



Comparative Study of Ultrasonography with MRI in Rotator Cuff Tears

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Abstract

Background: *Patients with shoulder disorders experience significant disability and reduced quality of life. For people over 65 years of age, shoulder pain is the most common musculoskeletal problem. MRI has been considered as the imaging modality of choice for evaluating the rotator cuff tears despite of its relatively high cost and limited availability. However, technical improvements such as 7.5 - 14 MHz transducers and better penetration of the ultrasound beam significantly improved ultrasonographic results. The reliability and reproducibility of shoulder ultrasonography makes it a more trustworthy diagnostic option. The present study aims to compare the accuracy of USG with MRI.*

Materials and Methods: *Designed as diagnostic test evaluation, among 60 patients who underwent MR imaging of shoulder at Govt, medical college hospital, Thrissur with suspicion of rotator cuff tear. Later these patients were subjected to shoulder ultrasonography. After completing both studies, sonographic findings were correlated with MRI results.*

Results: *The sensitivity, specificity and accuracy for detecting full thickness rotator cuff tears with USG were 93.54%, 89.6% and 91.67%. The sensitivity and specificity for detecting partial thickness rotator cuff tears with USG were 86.9% and 89.1%.*

Conclusion: *USG is a very useful non-invasive imaging modality having high sensitivity and specificity in the diagnosis of rotator cuff tendon tears. USG can be a better alternative to MRI in case of rotator cuff tendon tears.*

Introduction

Persistent shoulder pain is a very common condition, which often has an underlying multifactorial pathology. It is associated with high societal cost and patient burden¹. For people over 65 years of age shoulder pain is the most common musculoskeletal problem². About 50% of all

patients with shoulder disorders seek medical care. The location of shoulder pain is a poor indicator of its origin, and the value of clinical examination alone is often limited with regard to making a decision for further management with certainty^{3,4}. The results of the imaging of the shoulder may have clinical consequences as the

decision to proceed with surgery or to continue conservative management depends on the accurate diagnosis of the extent of the rotator cuff tear. Patients with a partial-thickness tear can be managed with conservative treatment, while patients with a full-thickness tear, associated with weakness of active shoulder abduction, require surgical repair^{3,4}. Traditionally, arthrography has been used through the years to detect full-thickness RCTs⁵. The rotator cuff can be visualized with non-invasive imaging techniques such as ultrasonography (USG) and magnetic resonance imaging (MRI)^{6,7}. Initial USG results in the detection of rotator cuff tears varied probably due to the use of low frequency transducers and limited experience with the examination procedure. Magnetic resonance imaging quickly became the favored investigation for pre-operative diagnosis of partial and full-thickness rotator cuff tears, with high sensitivity and accuracy. Subsequently, technical improvements such as 7.5-14 MHz linear array broad-bandwidth transducers and better penetration of the ultrasound beam, as well as increased experience, significantly improved ultrasonographic results. The reliability and reproducibility of shoulder ultrasonography makes it a more trustworthy diagnostic option⁸.

Materials and Methods

A descriptive study was conducted in 60 Patients who underwent MR imaging shoulder with suspicion of rotator cuff tear, at Govt. Medical College Hospital, Thrissur, during the period April 2011 to November 2012. Later these patients were subjected to shoulder ultrasonography. Patients with neoplasms or infectious disorders involving the shoulder joint and patients who underwent rotator cuff repair were excluded from the study.

Study Instrument

MRI scanning of the shoulder in this study was performed using GE Signa HDxt machine with a 1.5 Tesla field strength magnet in a closely

coupled extremity. Sonography was performed with Philips En Visor HD version C.1.3 scanner high frequency linear probe.

Study procedure

After obtaining the ethical clearance from the Human Ethical Committee of the institution the study was commenced. MRI and USG were done for sixty patients and the findings of rotator cuff tears were classified into Partial thickness rotator cuff tears and Full thickness rotator cuff tears. With USG the Infraspinatus and Teres minor were considered as a single body. If a patient has both full thickness and partial thickness tear, only the full thickness tear is taken into consideration. MRI results were taken as the gold standard.

