

Ultrasonographic and MR Diagnosis of Rotator Cuff Disorders & Shoulder Joint Instability

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Abstract: ***Objective:** To evaluate the role and efficacy of U/S and MR in diagnosis of rotator cuff disorders & shoulder joint instability. **Patients & Methods:** This study included 40 patients, who presented with shoulder pain and/or movement limitation. They underwent U/S examination followed by MR examination. The U/S & MR diagnostic criteria for each were analysed, compared & then correlated with orthopedic surgical findings and/or by arthroscopic findings. **Results:** Out of 40 patients, 20 patients had rotator cuff disorder & 15 patients had shoulder joint instability. Out of 20 patients of rotator cuff disorder, 17 of them (80 %) had rotator cuff tears & 3 (20%) had tendinosis. Supraspinatus muscle was involved in all the cases. Out of 15 patients of shoulder joint instability, 12 patients had anterior labral tear, 2 patients had superior labral tear & 1 had posterior labral tear. **Conclusion:** Both MR and U/S are valid diagnostic modalities in detecting, characterizing & discriminating the rotator cuff disorders. U/S may have some challenges in patients with shoulder joint instability, while MR provides accurate diagnosis even without contrast.*

Keywords: Full thickness tear (FTT), MRI, Partial thickness, Rotator cuff tear (PTT), Shoulder joint instability, U/S (USG)

1. Introduction

- Shoulder joint is such a unique and complicated joint of the body. It gives a great range of motion. The glenohumeral joint is a synovial joint, type of ball and socket joint. Due to large articular surface of humeral head as compared to small articular surface of glenoid cavity, there is more chance of dislocation and subluxation. Joint stability is provided by rotator cuff muscles (supraspinatus, infraspinatus, teres minor and subscapularis), long head of biceps, related bony process and extra capsular ligaments. Muscles of the rotator cuff help to lift & rotate the head of humerus.
- Depending on the pathophysiology of shoulder joint, it is divided into the two main type: (1) Primary rotator cuff disorders (Impingement syndrome or intrinsic tendinosis). (2) Secondary (consequences of glenohumeral instability).
- Anteriorly unstable humeral head usually causes narrowing of coraco-acromial outlet, which is the cause for rotator cuff pathology.
- U/S is inexpensive, fast, dynamic and easily accessible method for evaluation of tears. However glenoid rim fracture, labral tear & ligamentous capsular injury is very well diagnosed by MRI. MRI has the superior ability to evaluate both internal structures & soft tissue surrounding the joint.

Patients & Methods

Our study include 40 patients (25 male and 15 female) with age ranging from 20 to 60 years, who complains of shoulder pain or/and limitation of its movement mainly abduction movement. The patient referred from orthopedic surgery & physiotherapy department for U/S & MRI scan. After U/S & MRI, the findings were analyzed and correlated with arthroscopic & orthopedic surgical findings. Patients with hemiplegia, neurological deficit or referred pain to shoulder

due to some primary pathology somewhere else, excluded from the study.

2. Methods

- Full clinical history
- Plain x-ray shoulder (AP)
- Real time U/S

We used the high frequency superficial linear probe. First examine the biceps tendon by resting patient's forearm in a supine position on his/her thigh. Next examine the subscapularis tendon by rotating the patients arm externally. Then supraspinatus tendon by extending patients arm posteriorly and placing the palm side of the hand on posterior aspect of iliac wing with elbow flexed. Lastly the posterior shoulder was examined for posterior glenohumeral joint, infraspinatus and teres minor.

MR Imaging

MR examination was performed with 1.5 tesla, with phased array shoulder coil. Patient lying in supine position with arm in supine or slightly externally rotated and away from the chest.

Image Analysis

- In tendinosis, U/S findings – Heterogeneous bulky tendon, while in MRI intact tendon with T2 & STIR high signal intensity.
- Partial thickness tear appeared as anechoic fluid filled defect in part of the tendon (in bursal side, articular side or in the substance of tendon) while on MRI there is focal disruption of tendon with T2 & STIR high signal intensity within.
- Full thickness tear on U/S appears as fluid filled defect in the whole tendon while in MRI there is complete disruption of the tendon from its superior to its inferior border with high signal intensity equal to T2W & T2WI with fat suppression with loss of convexity in one of them.

MRI also detects the anterior, superior or posterior labral tear. AP value < 0.05 was considered significant.

3. Results

This study included 40 patients (25 males & 15 females) with age ranging from 20 to 60 years. Patients were divided into 4 groups according to their final diagnosis through U/S & MR findings in correlation to arthroscopic and orthopedic surgical data.

