Original Article

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Role of 3 Tesla Magnetic Resonance Imaging for Shoulder Pain and Instability in Tertiary Care Centre

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Abstract

Background: The objective of our study is to demonstrate the role of 3Tesla MRI in detecting shoulder pathologies encountered in patients with shoulder pain. **Subjects and Methods:** It is a hospital based prospective observational study which was carried out in 50 patients with a history of shoulder pain and suspects of rotator cuff tear and glenoid labral injuries in Narayana medical college and general hospital, Nellore. All age group patients were included in the study without any gender predilection. **Results:** Out of the 50 patients, 5 patients were excluded. Among the 45 patients included in the study the various pathologies were detected on MRI. **Conclusion:** To understand the role of MRI in the diagnosis of shoulder pain and instability and to understand pitfalls. MRI is the best among various imaging modalities as it is non-invasive and provides a better depiction of the soft tissues of the shoulder joint. It has the added advantage of being nonionizing modality.

Keywords: Rotator cuff tear, Labral tears, Bursal surface tear, Articular surface tear, Tendinopathy

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Introduction

Two joints noted in region of shoulder are Glenohumeral joint (GH) and the acromio-clavicular joint(AC). GH joint is a ball and socket joint.[1] Ball is formed by the humeral head while the socket is formed by the glenoid fossa of the scapula. The Head of the humerus is three times more than the glenoid surface of the scapula which is why the glenohumeral joint is unstable. To increase the stability of the GH joint the surface area of the glenoid fossa is increased by the glenoid labrum.[1] Glenoid labrum, Joint capsule & glenohumeral ligaments are the static stabilizers of the GH joint while the rotator cuff tendons are the dynamic stabilizers.[2] The shoulder joint is multiaxial with a wide range of movements. Joint stability is provided by surrounding muscle tendons forming the rotator cuff and the long head of the biceps brachii muscle.

Tendons of Supraspinatus, Infraspinatus, Teres minor & subscapularis muscles blend with the joint capsule and form a tendinous collar that surrounds the posterior, superior, and anterior aspects of the glenohumeral joint.[3] This cuff of muscles stabilizes and holds the head of the humerus in the glenoid cavity of the scapula. The tendon of the long head of the biceps brachii muscle passes superiorly through the joint. The chief complaint of rotator cuff tear is pain and restricted movement whereas shoulder instability in glenoid labrum injury.[3]

The common disorders involving the rotator cuff tendons include impingement and tendinopathy which leads to degeneration and to tears. Rotator cuff tears can occur mainly due to two mechanisms, Extrinsic and Intrinsic.[4] Extrinsic mechanisms include direct trauma or by repetitive microtrauma which results in a tear. Intrinsic mechanisms include degenerative changes which lead to tears because of decreased vascular supply to the critical zone.[4]

Rotator cuff tears can be classified into partial and complete thickness tears. Supraspinatus tear is the most common rotator cuff tear.[5]

MRI has a good spatial resolution for assessment of soft tissue, to identify tendon tears and muscle edema. Additionally, MRI has no radiation hazards.

MRI also provides information about adjacent structures,

muscle atrophy, fatty degeneration & size of a muscle.[6]
Good knowledge regarding the imaging characteristics of rotator cuff tendons on MRI and the abnormality in these tendons is necessary for appropriate diagnosis.[5] It is the role of radiologists to give an accurate diagnosis as shoulder pain can cause hindering of daily activities.

Aims and objectives:
To evaluate the patients presenting with shoulder pain using MRI at Tertiary care center, Nellore.

Subjects and Methods

Source of data:
This is a hospital based prospective study among 50 patients referred for Shoulder MRI to the Department of Radiology, Narayana medical college, Nellore.

Method of collection of data:
Adult patients presenting with Shoulder pain were referred for MRI to the Department of Radiology, Narayana medical college, Nellore.

The method of study consists of:
A structured format containing the patient details, clinical history, physical examination & investigations who meet the inclusion criteria were prepared and patients were subjected to plain MRI Shoulder using 3.0Tesla GE MRI imaging.

Patient preparation: No specific preparation was required for the examination.

Duration of study: The study was conducted over a period of one year from October 2020 to October 2021.

Protocol: MRI of the Shoulder was performed using 3Tesla GE imaging. The sequences used were:
AXIAL- T1W, T2W & PDFS.
CORONAL OBLIQUE- PDFS.
SAGITTAL OBLIQUE- T2W and PDFS.
No medication/IV contrast was used in the study.

