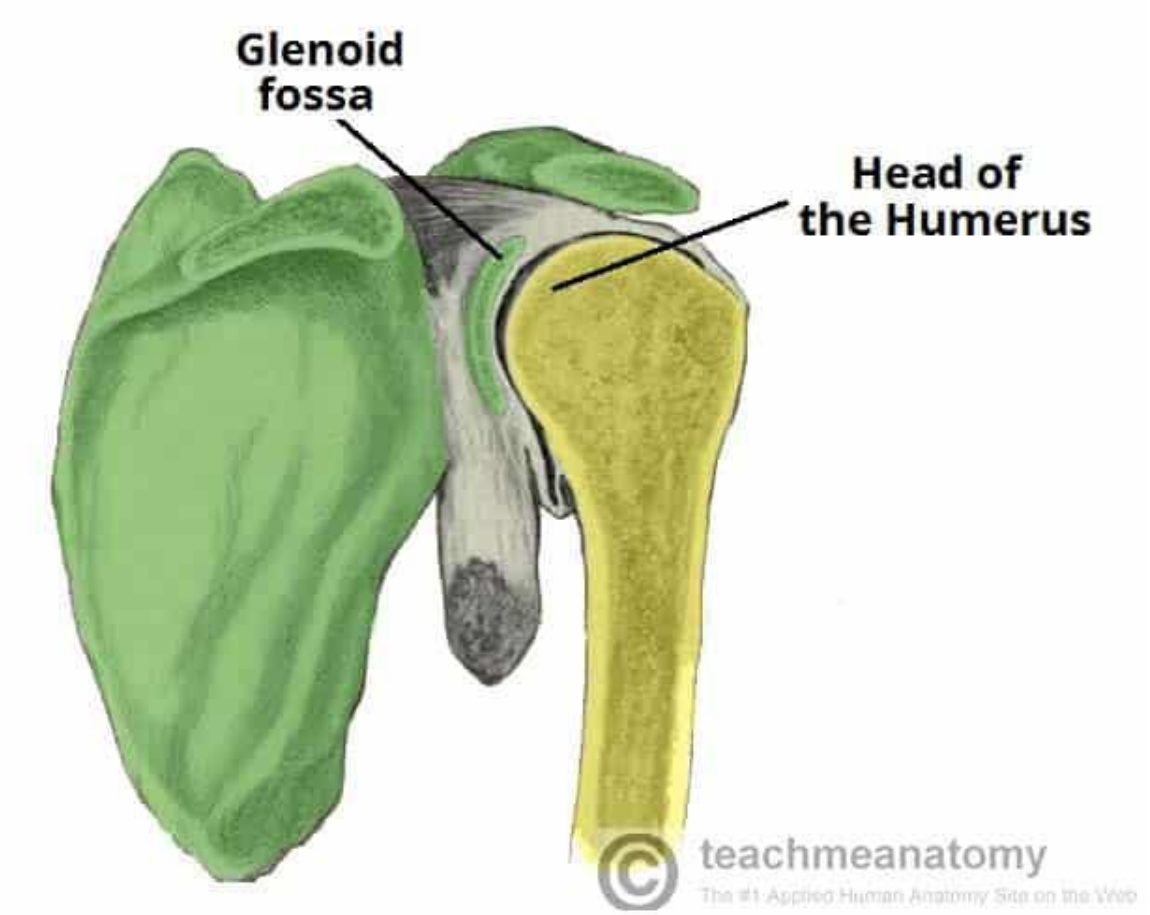
Magnetic resonance imaging (MRI) with its multiplanar capability, high contrast resolution, and lack of ionizing radiation is an excellent modality for evaluating painful conditions of the shoulder. Detailed knowledge of shoulder anatomy is essential in understanding its pathologies.

