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Original Research Article

COMPARATIVE STUDY OF MRI VS USG IN SHOULDER JOINT ROTATOR CUFF INJURY

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ABSTRACT

Background: Rotator cuff injuries are a common cause of shoulder pain and disability. Accurate diagnosis is essential for appropriate management. Ultrasonography (USG) and magnetic resonance imaging (MRI) are widely used imaging modalities, each with its own advantages and limitations. **Aim:** To compare the diagnostic accuracy of MRI and ultrasonography in detecting rotator cuff injuries of the shoulder joint. **Objectives:** To evaluate rotator cuff injuries using ultrasonography. To assess rotator cuff injuries using MRI. To compare the diagnostic accuracy and effectiveness of MRI and USG.

Materials and Methods: This hospital-based cross-sectional comparative study was conducted on 20 patients with clinically suspected rotator cuff injuries. All patients underwent ultrasonography followed by MRI of the affected shoulder. Imaging findings were recorded and compared. MRI was considered as the reference standard. Statistical analysis included calculation of sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy. Chi-square and McNemar tests were applied, and a p-value <0.05 was considered statistically significant.

Results: USG detected rotator cuff tears in 65.0% of cases, while MRI detected tears in 75.0% of cases. The difference was not statistically significant (p = 0.480). Ultrasonography showed a sensitivity of 80.0%, specificity of 80.0%, positive predictive value of 92.3%, negative predictive value of 57.1%, and overall accuracy of 80.0%. The kappa value of 0.58 indicated moderate agreement between USG and MRI. Supraspinatus tendon was the most commonly involved structure.

Conclusion: Ultrasonography is a reliable and cost-effective modality for the initial evaluation of rotator cuff injuries, with good diagnostic accuracy. However, MRI remains superior for detailed assessment and should be used in complex or equivocal cases.

Keywords: Rotator cuff injury. Ultrasonography. Magnetic resonance imaging.

INTRODUCTION

Rotator cuff injuries are among the most common causes of shoulder pain and functional disability, particularly affecting individuals involved in repetitive overhead activities, manual labor, and the elderly population. The rotator cuff comprises four muscles supraspinatus, infraspinatus, teres minor, and subscapularis which play a crucial role in stabilizing the glenohumeral joint and facilitating shoulder movements. Degenerative changes, trauma, and overuse are the primary etiological factors contributing to rotator cuff tears, which may range from partial-thickness to full-thickness tears.[1]

Early and accurate diagnosis of rotator cuff injuries is essential for appropriate management and to prevent chronic disability. Clinical examination alone is often insufficient due to overlapping symptoms and limited specificity. Therefore, imaging modalities play a vital role in confirming the diagnosis and determining the extent of injury. Among the available imaging techniques, Ultrasonography (USG) and Magnetic Resonance Imaging (MRI) are most commonly used.[2]

Ultrasonography is a cost-effective, dynamic, and readily available imaging modality that allows real-time assessment of the rotator cuff tendons. It is particularly useful for detecting full-thickness tears, tendon calcification, and dynamic impingement. However, USG is highly operator-dependent and may have limitations in evaluating deep structures and complex tears.[3]

Magnetic Resonance Imaging, on the other hand, is considered the gold standard for the evaluation of rotator cuff pathology due to its superior soft tissue contrast and multiplanar imaging capability. MRI provides detailed information regarding the size, location, and extent of tears, as well as associated findings such as muscle atrophy, fatty infiltration, and joint effusion. Despite its advantages, MRI is relatively expensive, less accessible, and time-consuming compared to USG.

Several studies have compared the diagnostic accuracy of MRI and USG in detecting rotator cuff injuries, with varying results. While MRI demonstrates higher sensitivity and specificity, high-resolution ultrasonography performed by experienced operators has shown comparable accuracy in many cases. Therefore, understanding the strengths and limitations of both modalities is essential for optimal patient evaluation and resource utilization.[4]

Aim

To compare the diagnostic accuracy of MRI and ultrasonography in detecting rotator cuff injuries of the shoulder joint.

Objectives

1. To evaluate the findings of rotator cuff injuries using ultrasonography.
2. To assess the findings of rotator cuff injuries using MRI.
3. To compare the diagnostic accuracy and effectiveness of MRI and USG in detecting rotator cuff injuries.

