Comparative Study between High Resolution Ultrasound and MRI in Diagnosis of Rotator Cuff Tears

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Abstract

Background: The four muscles that support the humeral head and come from the anterior and posterior sides of the scapula with their tendons situated in the smaller and larger tuberosities are collectively known as the "rotator cuff." The teres minor, supraspinatus, infraspinatus, and subscapularis are among these muscles.

Objectives: This study compares dynamic high-resolution ultrasonography to MRI, which was the gold standard to assess the value of each technology in identifying rotator cuff injury.

Patients and methods: This was prospective study for fifty patients were sent to the Diagnostic and Interventional Radiology Clinic in Qena City suspected to have rotator cuff injury. .

Results: Patients' ages ranged from 19 to 70, with a mean age of 36 years, a standard deviation of 16.35 years. In our study, there were a total of 32 affected males (64%) and 18 affected females (36%) with a male to female ratio of 1.78:1. In identifying complete tears in our patients, in general, we found that USG has 100% overall sensitivity, 92.68% overall specificity, and 94% overall diagnostic accuracy. Positive predictive value was 75%, whereas the negative predictive value was 100%.

Conclusion: MRI and ultrasound have similar levels of sensitivity and specificity. When high-resolution imaging is feasible, trained radiologists are on hand, and rotator cuff integrity is the main concern, US may be thought of as the screening method because it is less expensive and more widely available.

Keywords: Rotator cuff; Tear; Ultrasound; MRI.

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Introduction

Tendinopathy, the most frequent cause of rotator cuff failure, which can result in supraspinatus tendon full thickness rips and infraspinatus and/or subscapularis tendon tangles **(Lewis et al., 2009).** Prior to selecting a treatment plan, the kind and severity of the rotator cuff injury must be carefully diagnosed. **(De Jesus et al., 2009).**

Standard imaging methods, including as unenhanced MRI and ultrasonography, are utilised to identify rotator cuff tears. Conservative or surgical treatment is decided based on the diagnosis. **(De Jesus et al., 2009).**

Plain MRI is an excellent non-invasive imaging technique that can be used in several planes with excellent resolution, despite the fact that it is a static examination. Its absolute contraindications include the existence of cochlear implants; the limits of MRI include its availability, time commitment, and expense. cardiac pacemakers, automatic defibrillators, metallic foreign objects in the orbit, clips for intracranial aneurysms, biostimulators, and **(Whiting et al., 2003)**

More and more often, US of the shoulder is used to evaluate the rotator cuff's structural integrity. It is a non-invasive test with almost no adverse effects and is helpful for people who are claustrophobic. It helps with the dynamic assessment of the tendons while the shoulder is moving **(Al-Shawi et al., 2008)** However, operator dependence exists **(Rutten et al., 2006),** particularly in partial thickness tears where a considerable inter-observer variability is found. **(Le Corroller et al., 2008)**

Patients and Methods

This study was prospective study it was conducted among 50 patients with shoulder complaint presented to Diagnostic and interventional radiology clinic in Qena city.

This study has been given approval by the Ethics Committee of Faculty of Medicine, south valley University, Qena, Egypt. (**Ethical approval code is** SVU-MED-RAD028-1-21-3-153).

Study aids: History taking: name, age, sex, history of trauma, history of painful shoulder, local examination of shoulder joint, abduction, rotation, and examination of the localized tenderness of the acromioclavicular joint, clavicle, humerus and Investigations: shoulder ultrasonography and shoulder MRI.

Ultrasound protocol -US machine GE Health Care digital ultrasound imaging system (Model: P9) with settings for an 12MHz linear-array transducer. The rotator cuff examination can be distinguished by the long head of the biceps. The scan was then performed on the muscles of the teres minor, supraspinatus, subscapularis, and infraspinatus.

MRI protocol: A Philibs Achieva 1.5T system was used for the shoulder MRI, and the following approach was used: The patient is seen lying on his or her side with the injured arm at the side. A nearby shoulder coil is necessary. Holding the shoulder in a slight external rotation is recommended. **(Bureau et al., 2006),** The slice thickness – 5mm. Field of view (FOV)- 13-15 cm. fast spin echo sequences performed: coronal Oblique: T1WI, T2WI STIR. Sagittal Oblique: T1WI, T2WI with fat suppression Axial: T1WI, PDWI **(McMonagle et al., 2011)**.