Inclusion criteria:
- All patients with Shoulder pain were referred to the Department of Radiology for Shoulder MRI.
- Patients of all age groups are included in the study without gender predilection.
- Patients with a history of shoulder trauma are included in this study.

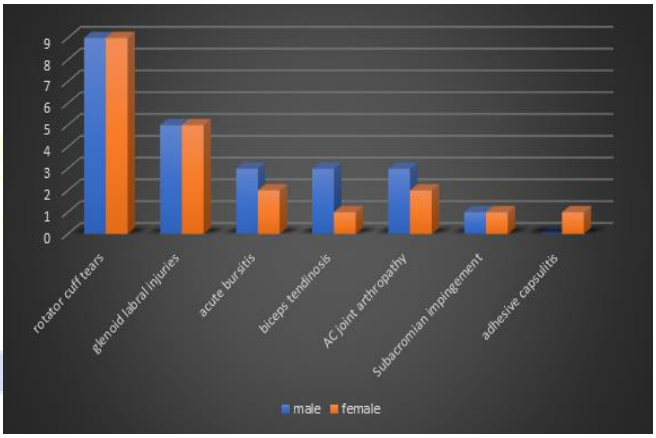
Exclusion Criteria
- Patients with benign/ malignant lesions of bone.
- Patients who have contraindications for MRI like pacemaker, metallic implants, claustrophobia, etc.

Results

Out of 50 patients, 30 (60%) were Males and 20(30%) were Females. Out of the 50 patients 5 patients were excluded due to various reasons. Among the 5 patients excluded 3 were males and 2 were females.
Among 45 patients, shoulder pathologies detected on MRI are tabulated as follows.

Pathology Detected in MRI	Males	Females	Total
Partial thickness rotator cuff tears	5	3	8
Complete thickness rotator cuff tears	2	4	6
Chronic rotator cuff tears	2	2	4
Glenoid labral injuries	5	5	10
Acute bursitis	3	2	5
Biceps tendinosis	3	1	4
Acromio-clavicular Joint arthropathy	3	2	5
Subacromian impingement	1	1	2
Adhesive capsulitis	-	1	1
Total			45

Chart showing distribution of shoulder pathologies among 45 patients.



Illustrative images:

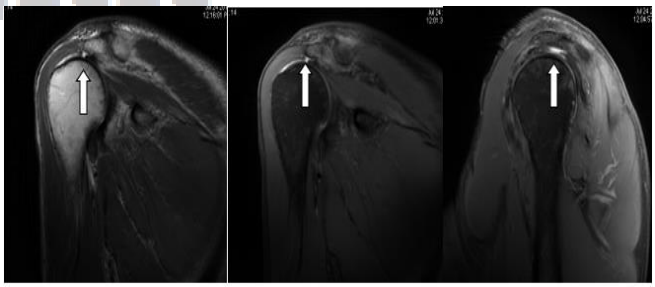


Figure 1: (a) Coronal T2W and (b) Coronal PDFS showing hyperintensity at the insertional site of supraspinatus tendon. Fig (c) sagittal PDFS image showing hyperintensity at supraspinatus tendon(Full thickness tear) corresponding to T2W image.

Figure 2: (a) Sagittal and (b) Axial PDFS images showing partial thickness subscapularis tear (white arrows) and fluid in subcoracoid bursa(Asterix)

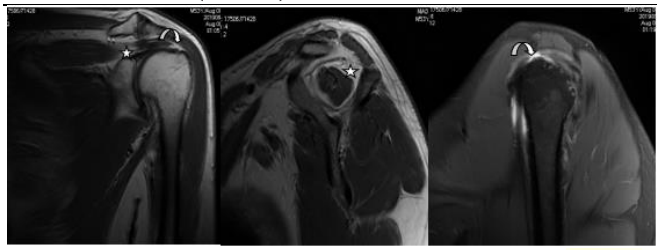


Figure 3: (a) Coronal T2 (b) Sagittal T2 (c) Sagittal PDFS images showing hyperintense signal due to chronic tear of supraspinatus (Curved arrows) with fatty degeneration(Asterix). Fig 3 (a) shows superior dislocation of humeral head due to complete tear of supraspinatus tendon.

