



A Comparative Study of High Frequency Ultrasonography and Magnetic Resonance Imaging in Shoulder Pathologies

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Abstract

Introduction: Shoulder pathologies are a frequent cause of pain and disability in the shoulder area. The most common issues affecting the shoulder include impingement, rotator cuff injuries, and instability, with adhesive capsulitis and biceps tendinopathy also being relatively common.

Patients experiencing shoulder pain, with or without limited range of motion, are often referred to radiologists for evaluation. Clinical examinations and plain radiographs help in choosing the appropriate subsequent diagnostic modality. Early diagnosis facilitates effective surgical treatment planning, preventing functional impairment.

Sonographic evaluation of the rotator cuff began over two decades ago, though it was not initially popular among radiologists due to early reports showing

unfavorable results. Traditionally, arthrography was widely used for shoulder joint assessment, but its invasive nature, associated discomfort, and risks have led to it being largely replaced by MRI, which provides the same diagnoses more easily.

Aims and Objective

1. To study the accuracy and relative role of high frequency ultrasound and MRI in imaging of painful shoulder.
2. To study the tendinopathic changes, partial thickness and full thickness rotator cuff tears.

Materials and Methods

A prospective study conducted in patients with clinically suspected pathologies of shoulder. A total of 50 individuals participated in the study. MR imaging was done with 1.5T MRI scanner (Philips Achieva) using

shoulder coil and the relevant sequences were selected. USG was done with GE LOGIQ P9.

Result

Partial articular surface supraspinatus tear was the most common diagnosis in this study seen in 10 (20 %) of this group, followed by full thickness supraspinatus tear (n = 9, 18 %) and degenerative tendinosis (n = 5, 10 %). Biceps tendinosis was seen in 3 patients (6 %). Infraspinatus involvement accounted only for 2 cases (4%).

Conclusion

1. MRI is a versatile investigation tool for studying all internal derangements of shoulder affording great soft tissue contrast and multi-planar imaging.
2. With the benefit of being cost effective tool USG is comparable to MRI in detection of full thickness tears of rotator cuff tendons.
3. But MRI is better than USG for detection of partial thickness tears of rotator cuff tendons.
4. MRI is an efficient tool in evaluation of shoulder instability with high sensitivity even without arthrography.
5. The clinical applications of High-Resolution Ultrasonography have been extended apart from rotator cuff evaluation to detection of Hill Sachs lesion, bony Bankart lesion, synovial thickening, effusions in joint and in subacromial bursa, biceps tendinosis, rotator cuff tendon calcifications, and guiding needle for MR arthrographic contrast injection & joint fluid aspiration. However, it suffers serious drawbacks in evaluation of labral and cartilaginous lesions.
6. Type III acromion morphology is a significant risk factor for the development of rotator cuff tears.

Inclusion criteria

The study includes patients with shoulder pain and shoulder instability

Exclusion criteria

1. Known cases of rheumatoid arthritis and sero-negative arthritis
2. Known cases of metabolic bone disorders
3. Patient having history of claustrophobia.

Keywords: Rotator Cuff Injuries, MRI, Radiologists, MR Imaging

Introduction

The shoulder joint is often overlooked despite its pivotal role in human evolution. Its unique structure, extending horizontally from the neck like a coat hanger, allows for unparalleled freedom of arm movement, crucial for manipulation and the ability to throw with precision and force^[1]. This mobility, however, comes at the cost of stability in the ball-and-socket joint configuration, making the shoulder susceptible to various pathologies from overuse, trauma, and other causes.

When it comes to diagnostic imaging, MRI (Magnetic Resonance Imaging) excels with its exceptional soft tissue resolution, making it the preferred non-invasive method for assessing shoulder morphology and pathology^[1]. MRI's capability to visualize cross-sectional slices from various angles enhances the detailed examination of both normal and abnormal shoulder structures. Techniques like arthrography further enhance its diagnostic utility by highlighting intra-articular abnormalities with contrast injection.

