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Comparative Evaluation of Ultrasonography and Magnetic Resonance Imaging in the Diagnosis of Rotator Cuff Injury: A Cross-Sectional Observational Study

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Abstract

Background: Rotator cuff pathology is a leading cause of shoulder pain and disability worldwide, and magnetic resonance imaging (MRI) is regarded as the reference standard for its evaluation, although ultrasonography (USG) is increasingly used as an accessible first-line alternative, particularly in resource-constrained settings.

Objective: To determine the MRI findings, the USG findings, and the level of concordance between the two imaging modalities in patients with clinically suspected rotator cuff injury.

Methods: This cross-sectional observational study was conducted in the Department of Radio-diagnosis of a tertiary care teaching hospital over eighteen months. Thirty-two patients aged 18 to 75 years with clinical features suggestive of rotator cuff injury underwent both MRI and USG of the affected shoulder within 24 to 48 hours of each other. Tendon integrity, tear type, muscle atrophy, joint effusion, and associated structural abnormalities were recorded and compared descriptively, with MRI as the reference standard.

Results: The cohort showed a male predominance (59.4%) and peak involvement in the 45 to 60 year age group (34.4%). MRI identified supraspinatus tendon abnormality in 29 of 32 patients (90.6%), with full-thickness and partial-thickness tears each present in 11 patients (34.4%). USG identified supraspinatus abnormality in 25 of 32 patients (78.1%), most frequently partial tear (43.8%). Overall, 23 of 32 patients (71.9%) showed agreement in at least 7 of 10 assessed radiological parameters, while MRI detected more associated findings, such as posterior glenohumeral effusion and muscle atrophy, than USG.

Conclusion: USG showed substantial concordance with MRI for supraspinatus tendon abnormality, supporting its role as a practical first-line screening tool, although MRI remained superior for detailed tear characterization and for detecting associated structural findings..

Keywords : rotator cuff; ultrasonography; magnetic resonance imaging; diagnostic accuracy; shoulder pain.

Introduction

Shoulder pain is among the most frequent musculoskeletal complaints encountered in both primary and specialist care, ranking third after low back pain and knee pain as a reason for consultation. A systematic review of global epidemiological data estimated that the incidence of shoulder pain ranges from approximately 8 to 62 episodes per 1000 person-years, with considerable regional variation and a substantial lifetime burden across populations [1]. Among the numerous causes of shoulder pain, rotator cuff pathology is one of the most common and functionally disabling diagnoses, encompassing tendinosis and partial- or full-thickness tears of the supraspinatus, infraspinatus, subscapularis, and teres minor. Its prevalence rises sharply with advancing age, driven by progressive tendon degeneration, reduced microvascular perfusion, and cumulative mechanical loading [2].

Timely and accurate diagnosis of rotator cuff injury is essential to guide conservative versus surgical management and to limit progression to irreparable tears and secondary muscle atrophy [3]. Magnetic resonance imaging has long been regarded as the reference standard for rotator cuff evaluation because of its high soft-tissue contrast, multiplanar capability, and ability to characterize tear morphology, muscle quality, and associated periarticular pathology within a single examination [4]. However, MRI is costly, time-consuming, and not universally accessible, and it is contraindicated in patients with certain implants, severe claustrophobia, or renal impairment precluding contrast administration [5].

Over the past decade, refinements in transducer frequency, image resolution, and operator training have narrowed the performance gap between ultrasonography and MRI for detecting full-thickness rotator cuff tears, with several contemporary series reporting sensitivity and overall accuracy for ultrasonography approaching that of MRI, particularly for supraspinatus pathology [6]. Point-of-care musculoskeletal ultrasonography has also expanded rapidly across emergency medicine, primary care, and physiotherapy practice, reflecting its portability, absence of ionizing radiation, and the growing comfort of non-radiologist clinicians with bedside scanning [7]. At the same time, the diagnostic performance of ultrasonography remains recognized as operator-dependent and comparatively less reliable for partial-thickness tears, non-supraspinatus tendon involvement, and secondary findings such as muscle atrophy and fatty infiltration, all of which continue to favor MRI when detailed characterization is required [8].

Despite this accumulating evidence base, much of the published comparative literature originates from centers with dedicated musculoskeletal radiology expertise, and there remains a relative paucity of data from routine tertiary care practice in resource-constrained settings, where the comparative reliability of ultrasonography against MRI can directly influence triage and referral decisions [9]. Few studies simultaneously document concordance across the full spectrum of rotator cuff parameters, tendon-specific tear type, muscle atrophy, joint effusion, bursitis, and osseous change, within the same cohort. This limits the ability of clinicians to judge where ultrasonography can be trusted and where MRI confirmation remains necessary [10]. This gap in the literature formed the rationale for the present study. The study was undertaken to systematically document the MRI findings, the ultrasonographic findings, and the level of agreement between the two modalities in a cohort of patients with clinically suspected rotator cuff injury presenting to a tertiary care radiology department.