Ultrasound anatomy: Biceps tendon is easily recognised in the humeral intertubercular groove by Normally, a small quantity of fluid can be observed encircling the tendon. **(Teefey et al., 1999)** The subscapularis tendon is put into the smaller tuberosity until the coracoid process medially obscures it from ultrasonography. **(Morag et al., 2011).** SST, supraspinatus tendon: The tendon is formed like a beak in the longitudinal plane. Its entry into the humerus. **(Morag et al., 2011).** teres minor and infraspinatus tendons are located more posteriorly. One way to picture the teres minor tendon is as a trapezoid. Most rotator cuff tears are found to have teres minor, which is typical. **(Melis et al., 2011).**

MRI anatomy of rotator cuff: On all pulse sequences, the tendons should show as homogenous, smooth, hypointense bands. (**Opsha and others 2008**) RCT's typical normal appearance varies, however unless there is a tear, it should not resemble fluid. **(Neumann et al., 1992**;**Chang et al., 2014)**

Ultrasound appearance of the disease: Full thickness and partial thickness are the two different forms of tears. Full-thickness tears extend from the bursal surface to the articular surface. Partial-thickness tears, only impact the bursal or articular surface. rotator cuff tear includes fluid-filled hypoechoic or anechoic deficits around the torn tendon **(Gerber et al., 1996)** .

Secondary signs of a torn rotator cuff include cortical irregularity of the greater tuberosity, shoulder joint effusion, which appears as anechoic fluid in the axillary pouch, and in the sheath of the long head of the biceps tendon (**Jacobson et al., 2004**); (**Martinoli et al.,2003**). Partial-thickness tears, which appear as discrete, clear-cut hypoechoic or anechoic anomalies in the tendon, only impact the bursal or articular surface. **(Vanholsbeeck and colleagues, 1995 ; Benjamin, 2001)**

MRI appearance of the disease: The most often afflicted muscles when checking for RCT tears are the supraspinatus and infraspinatus, which are best assessed in the coronal oblique plane. It is advised to assess the teres minor in the sagittal oblique plane and the subscapularis in the axial plane. RCT can be different from its typical appearance, but unless there is a rip, it shouldn't resemble fluid **(Chaipat and Palmer, 2006; Khoschnau et al., 2020)** One of the MRI findings of a full-thickness rip is a localised discontinuity in the tendon running from the articular to the bursal side, seen as fluid signal intensity on T2-weighted imaging. partial-thickness tear only affects the articular or bursal side of the cuff. Bursal-sided tears occur less commonly than articular-sided tears. **(Nakajima et al.,1994)** appears as a localised, very signal-intense tendon discontinuity on T2-weighted imaging. Fat-restricting sequences can help to show the tendon deficit. **(Chang and Chung from 2014)**

Intrasubstance tears are a specific kind of incomplete tear that exclusively occurs within the rotator cuff's substance and don't spread to the surface. **(Kwon et al., 2019; Lunn et al, 2008).**

Statistical analysis

Utilizing SPSS programme (Statistical Package for Social Sciences) software version 26.0, Microsoft Excel 2016 and MedCalC programme software version 19.1, the gathered data will be tabulated and statistically analysed. For numerical parametric data, descriptive statistics were performed using the mean, SD (standard deviation), Using the median, first and third interquartile ranges, for non-parametric numerical data, the minimum and maximum of the range are both appropriate strategies. In contrast, for categorical data like quantity and percentage, they had already been finished. The independent t-test and the Mann Whitney U were used for inferential analyses when there were two independent groups and parametric data for quantitative variables. Receiver operating characteristic (ROC curve) analysis was used to determine the parameter's overall productivity and the appropriate cut-off value, with the detection of sensitivity and specificity at this cut-off value. For inferential analysis of qualitative data, the independent group chi square test was used. P values under 0.05 were used to determine significance, and values beyond this limit are not significant. A statistical indicator of the likelihood that a study's findings were the result of P-value.

Results

The age of the studied patients ranged from 19 to 70 years and (60%) of them were males and (68%)of them with no comorbidities (**Table. 1).**

Table 1. Demographic characteristics in the studied patients

Parameters		Studied patients (n=50)	
		N	%
Age groups	**18- 30 years**	9	18.0%
	31- 40 years	18	36.0%
	41- 50 years	3	6.0%
	51- 60 years	7	14.0%
	≥ 60 years	13	26.0%
Age (years)	**Mean± SD**	44.36± 16.35	
	Median	36.0	
	Range	19.0- 70.0	

Gender	**Male**	32	64.0%
	Female	18	36.0%
Comorbidities	**No**	34	68.0%
	DM	16	32.0%
	Hypertension	10	20.0%