Classification of 40 patients of our study according to their final diagnosis:

- 1) Rotator cuff disorder includes: 20 patients in which,
 - Full thickness tear (FTT): 10 patients
 - Partial thickness tear (PTT): 7 patients
 - Tendinosis: 3 patients
- 2) Shoulder joint instability: 15 patients
- 3) Neoplastic disorders: 4 patients
- 4) Biceps tendinosis: 1 patient

Out of 7 patients who were diagnosed PTT by U/S, only 6 were confirmed on MRI, had PTT while the remaining case confirmed on MRI had FTT. Rest of the 10 patients with FTT & 3 patients with tendinosis were equally diagnosed on either U/S or MRI. Associated finding like subdeltoid-subacromial bursal fluid, shoulder joint effusion, atrophic changes of muscles, biceps tendon sheath fluid collection, AC joint hypertrophy were also evaluated by USG and MRI. In our study 15 patients had shoulder instability, out of which 11 patients had anterior labral tear, 3 patients had superior labral tear and only 1 patient had posterior labral tear. Patient with posterior dislocation and posterior labral tear (reverse Bankart lesion) had also reverse Hill sach's lesion in anteromedial aspect of humeral head and appeared as irregular defect in cortex on MRI. The diagnostic efficacy of U/S and MRI for diagnosis of rotator cuff disorder and shoulder joint instability was compared & correlate with arthroscopic and orthopaedic surgical findings.

The sensitivity, specificity and overall accuracy of USG and MRI were calculated.

4. Discussion

USG and MRI both are successful imaging modality for both rotator cuff and non rotator cuff disorder & they give important role in management of rotator cuff pathologies. MRI of shoulder widely used for assessing the impingement and instability related clinical condition.

Even a small pathology of shoulder joint is better evaluated by MRI. USG is powerful and accurate method for rotator cuff tears and other rotator cuff abnormality.

This study included 40 patients, divided into 4 groups according to their final diagnosis.

- 1) 20 patients with rotator cuff disorder.
- 2) 15 patients with shoulder joint instability.
- 3) 4 patients with neoplastic disorder.
- 4) 1 patient with biceps tendinosis.

In our study, most common cause of shoulder pain were rotator cuff disorder (20/40), followed by shoulder joint instability (15/40).

Group I included 20 patients with rotator cuff disorder, in which 17 patients were having rotator cuff tear (10 patients with FTT & 7 patients with PTT), 3 patients with tendinosis (3/20). Rotator cuff tendinosis occurs mostly at insertion site of the tendon and most commonly affected tendon is supraspinatus. In our study who had tendinosis (3 patients) occurring in supraspinatus tendon, which appears heterogeneously bulky in USG & confirmed on MRI which appears as abnormally high signal intensity in supraspinatus in T2W and T2W-fat suppression images. Most of the rotator cuff tear occurs at site of insertion of tendons into greater tuberosity. In severe cases tear may originate in supraspinatus tendon and extend posteriorly to involve infraspinatus & teres minor.

On USG FTT appear as non visualization of tendon which replaced by fluid or loss of normal convexity of tendon. Most specific finding on MRI is interruption in continuity of tendon.

On USG PTT appear as hypoechoic fluid filled defect in the tendon on its bursal, articular or intrasubstance tendon. In our study out of 7 patients of PTT - 5 of them on articular side, 1 on bursal side and 1 in intrasubstance region.

During MRI scan, we also found some osseous abnormality associated with rotator cuff disorders. Out of 20 patients of rotator cuff disorder, 10 patients (50 %) were having AC joint hypertrophy which diagnosed equally by USG and MRI. 1 patient had downward sloping of acromion which could be diagnosed only by MRI examination.

The glenohumeral joint is the most common dislocated joint of the body & anterior instability of shoulder joint is the most common type of shoulder joint instability.

In our study, 15 patients had shoulder joint instability, out of which 14 patients had anterior joint instability and only 1 patient had posterior joint instability.

All the labral tear are accurately diagnosed by MRI. In our study 15 patients were diagnosed as labral tear by MRI examination in which 11 patients had anterior labral tear, 3 patients had superior labral tear and only 1 patient had posterior labral tear.

During anterior dislocation of humerus, there is usually avulsion of antero-inferior glenohumeral ligament which is known as bankart lesion. Bankart lesion can be cartilaginous or may involve underlying bone. In recurrent anterior shoulder dislocation, there is compression fracture in posterosuperior aspect of humeral head which is known as Hill sach's lesion. It is confirmed by MRI which may reveal presence of fracture and edema.