Methodology

Study Design and Setting

This was a cross-sectional observational study conducted in the Department of Radio-diagnosis of a tertiary care teaching hospital. The cross-sectional design permitted simultaneous evaluation of ultrasonography (USG) and magnetic resonance imaging (MRI) findings in the same participants within a defined period, allowing determination of association and agreement between the two modalities without the need for follow-up. The department was equipped with a 3 Tesla MRI scanner and a high-resolution ultrasonography unit with a dedicated high-frequency linear probe, and image acquisition and interpretation were performed by experienced radiologists together with postgraduate residents to maintain consistency.

Study Duration

Data were collected over eighteen months, following protocol development, synopsis submission, and institutional ethical clearance. Data tabulation, statistical analysis, and manuscript preparation were completed in the subsequent months.

Study Population

Patients aged between 18 and 75 years who presented with clinical features suggestive of rotator cuff injury, including shoulder pain, weakness, restricted movement, or difficulty performing overhead activities, and who were willing to provide informed consent, were considered for enrolment. Patients were excluded if they had a history of prior shoulder surgery other than diagnostic arthroscopy, inflammatory arthritis or other significant shoulder pathology, neurological disorders affecting shoulder function, or contraindications to MRI. Patients with an interval exceeding 24 to 48 hours between MRI and USG were also excluded, in order to minimize confounding and preserve correlation between the two imaging studies.

Sampling Technique and Sample Size

A convenience sampling method was employed, with consecutive recruitment of eligible patients presenting to the department until the calculated sample size was achieved. The sample size was estimated using a standard formula for single-proportion studies, based on a previously reported ultrasonographic sensitivity of 0.9824 for detecting rotator cuff tears, a 95% confidence level (Z equals 1.96), and a margin of error of 0.041, yielding a minimum requirement of approximately 40 participants. The final analyzed cohort comprised 32 patients who completed both imaging modalities within the eligibility window.

Study Parameters

Each participant served as their own control, with USG findings compared directly against MRI as the reference standard. The parameters assessed on both modalities included tendinosis and partial- or full-thickness tears of the supraspinatus, infraspinatus, subscapularis, and long head of biceps tendons, muscle atrophy, posterior glenohumeral joint effusion, subacromial or subdeltoid bursitis, acromioclavicular joint bony spurring, osseous lesions, and spinoglenoid notch involvement.

Study Procedure

All participants underwent detailed clinical history-taking and physical examination prior to enrolment. Each patient then underwent MRI and USG of the affected shoulder within a 24 to 48 hour interval to optimize correlation between findings. MRI was performed using a dedicated shoulder coil with axial, coronal, and sagittal proton-density fat-saturated sequences, coronal T2-weighted imaging, and a sagittal T1 axial merge, with a slice thickness of 3 to 5 millimeters. USG was performed with a high-frequency linear probe of 3 to 11 megahertz. Dynamic maneuvers, including the Neer impingement test and the Hawkins-Kennedy test, were incorporated to assess tendon movement and impingement in real time.

Data Collection and Statistical Analysis

Data were recorded on a structured proforma capturing demographic details, clinical history, and imaging findings, and were entered into Microsoft Excel for coding. Statistical analysis was performed using IBM SPSS version 27. Quantitative variables were summarized as means and standard deviations, and categorical variables as frequencies and percentages. Concordance between the two modalities was expressed as the proportion of assessed parameters showing agreement per patient, with MRI considered the reference standard throughout. For the supraspinatus tendon, the structure most central to the comparative objective, chance-corrected agreement between MRI and USG tear classification was additionally quantified using Cohen's kappa, with a quadratic-weighted kappa calculated to account for the ordinal severity of tear categories (no abnormality, tendinosis, partial tear with tendinosis, partial-thickness tear, full-thickness tear); kappa values were interpreted using the Landis and Koch benchmarks. This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies [21].

Ethical Considerations

The study was conducted in accordance with the Indian Council of Medical Research National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017) after approval from the institutional ethics committee (approval number: [INSERT IEC APPROVAL NUMBER]). Written informed consent was obtained from all participants in their preferred language. Participation was voluntary, and patient information was anonymized and used only for research purposes, with no impact on ongoing clinical care.