The major complain is inability to raise arm up with right-sided dominance in (62%) patients. **Table 2**

The most affected tendons in rotator cuff tear and its different types in Ultrasound. **Table 3**

The most affected tendons in rotator cuff tear and its different types in MRI. **Table 4**

Comparison between USG & MRI in detection of different types rotator cuff tear. **Table 5**

Table 2. Distribution of the studied patients as regards clinical history

Parameters		**Studied patients (n=50)**	
		N	%
Complaint	**Can't raise his arm up**	28	56.0%
	Recurrent dislocation of right shoulder	4	8.0%
	Shoulder pain with lifting his arm up	18	36.0%
History	**Lifting heavy objects**	22	44.0%
	Motor car accident	22	44.0%
	No trauma.no operation	6	12.0%
Handedness	**Left shoulder**	19	38.0%
	Right shoulder	31	62.0%

Table 3. Distribution of the studied patients as regards US findings

Parameters		**Studied patients (n=50)**	
		N	**%**
Pathologies of rotator cuff on USG	**No abnormality**	6	12.0%
	Partial tear	25	50.0%
	Complete tear	12	24.0%
	Biceps tendon dislocation or tendonitis	7	14.0%
Tendon affected on US	**No**	6	12.0%
	Infraspinatus	3	6.0%
	Subscapularis	9	18.0%
	Supraspinatus	32	64.0%

Table 4. Distribution of the studied patients as regards MRI findings

Parameters		**Studied patients (n=50)**	
		N	**%**
Pathologies of rotator cuff on MRI	**No abnormality**	6	12.0%
	Partial tear	31	62.0%
	Complete tear	9	18.0%
	Biceps tendon dislocation or tendonitis	4	8.0%
Tendon affected on MRI	**No**	6	12.0%
	Infraspinatus	6	12.0%
	Subscapularis	9	18.0%
	Supraspinatus	29	58.0%

Table 5. Comparison between USG & MRI regarding pathologies of rotator cuff

Variables		USG								Kappa Agreement	P-value
		No abnormality		Biceps tendon dislocation or tendonitis		Partial tear		Complete tear			
		No.	%	No.	%	No.	%	No.	%		
MRI	No abnormality	6	100.0%	0	0.0%	0	0.0%	0	0.0%	0.807	<0.001
	Biceps tendon dislocation or tendonitis	0	0.0%	4	57.1%	0	0.0%	0	0.0%		
	Partial tear	0	0.0%	3	42.9%	25	100.0%	3	25.0%		
	Complete tear	0	0.0%	0	0.0%	0	0.0%	9	75.0%		

There was very good agreement between USG and MRI results in detection of type of the affected tendons (**Table 6).**

There was excellent efficacy of ultrasound in detection of full thickness tear of rotator cuff (**Table 7).**

Table 6. Comparison between USG & MRI regarding tendon affected

Variables		USG								P-value
		No		Infraspinatus		Subscapularis		supraspinatus		
		No.	%	No.	%	No.	%	No.	%	
MRI	No	6	100.0%	0	0.0%	0	0.0%	0	0.0%	<0.001
	Infraspinatus	0	0.0%	0	0.0%	3	33.3%	3	9.4%	
	Subscapularis	0	0.0%	3	100.0%	6	66.7%	0	0.0%	
	supraspinatus	0	0.0%	0	0.0%	0	0.0%	29	90.6%	

Table 7. Accuracy measures of USG in detection of complete tears

Complete tear (MRI)	USG					Sensitivity	Specificity	PPV	NPV	Accuracy
	Positive (n=12)		Negative (n=38)		Total					
	No.	%	No.	%						
Positive Negative	9 3	18% 6%	0 38	0% 76%	9 41	100%	92.68%	75%	100%	94%
Total	12	24%	38	76%	50 (100%)					

There was good accuracy detection of partial thickness tear of rotator cuff tendons (**Table 8).**

Accuracy of ultrasound in detection of biceps tendon dislocation and bicipital tendinitis was shown in (**Table 9).**

Table 8. Accuracy measures of USG in detection of partial tears

Partial tear (MRI)	USG					Sensitivity	Specificity	PPV	NPV	Accuracy
	Positive (n=25)		Negative (n=25)		Total					
	No.	%	No.	%						
Positive	25	50%	6	12%	31	80.65%	100%	100%	76%	88%
Negative	0	60	19	38%	19					
Total	25	50%	25	50%	50 (100%)					

