

# Accuracy of Shoulder Ultrasound for Diagnosis of Rotator Cuff Pathologies

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## Abstract

To assess accuracy of shoulder ultrasound (USG) for diagnosis of rotator cuff pathologies. Seventy- four adult patients in age range of 30-80 years with rotator cuff pathologies of either gender were subjected to USG taken with Philips IU22 and a 5-12 MHz linear array transducer. All tendons were examined and grayscale 2D USG images were stored. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) was measured. USG findings showed intact supraspinatus tendons in 36 and 32, full tear in 8 and 10, partial tear in 2 and 7 and tendinosis in 28 and 25 cases respectively. Statistical analysis showed non- significant difference ( $P>0.05$ ). USG findings showed intact infraspinatus tendons in 45 and 41, full tear in 0 and 7, partial tear in 3 and 10 and tendinosis in 26 and 16 cases respectively. Statistical analysis showed significant difference ( $P<0.05$ ). USG findings showed intact biceps tendons in 50 and 48, full tear in 2 and 3, partial tear in 4 and 4 and tendinosis in 18 and 19 cases respectively. Statistical analysis showed non- significant difference ( $P>0.05$ ). A high accuracy, sensitivity, specificity, PPV and NPV was observed with USG in diagnosis of supraspinatus tendon, infraspinatus tendon, biceps tendons, subcapularis tendons. USG found to be effective in assessment of rotator cuff pathologies having high sensitivity, specificity, positive predictive and negative predictive values.

**Keywords:** supraspinatus tendons, Rotator cuff, USG.

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## Introduction

The bone humeral head and scapula give attachment to the rotator cuff apart from a group of tendons and muscles. The shoulder is stabilized by these muscle and tendons and aid in movement freely. Teres minor, subscapularis, the supraspinatus and the infraspinatus are 4 muscles that make up the rotator cuff. The attachment of these muscles to the greater and lesser tuberosities of the humeral head is augmented by subscapularis, supraspinatus, and infraspinatus tendons.<sup>[1]</sup> Shoulder is the commonest bone affected by various pathologies and shoulder pain is the frequent complaint by patients.<sup>[2]</sup> Rotator cuff tears (RCTs), tendinosis, subdeltoid or subacromial bursitis, joint effusion, impingement and acromioclavicular joint degenerative changes are among various pathologies affecting shoulder joint. Advance age, dominant arm, history of smoking, history of diabetes, genetics, hypercholesterolemia and traumatic injury are few risk factors. Rotator cuff tears is seen among geriatric population in 6th decades in about 20-30% and near about 45-55% in 8th decades of life.<sup>[3]</sup>

Non-invasive imaging techniques such as ultrasound (USG) and magnetic resonance imaging (MRI) are useful in diagnosis of rotator cuff pathologies. MRI cannot be performed in patients with history of claustrophobia, metallic implants and pacemakers.<sup>[4]</sup> Moreover, it is also time-consuming process. On the other hand, USG is inexpensive, easily available and easily tolerable by patients. USG offers

dynamic assessment and contraction of the muscles adequately.<sup>[5]</sup> Procedures such as injections into shoulder, knee and hip can also be visualize with USG guided procedures. USG has been extensively validated and has achieved high levels of accuracy for detecting or ruling out full-thickness tears.<sup>[6]</sup> Considering this, we attempted present study to assess accuracy of shoulder ultrasound (USG) for diagnosis of rotator cuff pathologies.

## Subjects and Methods

Seventy- four adult patients in age range of 30-80 years with rotator cuff pathologies of either gender was enrolled in this prospective, observational study after considering the utility of the study and obtaining approval from ethical review committee of the institute. All selected patients were also made to give their written consent. Patients within specified age group and who agreed to participate were included and those did not allow to undergo MRI and USG examination and history of surgical intervention were excluded.