RESULTS

A total of 32 patients with clinically suspected rotator cuff injury who underwent both MRI and USG within the defined interval were included in the final analysis.

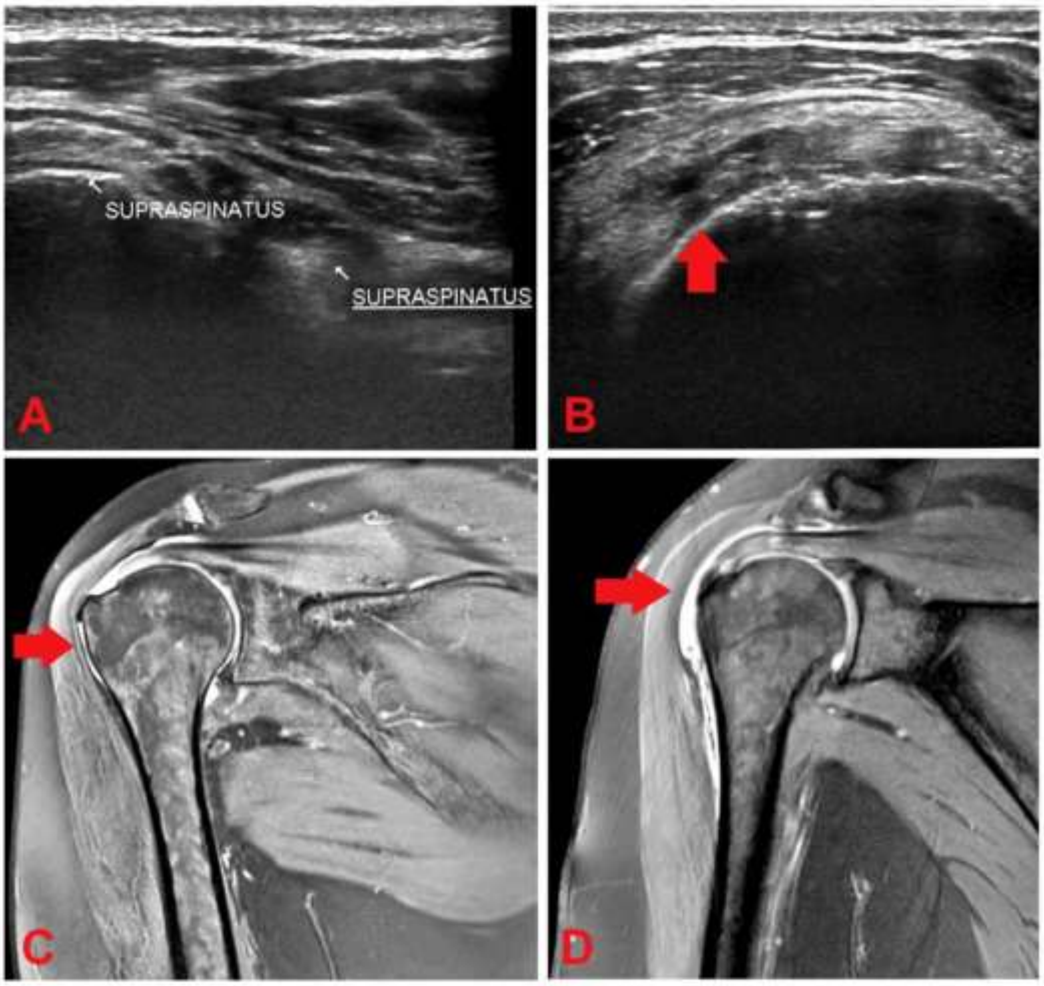

Figure 1. Comparison of ultrasonography (A, B) and MRI (C, D) in a representative patient with supraspinatus tendon abnormality. USG images (A, B) show the supraspinatus tendon with an area of altered echotexture (arrow in B) corresponding to tendon abnormality, while the corresponding MRI images (C, D) demonstrate the same pathology (arrows) with superior soft-tissue contrast.

Demographic and Clinical Characteristics of Study Participants
Rotator cuff injury was most frequent among patients aged 45 to 60 years (11 of 32, 34.4%), followed by those aged 30 to 45 years (9 of 32, 28.1%). Males constituted 59.4% of the cohort (19 of 32), and the right shoulder was more frequently affected than the left (62.5% versus 37.5%), consistent with the predominance of right-sided limb dominance (96.9%). Acute onset of symptoms (less than 4 weeks) was reported by 43.8% of patients, and all participants (100.0%) reported pain or weakness. Night pain, restricted range of motion, and difficulty with activities were reported in 71.9%, 93.8%, and 81.3% of patients, respectively. These demographic and clinical characteristics are summarized in Table 1.

