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Original Research Article

Ultrasonographic Analysis of Painful Shoulders and Correlation of Rotator Cuff Pathologies with Clinical Findings

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Abstract

Introduction: Shoulder pain ranks third most common presenting issue in orthopaedic outpatient department. In the examination of various shoulder illnesses, ultrasonography (USG) and magnetic resonance imaging (MRI) are widely used. The current study compared the accuracy of USG in detecting rotator cuff injuries and clinical features in patients with shoulder pain.

Methods: 50 patients with a history of shoulder pain were referred for shoulder USG based on clinical examination. All patients had Ultrasonography of the shoulder joint, followed by an MRI scan of the affected shoulder.

Results: MRI revealed that 74% of cases had either partial thickness tear, full thickness, or a combination of partial and full thickness rotator cuff injuries, whereas ultrasonography revealed that 66% of patients had either single or combined rotator cuff tears. MRI revealed rotator cuff damage in 74% of study subjects. Using MRI as a reference, ultrasound shows sensitivity of 86%; specificity of 100%; positive predictive value of 100%; and negative predictive value of 98% in identifying full thickness rotator cuff tears. It had a sensitivity of 72%, a specificity of 68%, a positive predictive value of 84%, and a negative predictive value of 54% for partial thickness tears. Using MRI as a reference, the overall accuracy of USG in detecting any rotator cuff rupture was 84%. The degree of agreement between MRI and ultrasonography in diagnosing rotator cuff tears is regarded significant (kappa coefficient =0.59, p=0.004).

Conclusion: Because ultrasonography is less cost, non-invasive, patient-friendly, and widely available, and it may be the first line of investigation. In the examination of rotator cuff anomalies, USG produced comparable results than MRI; and USG should be used as the first line of investigation in patients presenting with shoulder pain.

Keywords: Shoulder Pain, Rotator Cuff, Ultrasonography, Magnetic Resonance Imaging.

Introduction

Following low back and neck pain, shoulder pain is the third most common musculoskeletal complaint in Orthopaedics OPD patients [1]. The lifetime prevalence of shoulder soreness is as high as 67% [2]. The incidence of shoulder pain observed to be 0.9% - 2.5%, whereas the prevalence was ranged from 6.9-26% for point prevalence to 6.7-66.7% for lifetime prevalence [2]. Age, gender, obesity, and diabetes mellitus have all been evaluated as risk factors for shoulder discomfort. Shoulder pain is reported to be more common in middle-aged women.

Even before advanced imaging, a rotator cuff injury may be suspected through clinical examination and shoulder radiography [3-8].

Because some rotator cuff tears are difficult to diagnose with US, a number of secondary symptoms have been reported. These include increased tuberosity cortical irregularity, fluid inside the subacromial-subdeltoid bursa, and joint effusion [8]. Tendinosis is a relatively new phenomenon in the United States. Because eosinophilic, fibrillar, and mucoid degeneration are present, and acute inflammation is frequently absent, tendinosis is preferred over tendinitis. US is beneficial in the dynamic assessment of tendons during shoulder movement [8].

Differentiation from tendon tear may be difficult since both tendinosis and tendon tear may seem hypoechoic and coexist inside the same tendon. A dynamic examination of the shoulder in multiple planes can be performed, and areas of concern can be targeted swiftly to make a diagnosis.

MRI is more preferred than ultrasound for pre-operative diagnosis of partial and full-thickness due to its superior sensitivity. In the long run, however, when considering accuracy, affordability, availability, safety, and speed of treatment when used at the point of care, ultrasonography is likely the best option for diagnosis in most situations. MRA is a minimally invasive imaging treatment that involves injecting gadolinium, a contrast medium, into the joint. Patients suffering from claustrophobia are unable to have an MRI.

The optimal test should be determined based on clinical experience, availability, and the estimated sensitivity and specificity of the tests.

Current study aimed to identify the ultrsonographic shoulder abnormalities, and to correlate the rotator cuff abnormalities with clinical findings in patients with shoulder pain.

Materials and Methods

A cross-sectional study was conducted on 50 patients who presented with a history of shoulder pain and were indicated for ultrasound imaging based on clinical evaluation.

Patients with a history of pain in either shoulder, a history of restricted movement in either shoulder, and clinical suspicion of internal derangements such as rotator cuff injury, biceps tendon injury, or calcific tendinitis were included.