5. Conclusion

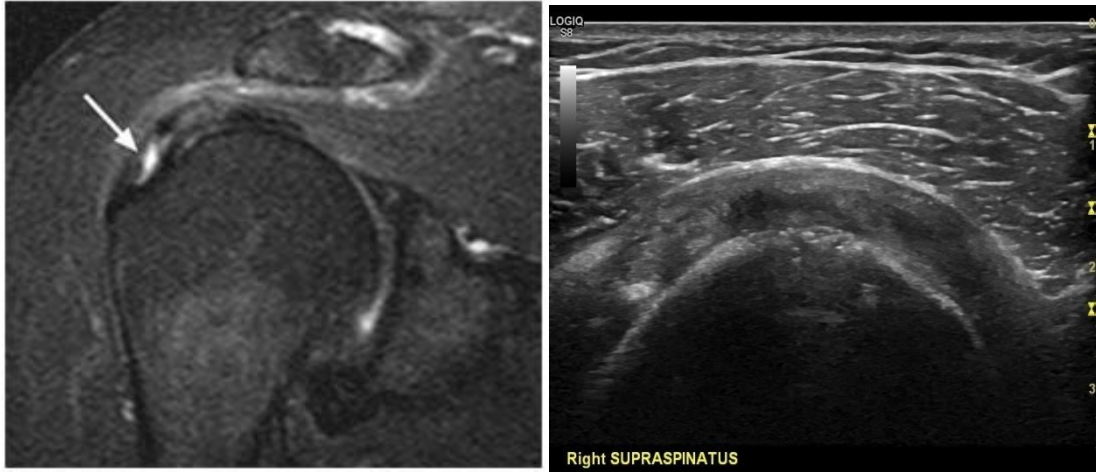
USG and MRI are the valid diagnostic modality for detecting, evaluating and characterizing the rotator cuff

disorder with no significant comparable difference. USG is ideal for screening tool, as it is cheap, non invasive, rapid, dynamic assessment, widely available and ideal for the patients who are unsuitable for MRI examination.

In shoulder instability USG has many challenges while MR provides accurate diagnosis even without contrast.

MR is indicated when there is an abnormality related to labrum, articular cartilage, bone marrow or deep soft tissue.

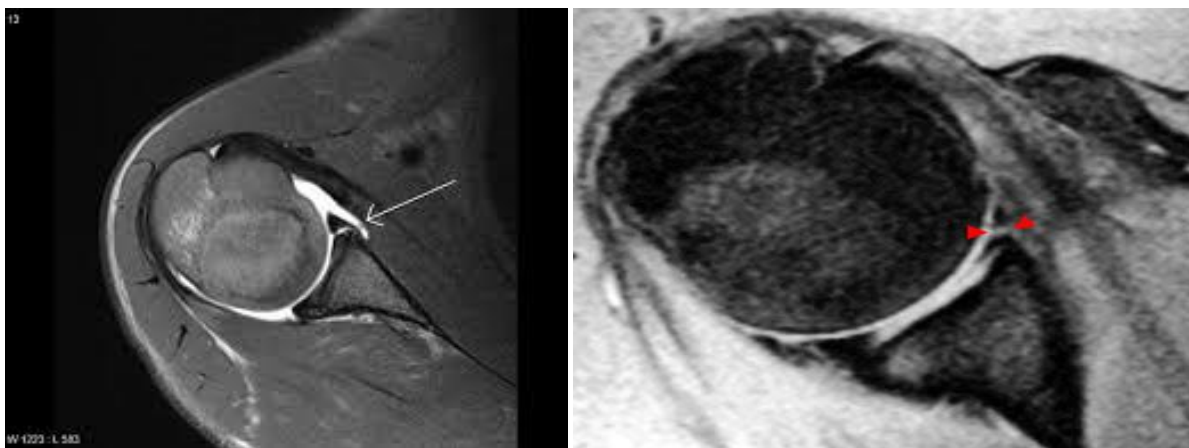
6. Images



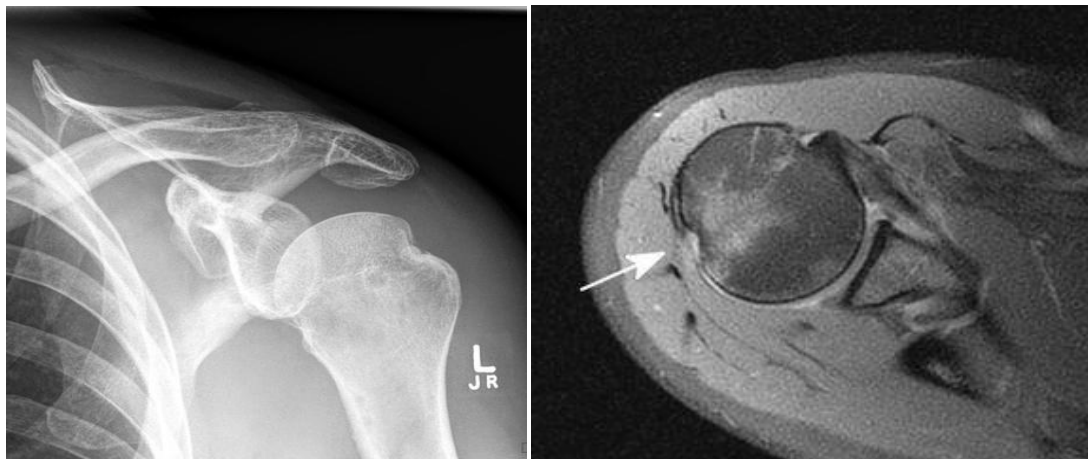
Partial thickness tear in supraspinatus tendon



Full thickness tear in supraspinatus tendon



Superior labral tear



Hill sach's defect (Due to recurrent anterior dislocation)

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