

# USG and MRI correlation of rotator cuff tears

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## Abstract

**Purpose:** To compare the accuracy of ultrasonography and magnetic resonance imaging in the detection of rotator cuff tears. **Materials and Methods:** Hundred patients with clinically suspected rotator cuff pathology underwent ultrasonography and magnetic resonance imaging of the shoulder. The findings in 94 patients were compared with arthroscopy or open surgery. **Results:** Full-thickness tear was confirmed in 42 cases, partial-thickness tear in 52 cases. The accuracy in the detection of full-thickness tears was 97 and 97.6% for ultrasonography and magnetic resonance imaging, respectively. The accuracy in the detection of bursal or articular partial-thickness tears was 88 and 92% for ultrasonography and magnetic resonance imaging, respectively. **Conclusion:** In experienced hands ultrasonography should be considered as an accurate modality for the initial investigation of rotator cuff followed by MRI in doubtful cases.

**Keywords:** USG, MRI.

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## INTRODUCTION

Tears of the rotator cuff are a common cause of shoulder pain and disability. Early diagnosis allows proper surgical treatment planning that can prevent functional impairment<sup>1-4</sup>. Sonographic evaluation of the rotator cuff was initially attempted over two decades ago, not in a popular manner though among radiologists<sup>5</sup>. Early reports did not show favorable results of ultrasonography (US)<sup>6</sup>. Magnetic resonance (MR) imaging became rapidly the favored technique of preoperative shoulder joint evaluation and succeeded in the detection of partial- and full-thickness rotator cuff tears with high sensitivity and accuracy<sup>7-11</sup>. Thus, MR imaging has been considered the imaging modality of choice for evaluating the rotator cuff tears despite its relatively high cost and occasional limited availability. The technological evolution of high-

resolution ultrasound scanners during the last decade allowed substantial improvement in the quality of images and renewed the interest related to US evaluation of the rotator cuff<sup>12</sup>. US has been reported to be reliable in detecting full-thickness rotator cuff tears, compared with surgical findings and/or MR imaging, but detection of partial-thickness tears has been controversial<sup>2,13-15</sup>. One study has reviewed the existing literature and provided summary sensitivities and specificities of MRI and ultrasound for the diagnosis of rotator cuff tears<sup>16</sup>. That study included literature with both surgical and nonsurgical reference standards and was published in 2003, after which important advances in both MRI and ultrasound imaging were made. The purpose of our study was to compare the diagnostic efficacy of US and MR imaging in the detection of full and partial-thickness rotator cuff tears in symptomatic patients using updated equipment, with arthroscopy or open surgery used as the reference standard.

## MATERIALS AND METHODS

This is a prospective study conducted in the department of Radiodiagnosis and imaging, NIMS Medical College, Jaipur from September 2012 to August 2014. The study protocol was approved by our Institutional ethics committee and informed consent was obtained from all patients before USG and MRI study. 100 patients with

traumatic shoulder injury or chronic shoulder pain that are clinically examined by orthopedician and highly suspicious of rotator cuff tear are referred for USG and MR evaluation. Examination conducted on

1. Voluson pro 730 USG machine using linear probe of frequency range 7-12 MHz.
2. Siemens Magnetom C \_ 0.3 T MR Scanner using a surface coil placed anteriorly over the shoulder.

**IMAGING PARAMETERS FOR THE SEQUENCES PERFORMED DURING THE MR EXAMINATION:**

The slice thickness – 5mm

Field of view (FOV)- 16 to 20 cm.

Sequences performed were:

**Oblique coronal :** T2 FSE  
                                  : T2 FSE FS

**Oblique sagittal :** T2 FSE

**Axial**                          : T1 FSE  
                                  : T2 FSE  
                                  : GRE

**Inclusion Criteria**

Patients who are clinically examined and highly suspected to have a rotator cuff pathology, both acute and chronic, and in those whom USG and MR imaging reveals a rotator cuff lesion.

**Exclusion Criteria**

- Patients with metallic implants, cardiac pacemakers, cochlear implants.
- Post treatment patients.
- Post surgery patients.
- Patients who are claustrophobic.
- Patient who are unwilling for imaging.

**Image Analysis**

All 100 shoulders were analyzed for rotator cuff injury and also assessed for rotator cuff signal and morphology, synovitis/effusion, bursitis.

**Sonographic criteria used for rotator cuff tear in present study:**

1. Nonvisualization of the cuff,
2. Localized absence or focal nonvisualization,
3. Discontinuity, and
4. Focal abnormal echogenicity.

**MRI criteria used for rotator cuff tear in present study:**

- A: At the articular surface
- B: At the bursal surface
- C: A complete tear, connecting A and B tears

**Statistical Analysis**

Results are calculated using chi square test and bar charts and tables were obtained using the SPSS software.