Patients with rheumatoid arthritis and those who had shoulder pain as a result of previous shoulder injuries were excluded. Patients with claustrophobia; implants/pacemakers or a history of shoulder surgery were excluded.

Data collection: Demographics; clinical features; and the duration of shoulder pain recurrences were documented.

Physical examination: discomfort; range of passive and active motion for abduction; forward flexion; impingement tests; external rotation and internal rotation; and manoeuvres to detect the location of the tendon injury.

Ultrasonography of the afflicted shoulder was performed on a Phillips US machine equipped with a high frequency linear array transducer (5-12MHz). The patient was made to sit on a rotating stool near and facing the US machine. The shoulder was tested statically and dynamically, and the results were compared to the other side.

The study used the tools and protocol provided by Jon A. Jacobson [9].

The following is the USG scanning protocol that we used in our study:

1. Biceps brachii tendon- long head.
2. Subscapularis and biceps brachii tendon; subluxation or dislocation.
3. Supraspinatus & rotator interval.
4. Acromioclavicular joint; subacromial-subdeltoid bursa; and dynamic

evaluation for subacromial impingement.
5. Infraspinatus & teres minor.

MRI imaging was performed using a 1.5 Tesla Siemens magnetom equipment and a shoulder coil by standard protocol.

A total of 50 patients with shoulder joint pain were studied, and USG findings were matched to MRI findings.

Both the USG and MRI- findings were statistically examined and interpreted.

Descriptive statistics were employed. Chi-square test was used to determine the significance of USG findings, which were expressed as a frequency and percentage. A p-value of less than 0.05 was considered statistically significant. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were calculated.

Results

Demographics: The average duration of shoulder pain was 8 months. The average age was 50 years (range: 35 to 70 years). The patients were 62% females and 38% males.

Abduction was the range of motion most affected by shoulder pain in research volunteers (90%), followed by external rotation (58%), and forward flexion (18%). The impingement indicator was positive in 10% of the shoulders.

On USG, 84% of patients had pathology involving the supraspinatus tendon, whereas 52% had pathology involving the subscapularis tendon.

Acromioclavicular joint arthropathy (ACJ) was the most common condition on USG, accounting for 48% of non-rotator cuff issues, followed by SASD bursa effusion (40%), SC bursa effusion (24%), Biceps dislocation (6%), and tendinosis (2%).

On MRI, 90% of the shoulders had supraspinatus tendon abnormalities. ACJ arthropathy was the most frequent disease observed in non-rotator cuff problems, accounting for 60% of patients, followed by subacromial-subdeltoid bursa effusion (26%), subcoracoid bursa effusion (16%), biceps tendinosis (2%), and dislocation (6%).

Table 1: Correlation of pathological findings of Ultrasound and MRI of patients with painful shoulders

		Full thickness tear	Partial thickness tear	Tendinosis	Intra substance tear
Subscapularis	US	2%	8%	40%	2%
	MR	2%	6%	44%	2%
Supraspinatus	US	12%	50%	20%	2%
	MR	14%	60%	14%	2%
Infraspinatus	US	0	6%	6%	0
	MR	2%	6%	10%	0
Biceps tendon	US	-	--	2%	-
	MR	-	-	2%	-
Teres Minor	US	-	-	-	-
	MR	-	-	--	-

Correlation analysis: Using MRI as a reference, 74% of patients had either partial thickness tears, full thickness, or mixed partial and full thickness rotator cuff injuries, whereas 66% of patients in the US had either solitary or combination rotator cuff tears.

MRI reveals rotator cuff injuries in 74% of patients.

USG revealed good sensitivity in diagnosing full thickness, properly identifying three out of four cases.

Table 2: Ultrasonography evaluation for rotator cuff tears

	Partial Thickness Tear	Full Thickness Tear
Sensitivity	72%	86%
Specificity	68%	100%
Positive predictive value	84%	100%
Negative predictive value	54%	98%

Table 3: Agreement between Ultrasonography and MRI to diagnose the rotator cuff tears of shoulder

		MRI	
		Partial Thickness Tear	**Full Thickness Tear**
Ultrasonography	Partial Thickness Tear	25	2
	Full Thickness Tear	0	6
Expected Agreement	Agreement	Kappa	Standard Error
44%	78%	0.59	0.079, Z= 5.98, p=0.004

The kappa value (Kappa=0.59) was used to measure the agreement between the USG and MRI procedures. The degree of agreement between MRI and ultrasonography in identifying rotator cuff tears is considered considerable (p=0.004).