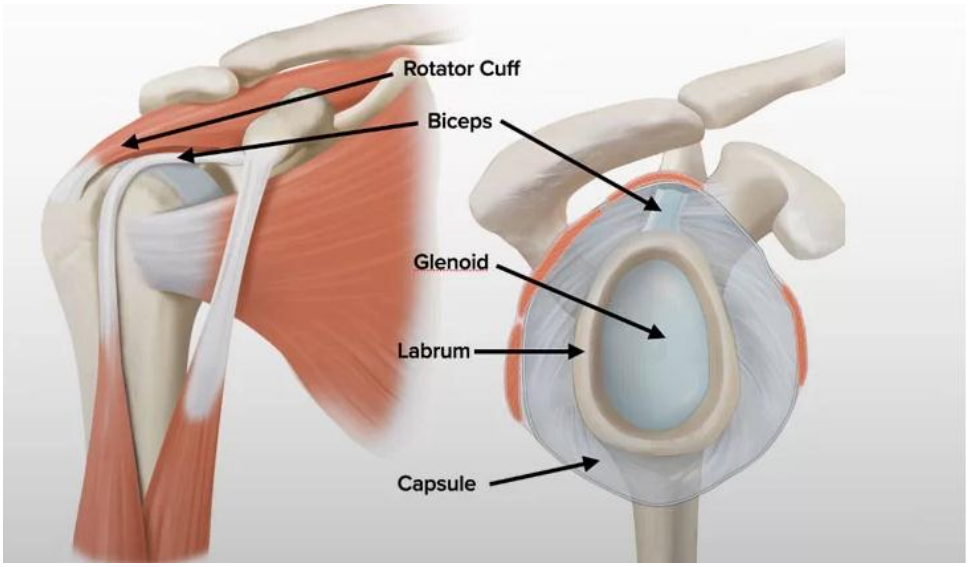
•Anatomical overview:

The shoulder joint is formed by an articulation between the head **of the humerus and the glenoid cavity (or fossa) of the scapula**.

This gives rise to the alternate name for the shoulder joint – the **glenohumeral joint.**

The head of the humerus is **much larger than the glenoid fossa**, giving the joint a wide range of movement at the cost of instability. To reduce the disproportion in surfaces, the glenoid fossa is deepened by a fibrocartilage rim – called the glenoid labrum.





(Fig.1) The articulating surfaces of the shoulder joint.

•**The MRI shoulder protocol** encompasses a set of different MRI sequences for the routine assessment of the shoulder joint.

•Indications of shoulder joint MRI:

1-Diagnosis and evaluation of impingement syndrome and instability.

Impingement Syndrome refers to a condition where the tendons of the rotator cuff in the shoulder become compressed as they pass through the subacromial space. This space is located beneath the acromion (a bony projection of the scapula) and the humeral head. Impingement syndrome is often caused by repetitive overhead activities, structural abnormalities, or inflammation, leading to pain, weakness, and limited range of motion in the shoulder.

MRI Indications for Impingement Syndrome

1. Rotator Cuff Tendinopathy:

- Thickening or signal changes in the supraspinatus tendon (most commonly affected).
- Increased signal intensity on T2-weighted or proton-density (PD) images, indicating tendon degeneration or partial tearing.
- Fluid or inflammation in, seen as high signal intensity on T2-weighted images.

2. Bone Marrow Edema:

- Edema in the greater tuberosity of the humerus or acromion, seen as high signal intensity on T2-weighted or STIR (Short Tau Inversion Recovery) images.

3. Rotator Cuff Tears:

2-Sometimes useful in the evaluation of frozen shoulder syndrome.

Frozen Shoulder Syndrome, also known as adhesive capsulitis, is a condition characterized by **pain, stiffness, and limited range of motion in the shoulder joint.** It occurs due to inflammation and thickening of the shoulder capsule (the connective tissue surrounding the joint), leading to the formation of adhesions and contractures. This results in a significant reduction in the shoulder's ability to move freely.

