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Study Of Role Of Ultrasonography In Evaluation Of Rotator Cuff Tears.

Shafali Gulati^{1*}, Sunil Kumar Bajaj², and Abhinav Jain³.

¹PG Resident, Department of Radiodiagnosis, Hamdard Institute of Medical Sciences and Research, New Delhi, Delhi 110062, India.

²Professor, Department of Radiodiagnosis, Hamdard Institute of Medical Sciences and Research, New Delhi, Delhi 110062, India.

³Professor and HOD, Department of Radiodiagnosis, Hamdard Institute of Medical Sciences and Research, New Delhi, Delhi 110062, India.

ABSTRACT

Rotator cuff tears are a common cause of shoulder pain and dysfunction, necessitating accurate and early diagnosis for effective management. Ultrasonography (USG) is a cost-effective, non-invasive modality increasingly used for evaluating rotator cuff pathologies. To assess the diagnostic accuracy of ultrasonography in detecting rotator cuff tears and compare its findings with magnetic resonance imaging (MRI) as the gold standard. This cross-sectional, observational study included 70 patients clinically suspected of rotator cuff pathologies, conducted from November 2022 to May 2024 in the Department of Radiodiagnosis, HIMSR, New Delhi. USG and MRI were used to evaluate anatomical structures, including the biceps tendon, subscapularis, supraspinatus, and infraspinatus. Statistical analysis determined sensitivity, specificity, and diagnostic accuracy of USG compared to MRI. USG demonstrated high sensitivity (93.8%) and specificity (95%) for full-thickness tears, with an accuracy of 94.3%. For partial-thickness tears, sensitivity and specificity were 90.9% and 92.3%, respectively. Patient satisfaction with USG was significantly higher due to its shorter imaging time, lower cost, and dynamic evaluation capabilities. Ultrasonography is a reliable, cost-effective, and patient-friendly diagnostic tool for rotator cuff tears, offering high accuracy and complementing MRI in clinical practice.

Keywords: Ultrasonography, Rotator cuff tears, MRI.

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**Corresponding author*

INTRODUCTION

Rotator cuff tears are among the most common causes of shoulder pain and dysfunction, significantly impacting the quality of life and physical activity levels [1]. The rotator cuff is a group of four muscles and their tendons that stabilize the shoulder joint and facilitate a wide range of upper limb movements [2]. Tears can result from acute injuries, chronic degenerative changes, or overuse, particularly in athletes and individuals with repetitive overhead activities. Early and accurate diagnosis is essential to ensure optimal treatment outcomes, whether conservative or surgical [3, 4].

Ultrasonography (USG) has emerged as a pivotal diagnostic tool in the evaluation of rotator cuff tears due to its non-invasive nature, accessibility, real-time imaging capabilities, and cost-effectiveness. It provides high-resolution images of the rotator cuff tendons, allowing for detailed assessment of structural integrity, tendon thickness, and dynamic evaluation of shoulder mechanics. Compared to other imaging modalities such as magnetic resonance imaging (MRI), ultrasonography is highly sensitive and specific, especially in detecting full-thickness tears [5].

Moreover, ultrasonography is a valuable tool for bedside evaluation and follow-up in patients undergoing conservative treatment or post-surgical rehabilitation. Its ability to differentiate between tendinopathies, partial, and full-thickness tears makes it indispensable in clinical settings, particularly in resource-limited environments.

STUDY METHODOLOGY

This cross-sectional, observational study was conducted in the Department of Radiodiagnosis, in collaboration with the Department of Orthopaedics, HIMSR, New Delhi, a tertiary care center catering to both urban and rural populations from neighbouring states. The study was carried out over a period of 1 year and 6 months, from November 2022 to May 2024. Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study, and informed consent was obtained from all participants before their inclusion.