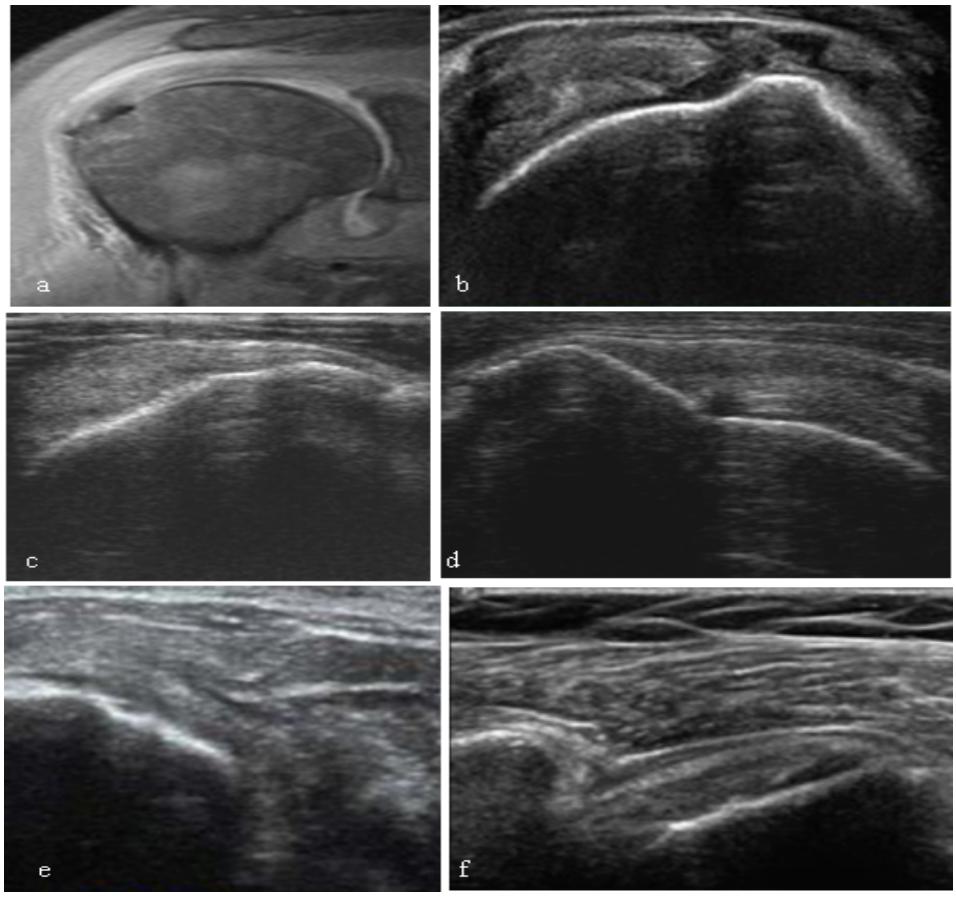

Figure 1

Figure 1: USG images of pain Shoulder. a. subacromial-subdeltoid bursitis . b. USG of supraspinatus tendon showing full thickness tear on longitudinal view. c. Supraspinatus- tendon -tendinosis. d. Sagging peribursal fat sign. e. USG of partial tear of subscapularis- tendon. f. Longitudinal- ultrasound of supraspinatus-tendon showing calcifications.

Discussion

This study included 50 patients, 62% of whom were females and 38% of whom were males. The majority of the patients in the study were in their fourth and fifth decades. The most common complaint among patients in this study was restriction of movement.

In our study, rotator cuff illnesses were determined to be the most common reason for referral to the radiology department, which was consistent with the findings of Mitchell et al [10].

Errors in US diagnosis most commonly consisted of a failure to differentiate between partial and full-thickness tears of approximately 1 cm in size, which had no substantial impact on the planned surgical approach.

Although ultrasonography is beneficial for evaluating shoulder joint problems, it has limitations such as a lack of visibility of the posterior section of the rotator cuff tendons, a limited view of the glenohumeral joint, and a high reliance on the operator.