Table 1. Demographic and clinical characteristics of study participants (N = 32)

Variable	Category	n	%
Age group (years)	23–30	5	15.6
	30–45	9	28.1
	45–60	11	34.4
	More than 60	7	21.9
Sex	Male	19	59.4
	Female	13	40.6
Affected shoulder	Right	20	62.5
	Left	12	37.5
Dominant side	Right	31	96.9
	Left	1	3.1
Onset of symptoms	Acute (<4 weeks)	14	43.8
	Subacute (4–12 weeks)	12	37.5
	Chronic (>12 weeks)	6	18.8
Pain or weakness	Present	32	100.0
Night pain	Present	23	71.9
Restricted range of motion	Present	30	93.8
Difficulty in activities	Present	26	81.3

Percentages are calculated out of the total study population (N = 32) for each variable category.

MRI Findings of Rotator Cuff Pathology
On MRI, the supraspinatus tendon was the most frequently involved structure, showing abnormality in 29 of 32 patients (90.6%); full-thickness tear and partial-thickness tear were each recorded in 11 patients (34.4%), tendinosis in 4 patients (12.5%), and partial tear with tendinosis in 3 patients (9.4%). Subscapularis abnormality was seen in 8 patients (25.0%) and infraspinatus abnormality in 5 patients (15.7%), while the extra-articular long head of biceps tendon was abnormal in only 1 patient (3.1%). Among associated findings, posterior glenohumeral joint effusion was the most common, present in 22 patients (68.8%), followed by acromioclavicular joint bony spurring in 19 patients (59.4%), muscle atrophy in 10 patients (31.3%), subacromial or subdeltoid bursitis in 8 patients (25.0%), and osseous lesions in 6 patients (18.8%); no patient showed spinoglenoid notch involvement. These findings are summarized in Table 2.