MRI Indications for Frozen Shoulder Syndrome

1. Thickening of the Joint Capsule:

- Best seen on T1-weighted or proton-density (PD) images.

2. Synovial Inflammation:

- Increased synovial tissue or inflammation in the joint, seen as high signal intensity on T2-weighted or STIR (Short Tau Inversion Recovery) images.

3. Reduced Joint Volume:

- The joint space may appear smaller due to capsular contracture.

4. Bone Marrow Edema:

5. Adhesions:

- Fibrous adhesions within the joint may be visible as low-signal-intensity bands on T1- and T2-weighted images.

3-Rotator cuff injury.

4-Pectoralis tear.

•MRI procedure (shoulder joint):

•Patient position:

1- Position the patient supine, head first. Offset the patient left or right and bring the shoulder as close as possible to magnet isocenter. To help minimize motion, oblique the patient, shoulder of interest down.

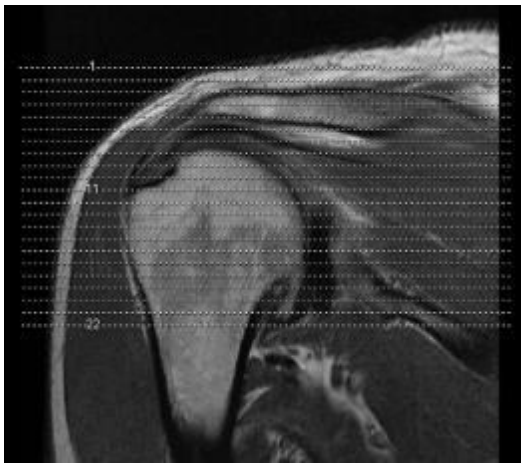
2- Set-up **the multi-channel shoulder coil.**

3- Recheck the straps to make sure they are secure to ensure immobilization of the patient.

Fig-2 patient position (shoulder joint MRI)

•Scout slice placement: -

1-Coronal localizer to obtain axial slice.



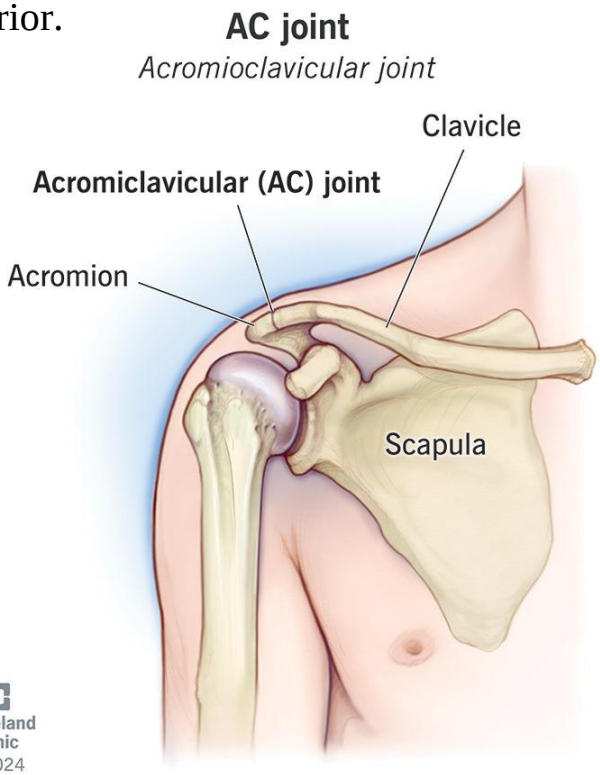
-Alignment: Usually true axial.

If the humeral head is sitting in an abnormally high position, some angulation to the supraspinatus muscle may be required.