Data collection and Analysis

Details of each patient was collected in a proforma. All the data were coded and entered in MS Excel, and analysed using SPSS 16. Sensitivity, specificity and accuracy of USG for full and partial thickness rotator cuff tears were calculated.

Results

The maximum number of patients affected belongs to the age group of 60-69 years and the mean age was 60 years. Males comprised 60% (36) of the group while the females comprised 40% (24). Out of 60 patients, 32 (53.33%) patients were complaining shoulder pain of dominant limb while 28 (46.67%) were having pain of non-dominant limb.

With USG of shoulder for assessing painful shoulder joint, 56 (93.33%) found to have rotator cuff tears. In that, 32 (53.33%) patients were having full thickness tears and 24 (40%) having partial thickness tears. MRI showed rotator cuff tears in 54 patients, of which full thickness tears in 31 patients & partial thickness tears in 23 patients

Table 1: Full thickness Rotator cuff tear involvement on USG and MRI

SITE	USG	MRI
SUPRASPINATUS	13	11
SUBSCAPULARIS	1	1
INFRASPINATUS	2	3
SSP + INF	11	11
SSP + SSC	2	2
MASSIVE TEAR	3	3

INF Infraspinatus, SSC- Subscapularis, SSP- Supraspinatus

Table 2: Partial thickness Rotator cuff tear involvement on USG and MRI

SITE	USG	MRI
SUPRASPINATUS	17	17
SUBSCAPULARIS	1	1
INFRASPINATUS	2	2
SSP+ INF	4	3

INF- Infraspinatus, SSP- Supraspinatus

Table 3:- observed statistical variables

	FTT	PTT
Sensitivity (%)	93.54	86.96
Specificity (%)	89.6	89.18
PPV (%)	90.62	83.33
NPV (%)	92.85	91.67

FTT- Full thickness tear, PTT- Partial thickness tear PPV- Positive Predictive Value, NPV- Negative Predictive Value

3 patients showed non visualization of rotator cuff tendon on USG and were later confirmed with MRI as having massive full thickness tear. Focal non-visualization was the commonest primary sign by USG (Figure 1), which was imaged in 38 patients. Of this 26 were having full thickness tears and 12 were having partial thickness tears.

Fig 1: Right supraspinatus tendon massive tear

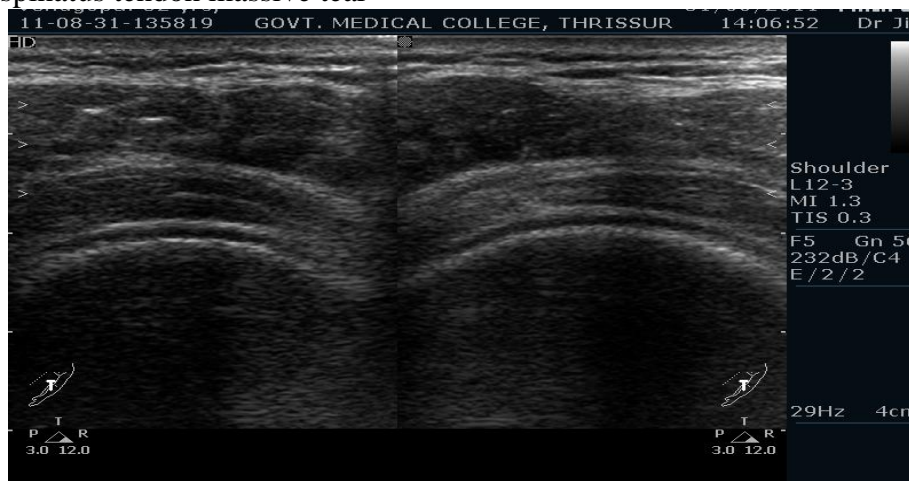


Figure 2 : partial thickness tear of supraspinatus tendon



Discontinuity in the cuff was the next common criteria among USG findings, which was seen in 16 patients. With USG, 6 were having full thickness tears and 10 were having partial thickness tears. Focal abnormal echogenicity was seen in 5 full thickness tears and 9 partial thickness tears by USG (0Figure 2). Subdeltoid effusion was the most common secondary sign, which was seen in 38 patients. Joint effusion imaged in 30 patients.