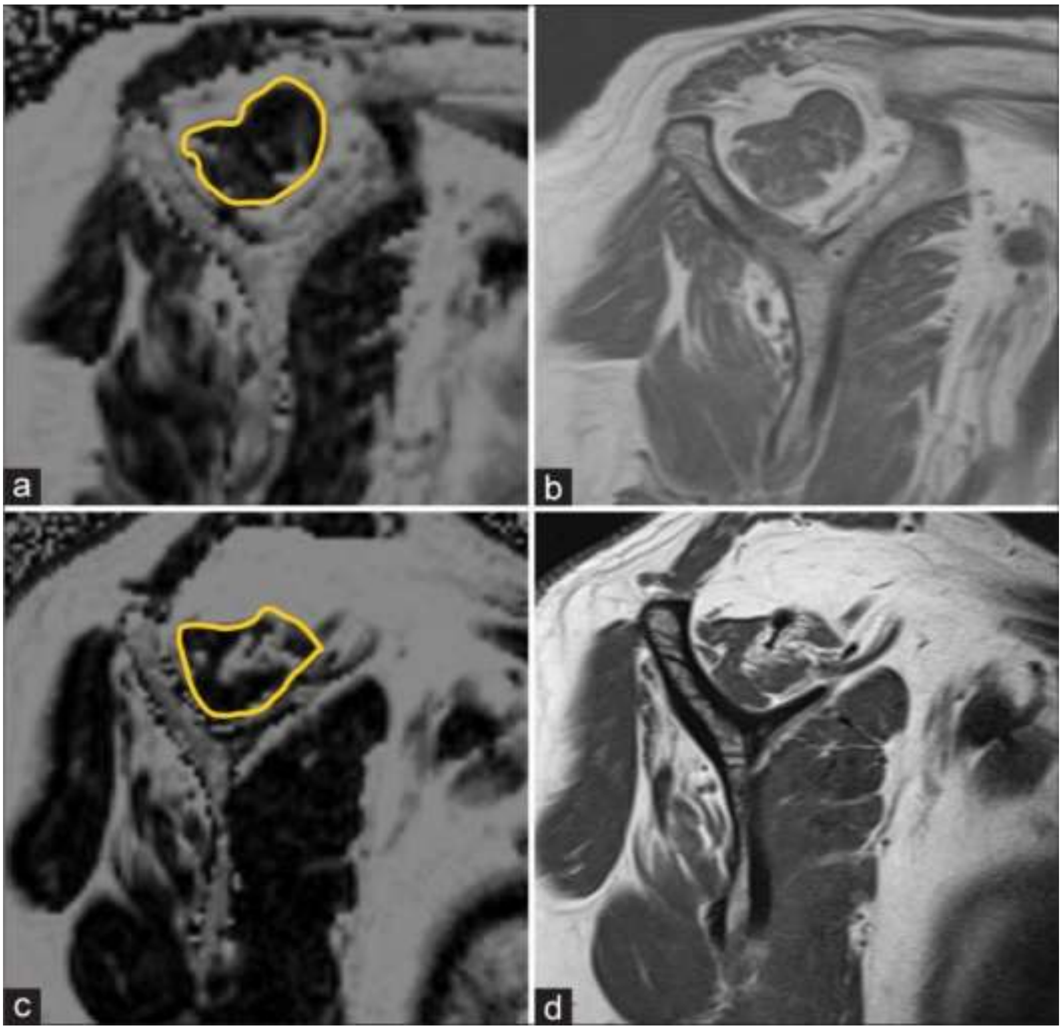

Figure 2. MRI images of the shoulder joint in a representative patient demonstrating rotator cuff pathology. Panels (a) and (c) show axial proton-density fat-saturated images with the supraspinatus tendon outlined, and panels (b) and (d) show corresponding coronal and sagittal sequences depicting tendon and muscle abnormalities.

Table 2. MRI findings of rotator cuff structures and associated abnormalities (N = 32)

Structure / Parameter	**Finding**	**n**	**%**
Supraspinatus tendon	No abnormality	3	9.4
	Full-thickness tear	11	34.4
	Partial-thickness tear	11	34.4
	Partial tear with tendinosis	3	9.4
	Tendinosis	4	12.5
Infraspinatus tendon	No abnormality	27	84.4
	Full-thickness tear	2	6.3
	Partial-thickness tear	3	9.4
Subscapularis tendon	No abnormality	24	75.0
	Full-thickness tear	2	6.3
	Partial-thickness tear	3	9.4

	Tendinosis	3	9.4
LHB tendon (extra-articular)	No abnormality	31	96.9
	Tendinosis	1	3.1
Posterior GH joint effusion	Present	22	68.8
Muscle atrophy	Present	10	31.3
AC joint bony spurring	Present	19	59.4
Subacromial/subdeltoid bursitis	Present	8	25.0
Osseous lesion	Present	6	18.8
Spinoglenoid notch involvement	Present	0	0.0

LHB, long head of biceps; GH, glenohumeral; AC, acromioclavicular. "No abnormality" corresponds to findings recorded as absent on MRI. Percentages are calculated out of the total study population (N = 32).

Ultrasonographic Findings of Rotator Cuff Pathology

On USG, the supraspinatus tendon again showed the highest frequency of abnormality, present in 25 of 32 patients (78.1%), with partial-thickness tear as the most common finding (14 patients, 43.8%), followed by tendinosis (8 patients, 25.0%) and full-thickness tear (2 patients, 6.3%). Subscapularis abnormality was identified in 5 patients (15.6%) and infraspinatus abnormality in 2 patients (6.2%). Associated findings were detected less frequently on USG than on MRI: posterior glenohumeral joint effusion was present in 3 patients (9.4%), acromioclavicular joint bony spurring in 4 patients (12.5%), and subacromial or subdeltoid bursitis in 4 patients (12.5%); muscle atrophy and spinoglenoid notch involvement were not identified in any patient on USG. These findings are summarized in Table 3.