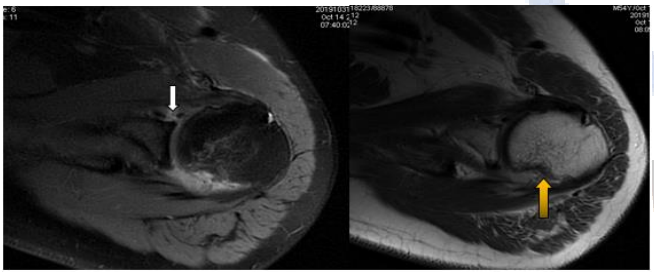


Figure 4: (a) axial PDFS showing antero inferior glenoid labrum tear (White arrow) with underlying bony cortex(Bony bankart lesion) (b) axial T2 image showing posterior depression(Yellow arrow) of humeral head(Hill sach's lesion).

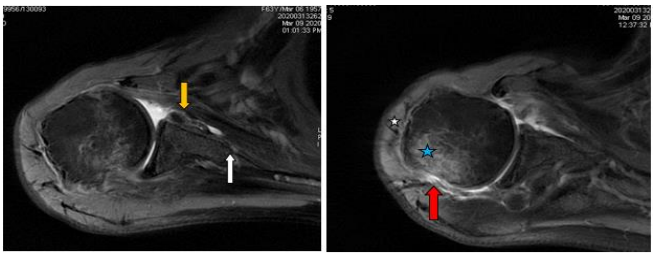


Figure 5: (a) axial PDFS image showing medial displacement of anteroinferior labrum(Yellow arrow) with intact periosteum(ALPSA Lesion) and (b) Axial PDFS image showing Bony contusions(Blue Asterix) and posterolateral depression(Red arrow) of humeral head(Hill sach's lesion) with thinning of lateral fibres of deltoid(white Asterix)

Figure 6: axial PDFS image showing tear in postero-inferior labrum (white arrow) with intact periosteum(POLPSA lesion).

Figure 7: Axial PDFS image showing mild amount of fluid surrounding biceps tendon within the synovial sheath (Biceps tenosynovitis).

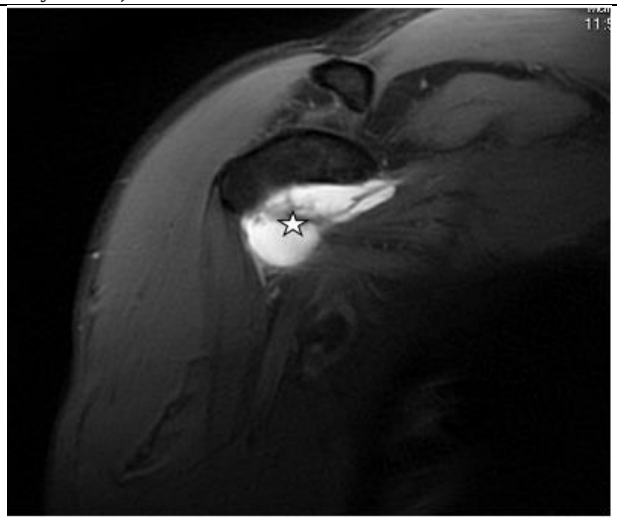


Figure 8: Coronal PDFS image showing mild amount of fluid(star) under the corocoid process (Subcoracoid bursitis)

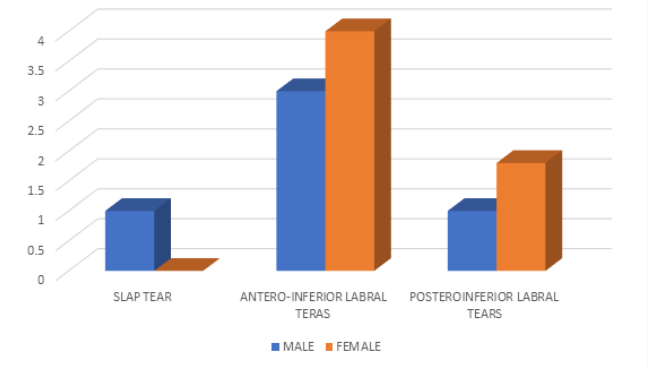
Discussion

MRI is the best modality for shoulder joint imaging as it is noninvasive and nonionizing in nature.[7,8,9] 3 Tesla MRI has a better signal to noise ratio (SNR) than 1.5 Tesla with better soft tissue evaluation. Most common pathology in patients presenting with shoulder pain is rotator cuff tears. Rotator cuff tears can be classified into partial thickness and complete tears.[10] Most common rotator cuff tears are supraspinatus tears followed by subscapularis tears. In complete tears, fluid in joint cavity communicates with sub acromion- subdeltoid bursae and seen on MRI as high T2/PDFS signal intensity. Partial thickness rotator cuff tears can be further classified into bursal-sided and articular surface tears. Articular surface tears are most common than bursal tears.[10] In Chronic rotator cuff tears, there will be less fluid in the joint cavity and fatty degeneration of muscle with superior subluxation of the humeral head.