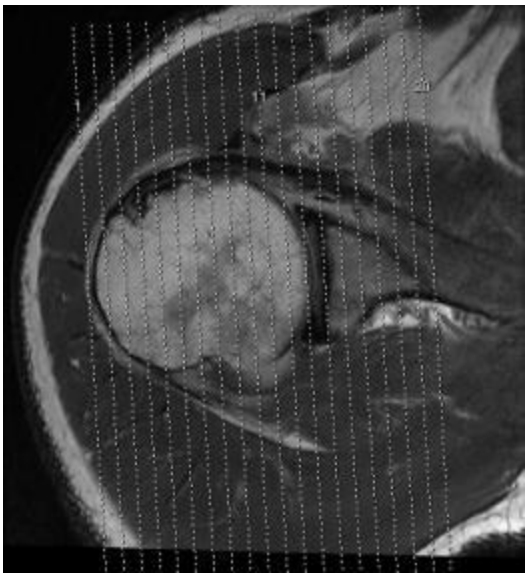
- Coverage:

From above acromioclavicular joint through surgical neck of humerus.

- Slice Acquisition: Superior to inferior.



2-Axial localizer to obtain sagittal slice

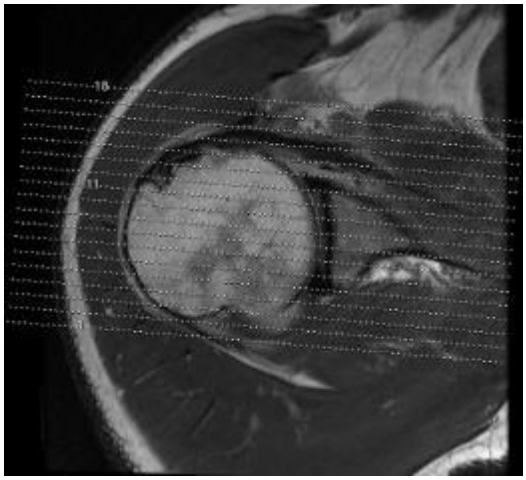


-Slice acquisition: Lateral to medial.

- Slice alignment: Parallel to the glenoid fossa.

- Anatomic coverage: Entire deltoid muscle through glenoid fossa.

3-Axial localizer to obtain coronal slice



-Slice acquisition: Anterior to posterior.

-Slice alignment: Perpendicular to the glenoid fossa, parallel to supraspinatus muscle.

-Anatomical coverage: Subscapularis muscle through the supraspinatus tendon.

•MRI Sequences (Shoulder joint)

Sequence	TR	TE	FA	ETL	Slice thickness
Coronal (T1WI)	500	Min	-	-	4mm
Coronal (T2WI) (FSE)	3600	85	-	18	4mm
Sagittal (T2WI) (FSE)	3200	68	-	7	3-4mm
Axial (T1WI)	500	Min	-	-	4mm
Axial T2* GRE	500	22	20	-	4mm

1. T1-Weighted Imaging:

Use: Provides detailed anatomical information and helps visualize the structures within the shoulder joint, including **bones, tendons, and ligaments. T1-weighted images are good for assessing anatomy.**

2. T2-Weighted Imaging:

Use: Highlights differences in tissue water content and is valuable for assessing soft tissues within the shoulder, **including muscles, tendons, and ligaments**. T2-weighted images are useful for detecting inflammation and pathology.

Gradient Echo (GRE) Sequences:

Use: **Sensitive to blood products and hemorrhage, GRE sequences are useful for detecting vascular lesions or bleeding within the shoulder joint.**

Structure/Condition	T1 Appearance	T2 Appearance
Bones	Hyperintense (normal), hypointense (edema/lesions)	Hyperintense (normal), Hyperintense (edema/lesions)
Tendons	Hypointense	Hypointense (normal), hyperintense (tears)
Ligaments	Hypointense	Hypointense (normal), hyperintense (injuries)
Muscles	Hyperintense (normal), hypointense (injuries)	Hyperintense (normal), hyperintense (injuries)
Blood	Hypointense (fresh), hyperintense (old)	Hyperintense (fresh), hypointense (old)
Inflammation	Hypointense	Hyperintense