In contrast, high-resolution ultrasound provides a cost-effective and efficient means to evaluate the shoulder, focusing primarily on rotator cuff and bicipital tendon issues while expanding to diagnose other pathologies.

[2] Its non-invasive nature and real-time imaging capabilities are particularly advantageous for dynamic assessments, crucial for detecting subtle tendon abnormalities and monitoring post-surgical repairs effectively.[3]

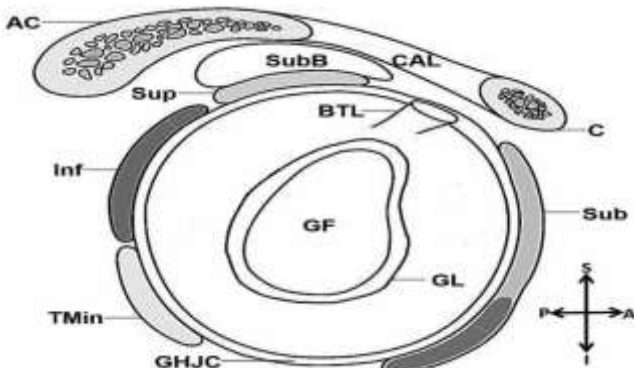


Figure 1: Axial view of tendons of rotator cuff



Figure 2: Ligaments of shoulder joint.

Result

1. Sensitivity of MRI is higher compared to USG for any kind of rotator cuff tears with statistical significance.
2. There is high value for a negative report of a rotator cuff tear in predicting the diagnostic outcome using MRI as compared to USG, there is significant difference.
3. Good agreement between USG and MRI (kappa value of 0.67).

Partial articular surface supraspinatus tear was the most common diagnosis in this study seen in 10 (20 %) of this group, followed by full thickness supraspinatus tear (n = 9, 18 %) and degenerative tendinosis (n = 5, 10 %).

Biceps tendinosis was seen in 3 patients (6 %). Infraspinatus involvement accounted only for 2 cases (4%). The results of present study correlate well with the literature especially with studies done by Burl DL et al⁶ in 1986 and Magee et al⁷ in 2009. Not much of specificity studies are available but whoever have reported have stated specificity of 100% reconfirming the value of positive report of full thickness tear to be absolute.

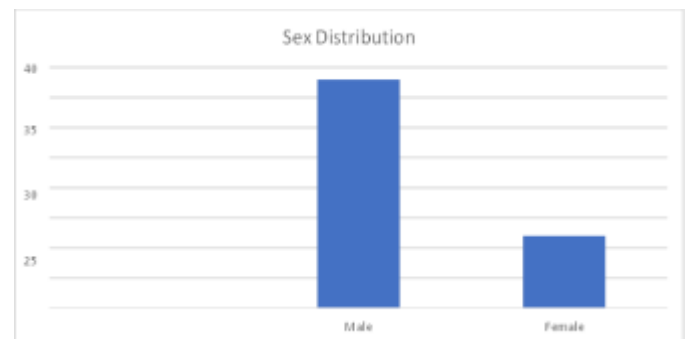
The study group comprised of fifty patients with symptoms and signs related to the shoulder joint.

Sex Distribution

Table 1:

Sex	Frequency	Percentage
male	38	76
female	12	24

Graph 1:



Comment Involvement of males was more as compared to females.

Age Distribution

Table 2:

Age Group	Frequency
21-30	6
31 – 40	1
41 – 50	8
51 – 60	3
61 – 70	7
71 - 80	5

Graph 2:

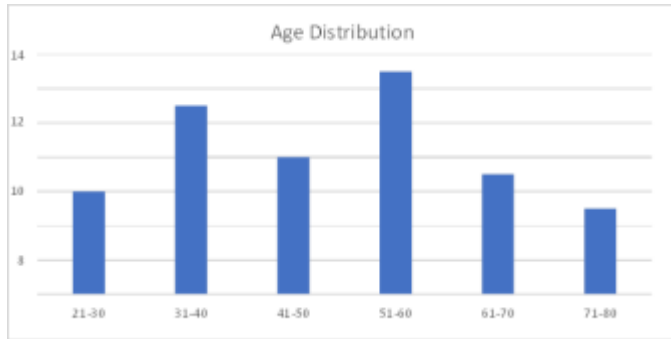
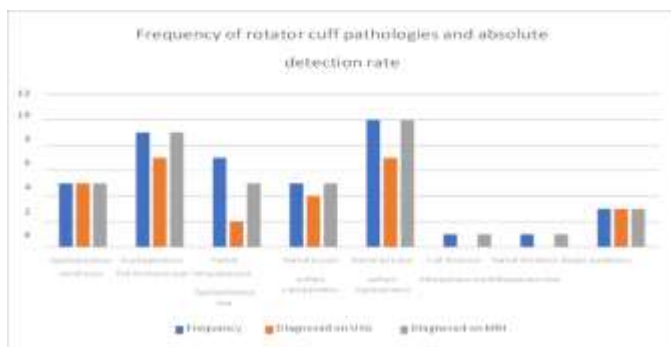


Table 3: Rotator cuff pathologies and their detection:

Diagnosis in 36 cases	Frequency	USG	MRI
Supraspinatus Tendinosis	5	5	5
Full thickness supraspinatus tear	9	7	9
Partial Intrasubstance supraspinatus tear	7	2	5
Partial bursal surface supraspinatus tear	5	4	5
Partial articular surface supraspinatus tear	10	7	10
Full thickness Infrapinatus tear	1	0	1
Partial thickness infrapinatus tear	1	0	1
Biceps tendinosis	3	3	3

Graph 3: Frequency of rotator cuff pathologies and absolute detection rate

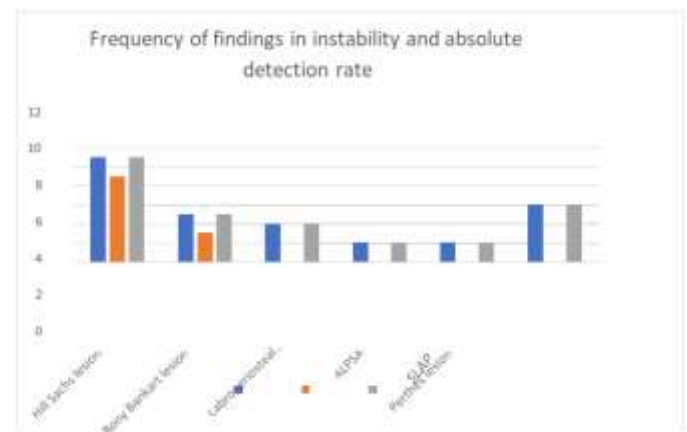


Frequency of rotator cuff pathologies and absolute detection rate

Table 4: Instability

Diagnosis in 22 cases	Frequency	USG	MRI
Hill Sachs lesion	11	9	11
Bony Bankart lesion	5	3	5
Labroperiosteal Bankart lesion	4	0	4
ALPSA	2	0	2
Perthes lesion	2	0	2
SLAP	6	0	6

Graph 4: Frequency of findings in instability and absolute detection rate



Discussion

Initially, the use of ultrasound (USG) in the musculoskeletal system was limited to early identification of tumours and detecting effusions. Its use expanded significantly with the introduction of high-frequency linear array probes and the growing expertise and interest globally. Nowadays, USG is ideal for examining superficial joints and structures, offering the benefit of real-time dynamic imaging.

Conversely, MRI has long been used for musculoskeletal diagnosis and has advanced rapidly with the development of high-field superconducting magnets, specialized coils (such as shoulder and Flex M coils), and new sequences that effectively suppress fat uniformly.