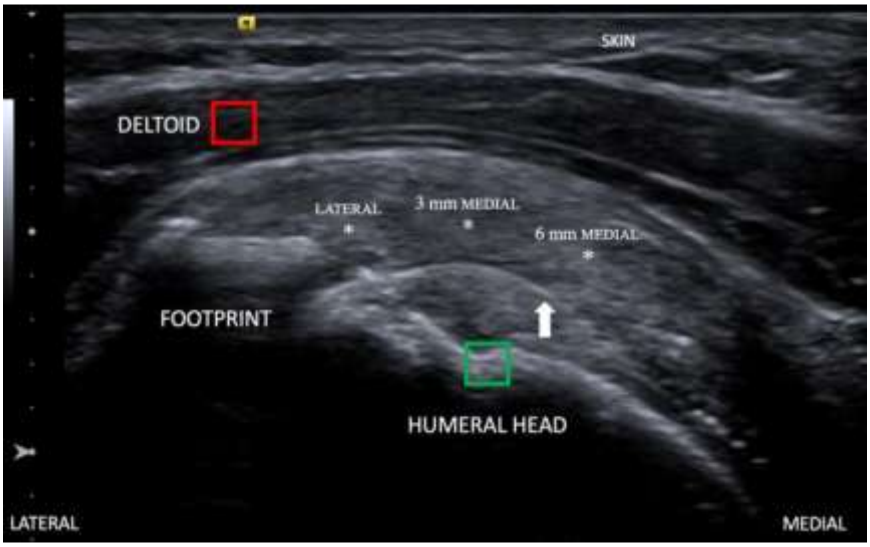

Figure 3. Ultrasonographic image of the rotator cuff showing the supraspinatus tendon with anatomical landmarks, including the deltoid muscle and humeral head, illustrating the transducer positioning and tendon footprint used for USG assessment of tendon abnormality.

Table 3. Ultrasonographic (USG) findings of rotator cuff structures and associated abnormalities (N = 32)

Structure / Parameter	Finding	n	%
Supraspinatus tendon	No abnormality	7	21.9
	Full-thickness tear	2	6.3
	Partial-thickness tear	14	43.8
	Partial tear with tendinosis	1	3.1
	Tendinosis	8	25.0

Infraspinatus tendon	No abnormality	30	93.8
	Nonspecific abnormality present*	1	3.1
	Tendinosis	1	3.1
Subscapularis tendon	No abnormality	27	84.4
	Partial-thickness tear	1	3.1
	Tendinosis	4	12.5
LHB tendon (extra-articular)	No abnormality	20	62.5
	Tendinosis	7	21.9
	Tendinitis / other*	5	15.6
Posterior GH joint effusion	Present	3	9.4
Muscle atrophy	Present	0	0.0
AC joint bony spurring	Present	4	12.5
Subacromial/subdeltoid bursitis	Present	4	12.5
Spinoglenoid notch involvement	Present	0	0.0

*LHB, long head of biceps; GH, glenohumeral; AC, acromioclavicular. *Nonspecific categories reflect original proforma coding distinct from tendinosis, partial tear, or full-thickness tear. Percentages are calculated out of the total study population (N = 32).*

Concordance Between MRI and Ultrasonographic Findings

Agreement between MRI and USG was assessed across ten radiological parameters per patient. The highest proportion of patients showed agreement in 7 of 10 parameters (11 of 32 patients, 34.4%), followed by agreement in 8 of 10 parameters (7 patients, 21.9%) and 9 of 10 parameters (5 patients, 15.6%). Overall, 23 of 32 patients (71.9%) showed agreement in at least 7 of 10 assessed findings, while lower levels of agreement, 6 of 10 (4 patients, 12.5%), 5 of 10 (4 patients, 12.5%), and 4 of 10 (1 patient, 3.1%), were less common. These results, summarized in Table 4, indicate a moderate to high overall level of concordance between the two modalities, with discordance concentrated in specific tendon-tear classifications and secondary structural findings rather than distributed evenly across parameters.

Table 4. Concordance between MRI and ultrasonographic findings across assessed parameters (N = 32)

Findings in agreement (of 10 assessed)	n	%
4 of 10	1	3.1
5 of 10	4	12.5
6 of 10	4	12.5
7 of 10	11	34.4
8 of 10	7	21.9
9 of 10	5	15.6
Total	**32**	**100.0**

Concordance was assessed across ten radiological parameters per patient: supraspinatus, infraspinatus, subscapularis, and long head of biceps tendon status; primary tear type; posterior glenohumeral effusion; muscle atrophy; acromioclavicular joint bony spurring; subacromial/subdeltoid bursitis; and osseous lesion. Twenty-three of 32 patients (71.9%) showed agreement in at least 7 of 10 parameters.

Tendon-Specific Comparison of Supraspinatus Tear Classification on MRI and USG

Because the supraspinatus tendon was the structure most frequently involved and most central to the comparative objective of the study, its tear classification was cross-tabulated between the two modalities. Of the 11 patients with an MRI diagnosis of full-thickness supraspinatus tear, only 2 (18.2%) were concordantly classified as full-thickness tear on USG, while the remainder were classified as partial tear (5 patients), tendinosis (2 patients), or showed no abnormality (2 patients). By contrast, of the 11 patients with an MRI diagnosis of partial-thickness tear, 7 (63.6%) were concordantly classified as partial tear on USG. Agreement was lowest for the smaller subgroup with partial tear and coexisting tendinosis on MRI (1 of 3 patients concordant on USG). Chance-corrected agreement for supraspinatus tear classification was slight on unweighted Cohen's kappa (kappa = 0.15) and improved to fair once the ordinal severity of tear categories was accounted for (quadratic-weighted kappa = 0.24). These findings, presented in Table 5, indicate that USG showed closer agreement with MRI for partial-thickness supraspinatus tears than for full-thickness tears in this cohort, although category-level agreement beyond chance was modest overall.