The most common complaint of glenoid labral injuries is shoulder instability. Glenoid labral injuries are associated with shoulder dislocations (Anterior, posterior, inferior & superior). The most common shoulder dislocation is anterior and is associated with Bankart lesion. Anteroinferior glenoid labral lesions are most common than superior and posteroinferior labral lesions.[11] Anteroinferior labral lesions are of various types including Perthes, Anterior labral periosteal sleeve avulsion (ALPSA), Glenoid labral articular defect (GLAD) & Bankart lesion. Posteroinferior glenoid labral tears are Posterior labral periosteal sleeve avulsion (POLPSA), reverse bankarts lesion, KIM lesion & Posterior GLAD.[12]

The other common pathologies commonly encountered in our tertiary care center are Bursitis, Bicep's tenosynovitis, shoulder impingement with decreased coracohumeral joint space & adhesive capsulitis.

Type of labral tear	Males	Females	Total
SLAP	1	-	1
PERTHES	-	1	1
ALPSA	1	1	2
BANKART	2	1	3
GLAD	-	1	1
POLPSA	1	-	1
REVERSE BANKART	-	1	1
KIM	-	-	0
Total			10



MRI has better sensitivity in detecting rotator cuff tears when compared to labral injuries, 9 out of 10 cases are confirmed on arthroscopy correlation.

PITFALLS:

When molecules(collagen) lie at 54.74 degrees to the main magnetic field, they will show high signal intensity on short TE sequences like T1W and PD (Magic angle artifact).[12] This can be mistaken for tendinopathy/tear. This artefact is not present on long TE sequences like T2W images. Magic angle artefacts are encountered with supraspinatus tendon, Proximal part of posterior cruciate ligament (PCL), Infrapatellar tendon at tibial insertion.

Magic angle artifacts are less with 3 Tesla imaging when compared to 1.5 Tesla MRI.

Tendinosis can be commonly mistaken for tear this can be differentiated by comparison with T2WI and PDFS. In tear, T2WI shows the corresponding hyperintensity with PDFS sequences, whereas in tendinopathy there will be no fluid intensity on T2WI.

The anterosuperior labrum is congenitally absent in a few individuals, it should not be mistaken for a labral tear. This condition is seen in the BUFORD complex. It is associated with the thickening of the Middle glenohumeral ligament (MGHL).[12]

Sub labral recess and foramen are normal anatomical variants that are commonly mistaken for SLAP tears. SLAP tears should present from 10-2'o clock position i.e., it extends from anterior to posterior and it also shows the irregular outline of the labrum. while the sub labral recess is a congenital superior labral defect from 11-1'o clock position.

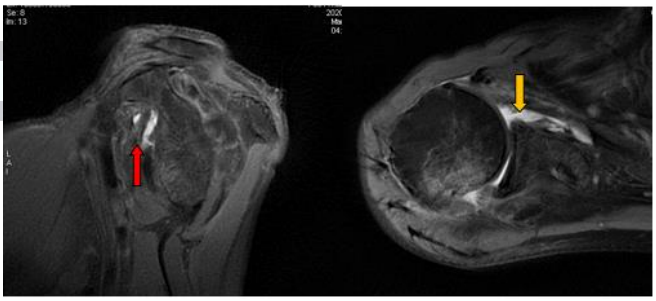


Figure 9: (a) Sagittal and (b) Axial PDFS images showing absence of antero-superior glenoid labrum (Yellow arrow) with thickening of middle glenohumeral ligament (Red arrow)-Buford complex

Conclusion

MRI is the best imaging modality for shoulder joint pathologies as it is noninvasive, non-ionizing & has a better soft-tissue resolution. 3 tesla MRI with a better SNR ratio reduces the artefacts which are commonly misinterpreted as pathologies. MRI has better sensitivity in detecting rotator cuff tears when compared to labral injuries. In our study, we reported various pathologies of the shoulder without using contrast agents & most of the cases were confirmed to have the same diagnosis with arthroscopy and other gold standard methods.

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