Table 9. Accuracy measures of USG in detection of Biceps tendon dislocation or tendonitis

Biceps tendon dislocation or tendonitis (MRI)	USG					Sensitivity	Specificity	PPV	NPV	Accuracy
	Positive (n=7)		Negative (n=43)		Total					
	No.	%	No.	%						
Positive	4	8%	0	0%	4	100%	93.48%	57.14%	100%	94%
Negative	3	6%	43	86%	46					
Total	7	14%	43	86%	50 (100%)					

Case I

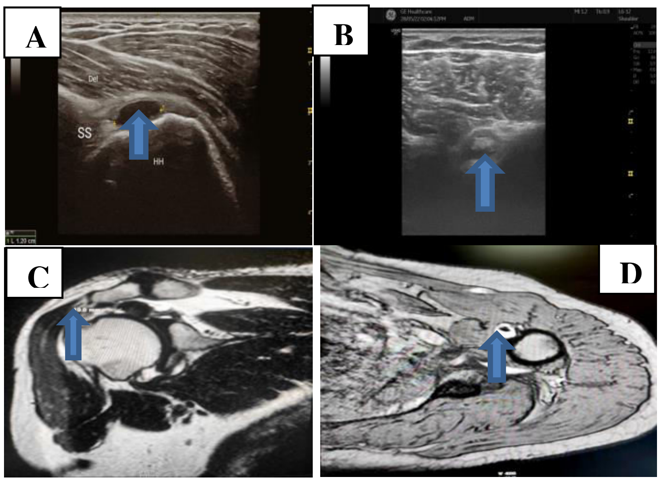

Fig.1. Male patient 49years old with full-thickness tear of supraspinatus tendon; (**A**) & (**B**) US: shows hypoechoic area representing distortion of tendon fibers with gap defect 12mm with bicipital tendinitis. (**C**) &(**D**) MRI: coronal T2WI sequence shows abnormal hyperintense signal intensity of full thickness tear with bicipital tendinitis.

CASE II

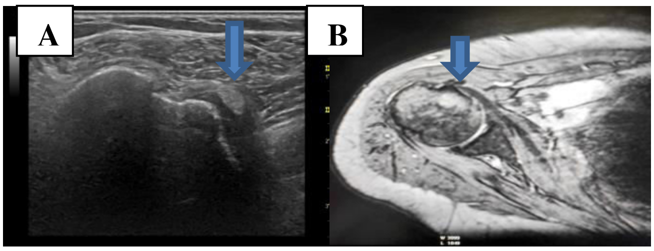

Fig.2. Female patient 60 years old complaining of biceps tendon subluxation from bicipital groove. (**A**) **US**: shows empty bicipital groove with echogenic tendon of long head of biceps muscle seen medial to lesser tuberosity; (**B**) MRI showed biceps tendon subluxation and empty bicipital groove.

Case III

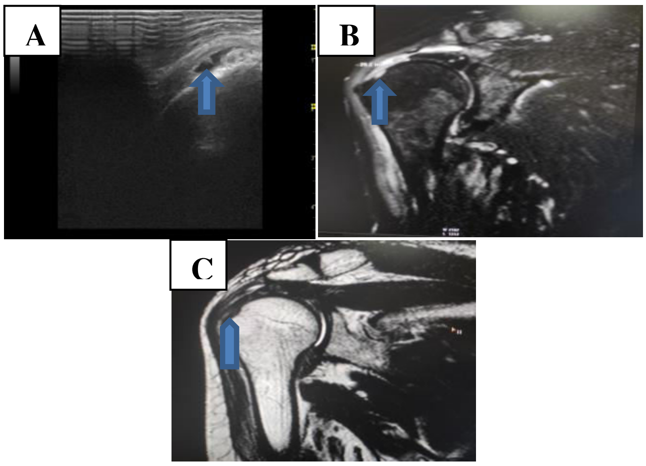

Fig.3.Male patient 44years old, with partial cut of the anterior fibres of supraspinatus tendon with preserved continuity of its posterior fibers; US (**A**) showed complete disruption of the anterior fibers of supraspinatus tendon represented by hypoechoic defect measures 2cm and preserved continuity of its posterior fibers; **MRI** (**B**) Coronal oblique STAIR showed shows abnormal hyperintense signals near tendon insertion, with fluid filled gap measuring about 2cm ; (**C**) T2WI showing preserved continuity of posterior fibers of supraspinatus tendon.