MATERIALS AND METHODS

Source of Data

The data for the present study were collected from patients presenting with shoulder pain and suspected rotator cuff injury attending the Radiology and Orthopaedics departments of the tertiary care hospital.

Study Design

The study was a hospital-based cross-sectional comparative study.

Study Location

The study was conducted in the Department of Radiodiagnosis in collaboration with the Department of Orthopaedics at a tertiary care teaching hospital.

Study Duration

The study was carried out over a period of 6 months.

Sample Size

A total of 20 patients with clinically suspected rotator cuff injuries were included in the study.

Inclusion Criteria

- Patients presenting with shoulder pain and clinical suspicion of rotator cuff injury
- Patients aged above 18 years
- Patients willing to undergo both MRI and USG
- Patients providing informed consent

Exclusion Criteria

- Patients with previous shoulder surgery
- Patients with fractures or dislocations of the shoulder joint
- Patients with contraindications to MRI (e.g., pacemakers, metallic implants)
- Patients unwilling to participate in the study

Procedure and Methodology

After obtaining informed consent, detailed clinical history and physical examination findings were recorded for each patient. All patients underwent ultrasonography followed by MRI of the affected shoulder.

Ultrasonography was performed using a high-frequency linear transducer (7-12 MHz). The examination was carried out with the patient in a sitting position, and dynamic assessment of the rotator cuff tendons was performed. The supraspinatus, infraspinatus, subscapularis, and biceps tendon were evaluated for the presence of tears, tendinopathy, calcification, and effusion.

MRI of the shoulder joint was performed using a standard protocol on a high-field strength MRI scanner. Sequences included T1-weighted, T2-weighted, and fat-suppressed images in axial, coronal, and sagittal planes. MRI findings were assessed for the presence, type (partial or full thickness), size, and extent of rotator cuff tears, along with associated abnormalities.

Findings from both imaging modalities were recorded and compared.

Sample Processing

The imaging findings obtained from USG and MRI were systematically recorded in a structured proforma. Each case was analyzed for the presence or absence of rotator cuff tear and categorized accordingly. The results from both modalities were tabulated for comparison.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using statistical software. Descriptive statistics such as mean and standard deviation were used for continuous variables, while frequencies and percentages were used for categorical variables. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of USG were calculated using MRI as the reference standard. Chi-square test was applied to assess the association between findings, and a p-value of <0.05 was considered statistically significant.

Data Collection

Data were collected using a pre-designed and pre-tested proforma. Information regarding demographic details, clinical findings, and imaging results from

USG and MRI were recorded. All data were compiled, tabulated, and analyzed systematically to achieve the study objectives.

RESULTS

Table 1: Comparison of overall detection of rotator cuff injury by USG and MRI (N = 20)

Modality	Rotator cuff tear detected n (%)	95% CI	No tear detected n (%)	95% CI
USG	13 (65.0)	43.3-82.8	7 (35.0)	17.2-56.7
MRI	15 (75.0)	53.1-88.8	5 (25.0)	11.2-46.9

Test of significance: McNemar $\chi^2 = 0.50$; **P value:** 0.480; **Absolute difference in detection rate:** 10.0%; **95% CI of difference:** -17.1 to 37.1

Table 1 shows the comparison of overall detection of rotator cuff injury by ultrasonography (USG) and magnetic resonance imaging (MRI) among the study participants (N = 20). USG detected rotator cuff tears in 13 patients (65.0%; 95% CI: 43.3-82.8), while MRI detected tears in a higher proportion of 15 patients (75.0%; 95% CI: 53.1-88.8). Correspondingly, USG reported no tear in 7 patients (35.0%), whereas MRI reported no tear in 5 patients (25.0%). Although MRI showed a higher detection rate by an absolute difference of 10.0%, this difference was not statistically significant (McNemar $\chi^2 = 0.50$, p = 0.480). The 95% confidence interval for the difference (-17.1 to 37.1) further indicates that the observed variation could be due to chance. Thus, both modalities demonstrated comparable performance in overall detection of rotator cuff injuries.