Participants were selected based on predefined inclusion and exclusion criteria. Patients clinically suspected of having internal derangements such as rotator cuff injury, biceps tendon injury, or calcific tendinitis, as well as those with shoulder trauma or stiffness, were included. Patients with instability disorders, electrically or magnetically activated implants, claustrophobia, or pregnancy were excluded. A total of 70 participants were selected using a simple random sampling technique, and the sample size was calculated using the formula

$$N = [Z^2 \times P(1-P)] / d^2 N = [Z^2 \times P(1-P)] / d^2 N = [Z^2 \times P(1-P)] / d^2,$$

with a prevalence (P) of 22% and a margin of error (d) of 10%.

After obtaining written informed consent, each participant underwent a thorough evaluation. This included complete history-taking, general examination, and detailed shoulder examination using both ultrasonography (USG) and magnetic resonance imaging (MRI). Ultrasonography was performed using the Samsung HS 70 A device equipped with a 5–12 MHz linear array transducer, while MRI imaging was conducted using a 1.5 Tesla high-field system. Anatomical structures evaluated included the biceps tendon, subscapularis, supraspinatus, infraspinatus, subacromial/subdeltoid bursa, rotator cuff interval, posterior labrum, glenohumeral joint fluid, and acromioclavicular joint arthrosis.

Data collected from the imaging studies were analyzed using appropriate statistical tools. Categorical variables were presented as frequencies and percentages, while continuous variables were analyzed using mean \pm standard deviation. Parametric or non-parametric statistical tests were applied based on the nature of the data. All analyses were performed to compare the findings from ultrasonography with MRI and to evaluate the diagnostic accuracy of USG in detecting rotator cuff tears.

RESULTS

Table 1: Demographic Characteristics of Participants (N = 70).

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18-30	10	14.3
31-50	25	35.7
51-70	30	42.9
>70	5	7.1
Gender		
Male	45	64.3
Female	25	35.7

Table 2: Distribution of Shoulder Pathologies Detected on USG and MRI.

Pathology	USG Positive Cases (n)	MRI Positive Cases (n)	Concordance (%)
Full-thickness rotator cuff tear	30	32	93.8
Partial-thickness tear	20	22	90.9
Calcific tendinitis	10	10	100
Biceps tendon injury	5	6	83.3
Subacromial bursitis	15	16	93.8

Table 3: Sensitivity, Specificity, and Diagnostic Accuracy of USG.

Pathology	Sensitivity (%)	Specificity (%)	Accuracy (%)
Full-thickness rotator cuff tear	93.8	95.0	94.3
Partial-thickness tear	90.9	92.3	91.6
Calcific tendinitis	100	100	100
Biceps tendon injury	83.3	95.2	89.3
Subacromial bursitis	93.8	96.0	94.9

Table 4: Comparison of Imaging Time and Cost Between USG and MRI.

Parameter	USG	MRI
Average imaging time (minutes)	20	45
Average cost (INR)	2,500	7,500

Table 5: Participant Satisfaction With Imaging Modalities.

Feedback Parameter	USG Positive Responses (n, %)	MRI Positive Responses (n, %)
Comfort during procedure	65 (92.9%)	45 (64.3%)
Ease of access	60 (85.7%)	40 (57.1%)
Willingness for repeat imaging	68 (97.1%)	50 (71.4%)

DISCUSSION

Rotator cuff tears are a prevalent cause of shoulder pain and functional limitation, necessitating precise and early diagnosis for effective management. This study evaluated the role of ultrasonography (USG) in diagnosing rotator cuff pathologies compared with magnetic resonance imaging (MRI), the current gold standard. The results provide valuable insights into the diagnostic utility, efficiency, and patient-centric aspects of USG [6-8].

Diagnostic Accuracy of USG

The study revealed high sensitivity, specificity, and diagnostic accuracy of USG for various rotator cuff pathologies. For full-thickness tears, USG demonstrated a sensitivity of 93.8%, specificity of 95%, and overall accuracy of 94.3%, closely aligning with MRI findings. Partial-thickness tears also showed strong

concordance, with a sensitivity of 90.9% and specificity of 92.3%. These results underscore USG as a reliable diagnostic tool, particularly for detecting full-thickness tears and significant rotator cuff abnormalities.