Case IV

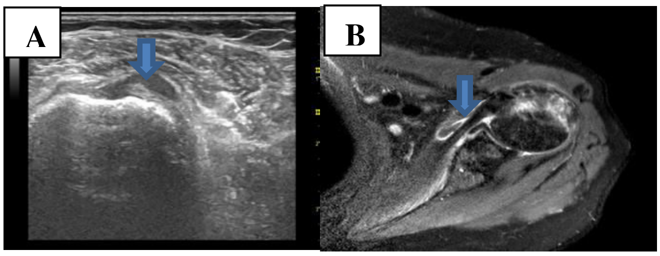

Fig.4. Male patient 44years complaining of partial subscapularis tendon tear; US (**A**) show hypoechoic defect at its insertion to lesser tuberosity with loss of its fibers continuity; **MRI** (**B**) show hyper intense signal intensity at insertion of subscapularis tendon.

Case V

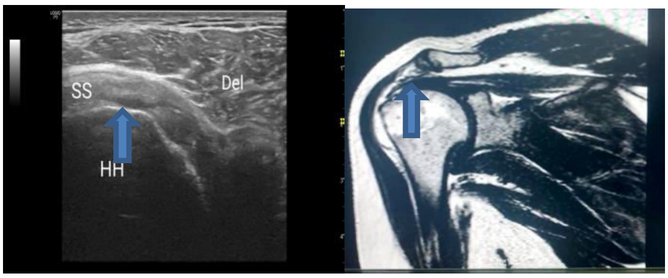

Fig.5. Female patient 33 years presented by partial tear of supraspinatus tendon near its insertion; US (**A**) shows abnormal linear hypoechoic defect within supraspinatus tendon, **MRI** Fig (B) coronal obliqueT2WI showed abnormal linear hyperintense signal at myotendinous junctionwithin supraspinatus

tendon; MRI (**B**) coronal obliqueT2WI showed abnormal linear hyperintense signal at myotendinous junction.

Discussion

The main goal of this study was to compare the performance of dynamic high-resolution ultrasonography, which we used as a benchmark in our patients, to MRI in identifying rotator cuff problems.

The main results of this study were as following: As regard demographic characteristics in the studied patients. The patients' ages ranged from 19 to 70 years, with a mean age of 36 years and a standard deviation of 36.36 years (SD). The age range from 31 to 40 years was the one with the greatest prevalence (36%) and the age range from 41 to 50 years had the fewest cases (6%). In our study, there were a total of 32 affected males (64%) and 18 affected females (36%) with a male to female ratio of 1.78:1. In relation to comorbidities, 16 (32%) patients had DM and 10 (40%) patients had hypertension. However, in the study of **Saraya & El Bakry et al.,2016** This cohort included 40 patients, ranging from 24 to 65 years old, with 13 men (32.5%) and 27 women (67.5%). (Mean Age: 56) **Zhang et a**l.,**2021** on the other hand, stated that there were 26 males and 29 women, with ages ranging from 21 to 70, and a mean age of (52.96 + 8.29) years. 42 patients had histories of trauma, including 3 people with hypertension and 6 people with diabetes.

The present study showed that more than half patients (56%) complained from their inability to raise arm up. Shoulder pain with lifting arm up was found in 18 patients (36%) while recurrent dislocation of right shoulder was seen in 4 patients (8%). History of lifting heavy objects was seen in 22 patients (44%), motor car accident in 22 patients (44%) while there was no history of trauma and operations was seen in 6 patients (12%). The right-sided dominance was seen in 31 patients (62%) and left-sided dominance in 19 patients (38%) in our study.