**OBSERVATION AND RESULTS**

**Mechanism of Injury**

The study group consists of 100 subjects, mode of injury was either RTA or traumatic injury or simply pain in shoulder. All patients had injuries in the last six months prior to the MRI examination. 65 are below the age of 60 years and 35 cases are above 60 years.

**Study shows**

out of 100 patients 94 patients were found to have rotator cuff tears. 42 patients were having full thickness tear and 52 patients were having partial thickness tear. From total 42 patients detected with full thickness tears – 40 patients were positive on USG and 41 patients were positive on MRI. From total 52 patients detected with partial thickness tear – 46 patients were positive on USG and 48 patients were positive on MRI.

**USG AND MRI CO-RELATION OF ROTATOR CUFF TEAR**

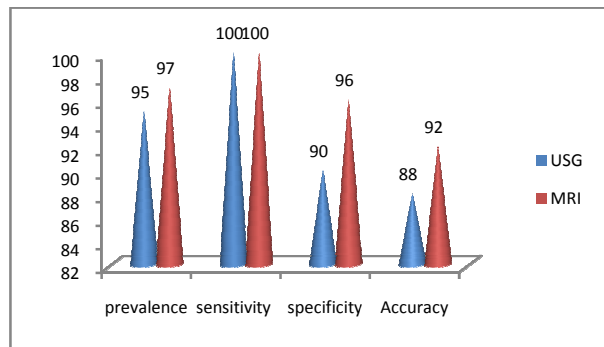
Out of 100 patients 94 patients were found to have rotator cuff tears. 42 patients were having full thickness tear and 52 patients were having partial thickness tear. From total 42 patients of full thickness tear – 40 patients were positive on USG and 41 patients were positive on MRI. From total 52 patients of partial thickness tear – 46 patients were positive on USG and 48 patients were positive on MRI.

**Table 1: Full thickness tear**

	TP	TN	FP	FN	TOTAL
USG	40	0	1	1	42
MRI	41	0	1	0	42
SURGERY	41	0	1	0	42

**Table 2: Observations of full thickness tears**

	USG	MRI
Prevalence	95%	97%
Sensitivity	100%	100%
Specificity	90%	96%
Accuracy	88%	92%



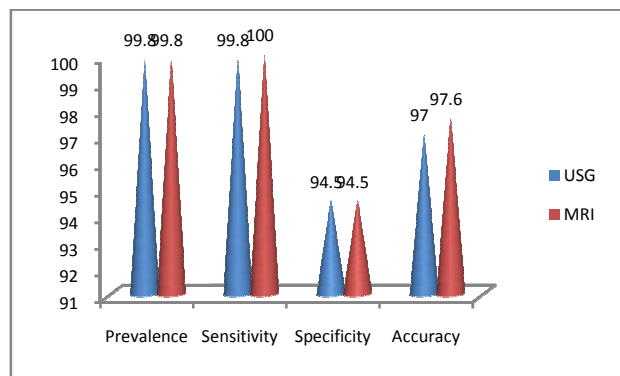
**Table 3: Partial thickness tear**

	TP	TN	FP	FN	TOTAL
USG	46	0	1	5	52
MRI	48	0	2	2	52
SURGERY	50	2	0	0	52

**Table 4: Observations for partial thickness tears**

	USG	MRI
Prevalence	99.8%	99.8%
Sensitivity	99.8%	100%
Specificity	94.5%	94.5%
Accuracy	97%	97.6%

P value : >0.05



## DISCUSSION

Shoulder disorders are common, with as many as 20% of people experiencing shoulder problems at some stage in life. Shoulder disorders account for 5% of all consultations with family physicians. Of patients presenting with shoulder symptoms, 80% remain symptomatic 6 months later, and 50% have symptoms at 18 months. The location of shoulder pain is a poor indicator of its origin<sup>17,18</sup>, and the value of clinical assessment of the shoulder is often limited<sup>19</sup>. Plain radiography, often used to supplement the clinical examination, is hardly diagnostic for Rotator Cuff Tears<sup>20</sup>. Traditionally, arthrography has been used through the years to detect Rotator Cuff Tears<sup>21,22</sup>. Both sonography<sup>23-27</sup> and magnetic resonance imaging<sup>27-29</sup>, developed as new imaging techniques in the past 10 years, can be applied to the visualization of shoulder pathology. A recent study<sup>30</sup> has shown that sonography and arthrography are of equal value for the detection of full-thickness Rotator Cuff Tears. However, arthrography is an invasive technique, with up to 50% of patients experiencing more pain<sup>24-48</sup> hours after injection of the contrast material<sup>31</sup>. Magnetic resonance imaging also seems to be a promising technique for shoulder pathology, including Rotator Cuff Tears. However, Magnetic resonance imaging is time-consuming, expensive, and not readily available. On the other hand, due to the specialized expertise required for shoulder sonography and the long learning curve, sonography might be less available than Magnetic resonance imaging in some countries. The purpose of the present study was to evaluate the ability of sonography and Magnetic resonance imaging to detect Rotator Cuff Tears in