Table 5. Cross-tabulation of MRI and ultrasonographic findings for the supraspinatus tendon (N = 32)

MRI finding	USG: none	USG: full tear	USG: partial tear	USG: partial + tendinosis	USG: tendinosis	Total
No abnormality	0	0	1	0	2	**3**
Full-thickness tear	2	**2**	5	0	2	**11**
Partial-thickness tear	2	0	**7**	0	2	**11**
Partial tear + tendinosis	1	0	0	**1**	1	**3**
Tendinosis	2	0	1	0	**1**	**4**
Total	**7**	**2**	**14**	**1**	**8**	**32**

USG, ultrasonography. Bold diagonal values denote concordant classification between MRI and USG. Row and column totals represent the number of patients with each MRI or USG classification, respectively. Unweighted Cohen's kappa = 0.15 (slight agreement); quadratic-weighted kappa = 0.24 (fair agreement), calculated using the ordinal category order given above.

DISCUSSION

In this cross-sectional evaluation of 32 patients with clinically suspected rotator cuff injury, ultrasonography demonstrated meaningful concordance with magnetic resonance imaging for the primary determinant of rotator cuff pathology, tendon involvement and tear classification, while showing more limited agreement for associated structural findings such as joint effusion, muscle atrophy, and acromioclavicular joint spurring. Middle-aged and older adults, particularly those between 45 and 60 years, formed the largest proportion of the cohort. This is consistent with the well-documented age-related decline in tendon vascularity and collagen integrity that predisposes to cuff degeneration [2].

Primary Objective: Supraspinatus Tendon Findings on MRI and USG

The supraspinatus tendon was the most frequently involved structure on both modalities, abnormal in 90.6% of patients on MRI and 78.1% on USG, confirming its established status as the tendon most vulnerable to mechanical impingement beneath the acromion during overhead activity [2]. However, tear-type classification diverged: MRI identified full-thickness and partial-thickness tears in equal proportion (34.4% each), whereas USG most frequently classified supraspinatus abnormality as partial tear (43.8%), with full-thickness tear identified in only 6.3% of patients. Cross-tabulation showed that of 11 MRI-diagnosed full-thickness tears, USG concordantly classified only 2 as full-thickness, with the remainder read as partial tear, tendinosis, or normal, whereas 7 of 11 MRI-diagnosed partial tears were concordantly read as partial tear on USG (Table 5). This corresponded to only slight chance-corrected agreement on unweighted Cohen's kappa (kappa = 0.15), rising to fair agreement when the ordinal severity of tear categories was accounted for (quadratic-weighted kappa = 0.24), indicating that although raw percentage agreement appeared moderate, agreement beyond what would be expected by chance alone was limited.

This pattern is broadly consistent with recent comparative series. A 2024 prospective Indian cohort reported that ultrasonography achieved 91.2% sensitivity and 88.6% overall accuracy for detecting rotator cuff tears when performed by an experienced operator [6]. A 2026 systematic review of thirteen comparative studies confirmed that ultrasonography approaches or matches MRI for full-thickness supraspinatus tears, with sensitivity reaching 100% and kappa values up to 1.0 in some cohorts, but shows greater variability for partial-thickness lesions, with sensitivity ranging from 72% to 94% [5]. The comparatively lower concordance for full-thickness tears observed in the present study, in contrast to some of this literature, may be explained by several factors: the smaller sample size, reliance on a single ultrasonography unit rather than a dedicated multi-operator musculoskeletal service, and the known difficulty of sonographically distinguishing complete tendon retraction with adjacent fluid from partial discontinuity. This difficulty is particularly pronounced when chronic scarring alters the normal acoustic window [12]. Comparable operator- and technique-dependent variability has been reported with handheld ultrasound devices, where inter-rater agreement for supraspinatus assessment fell to only moderate levels compared with conventional cart-based systems [11].