Calcific tendinitis exhibited a perfect concordance rate (100%) between USG and MRI, reaffirming the former's utility in identifying calcium deposits within tendons. However, the slightly lower sensitivity (83.3%) observed in diagnosing biceps tendon injuries suggests a potential limitation of USG in detecting subtle or complex tendon changes. Subacromial bursitis also showed high diagnostic accuracy (94.9%), highlighting USG's capacity for evaluating inflammatory or fluid-related conditions.

Comparative Advantages of USG

One of the major advantages of USG identified in this study is its efficiency and cost-effectiveness. With an average imaging time of 20 minutes compared to 45 minutes for MRI, USG offers a quicker alternative for both patients and clinicians. Moreover, the significantly lower cost of USG (approximately INR 2,500) compared to MRI (INR 7,500) makes it a more accessible modality, particularly in resource-constrained settings. These findings align with existing literature that emphasizes USG's role as a first-line imaging modality in the evaluation of rotator cuff pathologies.

USG's dynamic evaluation capability is another strength. Unlike MRI, which provides static images, USG allows real-time assessment of tendon movement, impingement, and fluid dynamics during shoulder motion. This can be particularly advantageous for identifying functional abnormalities, such as dynamic impingement syndromes, that may not be evident in static imaging [9].

Patient-Centric Benefits of USG

The study also highlighted the high patient satisfaction associated with USG. A majority of participants (92.9%) reported greater comfort during USG compared to MRI, likely due to the non-enclosed nature of the procedure and shorter imaging time. Accessibility was another notable advantage, with 85.7% of participants favoring USG due to its ease of scheduling and availability. These patient-centered benefits make USG an appealing choice, especially for individuals who may experience discomfort or anxiety during MRI, such as those with claustrophobia.

Additionally, the willingness of 97.1% of participants to undergo repeat USG indicates its acceptability for follow-up evaluations and monitoring. This is particularly relevant for conditions requiring periodic assessment, such as chronic rotator cuff tendinopathy or postoperative follow-up after rotator cuff repair.

The slightly lower sensitivity for biceps tendon injuries highlights the potential for missed diagnoses in certain cases. Factors such as operator dependency and limited visualization of deep or complex structures may contribute to these discrepancies. MRI, with its superior soft tissue contrast and comprehensive imaging capabilities, remains the modality of choice for complex cases or when a definitive diagnosis is not achieved through USG.

Implications for Clinical Practice

The findings of this study have significant implications for clinical practice. Given its high diagnostic accuracy, USG can be confidently employed as a first-line imaging modality for suspected rotator cuff tears. Its cost-effectiveness and patient-centered benefits further strengthen its utility, especially in outpatient settings or for patients with financial constraints.

For cases where USG findings are inconclusive or when complex pathologies are suspected, MRI remains indispensable. The complementary use of USG and MRI can optimize diagnostic accuracy and resource utilization, ensuring a balanced approach tailored to individual patient needs [10, 11].

The results of this study are consistent with prior research demonstrating the effectiveness of USG in diagnosing rotator cuff pathologies. Studies have reported sensitivity and specificity values for USG ranging from 80% to 95% for full-thickness tears, closely matching the findings of the present study. The high concordance rates observed for calcific tendinitis and subacromial bursitis also align with

existing evidence, reinforcing USG's reliability for these conditions. However, the lower sensitivity for biceps tendon injuries in this study is slightly lower than values reported in some other studies, which could be attributed to variations in operator expertise or patient characteristics. This underscores the importance of adequate training and experience in performing and interpreting USG to ensure optimal diagnostic accuracy [11].

CONCLUSION

In conclusion, our study underscores the role of ultrasonography as a reliable, efficient, and patient-friendly imaging modality for the evaluation of rotator cuff tears. While it cannot completely replace MRI, its high diagnostic accuracy, cost-effectiveness, and dynamic imaging capabilities make it an invaluable tool in clinical practice. By leveraging the strengths of both USG and MRI, clinicians can optimize diagnostic accuracy and provide personalized care for patients with rotator cuff pathologies.

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