

Original Research

Diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI)

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Abstract

Background: Multiple studies have demonstrated that US and MRI have comparable accuracy in diagnosing RCTs before surgery, although the accuracy of US is more operator-dependent. Hence, the present study was conducted to assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tears with respect to Magnetic Resonance Imaging (MRI).

Materials & Methods: Twenty consecutive patients who presented with shoulder pain, clinically suspected to have rotator cuff injuries within 6 months, underwent both Ultrasound and MRI of the shoulder at the Department of Radiodiagnosis. Clinical examination findings were recorded. Subsequently, patients underwent shoulder ultrasound using high-frequency probes with dedicated settings as per the guidelines of the European Society of Musculoskeletal Radiology. Following this, MRI was performed. Ultrasound and MRI findings were correlated and tabulated. Statistical analysis was performed using SPSS to determine the accuracy of ultrasound in comparison to MRI.

Results: On USG, complete supraspinatus tears, infraspinatus tears, and subscapularis tears were identified in 45%, 15%, and 5% of the patients, respectively. Partial tears of the supraspinatus, infraspinatus, and subscapularis were identified in 20%, 10%, and 5%, respectively. On MRI, complete supraspinatus tears, infraspinatus tears, and subscapularis tears were seen in 45%, 20%, and 5% of the patients, respectively. Diagnostic accuracy of USG for identifying complete supraspinatus, infraspinatus, and subscapularis tears were 100%, 82.3%, and 100%, respectively. For partial tears, the accuracy rates were 82.3%, 100%, and 100%, respectively.

Conclusion: Although MRI is a more advanced and sensitive modality compared to ultrasound for identifying and characterizing musculoskeletal injuries, particularly concerning the rotator cuff muscles, the accuracy rates observed in this study suggest that MRI should be utilized not only as a point-of-care imaging technique but also as a screening tool for patients with suspected rotator cuff injuries. Furthermore, MRI provides superior anatomical detail, including fatty streaks and tendon texture, which helps clinicians make better decisions regarding surgical versus conservative management.

Keywords-Magnetic resonance imaging, ultrasonography, rotator cuff tear, diagnostic accuracy, shoulder injuries

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Introduction

The shoulder joint is categorized as a ball-and-socket joint, yet it prioritizes mobility over stability. The glenoid, characterized as a shallow rim, can be likened to a golf ball resting on a tee or a basketball placed on a dinner plate. The rotator cuff comprises four muscles that originate from the scapula and attach to the superior aspect of the humeral head, enhancing joint

stability. Among these, the subscapularis muscle inserts at the lesser tubercle of the humerus and serves as an internal rotator.^{1, 2} Rotator cuff injuries can manifest in various forms, ranging from minor injuries and tendinopathy to partial and complete tears. Age is a critical factor in these injuries, with prevalence rates escalating from 9.7% in individuals aged 20 and younger to 62% in those aged 80 and above, regardless

of symptom presence. Furthermore, advancing age and the presence of unilateral pain increase the risk of a tear in the rotator cuff of the contralateral shoulder. In a study examining patients with unilateral shoulder pain, the average age of those without a cuff tear was found to be 48.7 years. After the age of 66, the likelihood of experiencing bilateral tears rises to 50%. Additionally, while age was associated with both the occurrence and type of tear, it did not show a correlation with the size of the tear.^{3, 4}

Multiple studies have demonstrated that US and MRI have comparable accuracy in diagnosing RCTs before surgery, although the accuracy of US is more operator-dependent. Although recent studies have found that experienced sonographers can provide accurate imaging, enabling the size and thickness of RCTs to be predicted, one may not always be readily available. However, US is more accessible and cost-efficient than MRI. The efficiency, relatively low cost, and low risk of US make it a good initial method for detecting RCTs.⁵⁻⁸ Hence; the present study was conducted for assessing the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI).

Materials & methods

The present study was conducted in Department of Orthopedics and radiology at Dr SS Tantia Medical college hospital and research centre, for assessing the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI). 20 consecutive patients who had presented with shoulder pain, clinically suspected to have rotator cuff injuries underwent Ultrasound and

MRI of the shoulder at Department of radiology were enrolled. Clinical examination findings were recorded. Subsequently patients underwent ultrasound of the shoulder with high frequency using dedicated settings as per the guidelines of ultrasound technical guidelines for shoulder of European society of musculoskeletal radiology. Following this patient, underwent MRI. Ultrasound and MRI findings were correlated, tabulated. Statistical analysis was done with SPSS to determine accuracy of ultrasound in correlation with MRI.

Results

A total of 20 patients were evaluated. Mean age of the patients was 49.2 years. 80 percent of the patients were males. On USG, complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 45 percent, 15 percent and 5 percent of the patients respectively. On USG, partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 20 percent, 10 percent and 5 percent of the patients respectively. On MRI, complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 45 percent, 20 percent and 5 percent of the patients respectively. On USG, partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 15 percent, 10 percent and 5 percent of the patients respectively. Diagnostic accuracy of USG for identifying complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were 100 percent, 82.3 percent and 100 percent respectively. Diagnostic accuracy of USG for identifying partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were 82.3 percent, 100 percent and 100 percent respectively.