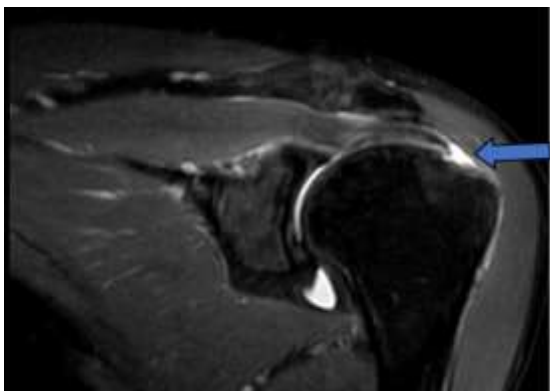
Both USG and MRI are valuable tools for evaluating internal shoulder issues.

MRI excels in soft tissue resolution and multi-planar imaging, allowing for detailed views of various angled structures. USG is cost-effective, patient-friendly, allows dynamic assessment, and is especially useful for guiding arthrography. Neither technique involves radiation exposure, making them safe for repeated use and for use in pregnant patients without safety concerns.

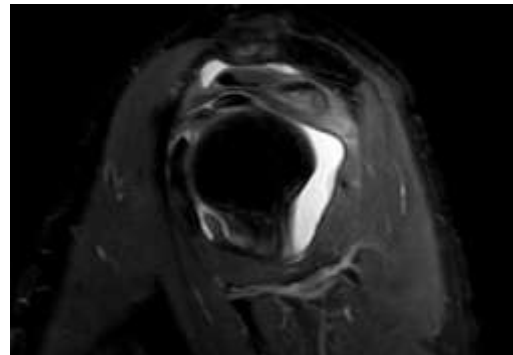
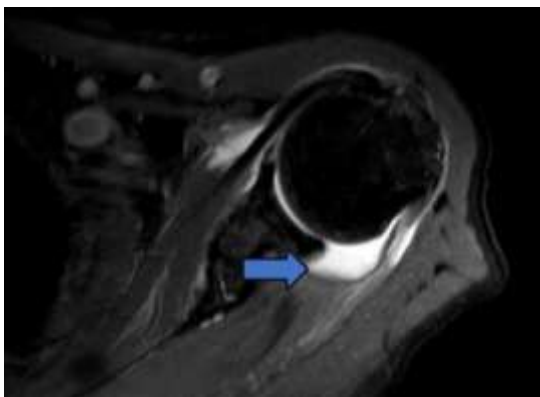
In this study both USG and MRI have significantly contributed to diagnostic information in all categories of shoulder pathologies

Case 1: 66 year old patient presented with trauma to left shoulder

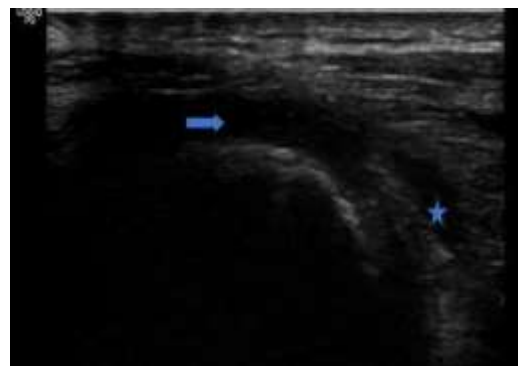
Full thickness tear of supra and infraspinatus tendons



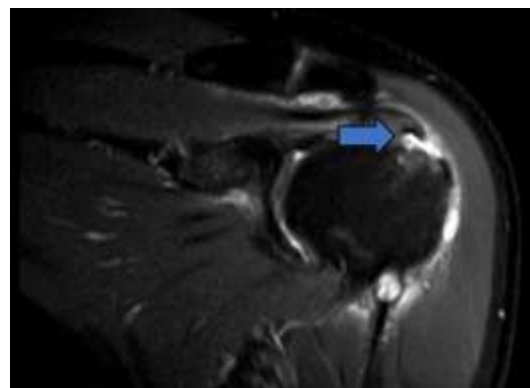
Full thickness tear of supra and infraspinatus tendons



Corresponding USG image showing Supra spinatus tendon tear and joint effusion



Case 2:

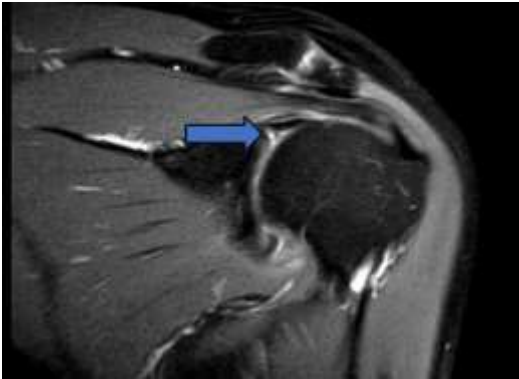


Full thickness tear at insertion of supraspinatus with marrow contusion



Corresponding ultrasound image shows fluid at its attachment

Case 3: 45year old male patient with complaints of recurrent dislocation of shoulder since 4months
SLAP II lesion (Superior Labral anterior and posterior lesion)

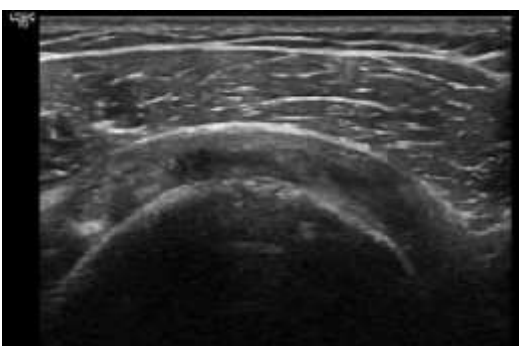


Case 4: 35 year old female with complaints of recurrent dislocation of right shoulder.



Bankarts lesion with partial thickness tear of the supraspinatus tendon.

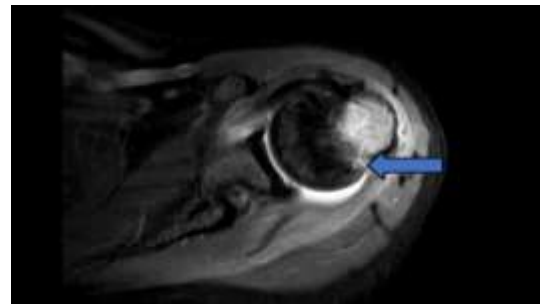
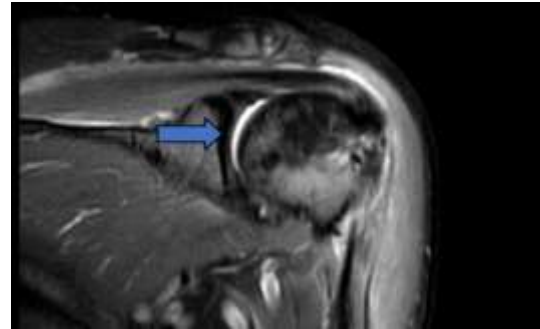
AC joint arthrosis with minimal effusion is also noted.



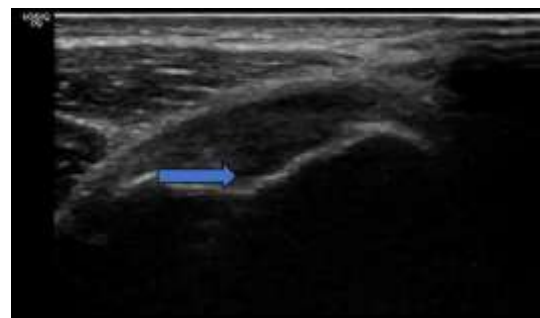
Corresponding USG image shows partial thickness tear of the supraspinatus tendon

Case 5: A 39 year old male patient presented with shoulder pain after RTA.

SLAP II tear. Intramuscular deltoid muscle edema is also noted.



Hill sach's lesion with partial thickness tear of supraspinatus tendon



Hill Sachs lesion confirmed on USG

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