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A CROSS SECTIONAL STUDY OF HIGH RESOLUTION ULTRASOUND AND MRI IN DIAGNOSIS OF ROTATOR CUFF TEARS IN A TERTIARY CARE CENTRE OF CENTRAL INDIA."

Radiology

Dr. Mayur Patel* Junior Resident. *Corresponding Author
Dr. Niveditha R. Nairy Junior Resident.
Dr. Vidhina Khade Junior Resident.
Dr. Aarti Anand Prof & Head Of Department.

ABSTRACT

Background: Rotator cuff tears (RCTs) are a leading cause of shoulder pain and functional disability in adults. Magnetic resonance imaging (MRI) is regarded as the gold standard for evaluating tendon pathology, but high-resolution ultrasound (HRUS) offers a cost-effective, dynamic, and widely available alternative. **Objective:** To compare the diagnostic accuracy of HRUS and MRI in detecting rotator cuff tears and to evaluate their complementary roles in musculoskeletal imaging. **Materials And Methods:** A cross-sectional observational study was conducted in a tertiary care centre in Central India involving 31 patients aged 18–80 years with clinically suspected rotator cuff tears. Each patient underwent both HRUS and MRI of the affected shoulder. MRI served as the reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated for HRUS. **Results:** Out of the 31 patients enrolled in the study, 21 (67.7%) were aged between 30–60 years, and a slight majority of patients were male (54.8%). The supraspinatus tendon was the most frequently involved tendon (77.4%). HRUS was found to have a sensitivity of 91.3%, specificity of 88.9%, PPV of 91%, NPV of 89%, and overall accuracy of 90.3% for detecting full-thickness tears. For supraspinatus and infraspinatus tears, there was excellent agreement between HRUS and MRI, while a few subscapularis and partial-thickness lesions were underestimated. **Conclusion:** High-resolution ultrasound demonstrates diagnostic accuracy comparable to MRI for full-thickness rotator cuff tears. Owing to its dynamic assessment capability, accessibility, and low cost, HRUS can serve as the first-line imaging modality, reserving MRI for equivocal or complex cases.

KEYWORDS

Rotator cuff tear, Shoulder pain, High-resolution ultrasound, MRI, Musculoskeletal imaging

INTRODUCTION

Rotator cuff tears (RCTs) are amongst the most common causes of chronic shoulder pain and functional limitation in adults, and account for a significant portion of the musculoskeletal complaints seen in the orthopaedic and radiology clinical setting. The rotator cuff is made up of the supraspinatus, infraspinatus, teres minor, and subscapularis tendons and is responsible for stability of the glenohumeral joint and motion of the upper limb. Age-related degeneration, overuse injury, and trauma have all been proposed as potential risk factors for the development of RCTs, and prevalence estimates of RCTs increase substantially in adults older than 50 years of age. Prompt recognition and accurate diagnosis of RCTs is important in preventing irreversible retraction of the tendon, muscle atrophy, and loss of function. Unfortunately, conventional clinical examinations to assess for RCTs can be challenging as associated symptoms often overlap with other related shoulder complaints including bursitis and impingement syndrome, and diagnostic imaging is frequently required to confirm clinical diagnosis. MRI has been demonstrated to be the gold standard in assessing soft tissue, however, the high cost of the procedure, and limited MRI availability in some clinical environments, has prompted greater reliance on high-resolution ultrasound (HRUS). HRUS provides better spatial resolution, enables dynamic assessments, and unequivocally allows for real time assessment of tendon integrity, bursal effusion, and dynamic assessments for impingement. The added ability to assess for contralateral comparison further enhances diagnostic confidence.