Demographic profile of each patient was entered in case history proforma. Various shoulder pathologies were recorded. Every patient was subjected to USG taken with Philips IU22 and a 5-12 MHz linear array transducer. All tendons were examined and grayscale 2D USG images were stored. All MRI examinations were performed with the machine Kodak 1.5 tesla. All images were thoroughly studied by an expert radiologist. Sensitivity, specificity,

positive predictive value (PPV) and negative predictive value (NPV) was measured. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

## Results

Age group 30-40 years comprised of 10 (13.5%), 40-50 years

had 14 (18.9%), 50-60 years had 26 (35.1%), 60-70 years had 16 (21.6%) and 70-80 years had 8 (10.8%) patients. The difference was non- significant ( $P>0.05$ ) [Table 1].

USG findings showed intact supraspinatus tendons in 36 and 32, full tear in 8 and 10, partial tear in 2 and 7 and tendinosis in 28 and 25 cases respectively. Statistical analysis showed non- significant difference ( $P>0.05$ ) [Table 2].

**Table 1: Patients distribution**

Age group (years)	Number (%)	P value
30-40	10 (13.5%)	0.16
40-50	14 (18.9%)	
50-60	26 (35.1%)	
60-70	16 (21.6%)	
70-80	8 (10.8%)	

**Table 2: Patients with intact supraspinatus tendons, tears, and tendinosis on USG**

Findings	USG	MRI	P value
Intact	36	32	0.94
Full tear	8	10	0.82
Partial tear	2	7	0.05
Tendinosis	28	25	0.75

**Table 3: Patients with intact infraspinatus tendons, tears, and tendinosis on USG**

Findings	USG	MRI	P value
Intact	45	41	0.92
Full tear	0	7	0.04
Partial tear	3	10	0.02
Tendinosis	26	16	0.05

**Table 4: Patients with intact biceps tendons, tears, and tendinosis**

Findings	USG	MRI	P value
Intact	50	48	0.97
Full tear	2	3	0.76
Partial tear	4	4	1
Tendinosis	18	19	0.92

**Table 5: Patients with intact subcapularis tendons, tears, and tendinosis**

Findings	USG	MRI	P value
Intact	52	49	0.95
Full tear	3	4	0.81
Partial tear	2	3	78
Tendinosis	17	18	0.93

**Table 6: Assessment of accuracy of USG in detection of pathologies**

Region	Findings	Sensitivity	Specificity	PPV	NPV	Accuracy
Supraspinatus tendon	Intact	62%	72%	76%	60%	68%
	Full tear	85%	82%	32%	98%	84%
	Partial tear	40%	72%	44%	68%	58%
	Tendinosis	63%	62%	82%	38%	64%
Infraspinatus tendon	Intact	88%	38%	96%	10%	86%
	Full tear	-	94%	-	100%	-
	Partial tear	36%	92%	16%	96%	92%
	Tendinosis	38%	84%	42%	87%	80%
Biceps tendons	Intact	100%	26%	92%	100%	94%
	Full tear	25%	100%	100%	98%	98%
	Partial tear	25%	100%	100%	96%	96%
	Tendinosis	34%	94%	62%	84%	68%
Subcapularis tendons	Intact	92%	18%	86%	28%	83%
	Full tear	-	100%	-	9%	-
	Partial tear	12%	94%	18%	90%	85%
	Tendinosis	25%	82%	43%	72%	66%

USG findings showed intact infraspinatus tendons in 45

and 41, full tear in 0 and 7, partial tear in 3 and 10 and

tendinosis in 26 and 16 cases respectively. Statistical analysis showed significant difference ( $P < 0.05$ ) [Table 3].

USG findings showed intact biceps tendons in 50 and 48, full tear in 2 and 3, partial tear in 4 and 4 and tendinosis in 18 and 19 cases respectively. Statistical analysis showed non-significant difference ( $P > 0.05$ ) [Table 4].

USG findings showed intact subcapularis tendons in 52 and 49, full tear in 3 and 4, partial tear in 2 and 3 and tendinosis in 17 and 18 cases respectively. Statistical analysis showed non-significant difference ( $P > 0.05$ ) [Table 5].