In accordance with our results, study of **Chauhan et al.,2016** since they demonstrated that in our investigation, left-sided dominance was only observed in one patient (3.2%), whereas right-sided dominance was observed in 30 individuals (96.8%). In 24 out of 31 patients (77.4%), there was a history of either minor or major trauma, whereas there was no history of trauma in 7 patients (22.6%). In 3 patients (9.7%), there was a history of both diabetes mellitus and trauma, but there was neither history in 2 patients (6.4%). Our results were in agreement with study of **Refaat et al.,2021** They reported that 19 patients (63%) and 11 patients (37%), respectively, had side pain for the right and left shoulder joints. **El-Shewi et al**.,**2019** demonstrated that there were 34 patients (68%) and 16 patients (32%), respectively, with affection on the right and left shoulder sides. Furthermore, **Bashir et al.,2014** found that the distribution of shoulder pain patients by decade of life was as follows: 5 (10%) patients in the 30–40-year age group, 11 (22%) in the 41–50 year group, 14 (28%) in the 51–60 year group, and 20 (40%) patients in the 61–plus year group. It has been found that as people get older, shoulder pain is more common. There were 42 patients (84%) with right shoulder discomfort and 8 (16%) with left shoulder pain. In addition, **Roopa et al.,2018** 90% of the patients were right-handed, and 10% were left-handed, according to the statement. Injuries to the rotator cuff were present on the left side of all three left-handed players (100%) and the right side of 80% of right-handed players. The statistical significance of this connection was high. The majority of patients (33.3%) who had rotator cuff injuries also had difficulty performing overhead abduction, stiffness (13.3%), pain and stiffness (20%), pain and weakness (6.7%), and weakness (3.3%). In their study, 76.6% of patients had reduced range of motion, and 26.7% of patients had a history of trauma. The current study showed that as regard clinical characteristics in the studied patients. The right-side was affected in 28 patients (56%) and left-side affection was in 22 patients (44%) in our study. The duration of complaint ranged from 1 to 3 months with mean ±SD was 1.78± 0.76 months. Whereas in the study of **Zhang et al., 2021,** The length of the illness ranged from three days to 12 years, with an average duration of (32.49 9.53) months.

In the study in our hands, as regard US findings; 32 patients had supraspinatus tears, 9 patients had subscapularis tears and 3 patients had infraspinatus tears. Out of 50 patients, USG showed 12 complete thickness tears, 25 partial thickness tears and 7 cases with Biceps tendon dislocation or tendonitis**.** Our findings were validated by a research by **Vijayan et al.,2020** who reported that the supraspinatus tendon was the most frequently damaged tendon in their study, with supraspinatus pathologies identified in 61 out of 67 patients. Subscapularis tendon diseases, which affected 32 out of 67 patients, were next. Similar to this, **Singh et al.,2017** showed that 85% of the participants with a sore shoulder who had USG had disease involving the supraspinatus tendon. Subscapularis tendon diseases were detected in 54% of patients after this. In the study of **Singh et al.,2021** 9(18%) of the 50 patients who underwent ultrasound of the samples showed full-thickness tears, 15 (30%) had partial-thickness rips, and 2% had no abnormalities. Nine patients showed bursal surface tear out of the 15 patients with partial-thickness tears.

Thirteen patients had tears without retraction and twelve patients had tears with retraction out of the 25 patients who had full-thickness tears.

The current investigation revealed that 29 patients had supraspinatus tears, 9 patients had subscapularis tears, and 6 patients had infraspinatus tears according to the results of an MRI. In 50 patients, MRI revealed 50 partial thickness tears, 9 complete thickness tears, and 4 cases of tendonitis of the biceps tendon. In line with our findings, **Chauhan et al.,2016** investigation's revealed that supraspinatus tendon tears were the most frequent, followed by infraspinatus tears, which were seen in 12 patients (38.7%) on MRI. On MRI, the subscapularis tendon was implicated 32.3% more frequently than the infraspinatus (10 patients). The least often injured tendon in patients with rotator cuff injuries was teres minor. Only one patient (3.2%) had a partial teres minor tear visible on MRI.

Similarly, on their MRIs, 93 subjects in **Singh et al.,2021** study's had disorders of the supraspinatus tendon.

In 50 patients who had MRI scans they found that 28 (56%) had partial-thickness tears, 10 (20%) had tendinosis, and 12 (24%) had full-thickness rips. As a result, rotator cuff injury was discovered in 40 patients' MRI images. There were twelve cases of partial-thickness rips and 28 patients with full thickness tears.

Ultrasonography failed to detect the biceps tendon in the intertubercle sulcus in 4 (8%) of 50 individuals.

An MRI supported these findings. Thirteen out of fifty individuals had biceps tendon effusion., with 6 patients showing it on USG and 7 patients showing it on MRI. Also, **Zhang et al.,2021,** found that MRI revealed partial tears in 37 patients (67.27%), complete tears in 12 patients (21.82%), full tears in 6 patients (10.91%). While **Bashir et al., 2014**.discovered that 16 individuals had partial thickness tears, 22 patients out of 50 had full thickness tears., and 12 patients were normal. As a result, MRI results for a total of 38 individuals revealed rotator cuff injuries. The results of the current investigation demonstrated that there was excellent agreement between USG and MRI findings in the identification of rotator cuff diseases (kappa = 0.807, p 0.001). Three patients who had partial tears that had been verified by MRI but were misdiagnosed as complete tears on USG when the two types of imaging were compared.