MATERIALS AND METHODS

All patients presenting with clinical suspicion of rotator cuff injury underwent thorough physical examination, including the Neer, Hawkins, and drop arm tests. Those fulfilling the inclusion criteria were enrolled after informed consent. The demographic data, clinical symptoms, and duration of pain were recorded. Imaging was performed first with HRUS followed by MRI within one week to minimize temporal variations in pathology. For HRUS, scans were performed by an experienced musculoskeletal radiologist with more than five years of expertise, using standardized scanning positions to evaluate each tendon. Dynamic maneuvers such as abduction and external rotation were incorporated to assess impingement and bursal fluid. Findings such as tendon discontinuity, echogenicity alteration, cortical irregularity, and bursal effusion were documented. For MRI, standardized sequences were employed to ensure optimal visualization of all tendons, and interpretations were made by another senior radiologist blinded to HRUS findings to minimize bias. Data from both modalities were compared against MRI as the reference standard, and diagnostic parameters including sensitivity, specificity, PPV, NPV, and accuracy were computed using standard statistical formulas.

Study Design And Setting:

This was a hospital-based cross-sectional observational study conducted in the Department of Radio-Diagnosis, at a tertiary care teaching hospital in Central India between 2022 and 2025. Institutional Ethical Committee approval was obtained, and written informed consent was taken from all participants.

Study Population:

A total of 31 patients aged 18–80 years with clinical suspicion of rotator cuff tear were included.

Inclusion Criteria:

- Age between 18 and 80 years
- Clinical suspicion of rotator cuff injury based on pain, weakness, and limited shoulder movement
- Difficulty in performing overhead activities or reaching behind back

Exclusion Criteria:

- Previous shoulder surgery or metallic implants
- Known degenerative joint disease
- Claustrophobia precluding MRI
- Non-consenting patients

MRI Shoulder:

MRI was performed on a 3T Siemens Magnetom Vida scanner using a dedicated shoulder coil. Sequences: Coronal oblique T1, PD-FS/T2-FS; Sagittal oblique PD-FS; Axial T2-FS and STIR. Parameters: TR 3000–4000 ms; TE 30–40 ms; slice thickness 3 mm; FOV 120–160 mm.

High-Resolution Ultrasound (HRUS):

HRUS was performed on Mindray Resona I9 using a 10–18 MHz linear transducer. Scanning Positions: Neutral for long head of biceps; Modified Crass for supraspinatus; Hand-on-opposite-shoulder for infraspinatus and teres minor; External rotation for subscapularis. Dynamic assessment for impingement, bursal fluid, and tendon movement was performed.

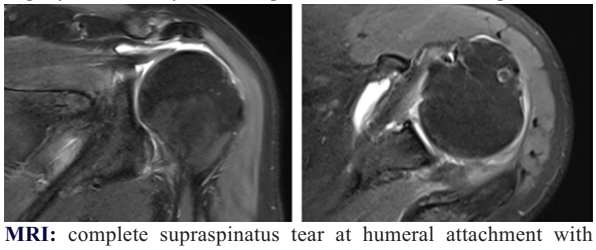
Data Analysis:
MRI served as the reference standard. Sensitivity, specificity, PPV, NPV, and accuracy were calculated for HRUS using Microsoft Excel 2019.

RESULTS

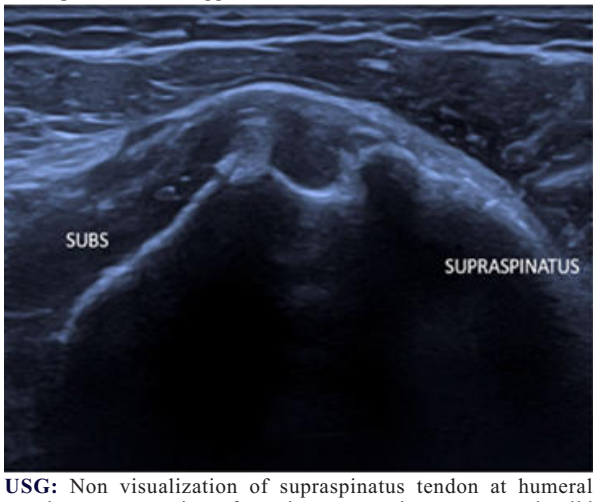
Among 31 patients, 17 (54.8%) were males and 14 (45.2%) females. The majority (67.7%) were aged between 30–60 years. The right shoulder was more commonly affected (61.3%).