A high accuracy, sensitivity, specificity, PPV and NPV was observed with USG in diagnosis of supraspinatus tendon, infraspinatus tendon, biceps tendons, subcapularis tendons [Table 6].

## Discussion

Shoulder pain is frequent complaints for the patients to report to hospitals.<sup>[7]</sup> Among various causes, fracture of shoulder joint, tendonitis, tendon tear, joint instability, arthritis etc. are common one. The rotator cuff disorders constitute the most common cause of painful shoulder.<sup>[8,9]</sup> Continuous active and passive forces predispose the rotator cuff tendons disposed to degeneration resulting in swelling of tendon with subluxation.<sup>[10]</sup> Ultrasonography and MRI are preferred radiological aids in establishing various shoulder pathologies.<sup>[11,12]</sup> In this study we assessed accuracy of shoulder ultrasound (USG) for diagnosis of rotator cuff pathologies.

In present study, age group 30-40 years comprised of 10 (13.5%), 40-50 years had 14 (18.9%), 50-60 years had 26 (35.1%), 60-70 years had 16 (21.6%) and 70-80 years had 8 (10.8%) patients. USG findings showed intact supraspinatus tendons in 36 and 32, full tear in 8 and 10, partial tear in 2 and 7 and tendinosis in 28 and 25 cases respectively. Mohtasib et al,<sup>[13]</sup> in their study observed sensitivity, specificity and accuracy of US as 86%, 82% and 83%, respectively for the detection of full-thickness supraspinatus tears compared with those of MRI. The sensitivity, specificity and accuracy of US for the detection of partial-thickness supraspinatus tears compared with those of MRI were 38%, 70% and 58%, respectively. Overall PPV, NPV, sensitivity, specificity and accuracy of US for the detection of full-thickness tears compared with those of MRI were 35%, 97%, 78%, 83% and 83%, respectively. For partial-thickness tears, the overall PPV, NPV, sensitivity, specificity and accuracy of US compared with those of MRI were 51%, 60%, 51%, 60% and 56%, respectively.

USG findings showed intact infraspinatus tendons in 45 and 41, full tear in 0 and 7, partial tear in 3 and 10 and tendinosis in 26 and 16 cases respectively. USG findings showed intact biceps tendons in 50 and 48, full tear in 2 and 3, partial tear in 4 and 4 and tendinosis in 18 and 19 cases respectively.

USG findings showed intact subcapularis tendons in 52 and 49, full tear in 3 and 4, partial tear in 2 and 3 and tendinosis in 17 and 18 cases respectively. Singh et al,<sup>[14]</sup> evaluated the accuracy of ultrasonography in diagnosing shoulder joint

pathologies in 60 patients. USG showed an accuracy of 70%, 95% and 98% in detection of any tear of supraspinatus, subscapularis and infraspinatus tendon respectively using MRI as reference. USG showed a sensitivity of 88.89%, specificity of 100%, PPV of 100% and NPV of 98.07% in diagnosing full thickness tear of rotator cuff using MRI as reference. For partial thickness tears, it showed a sensitivity of 78.04%, specificity of 89.47%, PPV of 94.11% and NPV of 65.38%. Overall accuracy of USG in detection of any tear of rotator cuff with MRI as reference was 82%.

A high accuracy, sensitivity, specificity, PPV and NPV was observed with USG in diagnosis of supraspinatus tendon, infraspinatus tendon, biceps tendons, subcapularis tendons. Chen et al,<sup>[15]</sup> assessed 36 patients with rheumatoid arthritis (RA) who underwent USG. They found USG to be a highly sensitive and accurate imaging modality for detecting full-thickness tears. The sensitivity and accuracy of US for detecting full-thickness tears were 92.2% and 89%, respectively.

Small sample size in this study is our limitation.

## Conclusion

USG found to be effective in assessment of rotator cuff pathologies having high sensitivity, specificity, positive predictive and negative predictive values.

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