patients with a clinically suspected Rotator Cuff Tears as a solitary, noninflammatory condition. In present study out of 100 patients 94 patients were found to have rotator cuff tears. 42 patients were having full thickness tear and 52 patients were having partial thickness tear. From total 42 patients detected with full thickness tears – 40 patients were positive on USG and 41 patients were positive on MRI. From total 52 patients detected with partial thickness tear – 46 patients were positive on USG and 48 patients were positive on MRI, this high positive value in our study could be due to refinement of patients with strong clinical suspicion of rotator cuff tears. Out of 94 patients, 82 patients were having supraspinatus tear, either isolated or in conjunction with infraspinatus and subscapularis tendon, rest 12 patients are having only subscapularis and infraspinatus tendon tear not involving supraspinatus tendon. So prevalence of supraspinatus tear is very high. In **Anastasia N. Fotiadou et al** study<sup>32</sup>, Out of 100 patients 88 patients were found to have rotator cuff tears. 57 patients were having full thickness tear and 31 patients were having partial thickness tear. From total 57 patients of full thickness tear – 56 patients were positive on USG and 57 patients were positive on MRI. From total 31 patients of partial thickness tear – 27 patients were positive on USG and 28 patients were positive on MRI. Whereas in present study of 100 patients, Out of 100 patients 94 patients were found to have rotator cuff tears. 42 patients were having full thickness tear and 52 patients were having partial thickness tear. From total 42 patients of full thickness tear – 40 patients were positive on USG and 41 patients were positive on MRI. From total 52 patients of partial thickness tear – 46 patients were positive on USG and 48 patients were positive on MRI. In full thickness tear, Anastasia N. Fotiadou et al Study shows accuracy of USG -98% and MRI-100% whereas present study shows accuracy of USG -97% and MRI-97.6% and In partial thickness tear, Anastasia N. Fotiadou et al Study shows accuracy of USG -90% and MRI -96% where as present study shows accuracy of USG-88% and MRI 92%. So both the studies are well correlating with p value <0.05, that is statistically insignificant. In **Joseph O. de Jesus study**<sup>33</sup> ROC curve is greatest for MR arthrography (0.935), followed by ultrasound (0.889) and then MRI (0.878); however, pair wise comparisons of these curves show no significant differences between MRI and ultrasound ( $p > 0.05$ ) and concluded that MR arthrography is the most sensitive and specific technique for diagnosing both full- and partial-thickness rotator cuff tears. Ultrasound and MRI are comparable in both sensitivity and specificity. And in present study, MRI and USG are comparable in both sensitivity and specificity with (P value of > 0.05%). Both studies are well

correlating in terms of sensitivity, specificity and p value, hence our study is well correlating with Joseph *et al* study. Siebold *et al* in 1999(34) study shows:

**Sensitivity and Specificity of USG and MRI in Siebold *et al* study:** Full thickness tear in USG Sensitivity 57-95% and specificity 76-94%. Full thickness tear in MRI Sensitivity 84-100% and specificity 93-99%. Partial thickness tear in USG Sensitivity 93% and specificity 94%. Partial thickness tear in MRI Sensitivity 85-92% and specificity 85-99%.

**Sensitivity and Specificity of USG and MRI in present study:** Full thickness tear in USG Sensitivity 85-99% and specificity 78-94%. Full thickness tear in MRI Sensitivity 89-100% and specificity 90-99%. Partial thickness tear in USG Sensitivity 100% and specificity 99%. Partial thickness tear in MRI Sensitivity 90-100% and specificity 85-90%. Sensitivity of USG and MRI both are coming high in present study as compared to Siebold *et al* study, this could be due selection of patients with strong suspicion of tear and exaggerated positive case inclusion in present study.

**Table 5:** Showing comparison of accuracy of full thickness and partial thickness on USG and MRI in present study results with other studies

	Diagnostic accuracy			
	Full thickness RCT		Partial thickness RCT	
	USG	MRI	USG	MRI
Present study	97%	97.6%	88%	92%
A.n.fotiadou <i>et al</i> , (2008)	98%	100%	90%	96%
Siebold <i>et al</i> (1999)	86%	92%	99%	87.5%

Hence, present study showed that Rotator cuff Injury are studied well on both USG and MRI and are well correlating. While in experienced hands USG can be used in emergency situation, MRI can be reserved for patient with stable condition and in doubtful cases.

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