Secondary Objective: Associated Structural Findings and Overall Concordance

Beyond tendon-specific tear classification, MRI consistently detected a greater burden of associated pathology than USG. Posterior glenohumeral joint effusion was identified in 68.8% of patients on MRI compared with only 9.4% on USG, muscle atrophy was seen in 31.3% of patients on MRI but in none on USG, and acromioclavicular joint bony spurring was recorded in 59.4% on MRI versus 12.5% on USG (Tables 2 and 3). This pattern mirrors observations from a recent scoping review, which noted that ultrasonography remains fundamentally limited in assessing deep intra-articular fluid collections and intramuscular fatty infiltration because these require volumetric, multiplanar tissue contrast that two-dimensional sonography cannot reliably provide [8]. The complete absence of USG-detected muscle atrophy in the present cohort, despite MRI identifying it in nearly one-third of patients, is explained by the limited acoustic penetration of ultrasound through overlying soft tissue and the qualitative rather than volumetric nature of sonographic muscle assessment. By contrast, MRI-based automated three-dimensional segmentation has been shown to quantify cuff muscle volume and fat fraction with far greater precision [13,20].

Despite these gaps in secondary findings, raw percentage agreement between the two modalities remained moderate to high, with 23 of 32 patients (71.9%) showing concordance in at least 7 of 10 assessed parameters. This figure is broadly comparable to pooled agreement estimates reported in contemporary comparative cohorts, where substantial to near-perfect agreement has been documented for full-thickness tears and calcific pathology, even though agreement for deeper or less accessible structures remained inconsistent [10,18]. However, as the kappa analysis above illustrates, percentage agreement alone can overstate true concordance once chance agreement is taken into account, particularly for a five-category classification with an uneven distribution of findings. Artificial-intelligence-assisted image analysis has recently been proposed as one route to narrow this gap. Deep-learning models have demonstrated high accuracy for automated supraspinatus tear detection on MRI [14] and for screening rotator cuff pathology on shoulder imaging more broadly [15,17]. Early work has also extended similar approaches to ultrasonographic image classification [16]. Together, these developments suggest that operator-independent, computer-assisted interpretation may in future reduce the variability that limited USG performance, and particularly kappa-based agreement, in the present cohort.

Implications and Limitations

Taken together, these findings support the use of ultrasonography as a practical, accessible first-line screening tool for suspected rotator cuff injury, particularly for identifying supraspinatus tendon abnormality in settings where MRI access is limited or delayed, while reinforcing that MRI confirmation remains necessary whenever precise tear grading, evaluation of muscle atrophy or effusion, or preoperative planning is required [19]. A stepwise approach of this kind has previously been shown to be cost-conscious without compromising diagnostic yield when USG is reserved for initial triage and MRI for equivocal or surgically relevant cases [4,19].

This study has several limitations, foremost among them its sample size. The calculated requirement was approximately 40 participants, but only 32 were enrolled within the study period and eligibility window, a shortfall that underpowers every comparison reported here, particularly for less frequent findings such as muscle atrophy, osseous lesions, and the smaller supraspinatus tear subcategories in Table 5. The cohort was also drawn from a single tertiary care center, which limits generalizability. Surgical or arthroscopic confirmation was not available to independently verify MRI findings, and formal diagnostic accuracy parameters such as sensitivity, specificity, and predictive values could not be computed for individual structures because a composite reference standard beyond MRI was not used; concordance was therefore assessed descriptively and using Cohen's kappa for the primary supraspinatus comparison, rather than through formal accuracy statistics. The modest and unevenly distributed cell counts underlying the kappa estimates (Table 5) also mean these values should be interpreted as indicative rather than precise. Interobserver variability for both modalities was not evaluated, functional or symptom-severity correlation with radiological findings was not undertaken, and the diagnostic performance of USG is inherently operator-dependent, so these findings may not be directly generalizable to centers with different levels of sonographic expertise. These limitations should be addressed in larger, adequately powered, multicentric studies incorporating arthroscopic or surgical correlation to more precisely define the comparative diagnostic accuracy of ultrasonography against MRI.

CONCLUSION

This cross-sectional study found that USG reliably flags supraspinatus tendon involvement, but the raw 71.9% parameter-level agreement with MRI masks a more modest picture once chance agreement is accounted for:

chance-corrected agreement for supraspinatus tear grading was only slight to fair (unweighted kappa 0.15; quadratic-weighted kappa 0.24). In practical terms, this means USG can be trusted to flag that a tendon is abnormal, but the specific tear grade it assigns should not, on the basis of this cohort, be relied upon in isolation for surgical planning without MRI confirmation. Because the study enrolled fewer patients than its calculated target, these kappa estimates should be treated as preliminary. Larger, adequately powered, multicentric studies that report kappa-based (rather than percentage-only) agreement, and that incorporate arthroscopic correlation where feasible, are needed before USG-based tear grading can be adopted with confidence in routine practice..

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