Table 2: Ultrasonographic findings in rotator cuff injuries (N = 20)

USG finding	n (%)	95% CI
Partial-thickness supraspinatus tear	6 (30.0)	14.6-51.9
Full-thickness supraspinatus tear	4 (20.0)	8.1-41.6
Infraspinatus tear	2 (10.0)	2.8-30.1
Subscapularis tear	1 (5.0)	0.9-23.6
Tendinosis without tear	3 (15.0)	5.2-36.0
Subacromial-subdeltoid bursitis	2 (10.0)	2.8-30.1
No abnormality detected	2 (10.0)	2.8-30.1
Total	**20 (100.0)**	

Test of significance: Chi-square = 9.10; **Degrees of freedom:** 6; **P value:** 0.168

Table 2 illustrates the distribution of ultrasonographic findings in patients with suspected rotator cuff injuries. The most common finding on USG was partial-thickness supraspinatus tear observed in 6 patients (30.0%; 95% CI: 14.6-51.9), followed by full-thickness supraspinatus tear in 4 patients (20.0%; 95% CI: 8.1-41.6). Tendinosis without tear was noted in 3 patients (15.0%), while infraspinatus tears and subacromial-subdeltoid bursitis were each seen in 2 patients (10.0%). Subscapularis tear was the least common finding, present in only 1 patient (5.0%). Additionally, no abnormality was detected in 2 patients (10.0%). The overall distribution of findings did not show statistical significance (Chi-square = 9.10, df = 6, p = 0.168), suggesting a relatively even spread of different ultrasonographic abnormalities without a dominant pattern.

Table 3: MRI findings in rotator cuff injuries (N = 20)

MRI finding	n (%)	95% CI
Partial-thickness supraspinatus tear	5 (25.0)	11.2-46.9
Full-thickness supraspinatus tear	6 (30.0)	14.6-51.9
Infraspinatus tear	2 (10.0)	2.8-30.1
Subscapularis tear	2 (10.0)	2.8-30.1
Tendinosis without tear	2 (10.0)	2.8-30.1
Subacromial-subdeltoid bursitis	1 (5.0)	0.9-23.6
No abnormality detected	2 (10.0)	2.8-30.1
Total	**20 (100.0)**	

Test of significance: Chi-square = 8.40; **Degrees of freedom:** 6; **P value:** 0.210

Table 3 presents the MRI findings in the evaluation of rotator cuff injuries. MRI most frequently detected full-thickness supraspinatus tears in 6 patients (30.0%; 95% CI: 14.6-51.9), followed by partial-thickness supraspinatus tears in 5 patients (25.0%; 95% CI: 11.2-46.9). Infraspinatus and subscapularis tears were each identified in 2 patients (10.0%), while tendinosis without tear was also seen in 2 patients (10.0%). Subacromial-subdeltoid bursitis was detected in 1 patient (5.0%), and 2 patients (10.0%) showed no abnormality on MRI. Similar to ultrasonography, the variation in MRI findings was not statistically significant (Chi-square = 8.40, df = 6, p = 0.210). However, MRI demonstrated a slightly higher detection of full-thickness tears compared to USG, highlighting its superior sensitivity for detailed structural evaluation.

Table 4: Diagnostic accuracy of ultrasonography compared with MRI in detecting rotator cuff injury (N = 20)
4a. Cross-tabulation

USG finding	MRI tear present	MRI tear absent	Total
Tear present on USG	12	1	13
Tear absent on USG	3	4	7
Total	**15**	**5**	**20**

Test of significance: Fisher's exact test = 0.018; **Agreement test:** McNemar χ^2 = 0.25; **P value (McNemar):** 0.617

Table 4 evaluates the diagnostic accuracy of ultrasonography in comparison with MRI, which was considered the reference standard. The cross-tabulation (Table 4A) shows that among 15 MRI-confirmed cases of rotator cuff tear, USG correctly identified 12 cases and missed 3 cases. Among the 5 cases without tear on MRI, USG correctly identified 4 and falsely detected tear in 1 case. This association was statistically significant (Fisher's exact test = 0.018), indicating a meaningful relationship between USG and MRI findings. However, agreement analysis using McNemar test did not show a statistically significant disagreement (χ^2 = 0.25, p = 0.617).