Three individuals with MRI-identified infraspinatus tendon affection were revealed to have had false subscapularis diagnoses on USG when the USG and MRI results were compared. Our findings concurred with **Singh et al.,2017**. Investigation`s, which discovered that the kappa coefficient was utilised to evaluate the agreement between USG and MRI. The degree of agreement on the diagnosis of rotator cuff injury is regarded as good (k=.79). Our findings were supported by a study by **Saraya & El Bakry et al.,2016** who discovered 28 patients (70%) had rotator cuff disease in line with both modalities, as follows: partial thickness tears and complete thickness tears were each present in 13 cases (32.5%) and 5 cases (12.5%), respectively. Despite the fact that they were only picked up by MRI as partial thickness rips in two cases (5%) when ultrasonography had missed them (one in the supraspinatus tendon and one in the subscapularis tendon), Only one incidence (2.5%) of a partial thickness tear of the supraspinatus tendon was recorded by ultrasound, and the MRI results were unremarkable, **Chauhan et al.,2016,** claimed that all 31 patients had supraspinatus tears, with USG revealing 22 partial thickness tears and 9 complete thickness tears in total. Ten patients out of 31 showed complete thickness rips on MRI, twenty patients had partial thickness tears, and one patient had tendinosis. One patient had a full thickness tear that had been verified by MRI but had been misdiagnosed on USG as a grade 3 partial thickness tear, and another had tendinosis that had been verified by MRI but had been misdiagnosed on USG as an intrasubstance tear. In certain cases, the USG also showed concomitant tears in the teres minor, subscapularis, and infraspinatus tendons. In comparison to an MRI, which revealed 4 full and 8 partial tears for the same tendon, it revealed 3 complete and 7 partial tears of the infraspinatus. Only one subscapularis rip was fully visible on either an MRI or USG, however eight individuals had partial subscapularis tears on USG, compared to nine on MRI. Only one patient had a severe rotator cuff tear that included the teres minor, and this patient's condition was clearly visible on both an MRI and USG. Our results showed that based on MRI as a reference standard, USG identified complete tear in 9 patients (true positives). USG did not detect complete tear correctly in 38 patients (true negatives). Three patients had false positive results. We found that USG had overall sensitivity, specificity, and diagnostic accuracy of 100%, 92.68% and 94% respectively in detecting complete tear in our patients. Positive predictive value was 75% while the negative predictive value was 100%.

Our results were in agreement with study of **Saraya & El Bakry et al.,2016** According to their findings, ultrasonography has a sensitivity and specificity of 100% for full thickness tears and a 90% accuracy rate when compared to MRI.

Also, **Refaat et al.,2011,** demonstrated that MRI and ultrasound both have 100% US sensitivity, specificity, and accuracy for diagnosing supraspinatus full thickness rips.

While in the study of **Vijayan et al.,2020,** ‘Sensitivity, specificity, positive and negative predictive values (PPV and NPPV) of the USG (NPV), in that order, are 70.4%, 100%, 100%, and 97.2% for evaluating total rotator cuff injuries. **Elmorsy et al study.'s 2017**found that the US had an NPV of 86.4%, a PPV of 84%, was 77% sensitive, and had a 90.9% specificity in FTTs (full thickness cuff tear). MRI was less sensitive (69%) and specific (89.3%) than US at detecting FTT, with a PPV of 82.6% and an NPV of 79.7%. P values are P=0.762, P=0.791, P=1, and P=0.302, respectively, for specificity, PPV, and NPV., there was no discernible difference between US and MRI in the detection of FTT. The present study showed that based on MRI as a reference standard, USG identified partial tear in 25 patients (true positives). USG did not detect partial tear correctly in 19 patients (true negatives). Six patients had false negative results. We found that USG had overall sensitivity, specificity, and diagnostic accuracy of 80.65%, 100% and 88% respectively in detecting partial tear in our patients. Positive predictive value was 100% while the negative predictive value was 76%.

Our results were supported with study of **Saraya & El Bakry.,2016.** They found that, compared to MRI, ultrasonography had higher values for sensitivity, specificity, PPV, NPV, and accuracy for partial thickness rips, at 88%, 89%, 94%, 80%, and 83% respectively. Despite the fact that **Refaat et al.,2011**. asserted that MRI had identified 10 cases with partial thickness supraspinatus tears, ultrasonography was only able to differentiate 8 of those cases, and the other 2 patients were determined to have supraspinatus tendinopathy.