Discussion

In the population of 60 patients we studied, MRI detected rotator cuff tears in 54 (90%) patients. 31 (51.67%) patients were having full thickness rotator cuff tears and 23 (38.33%) were having partial thickness tears. This prevalence of rotator cuff tears was similar to study by Wiliam D. Middleton et al⁹ in 2004, American Journal of Roentgenology.

In this study, the sensitivity and specificity for detecting full thickness rotator cuff tears with USG were 93.54% (95% Confidence interval between 77.16- 98.88%) and 89.6% (95% Confidence interval between 71.50- 97.29%) respectively. Similar results were published by Nitin G Chaubal in Indian Journal of Radiology & Imaging, August 2007, Vol 17, Issue 32007¹⁰ who reports sensitivity of 94% and specificity of 94% in detection of full thickness rotator cuff tear.

Sensitivity and specificity of USG in detection of partial thickness rotator cuff tears are 86.96 % (95% Confidence interval is between 65.33-96.56%) and 89.18% (95% Confidence interval is between 73.64-96. 48%) respectively. Similar values published in earlier literature by Kang et al in 2009¹¹ who reported 90% specificity in detection of partial thickness tears using USG.

The accuracy of USG for detection of full thickness rotator cuff tear was 91.67%. Similar results were published earlier in literature by Farin et al¹²(accuracy- 90%) and Teefey et al¹³ (accuracy- 94%) in case of full thickness tears.

In case of partial thickness tears we got an accuracy of 88.33%. Review of literature showed,

van Moppes et al¹⁴ with an accuracy of 88% and Bachmann et al¹⁵ accuracy of 90% in case of partial thickness tears.

With sonography there were 3 false positive cases of full thickness tears. In 2 cases MRI were suggestive of partial thickness tears. In the third case MRI reported as tendinosis. MRI identified 23 partial thickness tears. There were 4 false positives by USG in case of partial thickness tears. In 2 cases MRI was suggestive of full thickness tears. In other 2 cases MRI did not show any tear. The causes of the false positives in detection of full thickness rotator cuff may be attributed to anisotropy, acoustic shadowing by the deltoid septum, rotator cuff interval, acoustic shadowing by scar tissue or calcification & tendon in homogeneity.

There were 2 false negative cases with USG in case of full thickness rotator cuff tear. One of which showed full thickness tear of supraspinatus tendon & in the other case infraspinatus was involved on MRI. There were 3 false negative cases with sonography in case of partial thickness rotator cuff tear. The occurrence of the false negative rotator cuff tears at sonography has been noted earlier.

False negative studies in this study may be attributed Nondiastasis of the ruptured tendon fibers, Tendinosis, Calcifications, Synovial proliferation, granulation or scar tissue, Obesity or muscularity and Limited shoulder motion.

The most common USG criteria observed was focal non visualization of rotator cuff tendon. It was seen in 38(63.33%) patients. Non visualization of rotator cuff tendons yielded the best result with USG. 3 patients showed this finding, which were later, proved by MRI as having full thickness rotator cuff tear.

Discontinuity of the cuff or 'cartilage interface sign' was seen in total of 16 patients, of which 6 were having full thickness and 10 were having partial thickness tears. Focal abnormal echogenicity was the least yielding criteria, which classified 5 tears as full thickness tears and 9 as partial thickness tears. Newman JS et al¹⁶ reports

combination of tendon in homogeneity and anisotropy are the most common cause of a false-positive diagnosis of a partial thickness rotator cuff tear.

Conclusion

USG is a very useful non-invasive imaging modality having high sensitivity and specificity in the diagnosis of rotator cuff tendon tears. The reports of this and several earlier series suggest that USG can be a better alternative to MRI in case of rotator cuff tendon tears. As USG is fast, easily available and cheap investigation when compared with MRI, it should be considered as first-line investigation in case of suspected rotator cuff tendons

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