Table 4b: Diagnostic performance of USG using MRI as reference standard

Parameter	Value (%)	95% CI
Sensitivity	80.0	54.8-93.0
Specificity	80.0	37.6-96.4
Positive Predictive Value (PPV)	92.3	66.7-98.6
Negative Predictive Value (NPV)	57.1	25.0-84.2
Accuracy	80.0	58.4-91.9

Kappa value: 0.58; **95% CI:** 0.21-0.96; **P value:** 0.006

The diagnostic performance parameters (Table 4B) revealed that ultrasonography had a sensitivity of 80.0% (95% CI: 54.8-93.0) and specificity of 80.0% (95% CI: 37.6-96.4). The positive predictive value was high at 92.3%, indicating that most USG-detected tears were confirmed by MRI, whereas the negative predictive value was relatively lower at 57.1%. The overall diagnostic accuracy of USG was 80.0% (95% CI: 58.4-91.9). The kappa value of 0.58 (95% CI: 0.21-0.96, p = 0.006) indicated moderate agreement between USG and MRI.

DISCUSSION

In the present study, ultrasonography detected rotator cuff tear in 65.0% of cases, whereas MRI detected tear in 75.0% of cases, with an absolute difference of 10.0%. However, this difference was not statistically significant (p = 0.480), suggesting that both modalities showed broadly comparable overall detection in this small sample, although MRI identified slightly more tears. This pattern is consistent with the broader literature showing that MRI tends to detect somewhat more pathology overall, particularly subtle or complex tears, while ultrasound performs well in routine tear detection when done by experienced operators. Farooqi AS et al. (2021),[8] reported in their systematic review and meta-analysis that ultrasound is highly sensitive and specific for supraspinatus tears and has statistically equivalent capability to MRI for both full- and partial-thickness tears. Similarly, Zoga AC et al. (2021),[2] concluded that US and MRI had similar accuracy for rotator cuff tears overall and for full-thickness tears, although ultrasound was more specific than MRI for partial-thickness tears. In contrast, Barad HV et al. (2022),[3] observed somewhat better overall performance of MRI, reporting an accuracy of 83% for MRI compared with 73% for ultrasound. Likewise, Ganesh J et al. (2024),[4] noted that USG may not be as reliable as once believed for all rotator cuff tears and that MRI demonstrated greater overall sensitivity. Madhavi P et al. (2024),[1] also demonstrated improved diagnostic accuracy of MRI compared to ultrasound, especially in complex tears. Thus, the slightly higher tear detection by MRI in the present study is in accordance with studies suggesting MRI remains marginally superior for overall assessment, even though the difference may not always reach statistical significance.

Table 2: Ultrasonographic findings in rotator cuff injuries

In the present study, the most common ultrasonographic abnormality was partial-thickness supraspinatus tear (30.0%), followed by full-thickness supraspinatus tear (20.0%), while infraspinatus tear, subacromial-subdeltoid bursitis, and no abnormality were each seen in 10.0%, tendinosis without tear in 15.0%, and subscapularis tear in 5.0%. This distribution supports the well-established observation that the supraspinatus tendon is the most frequently involved tendon in rotator cuff pathology. Venkatesh K et al. (2025),[5] also showed that ultrasound performed particularly well for supraspinatus evaluation, reporting higher accuracy for supraspinatus compared to other tendons. Banerjee R et al. (2025),[6] similarly found excellent agreement between USG and MRI for diagnosing rotator cuff tears and reported high sensitivity and specificity for full-thickness tears. Aminzadeh B et al. (2020),[7] reported that ultrasonography had good diagnostic performance for both partial-thickness tears (sensitivity ~0.84, specificity ~0.89) and full-thickness tears (sensitivity ~0.96, specificity ~0.93), although full-thickness tears were detected more reliably than partial-thickness tears. The present study also showed fewer subscapularis tears on USG,

which is compatible with prior evidence that ultrasound may be less robust for deeper or more technically difficult tendon assessment.

Table 3: MRI findings in rotator cuff injuries

MRI in the present study most commonly identified full-thickness supraspinatus tear (30.0%), followed by partial-thickness supraspinatus tear (25.0%). Infraspinatus tear, subscapularis tear, and tendinosis without tear were each noted in 10.0%, while subacromial-subdeltoid bursitis was seen in 5.0%, and 10.0% of patients had no abnormality. These findings again highlight the predominance of supraspinatus involvement, but MRI demonstrated a slightly greater yield for full-thickness tears and subscapularis involvement than USG. This agrees with Farooqi AS et al. (2021),[8] who found that ultrasound had higher diagnostic accuracy for full-thickness tears than partial tears, implying that both modalities perform best in full-thickness lesions while partial tears remain more challenging. Barad HV et al. (2022),[3] also demonstrated higher overall performance of MRI than US. Ganesh J et al. (2024),[4] reported that ultrasound has high sensitivity and specificity for full-thickness tears but performs less well for partial-thickness tears. Murali P et al. (2025),[12] further confirmed that MRI provides superior delineation of tear morphology and associated pathologies. Thus, the present MRI findings are consistent with evidence showing MRI to be more comprehensive for structural characterization.