In the US, partial thickness rips have sensitivity, specificity, and accuracy scores of 80%, 95%, and 90%, respectively. While **Vijayan et al,2020**. studied "Sensitivity," "Specificity," and "Positive Predictive Value (PPV)" (14), and "Negative Predictive Value (NPV)" of USG are 64.5%, 95.8%, 66.6%, and 96.4%, respectively, in assessing "partial rips" of the rotator cuff tendons, In the **Roopa et al.,2018**. study, ultrasonography had a 61% diagnosis accuracy for rotator cuff problems (13). 58.33% for partial thickness tears. **Chander et al.,2019**. also mentioned that USG displays 100% sensitivity, specificity, PPV, and NPV for complete thickness tears and 83.7% for partial thickness tears. The study conducted by **Elmorsy et al.,2017.** they discovered that although US was less sensitive than MRI (23% and 54.1%, respectively) in detecting PTT (partial thickness cuff tear), The difference (P=0.333) was not statistically significant. MRI was shown to be statistically insignificantly (P=0.0008) less specific than US (72.6%), in comparison. There was no discernible difference between the PPV for the US and the MRI, which was both 21.4% and 30.9% (p=0.73). The NPV for the US and the MRI did not differ significantly from one another (p=0.48).

The current study showed that based on MRI as a reference standard, USG identified Biceps tendon dislocation or tendonitis in 4 patients (true positives). USG did not detect Biceps tendon dislocation or tendonitis correctly in 43 patients (true negatives). Three patients had false positive results. We found that USG had overall sensitivity, specificity, and diagnostic accuracy of 100%, 93.48% and 94% respectively in detecting Biceps tendon dislocation or tendonitis in our patients. Positive predictive value was 57.14% while the negative predictive value was 100%. The current study showed that based on MRI as a reference standard, USG identified Biceps tendon dislocation or tendonitis in 4 patients (true positives). USG did not detect Biceps tendon dislocation or tendonitis correctly in 43 patients (true negatives). Three patients had false positive results. We found that USG had overall sensitivity, specificity, and diagnostic accuracy of 100%, 93.48% and 94% respectively in detecting Biceps tendon dislocation or tendonitis in our patients. Positive predictive value was 57.14% while the negative predictive value was 100%. In the study of **Armstrong et al., 2006**, Using ultrasonography, subluxation or dislocation was detected with 100% specificity and 96% sensitivity. While all full ruptures of the biceps tendon were detected by ultrasound, the 23 partial-thickness tears of the tendon were not. In all, 35 out of the 36 normal biceps tendons and 17 out of the 35 faulty biceps tendons were found using ultrasonography (sensitivity: 49%; specificity: 97%). Ultrasound is a precise tool for determining whether the biceps tendon has completely ruptured, subluxated, or dislocated. According to **Yoon et al,.2018** The presence of a biceps subluxation/dislocation could predict a subscapularis full-thickness rupture with a sensitivity of 45% (45/99), specificity of 99% (332/333), positive predictive value of 98% (45/46), negative predictive value of 86% (332/386), and negative predictive value of 99% (332/333).

Conclusion

An extremely common cause of shoulder pain is rotator cuff diseases, notably tears. The utility of a clinical examination alone in determining the underlying etiology's therapeutic options is limited. The choice of either conservative management or surgical treatment will depend on the severity of any underlying rotator cuff injuries and the accuracy of the diagnosis. Numerous pathologic factors, such as trauma (acute or chronic), inflammation, or instability, may result in shoulder pain. The most common reason for rotator cuff failure is tendinopathy, which can affect the supraspinatus tendon and produce partial to full thickness rips as well as tangling of the infraspinatus and/or subscapularis tendons. In essence, Imaging is essential in pinpointing the causes of cuff muscle rips as well as identifying the involvement of tendon injuries and their extension because tendon injuries are difficult to diagnose clinically in cases of cuff muscle rips. Before choosing a course of treatment, the kind and severity of the rotator cuff injury must be carefully diagnosed. Similar levels of sensitivity and specificity can be found in MRI and ultrasound. When high-resolution imaging is feasible, trained radiologists are on hand, and rotator cuff integrity is the main concern, US may be thought of as the screening method because it is less expensive and more widely available.

Recommendation

For the results to be confirmed, additional research with a bigger sample size is required. Further study will be needed to confirm that US can be utilised as the screening method when competent radiologists and high resolution equipment are available, especially where rotator cuff integrity is the main concern.

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