Our current study compared ultrasound findings to MRI findings, with MRI serving as a reference standard for the detection of rotator cuff and related illness in patients referred to our department.

Rotator cuff tears were discovered in 66% of the 50 cases who had USG and 74% of the cases that received MRI. In our study, the largest incidence of rotator cuff tears was recorded in the sixth decade of life, which is similar with the findings of White et al. [11].

In our study, MRI was used as the reference standard, and 74% of 50 cases had either partial thickness tears, full thickness, or mixed partial and full thickness rotator cuff tears, whereas 66% of patients had either solo or combination rotator cuff tears on ultrasonography.

USG identified 84% of patients and MRI identified 90% of patients with supraspinatus tendon disorders such as tears, tendinosis, and calcifications.

Paramjit Singh et al [12] found similar results in another study.

According to one study, the supraspinatus tendon was involved in around 80% of patients [13].

MRI revealed rotator cuff damage in 74% of patients. Thirty patients experienced partial thickness tear, including one with an intrasubstance tear. 7 (14%) people had a full thickness tear or a combination of partial and full thickness tears. As a result, partial thickness tears were the most common rotator cuff pathology seen in the current study.

USG had a sensitivity of 72%, specificity of 68%, positive predictive value of 84%, and negative predictive value of 54% to diagnose the partial thickness tears, and had a sensitivity of 86%, specificity of 100%, positive predictive value of 100%, and negative predictive value of 98% to diagnose the full thickness tears.

These findings were similar to those of Bashir et al [13] and Rutten et al [15], who shows significant agreement between USG and MRI in the detection of rotator cuff lesions. The degree of sensitivity and specificity observed in our study closely resembles that reported by A study report shows that sensitivity of 89% and specificity of 100% to detect full thickness tears and which had sensitivity of 79% and specificity of 94% for detection of the partial thickness tears [13].

The agreement between USG and MRI in diagnosing Biceps pathology is moderate.

Saraya and Bakry's investigation produced similar results. Ahmed et al[17] discovered a greater diagnostic accuracy for biceps pathology during their research.

Other pathologies discovered included calcification, tendinosis, tendon impingement, subacromial-subdeltoid effusion, and bicipital tendon pathologies.

MRI was less accurate in detecting calcific deposits in tendon, according to our findings. Only one patient was diagnosed with calcific deposits in the supraspinatus tendon based on MRI findings.

The current study findings were consistent with various studies, and ultrasonography proved to be a better approach for detecting tendon calcification.

ACJ arthropathy was the most frequently found non-rotator cuff related illness in the current study. USG correctly diagnosed acromioclavicular joint arthropathy in 24 (48%) instances, with a sensitivity of 76% and specificity of 92%.

Another study found ACJ involvement in 51.5% of their patients and concluded that it is usually involved in people who have sore shoulders [18].

The results of the USG and MRI demonstrated good agreement in the diagnosis of partial and full thickness. MRI was found to be superior in terms of characterizing tears in terms of location and extent. MRI identified to be more successful in detecting non-rotator cuff disorders.

When it comes to rotator cuff disorders, USG has a greater diagnostic accuracy. There was very significant agreement in the rotator cuff injury for full tear and tendinosis, and good agreement for partial thickness tear. Various studies revealed comparable results [19-22].

The USG had a 100% sensitivity in identifying biceps tendinosis and dislocation. The current study found that USG has good sensitivity; specificity; and the accuracy for diagnosing rotator cuff injuries. The USG, and MRI findings were agreed in well identifying partial and full thickness tears. MRI was reported to be superior to diagnose the non-rotator cuff illnesses such as subacromial-subdeltoid effusion, subcoracoid effusion, and ACJ arthropathy.

Conclusion

Because MRI is very costly, US can be used as a screening test for evaluating shoulder pain. US can help determine the presence of a rotator cuff rupture as well as other possible causes of pain, such as long head of biceps effusion, subacromial-subdeltoid effusion, tendinosis, and calcific tendonitis. In cases of doubt, MRI is the gold standard and can be used to confirm lesions. MRI is superior in surgical planning for larger tears and provides much more information about prognostic factors. Because ultrasonography is less expensive, noninvasive, patient-friendly, and more widely available than MRI, it may be the first line of enquiry. USG has good sensitivity and specificity for full thickness tears, but somewhat low sensitivity and specificity for partial thickness tears.

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