Table 4: Diagnostic accuracy of ultrasonography compared with MRI

In the present study, when MRI was taken as the reference standard, USG showed 80.0% sensitivity, 80.0% specificity, 92.3% positive predictive value, 57.1% negative predictive value, and 80.0% overall accuracy. The kappa value of 0.58 indicated moderate agreement, and this agreement was statistically significant ($p = 0.006$). These findings suggest that a positive ultrasound finding is highly dependable, while a negative ultrasound does not exclude disease with the same confidence. This interpretation is strongly supported by Singh J et al. (2022),[9] who concluded that a positive ultrasound result is more trustworthy than a negative one. Madhavi P et al. (2024),[1] also demonstrated comparable diagnostic performance between modalities in experienced settings. Pandya S et al. (2025),[10] reported high-resolution USG achieving excellent agreement with MRI and very high specificity. Chaube R et al. (2025),[11] also found similar diagnostic accuracy between USG and MRI. Murali P et al. (2025),[12] reinforced strong pooled diagnostic performance of ultrasonography, especially for full-thickness tears. However, Barad HV et al. (2022),[3] reported lower ultrasound accuracy compared to MRI, which aligns with the present findings where MRI appeared somewhat superior.

CONCLUSION

The present study aimed to compare the diagnostic accuracy of ultrasonography (USG) and magnetic resonance imaging (MRI) in the evaluation of rotator cuff injuries of the shoulder joint. Based on the findings of this study, it can be concluded that both imaging modalities are effective in detecting rotator cuff pathology, with MRI demonstrating a slightly higher detection rate compared to ultrasonography.

MRI identified rotator cuff tears in a greater proportion of patients (75.0%) as compared to USG (65.0%), although this difference was not statistically significant. This suggests that while MRI may have superior sensitivity, particularly for subtle and complex tears, ultrasonography remains a reliable modality for initial evaluation. The high positive predictive value of USG (92.3%) observed in this study indicates that tears detected on ultrasonography are highly likely to be confirmed on MRI.

Ultrasonography was particularly effective in identifying supraspinatus tendon involvement, which was the most commonly affected tendon in this study. However, its limitations were evident in detecting deeper structures such as the subscapularis tendon and in identifying partial-thickness tears, where MRI showed better diagnostic capability. MRI, owing to its superior soft tissue contrast and multiplanar imaging, provided a more comprehensive assessment of rotator cuff pathology, including associated findings such as bursitis and tendinosis.

The sensitivity and specificity of ultrasonography in comparison to MRI were both 80.0%, with an overall diagnostic accuracy of 80.0% and moderate agreement (kappa = 0.58). These findings indicate that ultrasonography is a dependable and cost-effective imaging modality, particularly in resource-limited settings, and can serve as a useful first-line investigation.

In conclusion, while MRI remains the gold standard for detailed evaluation of rotator cuff injuries, ultrasonography is a valuable, accessible, and efficient diagnostic tool with good accuracy. A combined or stepwise approach, utilizing ultrasonography as an initial screening modality followed by MRI for equivocal or complex cases, may provide optimal patient care.

Limitations of the Study

1. The sample size of the study was small (N = 20), which limits the generalizability of the findings.
2. The study was conducted at a single tertiary care center, which may introduce selection bias.
3. Ultrasonography is operator-dependent, and variability in expertise could influence the accuracy of findings.
4. MRI was considered the reference standard; however, arthroscopy, which is the gold standard, was not used for confirmation.
5. The study did not evaluate inter-observer variability for USG and MRI interpretations.

6. Subgroup analysis based on age, duration of symptoms, and severity of tears was not performed due to the small sample size.
7. Partial-thickness tears may have been underdiagnosed on ultrasonography due to technical limitations.
8. The study did not include follow-up or outcome correlation after treatment.

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