Tendon Involvement:
- Supraspinatus: 77.4%
- Infraspinatus: 41.9%
- Subscapularis: 25.8%
- Teres minor: 6.4%

Diagnostic Accuracy:
HRUS had a sensitivity of 91.3% and specificity of 88.9%, along with a PPV of 91%, NPV of 89%, and a diagnostic accuracy of 90.3% for complete thickness tears. There was excellent agreement with MRI for supraspinatus and infraspinatus involvement, and although there was slightly less accuracy for subscapularis tears, it was underreported.



MRI: complete supraspinatus tear at humeral attachment with retraction of its fibers and intrasubstance PDFS signal intensity within subscapularis tendon suggestive of tendinosis.



USG: Non visualization of supraspinatus tendon at humeral attachment suggestive ofcomplete supraspinatus tear and mild thickness of subscapularis tendon with anechoic fluid within suggestive of tendinosis.

Table : The Diagnostic Performance Of Ultrasound (USG) For Evaluating Rotator Cuff Pathologies

Tendon	Pathology Type	USG Sensitivity (%)	USG Specificity (%)	PPV (%)	NPV (%)
Supraspinatus	Partial Tear	90.0	100.0	100.0	84.62
Infraspinatus	Partial Tear	66.67	100.0	100.0	96.55
Subscapularis	Partial Tear	66.67	100.0	100.0	96.55
Supraspinatus	Full Thickness Tear	83.33	100.0	100.0	96.15
Infraspinatus	Full Thickness Tear	100.0	100.0	100.0	100.0
Subscapularis	Full Thickness Tear	100.0	100.0	100.0	100.0
Supraspinatus	Tendinosis	66.67	100.0	100.0	92.59
Infraspinatus	Tendinosis	75.0	100.0	100.0	96.43
Subscapularis	Tendinosis	60.0	100.0	100.0	92.86
Biceps	Tendinosis	100.0	100.0	100.0	100.0

DISCUSSION

The present research validates previous discoveries that the HRUS is very reliable in evaluating full-thickness RCTs, especially of the supraspinatus and infraspinatus tendons. The sensitivity and specificity found in the current research agrees with previously reported meta-analysis (1,2,4). Differences found in evaluation of the subscapularis may be due to the deeper anatomy and limited acoustic window that can obscure subtle partial tears. In any case, with proper operator training and high-frequency probes, the HRUS diagnostic accuracy can be nearly that of MRI. Given that HRUS is real-time, there is a significant advantage during dynamic assessments as the operator can visualize the tendon in motion and therefore impingement during abduction, something that cannot be captured on an MRI. This considerably increases the clinical utility of the HRUS, particularly in symptomatic patients with intermittent pain. The portability of the HRUS is another benefit in this population as it allows for bedside assessments. The HRUS assessments may also be much more economical as MRI is quite expensive and often requires patient referral to tertiary care centers. HRUS allows for full evaluations to be conducted as part of the routine outpatient assessment, therefore improving access and lowering delays in completing diagnostics. Our findings support the HRUS as an effective screening and diagnostic tool, particularly valuable in developing countries with poor access to MRI. Operator dependence is still a significant limitation.

The accuracy of HRUS significantly correlates with the sonographer's experience and equipment quality (9). Another limitation of this study is the relatively small sample size, which may restrict the generalizability of results. Future studies with larger cohorts and inclusion of post-surgical correlation could further strengthen evidence for HRUS's role. Despite these constraints, our study demonstrates strong concordance between HRUS and MRI, emphasizing HRUS's role not merely as a supplementary tool but as a viable first-line investigation for RCTs in most clinical scenarios. Given the increasing healthcare burden associated with musculoskeletal disorders, the integration of HRUS into primary diagnostic workflows can contribute to early diagnosis, cost savings, and improved patient outcomes.

CONCLUSION

High-resolution ultrasound demonstrates diagnostic accuracy comparable to MRI in detecting full-thickness rotator cuff tears. Given its accessibility, dynamic capability, and lower cost, HRUS should be utilized as the primary imaging modality for shoulder evaluation, reserving MRI for complex or uncertain cases.

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