Table 1: Prevalence of injuries on USG

Injuries	Complete tear on USG		Partial tear on USG	
	Number	Percentage	Number	Percentage
Supraspinatus tear	9	45	4	20
Infraspinatus tear	3	15	2	10
Subscapularis	1	5	1	5

Table 2: Prevalence of injuries on MRI

Injuries	Complete tear on MRI		Partial tear on MRI	
	Number	Percentage	Number	Percentage
Supraspinatus tear	9	45	3	15
Infraspinatus tear	4	20	2	10
Subscapularis	1	5	1	5

Table 3: Diagnostic accuracy of USG in comparison to MRI

Diagnostic accuracy	Complete tear	Partial tear
Supraspinatus tear	100 percent	82.3 percent
Infraspinatus tear	82.3 percent	100 percent
Subscapularis	100 percent	100 percent

Discussion

Tears of the rotator cuff (RC) have been inherited by man from his ancestors with an association leading to the great apes. With the advent of newer techniques, good to excellent results can be expected in the appropriately selected and compliant patient. Besides extrinsic factors, the degeneration-microtrauma theory links advancing age and chronic microtrauma with PTT. Involvement of deep fibres leads to retraction, increased tension on intact fibres and conversion to FTT. Inflammatory changes and oxidative stresses causing tenocyte apoptosis along tissue remodelling are responsible for these tears.⁶⁻⁹

A total of 20 patients were evaluated. Mean age of the patients was 49.2 years. 80 percent of the patients were males. On USG, complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 45 percent, 15 percent and 5 percent of the patients respectively. On USG, partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 20 percent, 10 percent and 5 percent of the patients respectively. On MRI, complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 45 percent, 20 percent and 5 percent of the patients respectively. On USG, partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were seen in 15 percent, 10 percent and 5 percent of the patients respectively. Diagnostic accuracy of USG for identifying complete Supraspinatus tear, Infraspinatus tear and Subscapularis tear were 100 percent, 82.3 percent and 100 percent respectively. Diagnostic accuracy of USG for identifying partial Supraspinatus tear, Infraspinatus tear and Subscapularis tear were 82.3 percent, 100 percent and 100 percent respectively. Farooqi AS et al evaluated the diagnostic accuracy of US for partial- and full-thickness rotator cuff tears and biceps tendon tears, compare diagnostic values with those of magnetic resonance imaging (MRI) using arthroscopy as the reference standard. Diagnostic accuracy for supraspinatus tendon tears (0.83) and biceps tendon tears (0.93) as compared with subscapularis tendon tears (0.76). US was found to have a higher median accuracy (0.93) for full-thickness supraspinatus tears than partial-thickness tears (0.81). US had superior median sensitivity for partial-thickness supraspinatus tears when performed by radiologists as opposed to surgeons (0.86 vs 0.57). Meta-analysis of the 5 studies comparing US and MRI demonstrated no statistically significant difference in diagnostic sensitivity, specificity, or accuracy for any thickness supraspinatus tears ($P = .31-.55$), full-thickness tears ($P = .63-.97$), or partial-thickness tears ($P = .13-.81$).¹⁰ Crass JR et al summarized their experience with our first 500 diagnostic examinations. All patients were examined in the hyperextended internal rotation view with commercially available high-resolution real-time

ultrasound equipment. Patients were diagnosed as having a rotator cuff tear if a focal echogenic lesion or a defect within the rotator cuff was identified. This study confirmed the value of ultrasonography for the diagnosis of rotator cuff tears. Accuracy, sensitivity, and specificity all exceeded 90%, and correlated with surgical findings. This was better than arthrography in the same patient population. Ultrasound is an accurate noninvasive method of examining the rotator cuff for the presence of tears. They suggested that rotator cuff ultrasonography is the procedure of choice for the diagnosis of tears if adequate instrumentation is available.¹¹ Cox et al prospectively collected preoperative ultrasound and arthroscopic imaging data on 145 patients (80 or 55% men and average age of 60.7 years) who underwent arthroscopic posterior superior rotator cuff repair. Three independent experienced orthopedic surgeons retrospectively reviewed all ultrasound studies and arthroscopic imaging and determined if the posterior superior rotator cuff tendon edge was able to be viewed via ultrasound and determined with the arthroscopic images if the tear was repairable. On review of the ultrasound and arthroscopic data, if the edge of the rotator cuff tendon was able to be viewed on the coronal ultrasound image, it was most likely repairable with a positive predictive value of 97.6% and a positive likelihood ratio of 5.8. Sensitivity was 84.4%, and specificity was 76.9%. The negative predictive value was 37.5%, and the negative likelihood ratio was 0.17. The interobserver reliability was 0.63, and the observers were unanimous in determining the tendon edge was able to be visualized in 99 of 145 cases (68%). Preoperative ultrasound evaluation of the shoulder for posterior superior rotator cuff tears is a useful tool for assessing rotator cuff integrity and may help predict intraoperative reparability of the tendon.¹²

Conclusion

Although MRI is a more advanced and sensitive modality compared to ultrasound for identifying and characterizing musculoskeletal injuries, particularly concerning the rotator cuff muscles, the accuracy rates observed in this study suggest that MRI should be utilized not only as a point-of-care imaging technique but also as a screening tool for patients with suspected rotator cuff injuries. Furthermore, MRI provides superior anatomical detail, including fatty streaks and tendon texture, which helps clinicians make better decisions regarding surgical versus conservative management.

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